COUNTRY POLICY SUPPORT PROGRAMME (CPSP)

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1. GENESIS OF CPSP

The Second World Water Forum (WWF 2) held at The Hague in March 2000 deliberated on the World Water Vision for the year 2025 mainly under three components, namely, Water for Food (agriculture), Water for People (drinking, domestic, sanitation, industry, energy), and Water for Nature (ecosystem). ICID had earlier taken active part with other international organisations in bringing out a Vision on Water for Food and Rural Development (WFFRD) through consultations held in 43 countries of its membership. All these countries developed their country position papers and enunciated their perceptions on projected use of WFFRD, emphasising the close link between agriculture and rural development. The vision was supported by assessments done by FAO, IWMI (PODIUM), IFPRI (IMPACT-Water Model), besides others. Based on these assessments, the vision for WFFRD projected that for the world population in the year 2025, an increase in global water withdrawal by 17 percent, storage by 13 percent, irrigated area by 18 percent and funding by about 3 times will be required, assuming a maximum improvement in water use efficiency that was likely to be achieved, by then.

While the WFFRD based its projections on country specific assessments, the 'Sector Vision for People' based its perceptions on the accelerating urbanisation and industrialisation on one hand and lack of access to safe and adequate drinking water to weaker and rural societies on the other. It however did not quantify the increase in water supply required for the sector by 2025. The 'Sector Vision on Water for Nature' similarly did not project any quantification of water needed for eco-systems, but only recommended need to contain the water-land related ecological degradation due to pollution, due to various development-related activities and their impending acceleration. Even in absence of such quantification, the overview vision scaled down the findings of WFFRD. For instance, the water withdrawal needs for food sector were lowered from 17% to about 6-9%, storage requirements from 13% to nil, need for addition of irrigated area from 18% to nil, and requirement of funding to water sector from three times to little, giving rise to disagreements.

The overview vision also failed to recognise the 'non-consumptive' nature of the water for people sector, while it causes degradation of eco-systems in a big way particularly in developing countries, requiring need for ecological releases of expensive and already short fresh water. Further, no effort was made at enunciating the criticality of 'Integrated Water Resources Development and Management (IWRDM)' to meet with future water needs for the three sectors. ICID considers IWRDM as essential for meeting with the future needs of all the three sectors. It also considers that unless this integration is done, the development will not be sustainable. The Vision and the Framework for Action therefore remained hazy and came under attack from the professionals.

After the WWF 2, ICID adopted in the year 2000 a Strategy for Implementation of ICID's Concerns emanating from the Vision, for action and presentation of the output in the WWF3. As a part of this

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Strategy, a more detailed assessment supported by fresh consultations at basin, national and global levels was envisaged through a project titled as 'Country Policy Support Programme (CPSP)', evolved in consultation with several experts for implementation in two phases. Five major irrigating countries from different basin characteristics and continents namely, China, Egypt, India, Mexico and Pakistan accounting for 43 percent of world's population and 51 percent of world's irrigated area were identified as representative of ICID membership. IWMI, IFPRI, FAO (IPTRID), and the World Bank enthusiastically agreed to act as contributing organizations in the CPSP. Several NGOs and basin level organizations as well as international organizations participating in the Dialogue for Water, Food and Environment are also expected to actively associate in the programme.

2. COMPONENTS OF CPSP

The CPSP is a support programme for the water related policies of developing countries from amongst the ICID's membership, by way of identification of interventions through a process of sample assessments, compilation of building of a Knowledge-Base (KB) and consultations with stakeholders, as follows:

- Compiling existing information on country policies, strategies and framework for the predominant 'food sector' through the processes of irrigation-drainage-flood management in context of needs for the 'people and nature sectors' and updating the available KB.
- Water requirement assessments in two representative river basins each in China and India for sustainable integration of water needs for all the three sectors.
- Holding broad-based consultations on the basis of existing and the fresh assessments in China and India at basin levels.
- Projecting the integrated water needs at national level and holding national consultation.
- Preparing reports based on such consultations to serve as a basis for country specific policies and strategies for rural development, food security, environmental sustainability to take care of poverty and health issues.
- Holding consultations with concerned Governments.
- Holding briefing meetings with funding agencies such as World Bank, ADB and others.
- Holding broad-based consultations in Egypt, Mexico and Pakistan on issues brought out.
- Sharpening PODIUM and IMPACT models for initial use in China and India for assessments.
- Formulation of revised visions through the concerned National Committees of ICID.

Two basins of relatively medium size in India, viz., Sabarmati (catchment area 21,674 km², semi-arid) on the west coast and Brahmani (catchment area 39,268 km², tropical and humid) on the east coast were identified for assessments (**Figure 1A**). Similarly, two basins in China, viz., Qiantangjiang (catchment area 55,558 km²) and Jiaodong (catchment area 20,008 km²) were selected for carrying out assessments (**Figure 1B**). The size was chosen to be able to collect requisite information in time, secondly, the choice depended upon adequate mix of urban/industrial demands, significant pollution with sizeable irrigated/ rainfed areas deploying both surface and ground-waters.

3. CPSP AND DIALOGUE

While ICID was firming up its CPSP proposal, an international initiative sponsored by a consortium of 10 participating organisations was launched in August 2001 to conduct a 'Dialogue on Water, Food and Environment'. While the concept of holding consultation at various levels is included both in the

Figure 1A. Location of Brahmani and Sabarmati River Basins, India

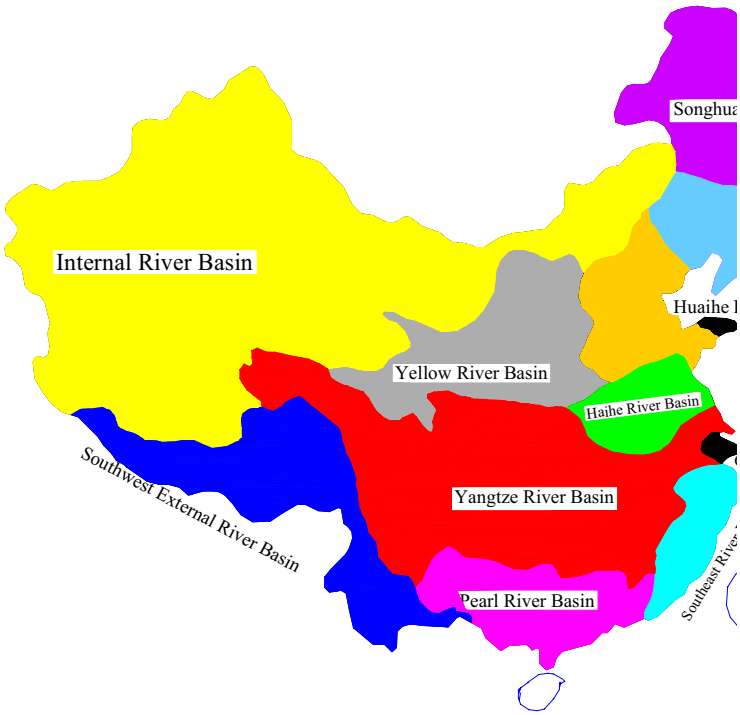

Figure 1B. Location of Qiantang and Jiaodong River Basins, China

'Dialogue' and 'CPSP', the former has a focus on building bridges between the bipolar water needs for food and environment, without accounting for the critical role of 'Water for People' sector, in its impact on environment. The latter on the other hand focuses on: the need for scientific assessments, the need for improvement of analytical tools such as PODIUM and IMPACT models, the scope for involvement of National Governments and funding agencies, the funding and stakeholder institutional mechanisms, and more importantly on recognition of an integrated approach for evolution of water policies for the three sectors.

The needs for water for 'Food' and 'People' sectors are mounting with continued growth of population. The consumptive requirement of the former far outweighs that of the latter. So also the development and abstractions. The people sector did not attempt in past perspective plans for development of its own resources through dedicated storages, largely riding piggyback on the former sector. Also, little has been done to evaluate basin-wise needs for 'Nature' sector, while claiming shortages and blaming the other two sectors for such needs. The quantification forms a core activity of the CPSP. While the Dialogue lays special stress on local actions, the CPSP relies on basin and national level consultations to be able to provide support to the country policies on macro scale. The CPSP thus is slated to be a major contribution of ICID to the water sector. Incidentally, it's output will be useful for the 'Dialogue'.

The intra-basin and inter-basin balancing of demands and supplies has become necessary due to increasing pace of urbanisation and industrialisation. Their uneven spread in a basin has caused tremendous strain on water resources, resulting in unbalanced and an un-equitable deployment of resources. Similarly, water needs for water deficit regions/basins are rising, calling for inter-basin transfers within administrative units. With the galloping water needs for people sector, the pollution load from point sources also is growing. The need for integration of 'supply' as well as 'demands' sides on a basin scale keeps intensifying. This imbalance between supply and demand has not been addressed adequately in the so-called IWRM, which seems to ignore the continued need for water 'development' component in the IWRDM. Although adequate published gray KB is available on these aspects, some basin wide illustrative assessments are necessary to bring home the facts.

The CPSP hopes to identify, over a limited period of 2 years in the first instance, the necessary interventions to facilitate implementation strategies for the selected National Committees of ICID and the concerned National Governments.

4. ACTION PROGRAMME FOR CPSP

During the year 2002, following steps were taken

1. Preparatory Workshop for CPSP, India at New Delhi, 4-5 October 2002
2. Orientation Workshops by IWMI for China and India teams of PODIUM - IMPACT: 7-11 October 2002
3. Preparatory Workshop for CPSP, China, 10-11 November 2002.
4. Launching of assessments of water needs for three sectors in two river basins for each country.

During the year 2003, following steps are planned

1. Completion of first phase of assessments in the two identified river basins.

2. Basin Level Consultations in India
   (i) At Bhubaneswar for Brahmani Basin, 16-17 January 2003.
   (ii) At Ahmedabad for Sabarmati Basin, 23-24 January 2003.
3. Basin Level Dialogues in China
   (i) For Qiantangjiang Basin, March/April 2003
   (ii) For Jiaodong Basin, March/April 2003
4. Presentation on CPSP at ICID Session in World Water Forum 3 (Kyoto), March 2003.
5. National dialogue for India, July 2003.
6. National dialogue for China, August 2003.
7. Briefing meetings with Governments and funding agencies, August 2003
8. Presentation on CPSP at 54th meeting of the IEC of ICID, Montpellier (France), September 2003
9. Dissemination of results/reports through websites and TDS of ICID after October 2003.
10. National Consultations in Egypt, Mexico and Pakistan bringing out the CPSP outputs.

During the year 2004, following steps are envisaged

1. Dissemination of results/reports in March 2004.
2. Policy Level Meetings with Governments, April to June/July 2004
3. Report to 55th IEC meeting of ICID in Russia in September 2004, co-terminus with the CPSP Phase 1.

5. OUTPUTS OF FIRST PHASE OF CPSP: INDIA

5.1 Basin Level Consultations

A comparative of salient features of the two identified river basins in India viz., Brahmani and Sabarmati are given in Annex 1. The preliminary assessments were presented to the Basin Level Consultations held at Bhubaneswar (Orissa State) and Ahmedabad (Gujarat State) in January 2003. More than 55 Stakeholders including Government Agencies, NGOs, Farmers, Water supply and Sanitation experts, Forestry, Wildlife experts, representatives of Contributing Organisations and Dialogue Partners participated in each consultation. Extensive documentation was prepared in advance and circulated. In each consultation, presentations on assessments besides specific topical issues were made as per Annex 2. Consultations were held in brainstorming mode on identified issues listed in Annex 3.

5.2 Methodology followed for assessment

Initial assessments of water uses/needs in the two basins were accomplished through commissioned study teams. A separate study team based in the basin region was constituted for each of the two basins in order to collect data and information about past, present & likely future situations as also to facilitate consultations. Apart from this, one team in the National Environmental Engineering Research Institute (NEERI) was constituted to study the nature sector and its water requirements in the two basins. One central team in the Indian Association of Hydrologists (IAH) was constituted to work out the water balances and to develop scenarios as also to analyse the results.

For each of the selected basin, an attempt has been made to present the water balances for three situations viz. past (1960), present (2000-1), and future (2025). The information as available in the Government's district Gazetteer was used for ascertaining 'past situation'. For the future, different likely scenarios are proposed to be developed. As a first step one scenario based on "business as usual" was developed, and the analysis of water balance and other results of these scenarios is proposed to be used to develop other more appropriate scenario which could become possible through policy interventions. The general methodology followed in working out water balance was as follows:

A simple hydrologic model depicting the land phase of the hydrologic cycle was developed. A schematic of this model is shown in **Figure 2**. For this purpose, the land surface was divided in accordance with land uses such as forests, pastures, fallow & barren lands, culturable wastes, land not available for cultivation such as roads & habitats, land under water bodies (reservoirs) and land under cultivation. The land under cultivation was further sub-divided into land having irrigation, facilities and land where rainfed agriculture is practiced. In each of these two categories, further sub-divisions according to the prevailing cropping cycles were also made. The complete water balance depicting rainfall, evapo-transpiration, and deep percolation to ground water etc. were modeled for each land use type. For irrigated land use, for each cropping cycle, the application of irrigation both from surface sources as also from ground water pumping, the additional evapo-transpiration due to irrigation and the returns of the applied water which is not used consumptively was modeled. Similarly, the abstraction of water both from surface and ground water for domestic water supply and industrial waters, the evaporation of these waters and their returns were modeled. All available returns were distributed to join the surface water or the ground water. This modeling configuration can be said to be a distributed hydrologic model in as much as the water balance of each land use type is computed separately. However, it is spatially lumped. An advantage of this model is that it

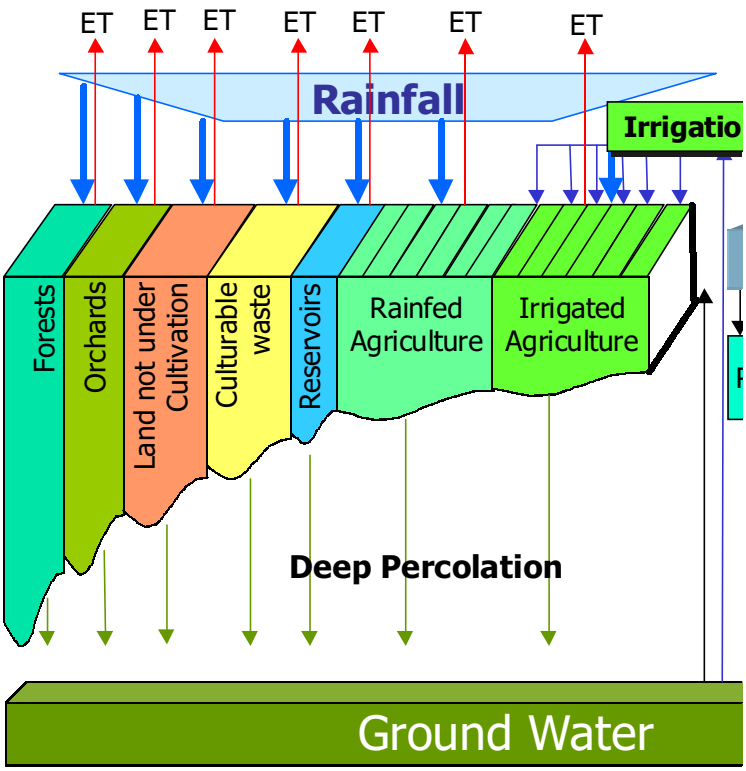

Figure 2. Schematic of Hydrologic Model

affords a full flexibility in changing land uses, cropping patterns, irrigated areas etc. and can monitor consequent hydrologic changes. However, it treats the entire surface and ground water systems as 'lumped' one, and cannot monitor local changes within the modeled basin or sub-basin.

In using the model, the evapo-transpiration from each land use was estimated by using the reference evapo-transpiration (ETo) and crop co-efficient (Kc) values as relevant to the plant type and water management practices. The inadvertent evapo-transpiration which would take place from fallow land as also the land not under a crop during the particular period, through the likely growth of grasses and shrubs etc. was also accounted for, by choosing appropriate Kc values. The additional evapo-transpiration under irrigated condition was modeled in accordance with the FAO practice by considering the effective rainfall and the percolation needs of crops. For paddies which form a major crop particularly in the Brahmani basin a continuous ponding and deep percolation was assumed. The ground water balance implied in the model allowed natural recharge from the rainfall as a small percentage of rainfall, returns from irrigated agriculture and from unconsumed domestic and industrial waters etc. Ground water outflows to the sea through the surface water system (rivers) as also a small ground water outflow directly into the sea was modeled. Ground water withdrawals for irrigation and other uses were also modeled. An approximate verification of the model parameters was obtained for the current situation by tallying the total basin outflow with the known flow measurements at the terminal stations. These parameters were then used for the past & the future situations.

5.3 Summary of assessments

Following is the summary of assessment for two sample basins as presented in the first phase of consultations:

5.3.1 Brahmani basin

The basin is rich in water resources and the per capita availability of fluvial fresh water in rivers and ground is at around 3077 m^3/year. The basin is also rich in minerals as also in forests, which occupy 37% of the basin area. Occurrence of floods, particularly in the deltas due to excessive precipitation is a common feature. On an average, annually a population of 0.6 million and crop production over 50,000 ha in the delta is affected. The Rengali storage has provided some relief in this regard, but has not eliminated the problem. Severe water shortages in spring and early summer also are common. The basin has a considerable potential for development of inland fisheries in reservoirs, ponds, tanks and canals. Irrigation development in the basin is not very large. Currently, a gross irrigated area is only about 0.36 Mha as compared to the gross cultivated area of 1.48 Mha. In particular, the upper area in the State of Jharkhand has little irrigation, and a considerable potential for future development. Also presently, the irrigation is almost entirely from surface sources and the large ground water potential is untapped. The initial assessment of past, present & future water balances as shown in **Table 1** indicates that the requirement of water for food is likely to increase from 12% in the past or 23% in the present to 33% in future. Water for people would also become important due to expected large scale industrialisation & urbanisation. However, even with this increase, quantitatively the use would not be sizeable, but quality concerns would become important. The water available for nature is likely to reduce from an earlier figure of 88% or present figure of 76% to a future figure of 66%. There is a heavy concentration of mineral based industries in the Angul-Talcher region of the basin. The consequent pollution has caused water quality and ash disposal related concerns in the local Nandira stream, but not in the main river. Prompt corrective action by the industries, including adoption of a zero effluent policy by the Aluminium plant and its captive thermal plant has significantly improved

the water quality. However, water quality concerns are still significant. While there will be no difficulty in maintaining the forest evapo-transpiration, the flows to the sea would reduce from the past figure of around 26 billion m^3 or the present figure of 23 billion m^3 to about 19 billion m^3. Since the low flows would still be available both as hydropower draft from the Rengali Power House as also from return flows, this reduction of outflows is hardly a cause for concern. The Brahmani estuary supports, mangroves in the Bhitarkanika sanctuary. There has been a significant reduction in the mangrove area, but this seems to be due to occupation of the land by migrant population. However, the estuarian water quality and its effects on mangroves needs further studies. Also, additional scenarios to avoid possible waterlogging due to large returns to ground water are sought to be developed. These could include scenarios where the paddy area is reduced and crop diversification is practiced.

Table 1. Water Availability and Use/ Need Scenarios in Brahmani basin

(Million m^3)

Description	Past (1960)	Present (2000-01)	Future (2025)
Water available			
• Precipitation	53,011	53,011	53,011
• Net export	(-) 100	(-) 100	(-)1,080
• Return flows from irrigation, domestic/ municipal & industrial uses	550	3,928	9,943
Total available water	**53,461**	**56,839**	**61,874**
Water for food			
• ET from rainfed agriculture	5,670	6,956	5,224
• Rainfall used in irrigated agriculture	309	1,969	5,103
• Withdrawals for irrigated agriculture	416	4,049	10,297
Total for food	**6,395**	**12,974**	**20,624**
% of total available	***12***	***23***	***33***
Water for people			
• Withdrawals for domestic and municipal use	108	325	493
• Withdrawals for industrial use	115	322	1,282
Total for people	**223**	**647**	**1,775**
% of total available	***0.4***	***1***	***3***
Water for nature			
• Evapo-transpiration from forest	13,445	13,275	13,071
• Evapo-transpiration and evaporation from non-cultivated land	7,644	7,308	7,503
• Outflows to sea including low flows	25,754	22,635	18,901
Total for nature	**46,843**	**43,218**	**39,475**
% of total available	***87.6***	***76***	***64***
Total water for food, people and nature	**53,461**	**56,839**	**61,874**

5.3.2 Sabarmati basin

The basin is a water deficit basin having intensive agriculture and industrial development, and large population density. The natural fresh waters in the rivers and ground water indicate a per capita availability of 362 m^3/year. About 52% of the population lives in urban areas. At present, the basin has very large irrigation development. The current gross irrigated area is about 1 million ha out of the gross cropped area of 1.3 million ha. This large irrigated agriculture, in the face of water shortages has been possible through import of surface waters from the adjoining Mahi basin, as also by creating storages in the basin. Another significant facet of irrigated agriculture is that the major part of the irrigation is supported by ground water development which is based both on local overexploitation, as also on mopping up of the returns from irrigated agriculture including those through the Mahi waters. In the Sabarmati basin, the upper areas are showing a significant over-exploitation of the ground water, whereas in the lower areas, where the imported water is being used, a ground water build up is seen. A separate water balance of these areas may be necessary to analyse this situation. The basin supports a comparatively small forest area, which is at 16% of the total basin area. The future scenario developed as "business as usual" is based on further import of waters from Mahi as also from the Narmada basin through the Sardar Sarovar Project. The initial assessment of water balances as worked is shown in **Table 2**. It can be seen that the water for food sector which was already consuming 44% of the total water in 1960, is consuming 53% of the water at present and may consume 56% of water in future. Water for people would vary from 2% to 5%, where as water for nature would reduce from 54% in 1960, or 44% at present to 39% in future. While the evapo-transpiration from the forest could be maintained at present level, the outflows to the sea seem to have reduced considerably from 3.7 billion m^3 from 1960 to 3.1 billion m^3 at present. In the future "business as usual" scenario this outflow could again increase to about 3.8 billion m^3 provided an additional net import of about 1.4 billion m^3 becomes possible. Even then the risk of increasing pollution due to the additional uses would have to be tackled by developing more appropriate future scenarios aimed at either improving ground water balance by reducing returns and withdrawals or based on lower imports and lower level of development.

5.4 Works to be carried out in future in the sample basins

The initial water assessments for the sample basins will further be refined and firmed up prior to the national level consultation, proposed to be held in July 2003. Attempts will be made to prepare assessments at sub-basin level, and at developing seasonal water balances both for normal and deficit years. Outputs of PODIUM and IMPACT-WATER will be incorporated in the assessments. For this purpose, some modifications in the PODIUM to couple it with a hydrologic model are being thought of. Additional future scenarios will be developed based on the projection in population growth and corresponding food requirement, and with the consideration of economic benefits and environmental constraints, in accordance with the basin-wise findings already discussed in para 5.3.1 and 5.3.2. Unfortunately, in absence of a methodology to carry assessment of water needs for eco-system, it has not been possible to project future water needs of eco-system.

6. POLICY INTERVENTIONS SUGGESTED DURING THE CONSULTATIONS

The participants in the consultations were provided with the preliminary assessments in advance. The discussions therefore were very much focussed on the aim of the consultation, namely the status of IWRDM in past, present and the likely one in future. The integrated approach adopted for the first time for the three

Table 2. Water Availability and Use/ Need Scenarios in Sabarmati basin

(Million m^3)

Description	Past (1960)	Present (2000-01)	Future (2025)
Water available			
• Precipitation	16,256	16,256	16,256
• Net import	Nil	1,371	2,716
• Return flows from irrigation, domestic/ municipal & industrial uses	569	3,301	5,215
Total available water	**16,825**	**20,928**	**24,187**
Water for food			
• Rainfed agriculture through evapo-transpiration	5,972	1,243	439
• Rainfall used in irrigated agriculture	642	4,285	4,645
• Withdrawals for irrigated agriculture	781	5,536	8,389
Total for food	**7,395**	**11,064**	**13,473**
% of total available	***44***	***53***	***56***
Water for people			
• Withdrawals for domestic and municipal use	236	598	1,038
• Withdrawals for industrial uses	27	106	260
Total for people	**263**	**704**	**1,298**
% of total available	***2***	***3***	***5***
Water for nature			
• Evapo-transpiration from forest	2,564	2,546	2,596
• Evapo-transpiration and evaporation from non-cultivated land	2,922	3,536	3,037
• Outflows to sea including low flows	3,681	3,078	3,783
Total for nature	**9,167**	**9,160**	**9,416**
% of total available	***54***	***44***	***39***
Total water for food, people and nature	**16,825**	**20,928**	**24,187**

sectors was appreciated by them and they could see for themselves how to improve it. Also they could correctly understand the perceived or real conflicts, hotspots and signs of hope. On the whole, ICID's approach to the issues was vindicated and found logical and accommodative by proponents of all the three sectors. Refinement of the assessments during the next few months will no doubt be helpful for further narrowing of the differences.

Following are some of the conclusions and possible policy interventions as suggested by participants during the basin consultations:

- There is no conflict in availability for use, but there is lack of development to promote rational use for the three sectors.

- In these basins, which are much smaller in size as compared to the nation or even a state, self sufficiency in food grains may not be an important objective, and the use of water for irrigation of cash crops for increased agricultural income could be a viable alternative.
- Inadequate finance for sustenance and requisite development constitutes the main constraints.
- Take up and complete intra-basin and inter-basin development simultaneously.
- Continue emphasis on increase in water use efficiency, participatory irrigation management (PIM) and eventually irrigation management transfer (IMT).
- Evaluate goods and services provided by "Nature Sector".
- Aim at sustenance of nature sector at present level. With increase in water use efficiency, the sector will get increased share in water.
- Assess degradation of water quality due to municipal and industrial uses and agriculture.
- Instead of using the scarce water resources for dilution of pollutants, treat effluents to required standards in order to reduce pollution in rivers.
- Explore possibilities of using treated domestic effluents for irrigation without allowing these to flow to rivers before treatment. Such measures, coupled with augmentation of river flows by imported waters, can significantly improve water quality in the Sabarmati river in the lower portion. (To a significant extent, these partially treated effluents are already being used for irrigation in the Sabarmati basin, but mixing with river waters is also occurring).
- Closely monitor ground water quality and adopt policies, which would prevent its pollution.
- Explore possibilities of using the good quality imported Narmada waters for domestic use in the urban centres in the Sabarmati basin, thus allowing the basin surface water to be increasingly used for agriculture in upper areas.
- In wet basins like the Brahmani, implement policies that would encourage ground water exploitation for agriculture and thus maintain a better ground water balance to avoid waterlogging.
- Explore possibility of artificial recharge to ground water in exploited aquifers.
- Development of rainfed areas to achieve livelihood security and to control migration from rural areas.
- Although rainfed area will be relatively small in Sabarmati basin, it is necessary to develop a strategy to make it more productive so that livelihood of poor can be secured. A concept note in this direction prepared by SOPPECOM, who have been assigned this task, is kept at **Annex 4.**
- A multipurpose mega-project comprising a 40 km long dyke-cum-dam across Gulf of Khambhat is presently under investigation. It will be a terminal reservoir for 3 major rivers of the region viz. Sabarmati, Mahi and Narmada, converting it into a freshwater storage. Irrigation, Tidal Power, Reclamation of saline lands, Drinking water supply and Ease in Transportation are some of the intended benefits. The ultimate study for Sabarmati basin will take a note of impacts of this project.

7. CONCLUDING REMARKS

Evolution of water policies and supporting changes in water policies is necessarily an iterative process. However, collection of existing information both in regard to the hydrologic behaviour of the river basins under human interventions and about the current policies has to form the basis of working out the desirable changes in the policies. Therefore an analysis of water balances to establish the past, present and the likely future situations, to understand the difficulties being experienced at present and those likely be experienced in future, and then to consider possible policy intervention to remove these difficulties seems to be a logical process which needs to be followed. In view of this, the ICID has designed its Country Policy Support Programme (CPSP) in such a way that typical basins would be studied, and the analysis of these results would form the basis of broad consultations both at the basin and at the national level. Policy interventions could result from these consultations. The initial feedback from this process, particularly in regard to the preliminary assessment in the two basins in India indicates that these studies do throw up a number of present and likely future issues which need broad based discussions which may eventually lead to appropriate policy interventions.

Annex 1

SALIENT FEATURES OF BRAHMANI AND SABARMATI RIVER BASINS

Sr. No.	Parameter	Brahmani basin	Sabarmati basin
1.	Length of the river (Km)	461	371
2.	Outfall	Bay of Bengal	Gulf of Cambay
3.	Population (million)		
	(i) Urban	1.252 (15%)	5.99 (52%)
	(ii) Rural	7.205 (85%)	5.45 (48%)
	Total	8.458	11.44
4.	No. of States covered by the basin	3 (Jharkhand, Chattisgarh & Orissa)	2 (Rajasthan & Gujarat)
5.	Catchment area (Mha)	3.92	2.17
6.	Climate	Tropical and Humid	Semi-arid
7.	Average annual rainfall (mm)	1304	750
8.	Soil type	Red-yellow, mixed red and black	Black, alluvial and sandy
9.	No. of tributaries	28	5 (major)
10.	No. of sub basins	6	3
11.	Total annual precipitation (Mm^3)	53,011	16,256
12.	Arable area (Mha)	2.0	1.33
13.	Cultivated area (Mha)		
	(i) Net	1.243	1.154
	(ii) Gross	1.476	1.293
14.	Irrigated area (Mha)		
	(i) Net	0.253	0.84
	(ii) Gross	0.358	1.012
15.	Net rainfed area (Mha)	1.000	0.281
16.	Forest area (Mha)	1.415	0.345
17.	Permanent pastures (Mha)	0.132	0.075
18.	Culturable wastes & fallow	0.937	0.381
19.	Land not available for cultivation (Mha)	0.138	0.228
20.	Major and medium irrigation schemes	11	10
21.	Major industries	Steel, Alluminium, Fertilizer	Textile, Chemical, Dairy

Annex 2

TOPICS PRESENTED AT THE BASIN LEVEL CONSULTATIONS

(a) Specific Topics

1. Water Need Assessment in Brahmani basin
2. Water Needs for Forestry and Mangroves in Brahmani basin
3. Integrated Water Resources Development and Management (IWRDM) for Brahmani basin
4. Water Needs Assessment in Sabarmati basin
5. Sabarmati Case Study: Issues and Views
6. Future Plans on Use of Narmada Water in Sabarmati basin
7. Water Needs for Forestry and Mangroves Development/Regeneration in Sabarmati basin

(b) Common Topics

1. Regenerative Rainfed Agriculture
2. Treatment and Reuse of Industrial and Municipal Wastewater: Status and Strategy
3. Wastewater Treatment and Reuse – a Case Study of Pune

Annex 3

ISSUES DISCUSSED IN BRAINSTORMING SESSIONS DURING BASIN CONSULTATIONS

1. Water for food

1.1 Rainfed agriculture

- Role of watershed development in productivity
- Role of rain-water harvesting in productivity
- Role of rainfed agriculture/ moisture augmentation
- Groundwater recharge plans/ reduction of dependence on GW
- Command/ Catchment users organisations. PIM/IMT

1.2 Irrigated agriculture

- Adoption of volumetric supplies and micro/ precision irrigation
- Use of Narmada waters
- Additional storages and area that can be irrigated
- Conjunctive use of surface and ground waters
- Volumetric supplies and pricing of irrigation water
- Status & Role of WUAs, PIM in IMT, and WUE, Privatization
- Water-saving plans
- Crop diversification, value addition, agro-industries
- Fish culture in irrigation systems

2. Water for people

- Urban growth, treatment/ reuse of wastewater for irrigation
- Zero-effluent policy for industries
- Community participation & local actions
- Investments

3. Water for nature

- How to reverse deforestation?
- Plans for increasing forest cover
- Irrigated forestry
- How to conserve mangroves?
- Fish culture in reservoirs and estuary
- River water quality & riverine eco-system
- River front development

4. Past, present and future sustainability

- Adequacy, import, export of water
- Role and plans for River Basin Organisation
- Status of integration of 3 sectors - food, People, Nature
- Flood control & management
- Energy needs for groundwater pumping
- Role for Bio-Technology
- Policy interventions, lessons for deficit basins
- Increasing investments in water sector

Annex 4

DEVELOPMENT OF STRATEGY FOR RAINFED AREAS IN SABARMATI BASIN

Datye, K.R.*

In rainfed areas, while developing watersheds with small water harvesting structures and ground water recharge, the most important requirement is to ensure that minimum domestic water needs of the population and the livestock are satisfied. This should be the first priority in any water resource planning. Dispersal of water resource development goes a long way towards providing for basic needs of each household. Further, priority needs to be given to creation of a groundwater reserve sufficient for this purpose and capable of being regenerated in good years. In a bad year the requirement can be halved and then the reserve should be able to cover consecutive bad years. The quantum of groundwater reserve to be maintained is not a parameter that is technically determined. Within the limits of the potential to create the "reserve", a social decision has to be arrived in a participative manner on the basis of adequate information.

Activity of water resource augmentation to provide for basic needs should be dovetailed into the process of building institutions to regulate water use and reserve ground water. This may call for restriction on extraction of water for cash income generation. In some cases even food grain production may have to be restricted. A facilitating legal frame work has to be created and a negotiating process needs to be set up to establish the basis of compensation or other benefits to be given to the well owners who give their consent to the regulation of the ground water use.

Matching needs and availability: taking priorities into consideration

Generally, we may assume that a high proportion of the surface flows may be intercepted with proper planning and placement of water harvesting structures. However, the situation is not that simple in respect of groundwater interception. Accordingly, sufficient margin should be available with regard to the provision of water for various needs and the availability assessed with the assumption that 80%of the surface water and 75% of the groundwater are intercepted. The pattern of resource availability in two sample study village areas of Sabarmati basin is given **Table 1**.

Table 1. Resources availability in Bhiloda Tehsil in Sabarmati basin

Name of the village	Mehru	Abapur
Total land area (Ha)	565	371
Total population	1339+	485+
No.of households	239	87
Forest area (Ha)	253	270
Agriculture land (Ha)	225.18	100
Total number of tube wells	98	50
Tanks	1	–
Ring bore wells	7	–
Irrigated area (Ha)	16.10	25
Present irrigated area (Ha)	10	10

+ As per 1991 census

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An assessment of water requirements for livelihoods needs is presented in Table-2.

Table-2. Assessment of livelihood needs and corresponding water requirements

Livelihood Component	Area/unit (Ha)	Water application (mm)	Water use m^3	At Source water require-ement (m^3)
Irrigated crop land(food security)	0.2	200	400	600
Irrigated forestry/ fodder	0.25	200	500	750
High value trees	50	2 m^3/tree	100	150
Intensive cultivated crops	0.05	400	200	300
Drinking water and domestic water needs			200	300
Water for livestock			200	300
Total			**1600**	**2400**

Thus, typically, 2400 m^3 of water is required to meet the livelihood needs of a rural family. The livelihood requirements need to be matched with the availability of water resources during the corresponding year.

Optimising water use, storing and pooling food grain and surplus biomass

Except for purposes like cattle and domestic water needs, water is mainly used as an input for the production of food grain, commercial crops and biomass produced and processed locally. Shortfalls in the bad years can be met by utilising the variable water available in the good years for biomass production and thereafter storing and pooling the food grain and biomass. Processed and unprocessed biomass, managed as biomass banks, can take care of various needs by making it available for income generation activities. Pools managed as grain banks and fodder banks, can go a long way towards ensuring adequate food and fodder availability in the bad years.

Best possible use of irrigation water can be made by using it in combination with soil moisture conserved in the field. High levels of sustainable productivity in the use of available water can be achieved by perennial trees and shrubs, if attention is given to soil improvement and integrated use of chemical and organic nutrients. Small water harvesting structures can serve as buffer storages and for recharge to facilitate dispersal of water facility and delivery of water on demand. This will enable the user to take decisions regarding the optimum water use. Collective regulation of land and water use for optimising biomass production and subsequent biomass storage, pooling and processing activities are important for the success of the strategy.

It is necessary to take note of the limitations of ongoing watershed projects with regard to raising water use efficiency and productivity enhancement by limited use of chemical fertilizer in combination with organic inputs. Importance is not usually given to making the best possible use of limited irrigation with soil moisture conserved insitu and its productive use by perennial trees and shrubs.

An assessment of water and biomass balance for two sample villages viz. Mehru and Abapur covering areas of 500 each in Bhiloda Tehsil of Sabarmati basin is shown in **Table 3.** .

Table 3. Approximate Water and Biomass Balance per Household (hh)

Average annual rainfall	=	700 mm
Average watershed area per household	=	3 Ha
Usable water 50 %	=	350 mm
Utilized runoff 90 mm 75 % of average @ 3 Ha /hh	=	270 Ha-mm
Ground water recharge 20mm for basic needs @ 3 Ha's/hh	=	60 Ha-mm
Water utilized for commercial purposes 30 mm @ 3 Ha/hh	=	90 Ha-mm
Net water available for agriculture and biomass production	=	(350x3) - 90 - 60
	=	900 Ha-mm
Water required @20 kg/Ha mm for food security	=	300 Ha-mm
Balance water available for biomass and other crops	=	600 Ha/mm
Water required at 20 kg/mm productivity for irrigated forestry	=	200 mm
Water required @10 kg/Ha-mm for rainfed areas	=	200 Ha-mm
Balance left for commercial crops	=	200 Ha-mm

In years of scarcity, hardly any water will be available for commercial crops and wheat area may have to be restricted. Shift to perennial trees and shrubs is essential.

A conclusion emerged that the average available water is sufficient to produce the required fodder, food grain and pulses for food security and generate biomass surplus which is sufficient for income stability through value added processing. However, presently the rainfed areas are not able to provide for food security and there are severe fodder deficits in the years of scarcity. A quick assessment of the water and biomass balance brings out the large gap between the present carrying capacity of the ecosystem and the potential of the area to provide for food security and generate non-farm income.