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RESERVOIR FISHERIES IN LAND/WATER ECOSYSTEM PLANNING FOR RESETTLEMENT

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For many developing countries, especially in Asia, damming of tropical rivers for hydropower and developing modern irrigation systems for intensifying agriculture are necessary to meet the urgent energy and food needs of burgeoning populations.

Many nations have little or indigenous oil or other energy resources, or have few funds to increase oil imports or initiate nuclear power development. In addition, both coal-fired power plants and nuclear energy are increasingly seen by many nations to be unsustainable, with unforseen economic and environmental impacts on not only present but also on future generations and environments.

... technical and engineering problems are no longer constraints - rather, resettlement and environmental concerns are the major obstacles to hydropower development.

For the vast majority of developing nations, hydropower is viewed as a clean energy source. In a modern context, technical and engineering aspects of river basin development projects are straightforward. Today it is the persistent problems of resettlement and the resulting economic and social disruption that accompany the advent of a new storage reservoir on the landscape that deter development of hydropower resources. The development axis has changed - technical and engineering problems are no longer constraints - rather, resettlement and environmental concerns are the major obstacles to hydropower development.

In scenes repeated throughout the World, a new reservoir floods rich agricultural lands that have been settled by traditional people for generations. This new ecosystem is, more often than not, an unwanted, unfamiliar alien. Virulent conflicts develop that pit local people against national interests, and rural, self-reliant traditions against national growth and urban demands.

Viable solutions must be found to this development conundrum in order to create new productive enterprises and alternative livelihoods for the hundreds of thousands of involuntarily displaced people, and to ameliorate environmental degradation from poorly planned hydropower developments. Solutions must be found that are both technically feasible and sustainable; solutions that are socially acceptable and environmentally appropriate.

... complex, dynamic aquatic ecosystems have been created.

Such solutions require a new view of the situation, one that treats reservoirs as ecological resources far more valuable than just water storage units. From an ecological perspective, humans have created a dramatic, unprecedented reordering of nature. As a result, a suite of complex, dynamic aquatic ecosystems have been created. With proper planning, these new ecosystems are potentially much more valuable than their contribution to national energy or agriculture production. Indeed these new ecosystems offer to the people who can adapt to living and working with them, vast new opportunities to increase employment opportunities in rural areas and to dramatically increase production of aquatic protein.

As a result, the planned, integrated development of reservoir ecosystems may not only ameliorate the negative social consequences of dams, but may enhance the overall economic benefits from hydropower and irrigation projects in developing counties.

ECONOMIC BENEFITS

... income from fisheries in reservoirs has in some years exceeded income generated from sales of electricity.

Use of integrated reservoir fisheries and aquaculture development as a tool for large-scale population resettlement and environmental rehabilitation have received little attention despite data from a growing number of projects that have reported unexpectedly high returns from fisheries. Indeed, in some years, income from fisheries in reservoirs has exceeded income generated from sales of electricity.

For example in 1978, the Ubolratana Reservoir in Northeast Thailand produced fish from capture fisheries worth 40 million Baht while electricity sales generated just 30 million. ***The Saguling and Cirata hydropower reservoirs in West Java, Indonesia flooded an estimated 12,300 ha of which 5,783 ha were rich ricelands, with an estimated financial loss to farmers of $5.21 million/year. However, by 1993, fish cages in the reservoirs produced over 10,000 tons of fish worth an estimated $10 million year.*** Consultants recommended that 1% of the total reservoir surface area (1 unit=4 cages/ha of water surface) be developed for cage aquaculture, or 12,300 cage units at maturity of the industry. If each of these cages produced a conservative estimate of 3 t/year, (12 tons/unit) the resulting 147,600 tons would generate revenues from fish of $147.60 million/year at 1992 fish prices.

Data from other regions of the world indicate the growing economic and social importance of reservoir fisheries. In Africa, reservoir fisheries are estimated by FAO to supply about 10% of the total inland fish supply. Fish sales from Lake Volta have frequently exceeded revenue obtained from the sale of electricity. Fish yields from Lake Kariba have exceeded even the most optimistic pre-inundation estimates.

Although less well known, similar successes have been reported from reservoirs in Latin America, especially in Brazil and Cuba.

SOCIAL AND RESETTLEMENT

Simply monetary compensation of displaced persons is unacceptable if an approach is available to:

(a) restore natural systems;
(b) preserve available traditional knowledge of natural ecosystems management, or if;
(c) programs can be created to develop new, economically-viable productive enterprise systems.

Such an approach would foster close interactions with the impacted communities to extract traditionally proven and modified technologies (technologies modified to the new resource base), and to create new systems that use as much as possible of this knowledge.

Development of integrated, land/water interactive systems shows such potential. These systems intensify the use of the reservoir water surface to assist in the restoration of economic and social livelihoods of displaced persons to (at least) their former levels.

... the displaced people evaluated cage aquaculture as easy and enjoyable work, allowing much leisure time, in contrast to the back-breaking toil they performed in rice and vegetable fields;...

The Saguling-Cirata (Indonesia) project was the first in the world to demonstrate the potential for a planned, "integrated ecosystems" approach to resettlement by using a land/water ecosystems development approach. Such an environmentally-oriented resettlement effort utilized fully the new water surface area for aquaculture and fisheries, and developed supporting production, economic and marketing infrastructure. These systems developed as part of an overall regional development effort which has promoted local recycling of resources from one productive enterprise to another and the development of complex interactions.

In Indonesia, some interesting social development have occurred using these approaches:

(i) dramatic acceptance and change in livelihoods from "land-based" to water-based" cultures;
(ii) surveys have shown the displaced people evaluated cage aquaculture as easy and enjoyable work, allowing much leisure time, in contrast to the back-breaking toil they performed in rice and vegetable fields;
(iii) most displaced persons who increased their incomes and status have been involved as owners or workers in water-based, environmentally-oriented businesses,
(iv) integrated fisheries systems increased the numbers and diversity of jobs, and increased the number of higher paying jobs. This occurred in an area where the lack of growth in rural jobs in rice and vegetable agriculture was a major concern in the 1970's, and where it was forecast the labor absorption capacity of rice-based agriculture systems was virtually nil; and
(v) new forms of community organization have arisen that are knowledge-based, relying on skills and education.

Fisheries cooperatives, schools, a labor service, and a fish farmers' organization are active.

... integrated development of reservoir fisheries show an exciting new way to create alternative livelihoods for displaced persons within the reservoir region.

In many areas of the world, fisheries is a traditional integration accomplished as part of an overall evolution of complex agroecosystems developed to meet human needs. What is exciting about the Indonesia example is that as many new jobs have been created in the "spin-off", or support industries, as created in the direct ownership of new fisheries enterprises themselves. ***From a total of 41,715 person displaced when flooding Saguling and Cirata reservoirs,it has been estimated that 6,000 to 7,200 are employed directly in the reservoir fisheries enterprises, and an additional 22,000 to 31,200 earn livelihoods in the new support industries created.***

The planned, integrated development of reservoir fisheries show an exciting new way to create alternative livelihoods for displaced persons within the reservoir region. Such developments require a great deal of preparation and planning, however, since not only the water-based systems must be considered but also the land-based infrastructure, seed, feed and other market and agriculture support systems must be planned for as vital components. However, as demonstrated in the example of Saguling and Cirata in Indonesia, if a number of conditions exist, integrated fisheries development may enhance greatly the overall economic and social benefits from hydropower and irrigation projects in many developing countries.

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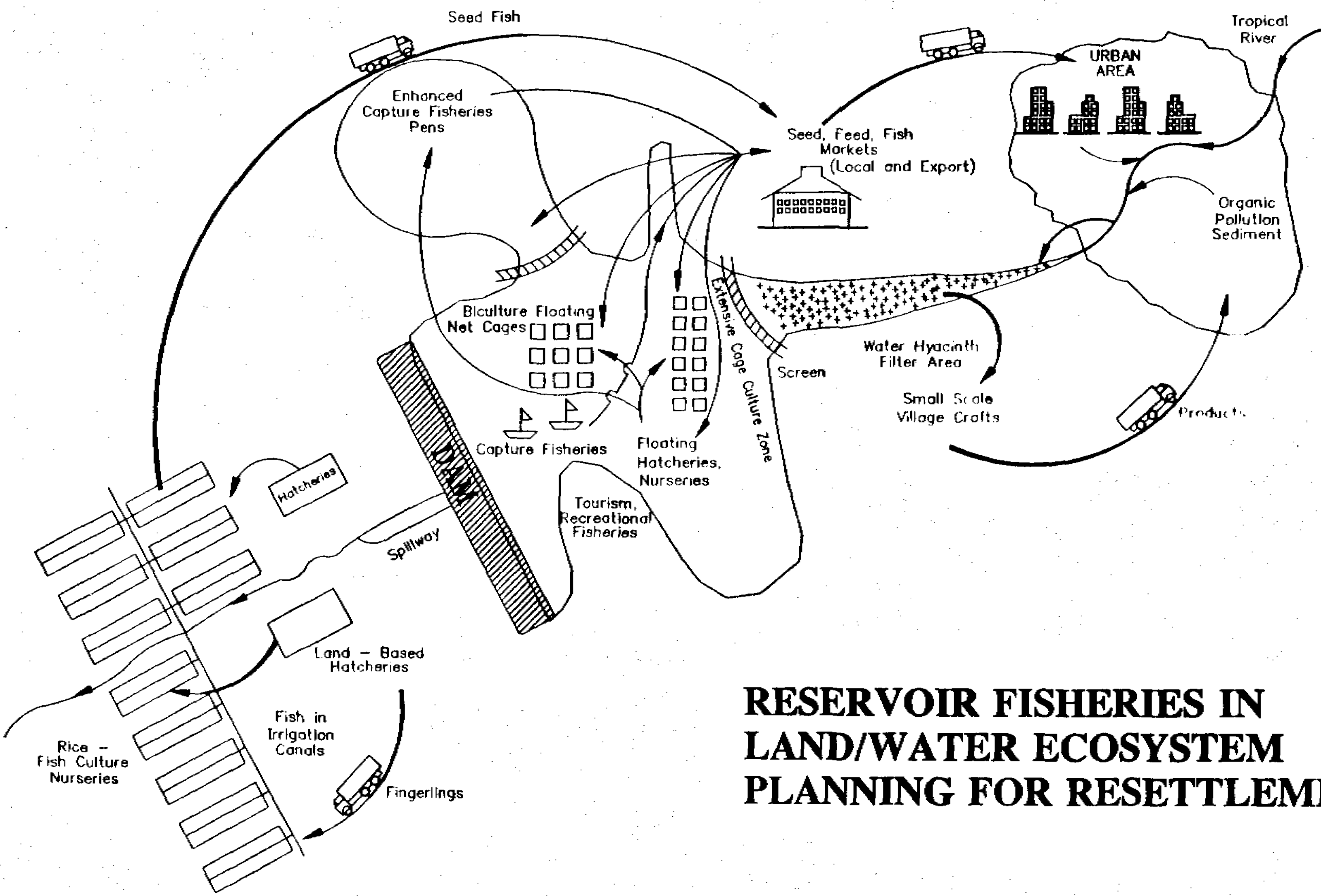

RESERVOIR FISHERIES IN LAND/WATER ECOSYSTEM PLANNING FOR RESETTLEMENT

Outline
REVISED DRAFT
Participation Handbook: Irrigation Section November 18, 1993

I. Introduction

A. Definition of Participation in the Irrigation Sector

To successfully utilize popular participation, projects must support beneficiaries in the formation and design of their own groups and create an institutional environment where successful interaction can be initiated and continue take place on a sustained basis between the project and these groups.

B. Why participation in the irrigation sector?

Irrigated agriculture, with exception of a very few specialized types of irrigation-notably tubewells-is itself a social occupation which even at its simplest level involves the collaborative involvement of farmers in the capturing and distribution of water. Traditional modes of participation have a long history in irrigation going back many centuries. We probably have had more experience with participation in irrigation than in any other area of development. This experience has provided both qualitative and hard quantitative evidence for its efficiency and high rate of return; this is briefly discussed. In addition, irrigation is often made up of large, diverse and scattered elements which make it difficult for governments to go it alone without learning to utilize all assets; this means, in part, learning to work with farmers.

C. When participation: preconditions for participation.

Attitudes toward popular participation must be assessed among four key institutional parties before one can decide whether the preconditions exist for participation in the irrigation sector. These parties are the Bank and its Task Manager, the senior policy/ decision-makers, the field technical level and the farmers. Discussion focuses on how to determine these attitudes and the their effects on project development.

C.1 The Task Manager
C.2 The Policy Makers
C.3 The Field Technical Staff
C. 4 The Farmers

D. Limitations of Participation

The general rule of thumb has it that farmers have a capacity to manage certain limited areas of irrigation (entire systems for minor irrigation, below the secondary level for larger systems). As experience grows, however, it is apparent that many of these limits are in the minds and perceptions of policy-makers, not in the abilities of farmers. Many of the limitations we have have often ascribed to farmers, either consciously or unconsciously, now seem more perceived than real. Although it may be true that all elements of irrigation cannot be handled through participation, it is certain that we haven't yet reached the limits of this approach and can benefit by widening our expectations. The example of the Mexican reform of the irrigation sector shows that given the proper institutional environment, the ability of people to take increasing responsibility for their own irrigation systems is very great.

II. Lessons Learned

A. Changes in Approach to Irrigation

Four major irrigation projects are briefly reviewed, showing several common threads about what kind of support is needed to design and implement successful participatory irrigation projects. Among these are: (a.) that these projects take a fair length of time (evidence of time needed for this versus other approaches), (b.)they require a special effort, that is specific activities to help farmers develop their organizations and develop their capacity for effective interaction with the government sector; (c.) that each program has to be designed to fit the cultures and conditions local to the project area, and that elements which are brought in from the outside often must first be carefully adapted to such local conditions and (d.) institutional and policy support is an essential requirement for success.

B. Case Studies in Participation

B.1 The Philippines

The Pre- Bank Period: Projects and origins of the methodology in the Philippines Bank projects.

B.2 Pakistan (USAID)

Farmer contributions, conditions for action and legal change, the support of existing Warabani groups to serve new purposes.

B.3 Nepal

The strong tradition of cooperation in Irrigation in Nepal, the origins of adapting this tradition to a participation methodology in USAID/IMP. Public sector irrigation as a participation methodology laboratory. Irrigation Sector Sector-wide support to small- scale projects.

B.4 Mexico

Large-scale reform in the irrigation sector: participatory projects and the salutary effect of strong government support.

(suggested: additional case studies from Africa and Eastern Europe, yet to be determined)

III. Elements for Success

A. Working with the Local level

Our willingness to understand the human element and integrate it into the development process is the basis for successful demand-driven development projects. This has improved over the last two decades. This section presents specific suggestions of: (a.) what the Task Manager can do, based on this understanding, to help develop participatory organizations which can take an active role in program development and implementation, (b.) who he/she can work with, and (c.) what he/she can do to counter opposition from entrenched interests.

A.1 Working with Participatory Organizations

A.2 Developing Strong Organizations

A.3 Organizations and Responsibility

A.4 Field Technical Staff: Dealing with Opposition

B. Institutional Intermediation: Working with Government Agencies, NGOs and Local Governments

One of the most important elements for success is the necessity for generating a clear strategy for participatory programs and a detailed program. Part of this generation requires inputs from farmers and their participation from the beginning of the project and throughout its implementation. The discussion stresses: (a.) ways for the Task Manager to support this "participatory" planning process, and (b.) ways he/she can bring in various local institutions, government organizations and NGOs to help maximize farmers' continued collaboration.

B.1 Generating Clear Plans and Designs: Institutions Design Support

B.2 Selection of Institutions Organizers

C. Policy Level: the Enabling Environment

Developing effective field-level programs is often not sufficient to develop a stable supportive institutional environment to ensure success for the participatory approach. This section shows what the Task Manager can do to help develop a strategy which fine tunes and draws lessons from the field approach, learns from pilot programs to allow larger project applications, and leads to improved national policies.

C.1 Generating Borrower Committment and Capacity

How the Task Manager can advise in all possible borrower stances on the continuum from total refusal to accept a participatory approach to a strong national committment to this method.

C.2 Improving the Task Manager's Commitment

C.3 Using Bank Procedures to Support a Participatory Approach

C.4 Moving from Pilot Programs through Projects to National Policy

IV. Bank's Work Cycle "How to Steps" for Each Stage.

The following presents a series of specific "how to steps" providing Task Managers with landmarks on a potential road map to design and implement participatory projects and the financial costs of taking these actions.

A. Sector Work and Policy
B. Identification
C. Preparation
D. Appraisal
E. Negotiations
F. Implementation
G. Monitoring and Evaluation

V. Indicators

A discussion of indicators that a Task Manager can use in his supervisions to determine if participation is actually occuring in an irrigation project.

VI. Resources in the Bank

A directory of resources for participation in irrigation within the Bank.

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PROMOTING PRIVATE IRRIGATION DEVELOPMENT: THE IRRIGATION SECTOR PROGRAM EXPERIENCE IN NEPAL

by Richard Reidinger and Upendra Gautam[1/]

Abstract

In 1988, Nepal embarked on development of an Irrigation Sector Program. The key ingredients of the program are direct farmer participation in irrigation development and establishment of private Farmer Irrigation Associations. Results so far indicate that private sector farmer participation has had a positive impact on implementation and sustainability of irrigation projects and can provide useful lessons.

Introduction

With a per capita annual income of some US$170, Nepal is one of the poorest countries of Asia. As a small country landlocked between giants India and China and with few natural assets except abundant water, Nepal faces immense and unique challenges to "get development moving." Nevertheless, the country has recently embarked on a highly innovative, long-term effort to promote private irrigation development through establishment of an "Irrigation Sector Program." The program assists small and medium sized Farmer Managed Irrigation Schemes (FMISs) which are indigenous in Nepal, and farmer-group participation is the kingpin of the program. Results so far have been positive and demonstrate that (a) direct involvement of farmer beneficiary groups from the earliest stages of project formulation to completion can play a key role in success; and (b) the necessary skills and capabilities exist or can be established fairly quickly to implement participatory irrigation development. The purpose of this paper

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is to summarize the process through which these results were obtained and to draw lessons which may be useful elsewhere.

Background and Setting

Irrigation Sector Program. In early 1988, His Majesty's Government of Nepal (HMGN) requested donor support to start the Irrigation Sector Program. Until the mid-1980s, both donors and government had emphasized public sector irrigation schemes which have proven difficult to implement and operate. In a shift in policy, HMGN decided to promote private sector irrigation development, focusing initially on private farmer managed irrigation, which accounts for 70-80% of Nepal's existing irrigation and is based on a strong tradition among Nepalese farmers to develop and manage irrigation cooperatively. HMGN wished to capitalize on this tradition, and to use it as a vehicle both to improve irrigation performance and benefits and to reduce the financial burden of irrigation development and operation on government.

In response, the World Bank included the Irrigation Line of Credit (ILC) Pilot Project to assist FMIS in Nepal's Western Region as a separate component under two large-scale irrigation projects in 1988 and 1990. Although designed as a pilot project, the investment resources allocated to ILC were substantial, totaling nearly US$20 million. Technical assistance for the Sector Program was funded by UNDP through two closely-linked Irrigation Sector Support Projects (ISSP), one executed by the World Bank directly and the other by the Asian Development Bank through a consultant firm.

Major objectives of ILC and the World Bank-executed ISSP are to prepare a full-scale Irrigation Sector Project (ISP) for Bank financing in 1994, and to develop and test a working model of the Sector Program in preparation for ISP and other future investments. A key requirement of the preparation process is institutional development and change in the Department of Irrigation (DOI) to support demand-driven irrigation development according to Sector Program principles based on farmer participation, and to establish the necessary skills and procedures for implementation. As with many such engineering and construction agencies, DOI had virtually no capacity or innate interest in farmer participation. ISSP has sought to develop, test and install in DOI the processes, procedures and tools to support effective farmer participation.

Implementation Performance. The results of this approach as applied under ILC have been encouraging. In the first two years of operation, some 43 ILC surface subprojects were completed out of a total of 61 subprojects processed and approved for implementation, and 81 tubewells were drilled. Altogether, these subprojects serve an area of some 3,400 ha and about

4,500 farm households in eight districts. Subprojects include new construction and rehabilitation for surface schemes and construction of new shallow, medium and deep tubewells.

This is exceptional performance, especially considering the relatively poor record of similar projects in Nepal in the past and the formidable, new demands placed on both the farmers and DOI. To participate, farmer groups have to agree to form statutory Farmer Irrigation Associations (FIAs), contribute to construction costs, and take full responsibility for operation and maintenance (O&M). And DOI staff have to implement with the full involvement and consent of the farmers concerned. Experience to date with ILC indicates that farmers are enthusiastic about the program, ready to cooperate and contribute together, and in fact beginning to drive the program. And DOI field staff at the district and regional levels have shown good capacity to implement the program with, at this stage, suitable guidance and specialized technical assistance. The primary shortcomings concern central DOI and are due mainly to inadequate administrative functions, weak performance motivation and accountability, poor environment for decision-making, and inefficient budgeting and funding channels. The initial elements of institutional reform and strengthening are underway to correct these shortcomings.

Program Objectives and Criteria

The overall objectives of ILC are to: (a) establish a sector program approach to irrigation development in place of the "project-by-project" approach of the past, and to enable large donors to assist small schemes; (b) make the program as demand-driven as possible based on local felt needs and demands; (c) develop, test and establish effective subproject selection criteria and implementation procedures; and (d) reduce the burden of irrigation costs on the government budget. Subproject selection and implementation criteria cover location, farmer requests, economic viability (10% minimum), construction timetable, FIA registration and agreement to contribute and take over O&M, and environmental assessment.

Setting the Stage for Implementation

HMGN/DOI Actions. In preparation for implementation of ILC, HMGN and DOI introduced a number of major institutional changes which included: (a) establishment of District Irrigation Offices (DIOs); (b) provision of Association Organizers; (c) promulgation of an Irrigation Working Policy defining the program; (d) promulgation of an irrigation regulation and directives enabling establishment of FIAs as legal, corporate entities; (e) establishment of a Mobile Irrigation Team in each Regional Irrigation Directorate; (f) establishment of Regional Appraisal Committees (RACs); and (g) establishment of an Approval and Coordination Committee

(ACC) at the ministry level. These actions show strong, policy-level support for the program.

Technical Assistance. The approach necessary for ILC implementation was new to farmers as well as to DOI personnel. Consequently, a new-style of technical assistance was also needed. This was provided through ISSP and ILC together. Expatriate and national consultants were engaged as advisors to assist DOI in ILC implementation. Assistance was through both traditional means such as preparation and feasibility studies and training; and through more institutionally innovative methods of teaching DOI field staff Sector Program/ILC implementation techniques through "learning by doing." In this process, ISSP advisors worked closely with DOI field staff to assist and fill temporary "gaps" where needed, but they did not actually do the work in place of DOI staff, nor did they have any responsibility for implementation. Together, ISSP and ILC became in effect a massive "on-the-job" training program for the Sector Program in preparation for ISP.

Establishing the Subproject Cycle

A key requirement for ILC was to establish a formal "subproject cycle." This was needed to implement the agreed standards for subproject selection and implementation, and was intended to become standard operating procedure in DOI for the Sector Program. The following subproject cycle steps were established in DOI through a self-corrective, iterative process and used for each ILC subproject: (a) identification, including dissemination of information on ILC and direct farmer applications for assistance through written request signed by two-thirds of the farmers and contribution of "earnest money" in cash; (b) preparation, in which the farmers and DOI staff conduct a field survey of needs and DOI prepares designs and cost estimates; (c) appraisal by RAC and approval by ACC to ensure that required technical and economic standards are met; (d) farmer organization and participation, in which DOI Association Organizers help farmers organize and register their FIA, arrange the FIA contribution and sign a formal agreement with DOI for construction; (e) construction, which is carried out by farmers and contractors under the joint supervision of FIA leaders and DOI engineers; and (f) commissioning and completion, including "walk-through" by the FIA and DOI and certification that all works meet specifications. The FIA then assumes full responsibility for the completed subproject. Previously, such projects were selected and implemented on an ad hoc basis and rarely completed.

Strengthening Private Sector Organizational Resources

The sector approach to irrigation development as outlined above has successfully strengthened and upgraded local organizational resources in the private sector through establishment of effective FIAs. Some 70 FIAs have been formed in the process of ILC implementation. They have legal standing as autonomous corporate entities and have proven to be a substantial asset for ILC implementation. Many are complex, having several tiers depending on the type, size and layout of the irrigation system around which they are formed. Within the ILC framework, FIAs have learned to participate effectively in the development process.

The FIAs constitute a potent private sector asset for irrigation development and have demonstrated the benefits of direct farmer participation. FIA ownership and oversight has improved the quality of construction. Direct FIA contributions have saved HMGN about 15% of the capital cost, and FIA's have assumed O&M costs estimated at about half that amount annually while at the same time providing better service to members. Farmer involvement in selection of contractors has provided a much needed element of transparency in the mobilization and use of agency financial resources. And FIAs have supplemented scarce DOI technical manpower resources and been a key factor in ILC's speedy progress. In short, the Sector Program participatory approach has produced a better product at less cost.

Indications of the organizational strength of the FIAs come from the techniques they use to strengthen their financial base. These include collecting membership fees from all users of the system, collecting ad hoc contributions for such purposes as the establishment of FIA offices, penalizing members who fail to abide by the rules and regulations set by the FIA, earning interest on loans the FIA provides to members from the common fund, and charging fees for FIA services to members. FIAs have also begun to exercise their organizational strength outside the domain of irrigation through, for example, development of local leadership, strengthening of discipline (e.g., through control of grazing), resolution of local conflicts, information collection and dissemination, construction activities (e.g., village school renovation), promotion of environmental protection, and mobilization of resources outside the community (e.g., loans from the Agricultural Development Bank).

Although focused on irrigation, the FIA concept has potential for application in other spheres of rural development. In ILC areas, more local, private resources are now available which can enable the private sector to assume a larger role in development, and communities have learned the techniques and benefits of joint participation. This can help improve the efficiency of government resource utilization by providing agencies with ready access to local leadership and information and less need for involvement in local conflict management.

Conclusion

The Sector Program approach has engendered behavioral changes in both farmers and agency personnel through legal, organizational and procedural reforms. Farmers have become more responsible for their own well-being, and agency personnel have become more responsive to the interests of farmers in the development and management of irrigation systems. It may be too early to credit the sector approach with all of the development achievements hoped for. Nevertheless, the experience gained thus far suggests that there has been a significant move in the right direction to generate, mobilize and upgrade local private sector resources and apply them effectively in all stages of program implementation. The Irrigation Sector Program not only establishes the conditions essential for rural welfare improvement and modernization of an agrarian economy, it also creates a self-sustaining, private sector capability for farmers to continue the process themselves.

A number of factors account for this achievement and can provide some lessons for other programs. The program was designed and implemented on a large scale but as a pilot scheme, which ensured maximum flexibility, self-correction and adaptability for testing and wider application in real-world situations. The government provided consistent policy-level support, including promulgation of necessary regulations and directives. Technical assistance was kept to a minimum to avoid the creation of unsustainable implementation processes, and it did not substitute for agency staff or leadership. A new generation of leaders and staff in DOI and in the private sector found in the program a means to develop and express their creative managerial abilities, and were encouraged to do so under the program. Farmers were given an opportunity to create, upgrade and modernize local physical and organizational resources; these resources had progressively deteriorated under the traditional supply-driven development process due to increasing beneficiary dependence on the public sector and poor public sector management. Technical assistance for institution building (ISSP) and development investment (ILC) was tightly integrated and complimentary; and it was executed and managed directly by the Bank, which provided a better understanding for the donor agency and enabled a more effective and frank dialogue on key institutional issues and constraints during the ISP preparation process. Finally, ILC itself was designed as a comprehensive package of assistance comprising social, physical, environmental, legal, procedural and organizational aspects, rather than a narrow set of design and construction activities for irrigation works.

INFRASTRUCTURE NOTES

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WATER AND SANITATION SERVICES FOR THE URBAN POOR IN BRAZIL: THE PROSANEAR APPROACH

A. Mejia, L.C. Tavares, A. Bakalian, V. Jagannathan

Recent experience suggests that residents of low-income urban settlements are willing to pay for water and sanitation services and participate in the decision-making process. This note briefly describes the design of PROSANEAR, a Bank-financed project in Brazil which promotes low-cost appropriate technologies and community participation.

Low-income settlements in developing countries are growing at 3-4 times the rates of urban cores. Residents of these areas are typically poor migrants from rural areas and lack adequate basic services. These settlements are often chaotic in nature and sometimes occupy the high risk areas of the city such as steep slopes and flood plains. Public utilities, even in well-off cities move only reluctantly to expand services to these areas. This reluctance is often attributed to the unplanned nature of these settlements, the poverty of the residents and therefore (assumed) inability to pay for the services. Given this prevailing culture in many large public utilities, the Bank's involvement in water and sanitation services for these areas has been primarily through urban development projects. However, experience gained in the 80s indicates that the residents of low-income settlements are willing to pay for services and also participate in the entire process. In this note, we describe the design of a large Bank-financed water and sanitation sector project in Brazil (PROSANEAR) where the target population is the urban poor.

THE PROSANEAR PROJECT

The aim of the project is to target the urban poor and to ensure participation from utilities (municipal and state companies) across the various states. The project has adopted the following selection criteria: (a) sub-projects should be located in marginal areas of cities with total population greater than 50,000 inhabitants; (b) at least 40 percent of the families to be served should have an income of less than one minimum salary; and (c) per capita construction cost should be less than budget ceilings of US$ 98 (December 1987) for water and less than US$ 140 for sanitation. On a limited scale, the project also finances in-house sanitary facilities, drainage works and solid waste collection. The financing is divided between the local utility (25 percent), the World Bank (50 percent) and the Caixa Economica Federal, CEF (25 percent), the borrowing entity which is a government-owned bank. The total Bank loan amount is US$ 50 million and full cost recovery through tariffs is expected. A project management group has been established within CEF to oversee the execution of the project, monitor and evaluate performance. The innovative aspects introduced into the subprojects are (a) the flexibility provided to state water companies with respect to the selection of technology and (b) the role of beneficiary participation in the subproject cycle. Table 1 provides a summary of a sample of approved subprojects. To date subprojects totalling US$ 87 million have been approved in 9 states. The largest subproject will cover 12 low-income areas in the city of Rio de Janeiro benefitting 350,000 people at a total cost of US$ 35 million (for water and wastewater).

Technology Selection

One of the innovative aspects in the project design is the encouragement given to engineers to develop cost effective solutions based on past Brazilian experiences. The range of technologies being tried out is particularly large for wastewater collection and disposal. The technologies that have been selected in the pool of approved subprojects range from on-site systems such as latrines (Manaus) and septic tanks (Belem), to condominial (shallow, back-of-the-lot) sewerage (Fortaleza, Recife, Rio de Janeiro) and conventional sewerage (Juiz de Fora). For water supply, in almost all cases, expansion of the service is through house connections, including the extension of the existing network and the construction of additional reservoir capacity. Per capita costs for the approved subprojects have generally been far below the budget ceilings established by the project: between $US 12 and 50 for water supply and between US$ 15 and 123 for sanitation (see Table).

Beneficiary Participation

Experience in Brazil and elsewhere has suggested that, in water and sanitation projects, beneficiary involvement at the various levels of project cycle can improve project sustainability. PROSANEAR has tried to operationalize this finding. Despite the initial resistance of many utilities to prepare a plan for the involvement of the community, attitudes have gradually changed through sustained dialogue with the project management group. In most of the subprojects technical solutions are chosen through a process of consultations with community leaders and potential beneficiaries. Beneficiaries are given an explanation of the ramifications of their choice with regard to cost and operation and maintenance and provided support through training and health education. Since the modalities of this work were left to the utilities, the tasks of community mobilization, organization, consultation, and health education are being carried out through a variety of institutional approaches. They range from the use of government agencies (municipal or State), to non-governmental organizations to private consulting firms. Moreover, the methodologies used by each group and the related outcomes are different and provide ample ground for learning. For example, in Juiz de Fora, Minas Gerais, where the work is carried out by the health department, the initial emphasis is put on the training of community leaders who then facilitate further training within their respective organizations (church, mothers, sports groups). In Rio de Janeiro, the private firm in charge of this component relies on small teams of community workers, who spend months in the area visiting all the residents and finding out their preferences for service levels and outlining the possible location of the water and sewer networks. In Fortaleza, Ceara, the community leaders initially rejected the idea of a condominial sewerage system on grounds of operational and maintenance failures elsewhere in the city. However, through negotiations mediated by the consulting firm in charge of community mobilization, agreement was reached between the community and the utility on (a) level of service (condominial sewerage), (b) tariff level (55 percent of water tariff instead of 60 percent) and (c) maintenance of sewer lines within the blocks to be carried out by a local resident employed by the utility (1 worker per 1000 houses).

Monitoring and Evaluation

The subprojects are attempting different institutional and technological solutions. As a result, the monitoring, evaluation and feedback mechanism assume great significance. CEF, in collaboration with the Bank, is putting in place a M&E system which includes, for each subproject, (a) a baseline socio-economic survey prior to implementation, (b) data on the community participation activities (descriptive and quantitative) and the performance of the implementing entity and (c) engineering and financial data. The evaluation of this data will provide a basis for the design of future projects targeting the peri-urban poor communities.

CONCLUSION

This note has shown that utilities, with help from non-governmental agencies and private consulting firms, can implement projects to extend water and sanitation services to the urban poor. Given that no one institutional setup would be appropriate in all situations, projects have to be initially designed with flexibility and learning in mind. In large countries, sector projects, like PROSANEAR, provide the opportunity to test multiple approaches under different urban conditions; and when subprojects are implemented in a phased mode, lessons from one subproject can be inputted in the subsequent ones.

TO LEARN MORE:

World Bank. 1988. "Brazil Water Project for Municipalities and Low-Income Areas". Staff Appraisal Report No. 7083-BR. Washington, DC.

Watson, Gabrielle. 1993. "Condominial Sewer Systems in Brazil - An Evaluation". TWUWS, World Bank. (forthcoming)

Nance, Anaya. 1993. "PROSANEAR Subprojects in Belem, Fortaleza and Manaus". TWUWS, World Bank. (unpublished)

Table 1. Sample of sub-projects (data are from approved bids)

STATE	CITY (section)	PER CAPITA COSTS, 1993 US$ (population base)			WATER SERVICE	SANITATION SERVICE	COMMENTS
		WATER	SANITATION	COMMUNITY MOBILIZATION (1)			
Santa Catarina	Joinville		104 (3190)			Condominial & Simplified sewerage; pumping to existing treatment plant (3km away).	Community participation in construction is organized by the municipality
Ceara	Fortaleza (Palmeira)		105 (17450)	6		Condominial / Conventional primary network / pumping / treatment plant (anaerobic & facultative lagoons)	
Ceara	Fortaleza (San Miguel)	12 (3105)	93 (3105)	6	Extension of existing system —	Condominial / Conventional primary network / 3 treatment plants (communal tanks & anaerobic filter)	Localized treatment of wastewater
Ceara	Fortaleza (Pantanal)	26 (3620)	111 (3620)	6	Extension of existing system	Condominial / Conventional primary network / 11 treatment plants (communal tanks & anaerobic filter)	Localized treatment of wastewater
[illegible]	Juazeiro		54 (33350)	6		Condominial / conventional primary network / interceptors (4 Km) to existing plant	Emphasis on community participation and income generation
Rio de Janeiro	Rio (Niteroi)	28 (5220)	48 (5220)	5	Extension of existing system / pumping stations / reservoirs	Condominial / Simplified sewerage to suit unplanned development / connection to existing network	Difficult environment (security & topography)
Amazonas	Manaus	85 (66962)	15 (44083)	4	Wells/Chlorination/Network	Slabs for latrines	
Mato Grosso do Sul	Dourados (Joquei Club)	55 (2062)	80 (2062)	23	Extension of existing system	Pour flush latrines with alternating pits.	Extensive community mobilization work by private consulting firm
Mato Grosso do Sul	Dourados (Cachoeirinha)		123 (5232)	23		Condominial/ simplified sewerage /pumping to existing plant	ibid.
Minas Gerais	Juiz de Fora	63 (18498)	93 (18498)	2	Extension of existing system	Conventional sewerage / localized treatment: 21 communal septic tanks with anaerobic filters	Close links with preventive health care programs of municipality

(1) Per capita cost for community participation is based on total value of contract and the total number of beneficiaries in a given city (for both water and sanitation services)

INTERNATIONAL RIVER BASIN ORGANIZATIONS IN SUB-SAHARAN AFRICA

A PERFORMANCE PERSPECTIVE

Presentation Note for Water Resources Management Seminar
Richmond VA, December 7-9, 1993

1. Background

1.1 In the Water Resources Management Policy Paper, the Bank makes two important statements relating to River Basin Organizations (RBOs), namely the Bank:

- will play a more proactive role in helping countries improve the management of shared international waters

- is ready, through technical, financial and legal assistance, to help governments strengthen institutions, such as RBOs, to address transnational water management affairs.

1.2 As part of its program to implement its new policies, the Bank is undertaking a range of actions including the preparation of regional policy papers, guidelines and papers on best practices, institution building and strategy formulation. It is in this context that the Africa Region has embarked on a review of the functions, performance and future perspective of RBOs.

1.3 It is intended that this performance study of RBOs will form one of the building blocks of the water strategy paper now in course of preparation by the Africa Region and at the same time it is hoped it will prove useful in operational work both within the Bank and among ESAs in general.

2. RBOs visited by the Bank Mission

2.1 The following RBOs and related regional organizations were briefly visited by the mission.

West Africa:

- Lake Chad Basin Commission, Ndjamena - LCBC
- Niger Basin Authority, Niamey - NBA
- Organization pour la Mise en Valeur du Fleuve Senegal, Dakar - OMVS
- Organization pour la Mise en Valeur du Fleuve Gambie, Dakar - OMVG

Central Africa:

- Kagera Basin Organization, Kigali - KBO
- Energie des Grands Lacs, Bujumbura - EGL and its parent organization Communauté Economique des pays des Grands Lacs- CEPGL

Southern Africa:

- SADC-ZACPLAN (Zambezi Action Plan) co-ordinating unit at ZESCO (the Zambia Electricity Supply Commission), Lusaka - SADC/ZACPLAN unit.

- Lesotho Highlands Development Authority, Maseru - LHDA
- Zambezi River Authority, Lusaka - ZRA
- Department of Water Affairs, Pretoria - DWA

3. The Water Development Potentials

3.1 All 41 countries in continental sub-Saharan Africa share the resources of international rivers and therefore the development of surface waters depends essentially on international collaboration.

3.2 Development has hitherto focused largely on hydro-electric power but, now, in southern Africa emphasis is moving towards multi-purpose projects for domestic, industrial and irrigation supplies. An Exception to this generalization is the Sudan, where irrigation has always been the priority need.

3.3 The surface waters of sub-Sahara Africa, taken as a whole, are remarkably undeveloped. Of a total power potential of some 300,000 MW., no more than about 5 per cent has been harnessed. Of the irrigation potential amounting to about 20 million hectares, only about 5 million hectares has been developed and over one third of that is in one country, the Sudan.

4. Main Characteristic of Sub-Saharan African Rivers

4.1 The major rivers have six general characteristics that influence their mode of development and have an impact on international collaboration:

i) Concentration of run-off is largely limited to mountainous and highland areas. Downstream users, often in dry climates, are thus very dependant on the actions of upstream riparians. An exception to this generalization is the humid zone of West Africa in and around the Zaire basin.

ii) The seasonal and annual river flows are subject to wide variations. Over this century, the 7 year moving average has varied by a ratio of as much as 2:1. Year to year variations in the flow of perennial rivers is in the range 3.5:1 to 10:1. These wide variations call for large storage reservoirs.

iii) Perennial water courses that form the main stems and some tributaries are very widely spaced. This imposes limitations on the extensive use of surface waters for domestic and industrial purposes. On the other hand, given large reservoir storage, the rivers can provide good poles of production for hydro-electric power.

iv) Surface waters are generally of good quality with low mineralization. Biological pollution is often high yet, essentially local.

v) With the notable exception of the alluvial plains of the Nile basin and the inland delta of the Niger, there are no extensive entities of irrigable land that are commendable from the rivers, as found in Asia. The irrigation potential, at 20 million hectares, is therefore modest and should be exploited with care.

vi) With the paucity, of good perennial tributaries, the best opportunities for water resource development generally lie along the main stems of the large rivers. Such development is lumpy and often beyond the resources of a single state. There is a need for international collaboration in project implementation, to share the "costs" of common "works".

5. The several forms of River Basin Organization and their various objectives

5.1 There are three broad categories of organizations dealing exclusively or partly with international water affairs:

- Those focussed on the development of water resources within defined river basins or part thereof. (LHDA, OMVS, OMVG, ZRA, Komati Basin and NBA)

- Those covering water and a range of other activities such as agriculture, energy, transport, fisheries and forestry (LCBC, KBO, EGL)

- Overarching organizations whose mandate includes water resource development and other activities throughout its member states (SADC and, to a lesser extent, CEPGL - which is the parent of EGL)

6. General Objectives and Past Performance

6.1 The all embracing objective of the several RBOs reviewed by the Mission is:

to promote studies and the construction of works that will lead to an integrated, economically sustainable and technically sound development of the water resources of a river basin.

As part of that role, some RBOs have a mandate to develop formulae for the equitable sharing of waters.

6.2 The performance of RBOs varies widely from almost complete failure to success. In the past the main elements for successful performance have been:

- real need for development with an emphasis on socio-economic benefits rather than on political aspirations

- well focused and technically sound objectives

- strong commitment by member states

- few country members

- emphasis on construction work rather than on planning

- active support form ESAs.

6.3 In most cases, with the notable exception of Kariba dam project on the Zambezi, it is too early to enter into any serious evaluation of benefits. For major investments such as those of the OMVS it will be many years before the overall regional impact can be judged.

The report prepared by the Mission discusses the above elements of past successes. Perhaps the most important observation is that emphasis on construction has led to commendable achievements in the implementation stages of major projects (as with OMVS dams, Kariba dam and the current phase of the LHDA) and this is partly attributable to the narrow and specific objectives characterized by a construction program. By contrast, planning involves a series of political decisions which are often unduly influenced by national interests rather than on objective consideration of the real benefits the project will generate.

6.4 Among the least successful RBOs, when viewed against the general objective stated above are the NBA, LCBC and OMVG. They have few tangible achievements to show for the efforts that have gone into these organizations over the last 10-20 years.

7. A Future Perspective

7.1 In the first few decades the objectives in the development of international rivers in Africa have been multi-purpose in the northern and southern regions and predominantly for hydro-electric power in the central regions. This trend is likely to continue but with a growing emphasis on domestic industrial and irrigation water in southern Africa. Navigation has never assumed much economic or commercial importance, except in limited situations such as the lower Niger and Zaire rivers, and is unlikely to do so.

7.2 Rapid demographic growth, poor land resources, unfavorable climatic conditions and a paucity of financial resources lead to a fragile environment in much of Africa. Environmental factors have been given prominence in the mandates of most RBOs but have often not come to the forefront having been subsumed in the general lack of progress. However, there is now a general recognition of the need for a more thorough treatment of the environmental factors (OMVS, LHDA).

7.3 The Long Term Perspective Study (LPTS) for sub-Saharan Africa carried out by the World Bank in 1989 put forward an ambitious target growth rate for agriculture of 4 to 5 per cent a year - twice what has ever been sustained in the past. The LPTS rightly stressed the need to create the right enabling environment which, among other things, demands institutional building and human resource development on an unprecedented scale. The mission, in its report, has referred to several important weaknesses in the enabling environment in which RBOs have to operate.

7.4 The ultimate objective of any RBO must be directed to the development of a specific potential to meet clearly identified needs. Wide, ambitious mandates, extending across non-water related sectors and into areas outside the river basins concerned should be avoided. Over diversification has led to dilution of effort and confused programs.

7.5 RBOs should concentrate as much as possible on projects of regional interest. They do not have any visible comparative advantage to pursue national projects.

7.6 The structure of RBOs varies considerably according to their mandate and financing arrangements. For example for the construction of "common works" a single executing agency is the preferred solution (OMVS, OMVG and ZRA). Where the works are owned by the country in which they are sited, even if jointly financed, a single executing agency is again appropriate (KOMATI). However where each riparian owns and finances the works situated on its territory it is logical to create one executing agency for each riparian state (LHDA).

7.7 Although in most cases the general structure of governance of RBOs is satisfactory, there are several instances where it is not put to good use owing to a lack of commitment by member states and a failure to provide financial support.

8. Recommendations

8.1 The report of the Mission presents a number of general and specific recommendations of which the following are the most salient:

8.2 Since most of the reliable surface water resources of sub-Saharan Africa occur in international rivers there is a strong case for ESAs to continue to give support to RBOs. There is however a case for ESAs to be more proactive and persuade decision makers that RBOs must focus on real needs and limited objectives which can be implemented within a reasonable time frame. Without clearer focus the present climate for donor fatigue is likely to persist.

8.3 The type of support required from ESAs varies widely. For individual RBOs the supporting requirements may be summarized as follows:

LHDA	-	environmental studies
OMVS	-	continued support for management studies, strategic planning and better use of the "common works" as now built
OMVG	-	planning
ZRA	-	capacity building and, ultimately, capital funding
NBA	-	complete in depth diagnostic evaluation
LCBC	-	review of mandate
	-	technical assistance
	-	human resource development in planning
KBO	-	review of objectives
	-	relative role of EGL
EGL	-	examination of its possible role as a river basin planning organization
SADC	-	continued support in its current and proposed activities in water affairs.

8.4 There is a general need for RBOs to build up planning capacity but at the same time avoiding the creation of a large bureaucracy for a function that does not offer long term employment for more than a few personnel.

8.5 Finally it is recommended that a better mechanism is established for collaboration between the ESAs involved in supporting RBOs. A concerted effort should be made to address some of the issues raised in the report in a practical manner, particularly in respect of some of the weak RBOs and those that have lost direction through an array of political considerations.

Haryana Irrigation Department (Water Resources Department)

Departmental Programs -- 1994-1999

Format of Statements --

Objective: (The objective of the program.)
Activity : (The activities involved in attaining the program objective.)
Assigned Units (The primary units having responsibilities for portions ar all of the tasks involved in completing the activities.)

Units/entities: (See Organizational Charts 1, 2 and 3):

Sec	--	Secretary of Irrigation (Water Resources) and Power
Reg	--	Regulatory (Groundwater) Office of the Secretary
WRC	--	Water Resources Commission
ENC	--	Engineer-in-Chief and his "staff" level offices including the Deputy ENC's
Adm	--	Administration Unit
Dat	--	Data sub-unit of the Planning and Data Unit
Pln/dat	--	Planning and Data Unit
Des/res	--	Design and Research Unit
Con	--	Construction Unit
WSU	--	Water Service Units (O&M Units)
Contr	--	private contractor/supplier
Consl	--	consultant

Program Statements --

1. Institutional Reform --

Objective: To increase the capability and effectiveness of Government of Haryana to carry out its responsibilities for the development and management of the water resources of the State of Haryana.

Activity: Formulate basic water development and management policies for guiding government programs and public and beneficiary roles formulate and seek enactment of needed legislation, rules and regulations; formulate and enact the necessary program, personnel and operating policies; restructure the organization; assign staff and introduce the associated primary operational procedures in all units necessary for the effective execution of their responsibilities.

Assigned Units: Sec/WRC (0.1), ENC (0.5), Adm (0.2), Consl (0.2)
Budget: Rs. 2.0 cr.
Duration: 2 years

2. Administrative Reform --

Objective: To consolidate all administrative functions into one unit and improve its administrative and support services to the agency.

Activity: Create needed individual sub-units in the Administrative Unit; introduce comprehensive cost accounting and cost allocation; introduce improved procedures including position descriptions and candidate qualification statements; create a modern statewide agency communications and basic computer capability in the agency to support all functional units and their activities; establish a management information system (MIS) to serve the information storage and retrieval needs for all units in carrying out their activities; introduce detailed agencywide programming and budgeting and establish a project and program tracking system (these to be introduced and implemented by a sub-unit of the Deputy Engineer-in-chief's office). (Some tasks associated with this program such as constructing communications facilities and procuring computer capability are set out as separate programs in support of administration reform.)

Assigned Units : ENC (0.1), Adm (1.0), Consl (2.5)
Budget: Rs.3.6 cr.
Duration: 2 years

3. Agency Direction and Management Program (routine)

Objective: To assure effective overall direction and management of the agency policy, programing and budgeting, legislative liaison, legal, environmental affairs, public information and vigilance.

Activity: Prepare and review basic agency policies, prepare the long-term and annual program and budget, maintain legislative liaison, conduct public awareness program, and provide other "staff" level functions including legal, environmental affairs and vigilance. Program tracking, instituted under the 'Administrative Reform Program', and policy and oversight of the system turnover, instituted under the "Turnover Program," will be continued under the Agency Direction and Management Program.

Assigned Units: ENC (9.8), WRC (0.3)
Budget: Rs.9.8 cr.
Duration: 6 years

4. Regulatory (Groundwater) Functions --

Objective: To administer the regulatory laws, rules and regulations enacted for the management of the water resources and associated activities.

Activity: Formulate a groundwater regulatory enforcement program to carry out the government's regulatory policies and enacted legislation; monitor the activities of government agencies, private enterprises and individuals for compliance with established laws, rules and regulations; aggressively take prompt actions to enforce penalties against violators in accordance with appropriate laws; draft appropriate legislation for improving the effectiveness of the regulatory function and prepare information regarding purpose, provisions and administration of the state's regulatory program for use by the Public Information Office of the agency. Initially, this function will focus on laws, rules and regulations governing groundwater.

Assigned to: Sec/Reg (5.8), Consl (0.2)
Budget: Rs. 6.0 cr
Duration: 6 years

5. Administration (routine) --

Objective: To assure comprehensive administrative support and services are provided efficiently to the agency in a manner that all units can efficiently perform their functions.

Activity: Provide administrative services and support in the areas of personnel, finance, procurement of supplies and selected equipment, real property procurement and management, staff training (set out as a separate program), communications and computer services (including any MIS modifications) and motor pool.

Assigned Units: Adm (14.0)
Budget: Rs 14 cr
Duration: 6 years

6. Administration Vehicle and Equipment Pool Procurement --

Objective: To provide cost effective efficient transportation and equipment support to all agency units except for the WSUs.

Activity: Procure vehicles and equipment for an agencywide motor pool managed by the Administration Unit to serve all agency units except the WSUs (Communications and computer equipment procured under separate programs described later)

Assigned to: Adm (0.1), Contr (1.8)
Budget: Rs 2.0 cr
Duration; 6 years

7. Training --

Objective: To increase the management capability and technical skills of agency staff and their awareness of agency responsibilities and functions.

Activity: Orient staff with agency policies, procedures and functions; conduct routine training of O&M staff and agency office support staff; and arrange for specialized training in technical areas as agency programs demand including re-training for reassigned personnel.

Assigned Units; Adm (0.9), WSU (3.0), Consl (0.2)
Budget: Rs. 4.1 cr
Duration: 6 years

8. Turnover --

Objective: To turnover to identified beneficiary entities the responsibilities for the operation and maintenance and defined aspects of assets ownership of selected facilities currently under the full responsibility of the agency. The initial emphasis will be on DIT wells and water courses.

Activity: Formulate statewide policies applicable to all services (water distribution, drainage and flood control) pertaining to the extent and the governing conditions of turnover including matters of ownership of assets, facilities rehabilitation, beneficiary contribution to costs of turnover, the rights and responsibilities of the beneficiaries and the government; prepare and secure enactment of legislation, rules and regulations pertaining to turnover; detail the program of activities for executing turnover; create, staff and train the specialized sub-units in the WSUs to carry out the program and initiate the program of turnover.

Assigned Units: ENC (0.3), WSU (0.9), Consl (0.6)
Budget: Rs. 1.8 cr.
Duration: 4 years

9. Agency Statewide Communications System --

Objective: To establish a reliable statewide communications capability for the use of all agency units, in particular for data collection, O&M, construction and routine management.

Activity: Design, construct facilities, install equipment and place in operation a communications system connecting primary WSU offices in the state and key data sensing sites with regional and central offices of the agency; procure, install and place in operation mobile and site communications equipment including terminals for computer and data monitoring equipment and completion of associated office modifications and housing.

Assigned to: Des (0.1), Con (0.2), Adm (0.1), Contr (18.7), Consl (0.4)
Budget: Rs. 19.5 cr.
Duration: 2.5 years

10. Agency Computer Capacity Upgrade --

Objective: To institute full modern computer capability as required to effectively carry out the agency responsibilities in a timely efficient manner.

Activity: Compile the computer hardware and software needs of the agency units and define, specify and procure computer software and hardware needed for all agency units including a central computer and PCs, office network, office software packages and special software for the various units and establish the programing and support backup services.

Assigned to: Adm (0.1), Cons (0.1), Contr (9.0), Consl (1.2)
Budget: Rs.10.4 cr.
Duration: 3.5 years

11. Offices and Housing Construction --

Objective: To provide adequate and appropriate office and housing facilities for the central and regional units and their sub-units to permit effective and efficient functioning.

Activity: Plan, design and construct modifications to existing buildings and new facilities as required.

Assigned to: Des (0.1), Con (1.5), Contr.(15.0)
Budget: Rs 16.6 cr
Duration: 4 years

12. Hydrologic Data Collection and Management --

Objective: To consolidate and improve the quality and comprehensiveness of surface and groundwater hydrologic and meteorological (as appropriate) information for use by all government and private sector entities and individuals.

Activity: Formulate a comprehensive hydrologic collection and processing system, consolidating the functions of other government entities into the Data Subunit of Pln/dat; assign qualified staff, partially through reassignment from other entities; upgrade existing and install new hydrologic and meteorological stations to form an adequate network of sites; provide data collection platforms and equipment to interface with the statewide agency communications system being built under another program and formulate and install the necessary procedures and software to provide prompt, accurate recording, evaluation and reporting of information. In addition, analytical services will be offered, under specific service agreements, for the specialized analysis of the hydrological information for use by government and private entities.

Assigned Units: Plan/Dat (Dat) (12.0), Des (0.1), Con (0.1), Contr (0.6) Consl (0.2)
Budget: Rs 13.0 cr
Duration: 6 years (2 years site construction)

13. State Water Plan Preparation --

Objective: To prepare and upgrade at regular intervals The State Water Resources Plan with time horizons of 10, 25 and 50 years for the development and management of the state's water resources consistent with the state's goals, objectives and policies.

Activity: Document available resources; established goals, objectives and policies; existing uses and new projects and programs adopted by legislation. Subsequently, define alternative future conditions in the state consistent with official spatial plans, projected changes and existing programs; formulate alternative programs and projects to satisfy the state goals under those conditions for the consideration of the public and political bodies and document programs and projects that are formalized by laws. The initial State Plan is to be issued within two years and fully updated whenever major changes occur and at maximum intervals of five years.

Assigned Units: Pln/dat (2.0), Consl (0.3)
Budget: Rs. 2.3 cr.
Duration: 6 years (2 years issue initial plan)

14. Project Planning --

Objective: To prepare reconnaissance and feasibility level plans for major projects to provide the various services (bulk supply, flood control, irrigation, drainage etc) under the responsibility of the agency and for programs such as groundwater recharge and wastewater reuse to meet agency responsibilities in accordance with the water resources development and management priorities established under the State Water Plan.

Activity: Conduct reconnaissance and feasibility planning, present alternative solutions and, through appropriate procedures, develope project plans for use in project authorization, budgeting and scheduling. These plans are to serve as the basis for the Design Unit to conduct final design leading to the final construction plans, specifications and related documents.

Assigned to: Pln/dat (2.0), Des (1.5 site investigations), Consl (0.3)
Budget: Rs. 3.8 cr.
Duration: 5.5 years (begin after 1.5 years)

15. O&M Equipment Procurement --

Objective: To furnish the WSUs with vehicles and maintenance equipment adequate for efficient maintenance of facilities.

Activity: Determine the equipment needs, prepare procurement documents and procure equipment.

Assigned to: Adm (0.1), WSUs (0.1), Contr (16.0)
Budget: Rs. 16.2 cr
Duration: 3 years

16. Routine Operation, Maintenance and Replacement of Agency Services Facilities --

Objective: To provide agency services in an equitable, reliable, cost efficient manner in accordance with established objectives and agreed operating plans and to maintain service facilities in a manner to assure services at least costs sustainable on into the future.

Activity: Prepare service plans for every service offered by the agency (bulk supply, irrigation distribution, agricultural drainage,storm drainage and flood control), with beneficiaries' assistance as appropriate; prepare agency annual operating schedules; execute operations to meet the service objective; and monitor and report on services rendered. Prepare annual, near-term and long term maintenance and replacement plans for all agency service facilities; prepare annual agency maintenance schedules; execute maintenance work;and monitor and report on maintenance conducted.

Assigned to: WSUs (Yamuna and Bhakra) (617.4)
Budget: Rs. 617.4 cr.
Duration: 6 years

17. Modernization of Canal System --

Objective: To modernize selected features of bulk water supply canal system to improve the reliability and efficiency of the service, save 18,000 hectare meters water of present operational and seepage losses and reduce by a like amount the contribution to rising the saline water table.

Activity: Line existing canals, construct augmentation link canal and upgrade key control structures.

Assigned to" Des (0.7), Con (1.5), Contr. (146.0)
Budget: Rs. 148.2 cr.
Duration: 5 years

18. Construct New Minors --

Objective: Increase area irrigated by 19,900 ha.

Activity: Determine water availability and allocation and specific project uses under State Water Resources Plan and if this work is consistent with the allocation of water under the plan and fully authorized; design, construct and place in operation 40 new minors.

Assigned to: Des (0.1), Con (2.0), Contr (20.2)
Budget: Rs. 22.3 cr.
Duration: 2 years (initiated after State Water Plan, if approved)

19. Construction of Hathnikund Barrage and Link Channel --

Objective: Re-establish reliability and increase operational flexibility of primary water services from Western Yamuna Canal to a major portion of Haryana and the Delhi urban area.

Activity: Secure inter-state agreement for construction of facility to replace existing Tajewala Barrage and channels with new barrage and link canal and, once signed, design and construct the facilities.

Assigned to: ENC (0.1), Des (4.0), Con (15.0), Contr (141.9)
Budget: Rs. 161.0 cr.
Duration: 3 years (commencing after inter-state agreement)

20. Modernization of water courses --

Objective: To reduce seepage, reduce saline groundwater rise and save 19,200 ha meters water.

Activity: Line existing water courses.

Assigned to: Des (4.0), Con (17.0), Contr (157.8)
Budget: Rs. 179.8 cr.
Duration: 5 years

21. Canal Rehabilitation --

Objective: To reduce water losses and re-establish canal conveyance capacity.

Activity: Repair existing lining, remove silt from canals, repair structures and reshape canal embankments.

Assigned to: Des (0.1), Con (10), Contr (92.4)
Budget: Rs. 102.5 cr.
Duration: 4 years

22. Water Course Rehabilitation --

Objective: To reduce water losses and re-establish canal conveyance capacity.

Activity: Remove silt, reshape channels and place 1.34 million m2 rigid lining

Assigned to: Des, Con (0.1), Contr (0.8)
Budget: Rs. 0.9 cr.
Duration: 1.5 years

23. Drainage System Rehabilitation --

Objective: To re-establish channel conveyance capacity and system capability to reduce damages from inundation to crops and property.

Activity: Channel clearance, 3.5 million cum earthwork and rehabilitate 260 key structures.

Assigned to: Des (0.2), Con (6.0), Contr (60.7)
Budget: Rs. 66.9 cr.
Duration: 4 years

24. River and Channel Rehabilitation --

Objective: To return the erosion control and levee structures in natural and flood channels to a condition of acceptable flood control performance and reasonable cost-effective maintenance.

Activity: Design construct remedial works and repairs on channel boundaries, groins, channel structures and levees.

Assigned to: Des (2.0), Con (3.0), Contr (27.0)
Budget: Rs. 32.0 cr
Duration: 2.5 years

25. Augmentation Tubewell Rehabilitation --

Objective: To return the wells to a state of production required to meet needs.

Activity: Repair pumps, risers and associated features

Assigned to: Des (1.0), Con (0.1), Contr (2.8)
Budget: Rs. 3.0 cr
Duration: 1 year

26. Direct Irrigation Tubewell O&M --

Objective: To operate and maintain existing DIT wells that are functioning with an adequate submergence in the groundwater. (No new wells are to be constructed nor existing wells lowered to secure suitable submergence.

Activity: Operate existing DIT wells that are effectively and efficiently operating and maintain them properly to the extent that it does not require lowering the well or pump unit. Place in operation and maintain those existing DIT wells that become adequately submerged by a rise in the groundwater.

Assigned to: WSUs (0.5)
Budget: Rs. 0.5 cr.
Duration: 5 years

27. Research on Drainage Collector Design --

Objective: To determine the most effective configuration of the drainage collection scheme, identified as promising under current and subsequent studies, to be adopted for control of high water tables in areas underlain by saline groundwater.

Activity: Select three sites for research; design the field studies appropriate for consideration and design, construct and monitor performance of various tile collector configurations. This activity will be consistent with the findings of the Northwest Drainage Study now underway and any subsequent studies that will define the most promising collector schemes and configurations for testing.

Assigned to: Des/res (0.8), Con (0.2), Contr (8.0)
Budget: Rs. 9.5 cr.
Duration: 1 yr construction and 4 years monitoring

28. Research on Sprinkler Irrigation --

Objective: Identify and introduce efficient sprinkler systems for reducing water demand for the suitable crops under irrigation in Haryana.

Activity: Identify lands and conditions where greatest benefits could be derived by the use of sprinkler irrigation as opposed to current practices; select five sites for the installation of pilot studies; conduct a literature search of information available on commercial irrigation experience under like soils, topographic, micro-climatic conditions and potential crops; design the agronomic and equipment tests to be conducted that best applies to commercial application in the area; procure commercial equipment under specifications; conduct studies and publish findings with recommendations.

Assigned to: Des/res (0.2) and Ministry of Agriculture, Contr (0.4)
Budget: Rs. 0.6 cr.
Duration: 4 years

29. Research on Drip Irrigation --

Objective: Identify and introduce efficient drip systems for reducing water demand for the suitable crops under irrigation in Haryana.

Activity: Identify lands and conditions where greatest benefits could be derived by the use of drip irrigation as opposed to current practices; select five sites for the installation of pilot studies; conduct a literature search of information available on commercial irrigation experience under like soils, topographic, micro-climatic conditions and potential crops; design the agronomic and equipment tests to be conducted that best applies to commercial application in the area; procure commercial equipment under specifications; conduct studies and publish findings with recommendations.

Assigned to: Des/res (0.1) and Ministry of Agriculture, Contr (0.3)
Budget: Rs.0.4 cr.
Duration: 4 years

IMPLEMENTATION SCHEDULE - INSTITUTIONAL MODIFICATIONS - ATTACHMENT E

NAME	DEFINE BY	INTRODUCE BY	RESPONSE
Reorganization			
Finalize organization structure/staff level	10/15/93	4/1/94	HID, Con
Finalize unit responsibilities	11/15/93	4/1/94	HID, Con
Prepare position descriptions	11/15/93	4/1/94	HID, Con
Finalize basic implementation schedule	2/1/94	4/1/94	HID, Con
Establish Staff Officer			
Groundwater regulation			HID
Water service policy support	2/1/94	4/1/94	
Environmental affairs	11/1/93	4/1/94	
Coordination Chief Engineer	2/1/94	4/1/94	
Budget/program tracking	2/1/94	4/1/94	
Establish Units			HID
Administration Unit			HID, GOH
Personnel training	2/1/94	4/1/94	
Real property	2/1/94	4/1/94	
Finance and accounting	2/1/94	4/1/94	
Procurement and supplies	2/1/94	4/1/94	
Computer services	2/1/94	4/1/94	
Motor pool	2/1/94	4/1/94	
Data Collection and Water			
Resources Planning Unit			HID, GOH
Ground water	2/1/94	4/1/94	
Surface water	2/1/94	4/1/94	
Documents	2/1/94	4/1/94	
Special studies	2/1/94	4/1/94	
State water plan	2/1/94	4/1/94	
Project planning	2/1/94	4/1/94	
Drought planning	2/1/94	4/1/94	
Design and Research Unit			HID, GOH
Civil engineering	2/1/94	4/1/94	
Mechanical and electrical engineering	2/1/94	4/1/94	
Geology and field exploration	2/1/94	4/1/94	
Specifications	2/1/94	4/1/94	
Research	2/1/94	4/1/94	
Construction Unit			HID, GOH
Headquarters circle	2/1/94	4/1/94	
Project circles	2/1/94	4/1/94	
Yamuna Water Service Unit			HID, GOH
Unit administration	2/1/94	4/1/94	
Unit support	2/1/94	4/1/94	
Service circles	2/1/94	4/1/94	
Bhakra Water Service unit			HID, GOH
Unit administration	2/1/94	4/1/94	

Unit support	2/1/94	4/1/94	
Service circles	2/1/94	4/1/94	
Policies			GOH, HID
Full budgeting of all O&M	10/15/93	4/1/94	GOH
Full cost recovery of all services	10/15/93	12/31/99	GOH
Dedication of all O&M revenues to HID	10/15/93		GOH
Capital recovery on new construction	10/15/93	1/1/94	GOH
Beneficiary contribution to rehabilitation work	10/15/93	4/1/94	GOH
Delegation of authority - personnel actions	10/15/93	12/31/94	GOH
Staff specialization	10/15/93	6/30/94	HID
Minimum duration for CEs	10/15/93	11/1/93	GOH
Staff housing and incentive benefits	10/15/93	6/30/94	HID
Turnover (concept and facilities involved)	10/14/93		HID
Training	10/15/93		HID
Procedures			GOH, HID
Adopt programming and budgeting	12/31/93	3/1/94	HID
Initiate program tracking	2/15/94	4/1/94	HID, CON
Introduce cost accounting	2/15/94	4/1/94	HID, CON
Introduce service cost allocation	2/15/94	4/1/94	HID, CON
Computerize maintenance scheduling/records	2/15/94	12/31/94	HID, CON
Computerize management actions/records	2/15/94	12/31/94	HID, CON
Legislation/Decrees			GOH, HID
HSMITC/CADA restructuring	2/15/94		
Personnel benefits	2/15/94	4/1/94	
Staff specialization/rotation	2/15/94	6/1/94	
HID reorganization	2/15/94	4/1/94	
Service charges for all services	2/15/94	4/1/94	
Establishment of beneficiary organization	3/31/94	9/1/94	
Turnover-responsibilities/facilities	2/15/94	9/1/94	
Dedication of service rev. to O&M expense	3/31/93	4/1/94	
Groundwater regulation	3/1/94	4/1/94	

Figure 1

		HARYANA WRCP Tentative Program Statements												
	TOTAL	SEC	REG	WRC	ENC	ADM	DAT	PLN/DAT	DES/RES	CON	WSU	CONTR	CONSL	EQUIP
Rupees crores														
Institutional Reform	1	0.05		0.05	0.5	0.2							0.2	
Administrative Reform	3.6				0.1	1							2.5	
Agency Direction & Management	10.1				9.8								0.3	
Regulatory (groundwater) Functions	6	3	2.8										0.2	
Administration (routine)	14					14								
Administration procurement	1.9					0.1								1.8
Training	4.1					0.9					3		0.2	
Turnover	1.8				0.3						0.9		0.6	
Communication systems	19.5					0.1			0.1	0.2			0.4	18.7
Computer capacity upgrade	10.4					0.1				0.1		9	1.2	
Office & Housing Construction	16.6								0.1	1.5		15		
Hydrological Data Collection	13							12	0.1	0.1			0.2	0.6
State Water Plan Preparation	2.3							2					0.3	
Project Planning	3.8							2	1.5				0.3	
O&M Equipment Procurement	16.2					0.1					0.1			16
Routine Operation Maintenance and Rep	617.4										617.4			
Modernization of canal systems	148.2								0.7	1.5		146		
Constructions of new minors	22.3								0.1	2		20.2		
Construction of Hathnikund barrage	161				0.1				4	15		141.9		
Modernization of watercourses	178.8								4	17		157.8		
Canal rehabilitation	102.5								0.1	10		92.4		
Watercourse rehabilitation	0.9								0.1			0.8		
Drainage rehabilitation	66.9								0.2	6		60.7		
River & channel rehabilitation	32								2	3		27		
Augmentation tubewell rehabilitation	3.9								1	0.1		2.8		
Direct irrigation tubewells	0.5										0.5			
Research on drainage collector design	9								0.8	0.2		8		
Research on sprinkler irrigation	0.6								0.2			0.4		
Research on drip irrigation	0.4								0.1			0.3		
	0													
TOTAL	1468.7	3.05	2.8	0.05	10.8	16.5	0	16	15.1	56.7	621.9	682.3	6.4	37.1

Figure 2

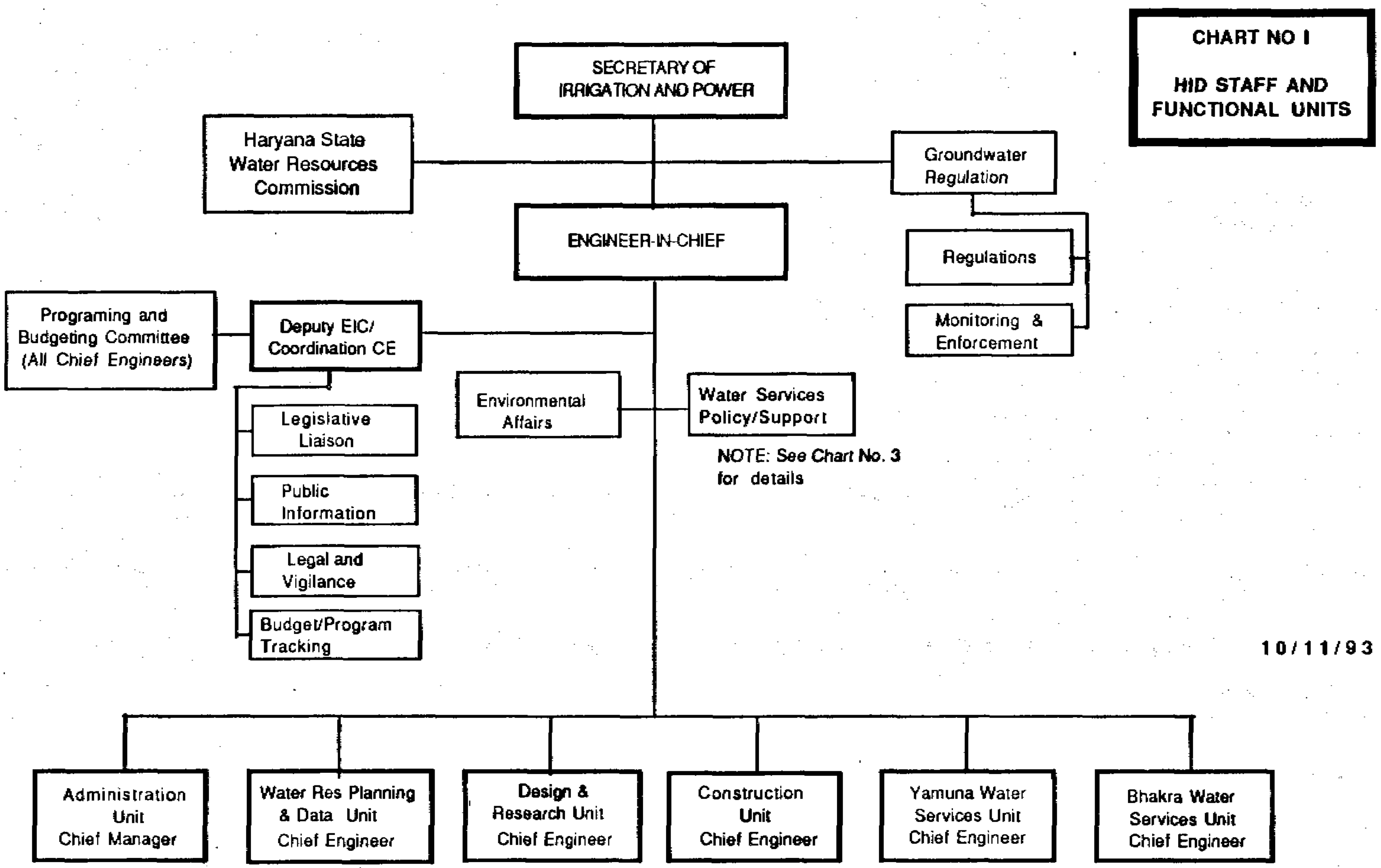


CHART NO I
HID STAFF AND FUNCTIONAL UNITS
SECRETARY OF IRRIGATION AND POWER
Haryana State Water Resources Commission
Groundwater Regulation
ENGINEER-IN-CHIEF
Regulations
Monitoring & Enforcement
Programing and Budgeting Committee (All Chief Engineers)
Deputy EIC/ Coordination CE
Legislative Liaison
Public Information
Legal and Vigilance
Budget/Program Tracking
Environmental Affairs
Water Services Policy/Support
NOTE: See Chart No. 3 for details
10/11/93
Administration Unit Chief Manager
Water Res Planning & Data Unit Chief Engineer
Design & Research Unit Chief Engineer
Construction Unit Chief Engineer
Yamuna Water Services Unit Chief Engineer
Bhakra Water Services Unit Chief Engineer

Figure 3

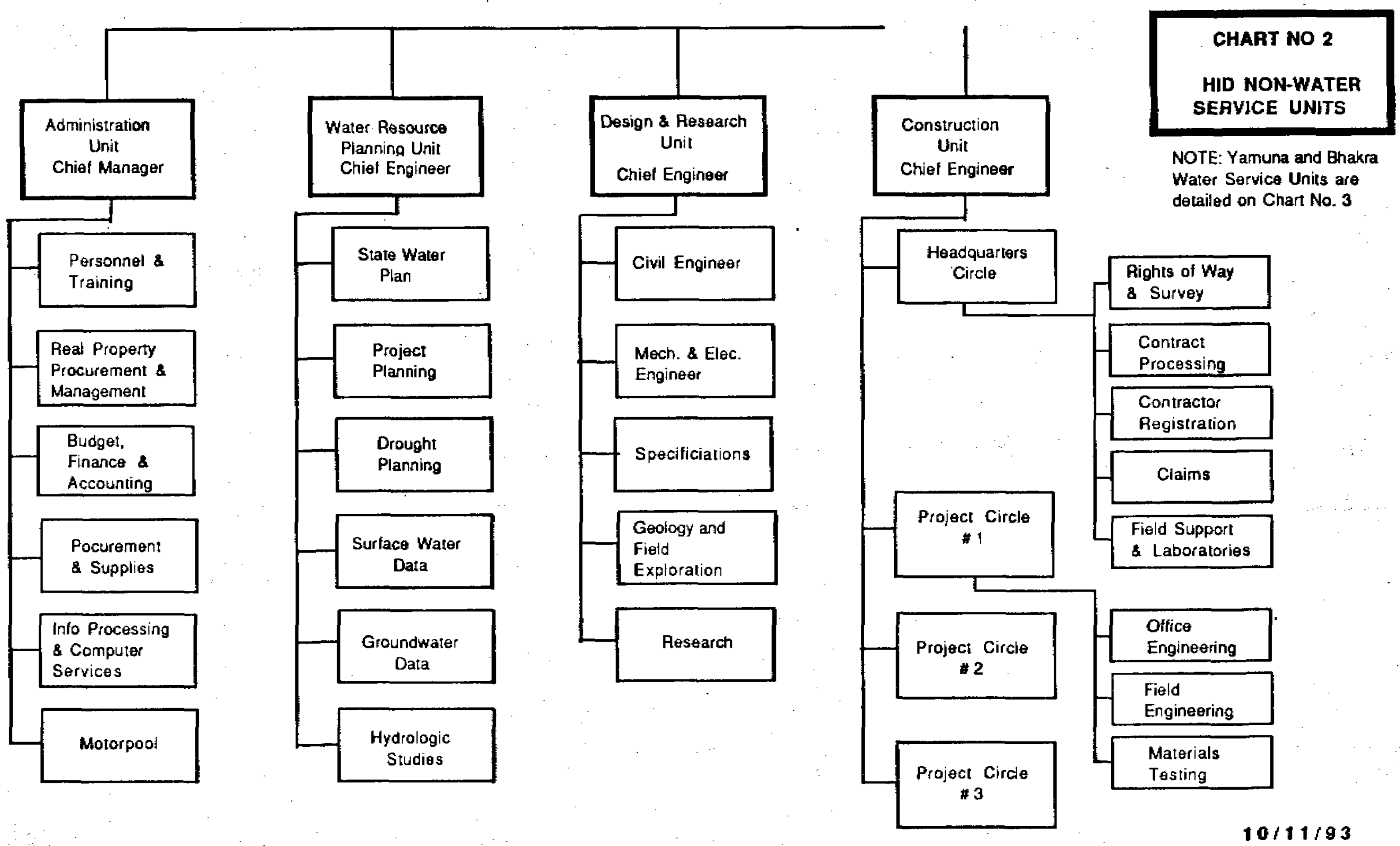


CHART NO 2
HID NON-WATER SERVICE UNITS
NOTE: Yamuna and Bhakra Water Service Units are detailed on Chart No. 3
Administration Unit Chief Manager
Personnel & Training
Real Property Procurement & Management
Budget, Finance & Accounting
Pocurement & Supplies
Info Processing & Computer Services
Motorpool
Water Resource Planning Unit Chief Engineer
State Water Plan
Project Planning
Drought Planning
Surface Water Data
Groundwater Data
Hydrologic Studies
Design & Research Unit Chief Engineer
Civil Engineer
Mech. & Elec. Engineer
Specificiations
Geology and Field Exploration
Research
Construction Unit Chief Engineer
Headquarters Circle
Rights of Way & Survey
Contract Processing
Contractor Registration
Claims
Field Support & Laboratories
Project Circle #1
Office Engineering
Field Engineering
Materials Testing
Project Circle #2
Project Circle #3
10/11/93

Figure 4

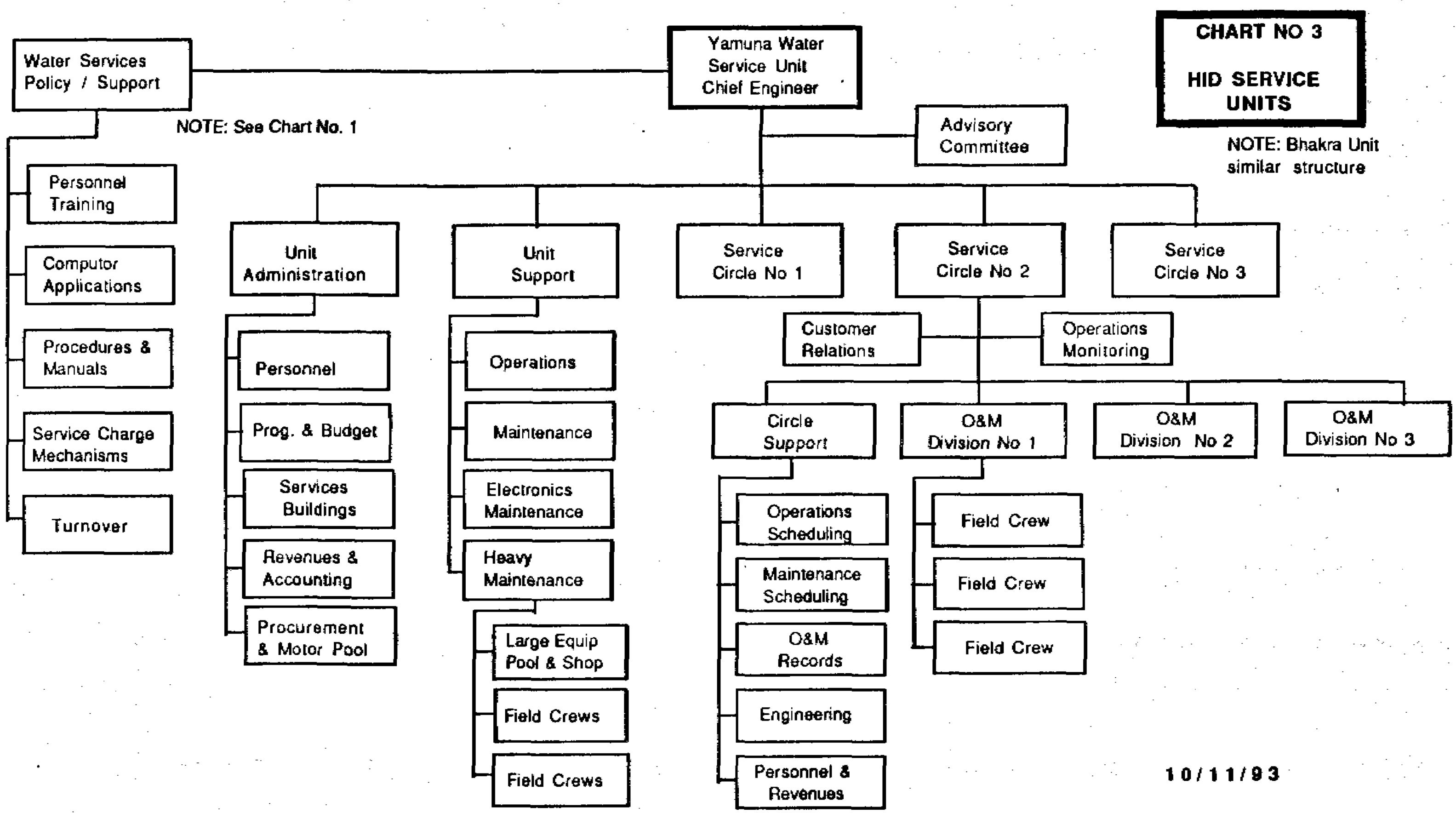
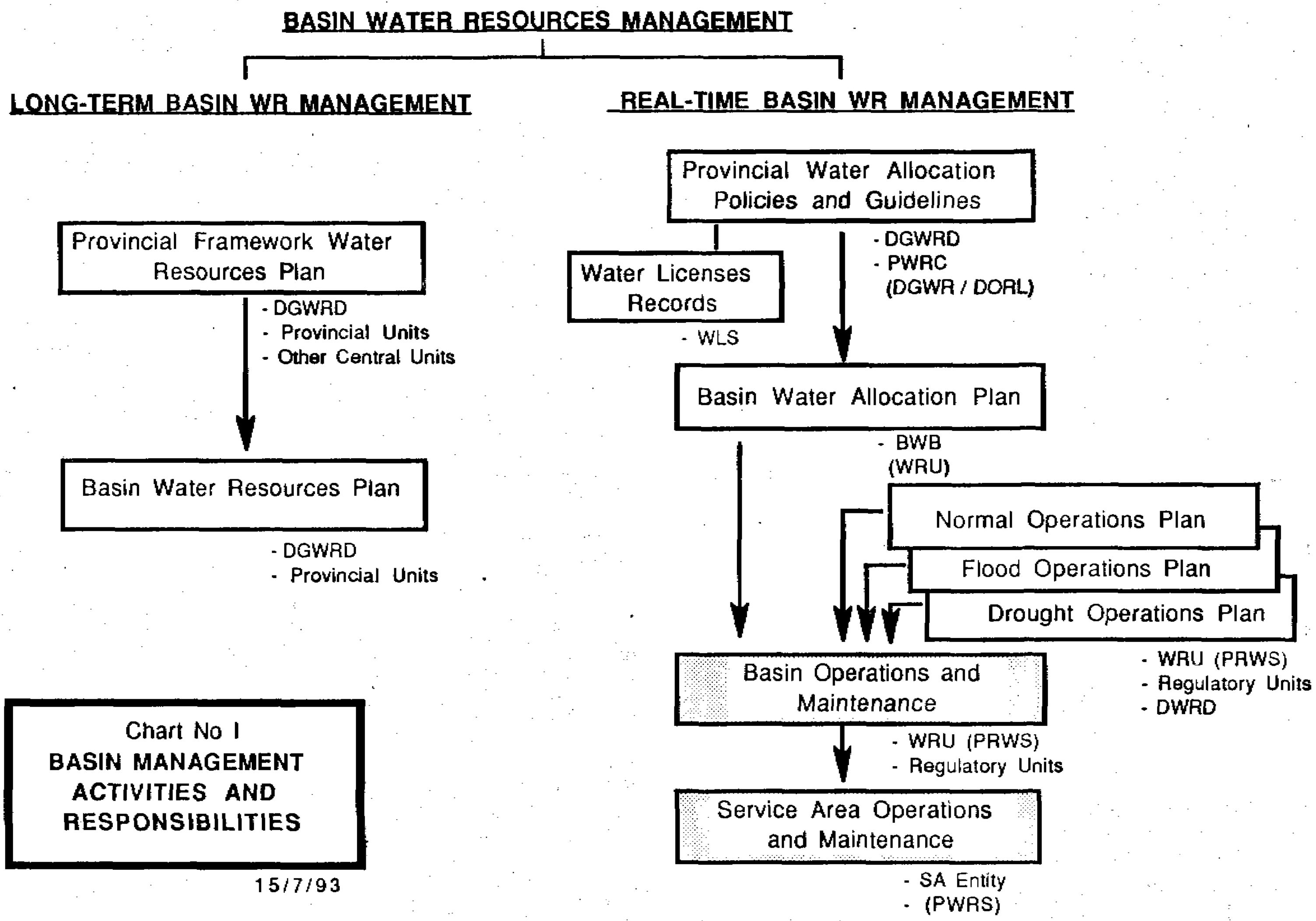


CHART NO 3
HID SERVICE UNITS
NOTE: Bhakra Unit similar structure
Water Services Policy / Support
NOTE: See Chart No. 1
Yamuna Water Service Unit Chief Engineer
Advisory Committee
Personnel Training
Computor Applications
Procedures & Manuals
Service Charge Mechanisms
Turnover
Unit Administration
Personnel
Prog. & Budget
Services Buildings
Revenues & Accounting
Procurement & Motor Pool
Unit Support
Operations
Maintenance
Electronics Maintenance
Heavy Maintenance
Large Equip Pool & Shop
Field Crews
Field Crews
Service Circle No 1
Service Circle No 2
Service Circle No 3
Customer Relations
Operations Monitoring
Circle Support
Operations Scheduling
Maintenance Scheduling
O&M Records
Engineering
Personnel & Revenues
O&M Division No 1
Field Crew
Field Crew
Field Crew
O&M Division No 2
O&M Division No 3
10/11/93

Figure 5


BASIN WATER RESOURCES MANAGEMENT
LONG-TERM BASIN WR MANAGEMENT
REAL-TIME BASIN WR MANAGEMENT
Provincial Framework Water Resources Plan
- DGWRD
- Provincial Units
- Other Central Units
Basin Water Resources Plan
- DGWRD
- Provincial Units
Provincial Water Allocation Policies and Guidelines
- DGWRD
- PWRC
(DGWR / DORL)
Water Licenses Records
- WLS
Basin Water Allocation Plan
- BWB
(WRU)
Normal Operations Plan
Flood Operations Plan
Drought Operations Plan
- WRU (PRWS)
- Regulatory Units
- DWRD
Basin Operations and Maintenance
- WRU (PRWS)
- Regulatory Units
Service Area Operations and Maintenance
- SA Entity
- (PWRS)
Chart No I
BASIN MANAGEMENT ACTIVITIES AND RESPONSIBILITIES
15/7/93

EXPERIENCE IN IMPLEMENTING THE WORLD BANK WATER RESOURCES INITIATIVES IN ASIA

1993 WATER RESOURCES SEMINAR

ABSTRACT

A deteriorating water resources situation has reached a critical state in many countries. Several will soon experience major social and economic disruptions even if wisely crafted actions commence in the immediate future. In response, the World Bank has launched initiatives at various levels to help borrowers address the underlying institutional and programmatic constraints to sound resources management.

Two recently appraised Bank projects in the Asia Regions reflect concepts and principles set forth in the Bank's policies and guidelines. A modern Department of Water Resources responsible for comprehensive resources management from planning to delivery of services is being created to replace the existing Irrigation Department in Haryana, India. Broad reforms both, institutional (resources, policies, organization and legislation) and administrative (personnel policies, programing and budgeting and cost accounting/allocation) supported by a full complement of modern procedures, computers and state-wide communications are being introduced. In Indonesia, comprehensive basin water management (long-term planning and real-time management) are being introduced in several basins covering a substantial portion of Java. Appropriate institutional and procedural changes will upgrade the agency capability to match the tasks. All measures are founded on Indonesia's adopted policies to decentralize management to the local levels of government.

The experience with these undertakings verify the complexities of modern water resources management and the intricacies of needed institutional reform. They confirm that substantial time and highly specialized expertise in water resources management must be committed to formulate successful change. Furthermore, the success of attaining permanent institutional change depends on fulfilling essential preconditions. Top government officials must fully believe in the need, thoroughly understand and actively participate in efforts to devise the alternative approaches and wholeheartedly apply the solutions finally selected. Most importantly, they must express unquestionable support for the changes and -- through meetings and statements -- explicitly inform the agencies and their staff of the program details, the consequences for the organization and its staff and the schedule for implementation. This takes time. And it takes effort by both the officials and Bank personnel. The Bank staff must also thoroughly understand successful institutional approaches because ill-conceived experimentation can cause great harm, particularly when conditions are already critical. It must know intimately the principles and the politics involved in a successful solution. Realistically, capacity will have to be greatly increased to meet the more demanding future undertakings in the water resources sector.

INTRODUCTION

We need not catalogue the present water resources problems of the world before discussing the topic of water resources management. Suffice it to say that most of our countries are facing immense problems today. And with the population growth, particularly urban, over the next thirty to fifty years, the presently ill-defined measures to accommodate this growth will, at best, result in major economic and social disruptions. Disruptions will occur even if the required funds and technology can be marshalled promptly. What should be more worrisome to world leaders and institutions, such as the Bank, is that recent history is not encouraging. We have been losing ground in meeting the needs of the water sector under lessor demands of today.

A major program was launched by the Asia Regions in 1988 to better define the Region's problems and devise an approach for the Bank to improve water resources development and management in the borrower countries. The main report, Water Resource Management in Asia, World Bank Technical Paper 212, was distributed in Fall 1993.[1] The dominant problems and associated issues are identified in each country. In turn, those issues generic to the region were consolidated for evaluation. In parallel, the principles and practices applied to these same issues by countries, relatively successful in managing their resources, are examined and documented for consideration.[2] Besides annexes to the Technical Paper 212, several Technical Papers have been issued.[3]

The Technical Paper 212 sets forth the findings of the investigation and presents recommendations to address the critical water resources situation in essentially every country. In summary, it recommends in-depth institutional strengthening and comprehensive, sustainable resources management should receive high priority in each country with focus on the river basin within a national framework plan.

As a foundation for programs to fulfill these objectives, the AWRS report recommends that the operating departments prepare a water strategy for each country and that Bank capacity be greatly strengthened on an urgent basis to assist with the resulting programs. Proposed actions include: (i) establishing departmental country water resources committees to coordinate water-related activities of the individual country divisions patterned on the successful arrangements of the Indonesia Department; (ii) expanding substantially the regions' technical staff in the water resources field, particularly in the operating departments; (iii) formulating country water resources strategies to introduce appropriate programs into the country-lending strategy; and (iv) increasing the coordination of Bank-wide efforts. At the request of the regional vice presidents, guidelines for formulating country water resources strategies were prepared and distributed. (See Attachment A.) Several departments have made provisions to complete these in the coming year. However, this will depend on technical staff capacity and available funding.

The Asia Regions' endeavors are consistent with the Bank's recently issued Water Resources Management Policy Paper. I would like to describe programs in two countries that exemplify efforts to introduce essential actions to deal with their situations. The specific projects that will be described have just been appraised. Slight adjustments may still be made.

Major credit for the launching programs to deal with the basic water resources issues must be given to leaders within the countries. Many have taken important initiatives in key areas -- some

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1 Water Resources Management in Asia, Technical Paper 212. (Washington, D.C.: November 1993.)

2 Principles and Practices for Dealing with Water Resources Issues, Annex 1 to Water Resources Management in Asia. (The World Bank, Washington, D.C.: December 1993.)

3 Drought Planning and Water Efficiency Implications in Water Resources Management, World Bank Technical Paper No. 185.

Water Resources Institutions - Some Principles and Practices, World Bank Technical Paper No. 191.

Water Allocation, Rights, and Pricing - Examples from Japan and the United States, World Bank Technical Paper No. 198.

with and some without direct Bank assistance. Indeed, officials from several borrower countries question where they can find the needed assistance with their most critical water resources issues. They cite inconsistent, unproven and vague concepts and actions being proposed by outside entities as examples of the lack of an in-depth understanding of the sector. Lending agencies have an obligation to not let expedience nor current fads dictate program composition or schedule. There should be no compromise on securing necessary expertise or budgeting ample time and resources before going forward with these programs.

EXAMPLE 1: INDIA

Broad Institutional Reform of an Existing Agency, The Haryana Water Resources Consolidation Project (HWRCP)

History of the Project Concept

The Bank's India Irrigation Division, with the participation of the department's water resources committee, has initiated programs to strengthen the irrigation departments in three states -- Haryana, Orissa and Tamil Nadu. The introductory concept was devised and first proposed in Orissa in 1986. However, after gaining full support of senior state officials in the course of several visits, questions of the role of India's central agencies in the project and the impact of additional delays on Bank-lending objectives caused abandonment of the proposal. While a sectorwide, national hydrologic data collection project put forth at the same time suffered a similar fate, a proposal to institute a dam safety assurance project fared better.

Subsequently, this concept for strengthening the states' water resources institutions was again presented in the division's irrigation sector report and recommended for early consideration. Follow-up discussions with the central government and several states yielded the above three projects. Thus, it may be seen that extensive concerted efforts, both independently by government officials and by the Bank, are necessary to move forward with any substantial remedial actions in the water resources sector. To help in this regard, all efforts have been limited to the one agency within government to better assure a manageable program of institutional reform. Of course, the irrigation agencies have the dominant state role in water resources management under their typical legislative charter. Indeed, in the case of Haryana, the government intends to rename the department as the Water Resources Department. This will more properly reflect its responsibilities and change the perceptions of other agencies, staff and public.

The Concept

Unquestionably, the Haryana Irrigation Department (HID) has one of the best irrigation performance records in India. Nevertheless, it is not meeting its legislated responsibility -- comprehensive water resources management. This responsibility is reflected in its delegated charge for state-wide water planning and for providing bulk supply to urban areas and villages, irrigation distribution, agricultural drainage, flood control and bulk storm drainage and river channel maintenance services. Gaps exist in all functional activities involved with serious deficiencies in delivery of services.

The emphasis on allocating available budget to construction projects has been for years an almost universal fact in most states in India, while data collection, planning and facilities operation and maintenance (O&M) suffer. The content and administration of Bank projects have supported this emphasis. Its country loan program has given inadequate attention to the states' data collection, water resources planning and delivery of services. A minimal analysis of project quality, system performance and the broader conditions in the sector readily expose the fundamental program deficiencies and the diversion of the states' efforts from sound resources management.

The goal of the HWRCP is to address the causes of these shortcomings. Simply stated, a primary project objective is to introduce rigorous, balanced programming and budgeting that allocates available funds on a priority basis to truly meet agency responsibilities. This is the single, most important thrust of the project.

The implications of this goal for the agency include major restructuring to create the capability to effectively execute the resulting program of work. It requires introducing organizational flexibility so the agency may adjust over the years as changing priorities alter the program composition, not letting agency structure dictate the program composition. It will entail new legislation and policies.

The condition for the proposed project was that HID formulate an agency five-year (later changed to six-year) compliment of programs within the available budget and a schedule of institutional and administrative changes. On the order of US$ 200,000,000 would then be provided to augment HID's budget. Increasing service fee collection -- another policy to be adopted -- would gradually replace the Bank infusion, diminishing uniformally over the life of the project. To assure the government's adherence to the agreed budget allocations to the adopted programs, the loan would be allocated proportionately to the total effort in each of the agency's primary functional areas.

Formulation of Programs

Unfortunately, there was no state water resources plan to guide formulation of programs or set priorities in preparing a departmental budget. Thus, the HID officials' first step was to set out all proposed HID programs, considering the present conditions and anticipated situations likely to evolve within the sector over the next few decades. These programs were detailed, categorized and listed by priority within the primary functional areas -- (i) data collection and processing, (ii) long-term planning, (iii) design, (iv) construction, (v) O&M and (vi) regulatory -- with all units having substantial roles in a program being identified. Subsequently, these functional programs were jointly reviewed to form a combined department-wide list of priority programs.

The second step involved determining the six-year funding, including the proposed Bank loan and projected increases due to implementing adopted cost recovery actions. Allocating this amount to the departmental priority program list readily determined those that could be effected during the six-year period. Obviously, setting the priorities entailed considerable debate.

The process was judged a success. Data collection, planning and O&M allocations were greatly increased. Routine O&M received over 40 percent of the total budget. Rehabilitation of irrigation, drainage and flood control works another 40 percent. Design and construction were curtailed, limited to rehabilitation of critical structures and system modernization. Planning was adequately supported to immediately prepare a State Water Resources Plan (SWRP), agreed to be an urgent action to be completed before pursuing any further resources exploitation. New tubewell construction and irrigation system expansion was halted until the SWRP is accepted. Further lowering wells would also await effective introduction and field enforcement of a groundwater regulatory plan for the overdrafted aquifers. Project planning would depend on priorities established by the SWRP, as the overall agency thrust shifts to providing bulk services to urban areas, increasing flood control and expanding agricultural drainage. The adopted programs are presented in Figure 1. (See attachment B for programs statements, unit responsibilities, budget allocations and general schedule for implementation.)

Organizational Restructuring

The institutional component was pursued in parallel with the program formulation. A review of the organizational structure, in-depth interviews of staff and examination of ongoing programs identified the principle deficiencies. Overlapping responsibilities, inactive functions and poor utilization of personnel were evident under the existing institutional arrangements. As a result, HID will be reorganized -- with specialized staff offices reporting to top management and the line units organized by functional areas reporting to the Engineer-in-Chief (ENC). (See Figures 2,3 and 4.) A brief description of each units function and responsibilities is provided in Attachment C.

The Secretary, the top civil service position, will be supported by a Water Resources Council and a Water Resources Regulatory Office. HID will establish new policy, environmental, programming and oversight offices, that in addition to the line units, will report to the ENC. The department will realize major improvements in management and overall efficiency by creating an administrative unit headed by a senior level manager equivalent to the Chief Engineer who heads the traditional engineering areas. The O&M for all service facilities -- bulk supply, irrigation, agricultural drainage, storm drainage and flood control -- will be consolidated under two service divisions. This will facilitate conjunctive management of the surface and groundwaters, including groundwater recharge. Efficient year-round utilization of O&M staff and equipment will be secured. Each service division will cover approximately one-half of the state, delineated by the hydraulic boundaries of the systems. The service units will be structured as self-sustaining "utilities" with the ultimate goal of financial independence funded entirely from service charges.

Legislative, Policy and Procedural Changes

HID will institute major policy and procedural changes. The state proposes to adopt a policy to recover the cost of every service through service charges and/or betterment taxes by 1999. Under an extensive administrative reform, cost accounting and cost allocation will be introduced with a breakdown by category and class of service. This will make costs and subsidies in every service transparent to both the beneficiary and the public. Ultimately, this information will form the basis for assessing service charges to the individual beneficiaries. Charging for all services will promote rational, least-cost actions to co-manage water quality and quantity, including investments in wastewater reuse.

Program and organizational management will benefit greatly from several complementary measures. The permanent programming and budgeting unit under the Engineer-in-Chief will also have the capability for timely program tracking. Through this activity, every unit manager and every task manager will be informed of the status of programs in their area of responsibility. An agency MIS system -- supported by a central computer and 500 PCs -- will be installed and staff trained during the first two years. This will support adminstration, data collection and all other line units. A state-wide communication system will be constructed to allow access to the MIS, other offices and the transmission of information and data.

HID is proceeding with drafting the necessary legislation, decrees, rules and regulations. Immediate attention will be given to formulate groundwater regulatory legislation with clear penalties and a fully staffed monitoring and enforcement unit. Licensing of water use, already instituted for groundwater, will be expanded to include surface waters in the future. This is a basic pre-requisite to effective supply management, including surface and groundwaters. More immediately, it is an essential step to the successful turnover of distribution schemes to beneficiaries, both at the scheme level and for the individuals. However, the underlying policies and the series of actions preliminary to turnover will be formulated and implemented after in-depth study under the project for they must be mutually suppo tive and complete. Policies pertaining to cost recovery, facilities ownership, beneficiary cost contribution to the turnover program and extent of financial support from government are complex. The legislation under which the entities will be created and function is complex. And the structure and field implementation of the government's regulatory/oversight function is complex, as well. The absence of water masters to enforce water licencing and allocations and the lack of effective timely oversight of the beneficiary entities' service and financial performance have created chaos and failure of premature turnover programs. (Attachment D presents a list of topics relating to turnover.)

HID and GOH are also reforming key personnel policies. The department will create promotion paths in each functional area, modifying the present three-year job rotation effected throughout a person's career. Only in this new manner can the technological and managerial expertise required for comprehensive resources management be developed and maintained within the department. To further this objective, the department will modify its compensation and benefits package, including housing assistance to assure equity in net income to personnel whether in the field or headquarters.

Implementation

The implementation schedule for institutional and administrative reform is largely set as presented in Attachment E. Several dates are very ambitious, but the officials see the water situation as being extremely serious. Senior officials must apply substantial effort to these tasks. Consultants are assisting in the immediate months ahead. Undoubtedly, the results will depend directly on the success of securing skilled assistance to augment the limited expertise that the borrower and the Bank can mobilize.

Patience and a steady focus by both the borrower and the Bank on the quality and adequacy of task work is essential. And these must not be over-ridden by any other objectives. For the government has taken a decisive course to introduce radical improvements. It has no choice but to immediately upgrade the capability of the new Department of Water Resources to match the assigned responsibilities -- managing the resource most essential for the social and economic well-being of Haryana.

EXAMPLE 2: INDONESIA

Comprehensive Basin Management, The Java Irrigation and Water Management Project

History of the Project

Indonesia has immense problems, particularly in the congested mushrooming urban areas. With great wisdom the government's officials are openly and comprehensively addressing the sector-wide problems. In the mid-1980s, the government of Indonesia (GOI) began exploring institutional change in the water resources sector. Various forms of basin management entities, as well as other institutional and technical measures, were discussed in conjunction with several proposed Bank projects. A few were launched. However, it soon became evident to the borrower and the Bank that the Bank's divisional programs were not coordinated. As a result, in 1988 the Indonesia Country Department established and budgeted an inter-divisional Water Resources Working Group to informally discuss proposed water-related projects to better assure a consistent comprehensive approach to the Bank's lending.

The Group's first action was to examine the country's water resources institutions and formulate recommendations addressing differences in treatment of issues by separate divisions. This supported an expanded Bank/GOI dialogue. In parallel, the GOI established an ad hoc committee to work on this subject focussing heavily on the institutional component of the action plans under the Bank's Irrigation Subsector Projects (ISSP).

Over the ensuing years, the Bank/GOI dialogue expanded with several internal and external workshops discussing all aspects of institutional reform in the water resources sector held throughout the country. Participants included administrative and technical personnel from every level of government, individuals with a range of backgrounds pertinent to the field and Bank staff. A detailed water resources program strategy for Indonesia was developed in the October 1992 workshop. (This closely followed the approach outlined in the Guide for the internal use of departments in the Asia region, please refer to Attachment A.) Simultaneously, Directorate General of Water Resources Development (DGWRD) distributed an internal proposal for reorganizing the department. The features of comprehensive basin management suitable to Indonesia were framed in the course of discussions in three workshops held in 1993. All proposed reforms were adjusted to reflect the broader decentralization policies now being introduced in the civil government structure.

In 1993 GOI removed irrigation from the agricultural bureau of BAPPENAS, the national planning agency, and created a new water resources bureau. BAPPENAS has selected water resources management to receive the same emphasis for the next twenty-five years as given to food self-sufficiency during the preceding twenty-five.

The evolving actions in basin management provide an insight into the considerations and directions of the larger, ongoing reform program. In 1989, a pilot component to introduce real-time water management in two basins was included in the Irrigation Sub-sector Project (ISSP-II). Important information was gained and now, under a new comprehensive water resources management project -- Java Irrigation and Water Management Project (JIWMP) -- both real-time operations and long-term basin water resources planning will be introduced in more basins covering a substantial portion of Java.

Integrated Water Resources Management reflecting Indonesia's Established Institutions

Comprehensive water resources management includes both: (i) long-term resources management as reflected in water and spatial plans, and (ii) current management as reflected in real-time water operations including the regulatory actions. To the extent possible, water resources management should be conducted within the framework of the established government administrative structure and boundaries. This dictates much of the adopted institutional changes in Indonesia.

GOI administrative structure, set forth in the 1945 Constitution is based on a unitary state with local autonomy in each of the administrative divisions of the state. This means that the governor (at the provincial level) and the "bupati" and "walikati" (at the local government level) are representatives of the central government and at the same time are the heads of autonomous areas at the respective levels of government. Accordingly, water resources development and management activities generally are also part of and integrated within the various levels of government administration.

The physical nature of water, of course, dictates that water operations -- planned and real-time -- be formulated and executed within the bounds of hydraulic systems, the river basin being the primary level. Long-term plans contain projects and programs tied to the physical river system and, hence, key aspects of the long-term planning also must be considered and presented within the context of the river basin. The constraints of nature necessitate that government's administrative boundaries must accommodate the river basin boundaries for certain aspects of water management. This is common in situations dealing with international waters and managing inter-provincial and inter-district systems.

As an example at the provincial level, planning may be seen to comprise the setting of overall development and management objectives and policies and the preparation of broad spatial plans. These set out the selected use of all resources applied in the individual basins within the province. The spatial plans incorporate the land use that determines water demands, water quality requirements, water pollution potential and storm drainage and flood control needs. The water plans -- provincial and basin -- include mainly the water resources-related programs and projects to fulfill the anticipated needs presented in the spatial plans. Obviously, spatial and water planning should be closely coordinated by provincial and local entities; it is essential that availability and constraints of water resources be considered at an early stage of spatial planning.

With further refinement, the basin plans within a province will in combination constitute a more detailed provincial plan. The regular updating of the plans at five-year intervals (or more frequently) is a continuous cycling through this process -- provincial/basin/provincial.

Detailed project planning within each sector -- irrigation, urban supply, waste management, transportation, etc. -- can then be conducted consistent with the provincial and basin plans. The completion of physical facilities are, after all, merely the means to translate the long-term plans into the ability to perform the desired real-time operations. And the maintenance of the associated facilities are the means to sustain the operations capability and related investments.

The interlinkage of spatial planning with water resources planning and the interlinkage of water resources planning and real-time water operations are reflected in the overall approach to planning and operations adopted by GOI. This overall approach is the basis for the water resources management (WRM) activities included in the JTWMP.

Interrelationships and Independencies of Basin Planning and Real-time Operations

Basic to formulating the overall basin water resources management arrangements is the clear understanding of the inter-relationships and the independencies of basin planning and real-time operations. In particular, the fundamental differences between these two elements in the level of decisionmaking, the skills applicable and the required time frames, not only allow simplifying the overall institutional arrangements, but also the schedule for implementing the respective activities. See figure 5.

Water Resources Management -- Long-term Water Resources Planning

Spatial Planning. Indonesia's Law 24, 1992, stipulates that spatial planning will be conducted at three levels -- national, provincial and local. The geographical areas of this planning will conform to the respective governmental administrative boundaries.

BAPPENAS, as Chair of the National Spatial Planning Coordination Board, has the lead responsibility for national-level spatial planning. Under the direction of the Board, a national spatial framework plan has been drafted identifying: (i) national urban growth areas, (ii) primary transportation network and (iii) 110 key priority areas within the country that require additional infrastructure. The national level spatial planning has identified the broadly anticipated land-use, thus providing the initial guidance for water resources development and management. But water resources planning should be more directly incorporated into the national level spatial planning.

BAPPEDAS has responsibility for provincial-level spatial planning. The purpose of these plans is to identify general urban, industrial, agricultural, and forestry land-uses and natural preserves in accordance with national and provincial objectives. Major provincial infrastructure needs, such as transportation and water, can then be better identified for use in the programs of the responsible agencies and local planners. Framework spatial plans for all provinces in Indonesia have been prepared and many have been enacted into law by provincial assemblies. These were completed with the assistance of Cipta Karya (urban). But further strengthening of BAPPEDAS is necessary to improve their internal planning capability, an objective of an Asian Development Bank project soon to be launched.

Spatial planning at the local government level is the most detailed. These plans reflect the local residents' intentions for pursuing orderly development. Local spatial plans are the basis for issuing permits for new land uses and all related development, and therefore provide the detailed framework for water resources planning, development and management at the local level.

Water Resources Planning. GOI sees a pressing need for national and provincial water resources framework plans as further elaboration of the spatial planning at these levels. As noted earlier, the provincial level water resources planning must focus to an important extent at the basin level while being fully integrated with all spatial planning. However, presently the provincial dinas pengairan (deconcentrated Ministry of Public Works unit), which has the responsibility, has limited capability to conduct such water planning. Likewise, capability must be developed at Centre to conduct the national-level water resources planning and provide the input to the national-level spatial planning efforts.

GOI intends to create a government capability to carry out all water resources planning at all but the local levels. This will consist of an inhouse capability supported as needed by consultant specialists; a decision reflected in the JIWMP. It is proposed to formally establish a joint effort at all levels for the purpose of coordinating water resources planning with the spatial planning effort.

Within DGWRD, the Directorate of Bina Programs will be strengthened under JIWMP and assigned responsibility for water resources planning at the national level. Further, it will assist the dinas pengairan to carry out the provincial framework and basin water resources planning for provinces lacking the ability and provide assistance with creating such capability in all provinces as rapidly as possible. It is envisaged that gradually the planning and programming function will be deconcentrated to the Kanwil PU (district public works unit), which will conduct in cooperation with the provincial dinas pengairan, all provincial framework and basin water resources planning in each of the respective provinces.

Water Resources Management -- Real-time Water Operations

There are two separate activities involved in real-time water supply management: (i) allocation policy and determination of allocations, and (ii) delivering services in conformance with the allocations. Indonesia has wisely separated these functions, to be effected under JIWMP. The broader policy considerations and politics of water allocation among conflicting demands is isolated and assigned to an appointed body with representatives from various sources. The actual deliveries are by technicians that carry out the allocations. They have no power and hence are free of local pressures being applied in the course of their operations. This a key concept being introduced in JIWMP.

GOI has decentralized real-time water operations to the provincial and local levels of government. The principle water agency at the provincial level is the dinas or sub-dinas PU/pengairan which has a local area operating unit, the cabang dinas. At the local level the water operation function is executed by the pengairan unit of the dinas PU Tingkat II. Consideration is being given to gradually transfer the cabang dinas responsibility of the province to the Tingkat II PU/pengairan. Centre's only direct role in water operations exists in inter-provincial basins where it will chair the water allocation committee.

Presently, each governor has an Irrigation Committee that advises on irrigation allocations for the year. However, no formal means exist for setting provincial policies and guidelines for allocating water for all uses. Nor does it have a formal mechanism for considering all the demands and the actual water availability in a given season and applying the provincial policies for that season's allocations.

Under JIWMP, GOI will now create entities and procedures to formulate the provinces' allocation policies and to set out the seasonal plans to execute them under actual conditions. A Provincial Water Resources Committee (PWRC) will set allocation policy and issue guidelines for the allocation of water supplies within each province. (The allocation policy committee for inter-provincial basins would comprise the PWRCs of the involved provinces.) The PWRC members will be selected by the governor from government entities at every level and respected individuals from the community. It is contemplated that some PWRCs will have both policy advisory and technical sub-committees. (However, the provincial dinas will serve as the permanent technical support unit to the PWRC.)

For purposes of the management of the water resources in accordance with provincial policies, the province will be divided into three or four 'regions' defined by the boundaries of one or more river basins. Within each provincial 'region', a Water Resources Unit (WRU) will operate the physical facilities delivering water to the service areas. (The service areas comprise the local government jurisdictions.) It is intended that the WRU will be institutionalized within the structure of the dinas/subdinas PU/pengairan, which are expected to be adjusted following a regional/area division consistent with the forthcoming new organization of DGWRD.

The PWRC policies and guidelines established for the province will be used to guide the formulation of detailed annual and seasonal allocation plans to be followed by the WRU. Whether the detailed seasonal allocations for each region's basins would be made by the PWRCs or by a Basin Water Resources Committee (BWRC) remains to be decided. BWRC members would be governor-appointed representatives of the local entities within the specific basin, in addition to respected individuals from the community. This plan is being studied, particularly as it relates to the start-up of WRM in the isolated basins under JIWMP, and will be resolved following further discussions concerning the implications for the provincial and local government administrative structure. Whatever the decision for commencing activities under the JIWMP, experience gained during the first few years will permit reconsideration of the initial decisions.

Through the PWRC/BWRC mechanism, the province would provide both quality and quantity management of surface waters -- though quality management is still mostly dependent on the land-use licensing and pollution enforcement actions by the local government. The Office of the State Ministry of the Environment through BAPPEDAL (the provincial environmental agency) and the Ministries of Industry and Home Affairs are involved and have the principle role in guiding these actions. Groundwater management is under the licencing control of the governor while the technical evaluation of groundwater basins is now under Ministry of Mining and Energy. However, efforts are under way to modify the evaluation responsibility and decentralize it to the provinces as capability evolves. This would allow more effective conjunctive management of the provincial surface and groundwater resources.

The WRU would be the basin O&M organization as the unit within the dinas/subdinas PU/pengairan at the provincial level under the principles of decentralization adopted by GOI. However, as implied, it will receive its allocation plans from the BWRC/PWRC. It will also serve as the 'secretariat' regarding basin matters to whichever entity allocates the basin water.

As stated earlier, local entities are to be responsible for real-time operations in the service areas. They will serve as the service area customer receiving bulk supplies and any other services from the basin WRU. This assignment of responsibility is already effected in most areas except on large irrigation projects. Scheme turnover will accelerate the delineation of the service areas.

Regulatory and Public Oversight

JIWMP will also support creation of a regulatory capability in water licensing and enforcement. This will consist of expert support in establishing a water rights system. Other experts will assist a DGWRD unit in drafting alternative allocation policies and procedures for consideration by the provincial entities.

Indonesia has requested assistance under JIWMP with a parallel program of public awareness. This is to provide general information on the use and abuse of water, how it affects the people and what they can do about it. Experts will be secured from agencies with successful programs in schools and in the community

Implementation Program

The plans for implementing the institutional modifications for water resources management at the provincial and basin level under JIWMP have been outlined in the course of presenting the government's program for institutional change. Greater detail on the activities and related tasks are presented in the JIWMP Action Plan. Both the planning programs and revised real-time water operations to be initiated under JIWMP will become permanent activities of the assigned agencies. It is important to realize that the assistance to be provided under JIWMP is only to help resolve the inevitable problems of start-up and to increase the technical/operations capabilities of the designated units in the course of executing these activities in the identified basins. Thus, the WRM component of the Project will focus assistance on these basins, while government will continue expanding geographically the WRM activities to other areas during the latter years of JIWMP.

CLOSING

The final success of these projects can only be judged in the future. However, both the initiatives themselves and the governments' support for broad institutional reform constitute important steps toward comprehensive water resources management in these countries. The principles adopted are consistent with those applied successfully by other countries and follow the Bank's policies and guidelines.

Lessons may be gleaned already as the characteristics of such undertakings that are directly pertinent to other work under the Bank's water initiatives are confirmed. Both projects have demonstrated that formulating major institutional reform is extremely complex and time consuming if it is to have a chance for success. There are many examples where this course of action has been ignored with unfortunate results. The complexities of water resources management and the traditional interdependencies of government institutions demand that ample time and highly experienced talent are applied to formulate the government's program and the associated external support. Completeness must over-ride any other objectives. And we must remember that the Bank's projects are only part of the borrower's broader program and must fit within its specific objectives. Comprehensive institutional reform or even more narrow changes must be a high priority in a borrower program from the onset or it is best to limit Bank efforts to persuasive dialogue.

THE WORLD BANK
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GAINS THAT MIGHT BE MADE FROM WATER CONSERVATION IN THE MIDDLE EAST

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CONTENTS

GAINS THAT MIGHT BE MADE FROM WATER CONSERVATION IN THE MIDDLE EAST[1]

I. INTRODUCTION

1. An absolute scarcity of fresh water is becoming a concern in many countries throughout all regions of the world. As populations increase and the pace of economic development quickens, the demands for good quality water, a fundamental input for most domestic, industrial and agricultural purposes, increases considerably. Even in countries where total fresh water resources are more than adequate, water-deficit areas are appearing, especially around urban agglomerations. Exacerbating these water shortages is the reduction in usable yield of many existing water sources because of pollution from uncontrolled or only partially treated municipal and industrial wastewater effluents. Similarly, the irregularity of precipitation is becoming increasingly significant as demands on natural supplies increase and the margin of safety between water supply and demand decreases.

2. As demand for fresh water grows and the pressure on water companies and government supply agencies increases, there is growing recognition that much of the water being supplied is lost or wasted. Until water becomes scarce its critical importance to human needs is rarely acknowledged, supplies are taken for granted and it is used wastefully in many households, industrial plants and agricultural operations. In addition, there is great wastage of water in most distribution systems. In the majority of urban supply networks between a quarter and a half of all water which leaves pumping stations is lost from the system. Similarly, with some notable exceptions, a high proportion of irrigation water, which accounts for well over 70 percent of the world's total water withdrawals, is lost to excessive leakage and evapotranspiration. There is, therefore, a steadily growing awareness worldwide that water conservation has a key role to play in alleviating the quantitative and qualitative water constraints on human development.

3. Traditionally, the response to water shortages has been to develop more supplies. In humid regions, this meant little more than the construction of local reservoirs to smooth out seasonal variations in supplies for satisfying the more regular community needs. In arid regions, supply-side solutions also involved the construction of large dams and canals, for transporting water to irrigated lands and towns often over long distances. But as the uses for water have changed and expanded, and as more accessible resources have been fully exploited, so the costs of further supply-side options have increased

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[1] The paper was prepared by staff of the World Bank, Washington, D.C., in response to a request from the Multilateral Working Group on Water to the Middle East Peace Initiative. Views expressed do not necessarily reflect the official position of the World Bank.

dramatically. Even water-rich countries are finding it increasingly expensive, in some cases prohibitively so, to resort to large-scale infrastructural solutions for providing water to meet increasing demands. Furthermore, in addition to direct investment costs, issues related to resettlement of population, and to adverse effects on the natural environment have become more difficult and more expensive to overcome. Such concerns add weight to the need for major changes in the approach to water resources management, if the challenges of imbalances between usable water supplies and demands are to be overcome.

II. OBJECTIVES AND SCOPE OF THE PAPER

4. This paper addresses the growing interest in water conservation and demand management and does so particularly from the perspective of practices and measures developed over the past decades in countries of widely differing economic and political philosophies and with widely differing access to water. More and more countries are convinced that "the water problem" can no longer be seen simply as one of new source development or of inter-basin transfer, as a matter of building a new reservoir or digging a new canal. In some areas, new reservoirs will add nothing to reliable flow of rivers - indeed, some rivers may now be over-regulated, with evaporation from reservoirs cancelling gains from storage. In other areas, concern over government budget deficits or over special features of the natural environment may place overwhelming obstacles in the way of water resources development; hence the interest in a broader notion of management in which the users of water, water conservation and demand management receive particular attention.

5. Following a discussion on the imperatives for conserving water in the Middle East, the paper draws an important distinction between water conservation and demand management, a distinction which should influence the approaches employed. The paper then discusses the nature of gains which might be made from water conservation; gains which go beyond simple water volume. Worldwide experiences in water conservation <u>practices</u> and various <u>measures</u> being used for their implementation are then reviewed. Three classes of water conservation practices are considered (i) reducing end-user demand, (ii) reducing water losses, and (iii) substituting for fresh water. These practices are implemented by: (i) institutional and regulatory measures, (ii) economic incentives and disincentives, and (iii) education and persuasion. Throughout the paper emphasis is placed on <u>gains</u> that have been made by introducing various water conservation practices and measures. Next, criteria for analyzing and ranking conservation priorities are briefly discussed. Since implementation of water conservation programs pose many practical problems, these aspects are given special attention in the paper. The paper then briefly looks at potential gains and suggests some priority actions which might be taken in the Middle East. However, it is essential to recognize that any particular combination of practices and measures should be determined by specific countries and that the package of practices will change over time. Finally, attention is drawn to the importance of cross-referencing experiences in water conservation and to the need for standardized evaluation procedures. A regional database on water conservation is proposed.

III. IMPERATIVES FOR CONSERVING WATER IN THE MIDDLE EAST

6. It is now recognized worldwide, and almost irrespective of natural water supplies, that the consistent supply of good water to burgeoning urban conurbations and far flung rural communities is making demands on financial and energy resources which are not sustainable in the long run. Increasingly countries are turning their attention to the demand side of the water equation. Even in water-rich countries, such as England, Canada, and the United States, water plans are increasingly emphasizing the need for resource conservation and demand management. How much more important then should this drive be in the water-short countries of the Middle East?

7. Water conservation is certainly not new to the Middle East. Indeed, conservation practices are as old as civilization itself which had its very foundations in the Region. However, Man's demands for water, fueled by increasing economic prosperity and by the various technologies that drive that advancement have now outstripped supplies, in some instances rendering civilization itself precarious.

8. The Middle East is one of the world's most extensive arid regions. Almost three quarters of the land from Egypt through Iraq is desert. In 1990, only seven Middle East countries had a per capita water availability of more than 1,000 m^3/year (a conventional definition of water scarcity). With an average annual growth rate of 3.6 percent, the population of the Middle East will more than double during the next 20 years or so. Such population growth increases the demand for goods and services, and, if practices remain unchanged, implies increased water use. Increasing industrialization and urbanization place also additional pressure on limited water resources. For the region as a whole, per capita supply within little more than one generation is projected to fall to 677 m^3/year, only 30 percent of the estimate for Asia, 25 percent of that for Africa and 15 percent of the world estimate. Under such circumstances, water conservation is not a matter of choice; it is an imperative.

9. Over-Exploitation of Natural Water Supplies. Water withdrawals in several Middle East countries already exceed renewable supplies. Other countries are essentially at the fine point of balance in the water equation and must soon start to mine their water resources. Even where countries of the Region appear to have a total water surplus, they face severe localized deficits due to over-exploitation of nearby resources and the lack of a physical network to distribute water according to demand. Mobilizing local surpluses for use elsewhere can be very expensive, and full mobilization is invariably impracticable. The greatest freshwater resources of the Middle East lie in aquifers, some of which are recharged from surface waters. Many deeper aquifers are isolated and contain fossil water. Some countries are mining these aquifers, a measure that may be temporarily justified but which is always risky.

10. Increasing Costs of Developing New Sources. In the Middle East, as in many parts of the world, the least expensive surface water sources have already been developed (see Box 1). The remaining sources are more distant, requiring large expenditures for pumping and transmission. Additional ground water sources are at greater depth, requiring more expensive boreholes and higher pumping costs.

Although fossil aquifers found in the region (e.g. the Nubian aquifer) are very large, there will be serious economic constraints on their exploitation, with the costs of pumping increasing as watertables decline.

Box 1

RISING COSTS OF NEW WATER DEVELOPMENT

The costs of new water supplies are rising rapidly in most areas of the World. The most dramatic examples are in large and growing urban areas; in Mexico City new supplies may have to be pumped over an elevation exceeding 1,000 meters; in Lima, upstream pollution has increased treatment costs by about 30 percent; in Shanghai water intakes have been moved 40 km upstream at a cost of $33 million; and in Amman the most recent works involve pumping water up 1,200 meters over a distance of 40km. A recent analysis[1] of the costs of supplying raw water for urban areas in World-Bank financed projects shows that the unit costs of developing new water could double or in some cases more than triple in future projects. The Middle East is no exception to this trend. Incremental water costs in Jordan in 1988 were estimated[2] as follows:

	Average Incremental Cost
Agricultural users in the Jordan Valley	US \$0.23 per m^3
Wastewater Treatment in Amman	US \$0.37 per m^3
Groundwater exploitation in Amman	US \$0.41 per m^3
Pumping surface water from the Jordan Valley	US \$1.33 per m^3
Supply to Amman from the proposed Unity Dam	US \$1.50 per m^3

These estimates can be compared with those of seawater desalination which are about US $1.5-2.0 per m^3 excluding the costs of water transport. Other examples of the high cost of water include groundwater extraction in Israel which range from US $0.03 per m^3 for low lift, small distance schemes to US $0.50 per m^3 for high lift long distance schemes; wastewater treatment costs which are quoted at between US $0.12 per m^3 in Morocco and Tunisia to US $0.40 per m^3 in the Gulf States; and the expected long-run marginal cost of raw water supplies in Algeria of US $0.39 per m^3, giving an average incremental cost in urban uses of US $0.70 per m^3 including distribution costs and US $0.49 per m^3 in irrigation.

[1] See World Development Report, 1992. The World Bank, Washington D.C.

[2] Jordan Water Resources Study, 1988. World Bank Report No. 7899-JO.

11. __Deterioration of Water Quality.__ Degradation of water quality is adding to the problem of water shortage in the Middle East. Poor quality water not only poses health problems, it jeopardizes sustainable agriculture, results in industrial production losses, and chronically degrades the economic well-being of nations. The unconfined aquifers closer to the surface and therefore strategically more important are susceptible to contamination from pollutants. The principal sources of surface and groundwater deterioration are the increasing volumes of discharge of untreated or inadequately treated domestic waste, emissions from agroprocessing plants, poorly regulated chemical fertilizer and pesticide use and hazardous industrial wastes. A critically important dimension to water conservation is that by definition it results in reduced amounts of *wastewater* and consequently makes possible reductions in the size and costs of proposed collectors, treatment plants and disposal systems which are essential for safeguarding freshwater supplies.

12. Cumulative Damage to Water-Based Habitats. In addition to the primary impacts of withdrawals from surface water sources, altered flow regimes, including artificially low flows during dry periods, deny suitable habitats to some indigenous aquatic species. This may be true for large wetland areas in the Middle East, for example the extensive marsh region in Southern Iraq. To the extent that water conservation can reduce withdrawals and related modifications of natural flow regimes, cumulative damage to water-based habitats can be reduced, postponed, or avoided.

IV. WATER CONSERVATION AND DEMAND MANAGEMENT

13. Clarifying Definitions. The terminology used in water management and planning is often confused and confusing, which causes problems when comparing experiences across regions and countries. The problem stems from the very nature of water, whereby "conservation" can at times be synonymous with supply enhancement. Similarly, water conservation and demand management are often interchanged. However, water conservation is a broader concept which involves the process of preserving and protecting the natural water resource; it implies the careful management of all water to minimize losses in quantity and quality through neglect, destruction or inefficient exploitation, and contributes positively to the protection and enhancement of water related environmental amenities. Whereas conservation may at times involve purely physical techniques (e.g. rainfall channeling or reducing evaporation), *demand management* always involves changing requirements for water and therefore always involves *choice*. Thus, demand management has at its core a human element; it includes all practices and measures to manipulate the quantity and quality needs for water to serve planned purposes. A key element of demand management, therefore, is recognition that water users have choices regarding how much water they wish to use, for what purpose, and from what source. Demand management essentially involves influencing that choice.

14. The term "demand" is often used interchangeably with "requirement" in discussions of water use. This, however, confuses two ideas that should be kept separate. Indeed, there are few absolute water "requirements" except for relatively small amounts for drinking, cleaning, fire fighting and other irreducible social and environmental purposes. In agriculture and industry too, the true "requirements" are usually only a small fraction of observed water use and are almost never what major projects are built to supply. In terms of absolute requirements, therefore, the Middle East has sufficient water to last for millennia. In practice of course, there are "demands" for water and water-related services that are affected by a host of demand-determining variables and policy decisions, some in fields far removed from what is generally considered to be water policy (e.g. state subsidies reinforcing the current agricultural practices to promote rural employment). Obviously the price of water and level of wastewater charges play a specially important role among those demand-determining variables.

V. THE NATURE OF GAINS

15. Viewed simplistically, the gains which might be made from water conservation would be measured in terms of water alone. Many examples given in the literature and highlighted in this paper illustrate how various procedures or techniques have influenced the demand for water and have reduced the volume of water used. Behind those figures, however, lie more fundamental types of gains; gains for governments and agencies, gains for communities and individuals, and gains for the socioeconomic well-being of a country and of a region.

Box 2

LESSONS FROM "CLOSING WATER SYSTEMS"[1]

A water system, for example a river basin, is said to be "closing" when water use and reuse exceeds water entering the system. In a perfectly closed system, water will progress through many use cycles until it evaporates or reaches a salt sink. The result is a "water multiplier" effect which can be calculated.

When a water system is closing:

* users become increasingly interdependant as water reuse increases;
* efficiency of water use and reuse becomes a public issue as well as a private one;
* water management improvements have system-wide consequences;
* the widespread consequences of improvements in water use efficiency or water quality allow costs to be shared amongst users;
* conjunctive use of surface water and groundwater increases in importance;
* system-wide management requires flexible operations;
* reallocation of water becomes increasingly important, with possible consequences for established rights and uses.

[1] From Water Policy Innovations in California. World Bank Working Paper, 1992. Edited by N.S. Peabody, Winrock International Institute for Agricultural Development.

16. Gaining More Benefit from Existing Resources. The current freshwater resources of the Middle East can for all practical purposes be considered as finite. Obviously, if economic considerations could be ignored, then the potential for desalination of seawater or for inter-basin transfers is virtually infinite, but in practical terms the water system of the region can be described as "closing" (see Box 2). Using this finite amount of water to its greatest economic and social effect should therefore be at the core of strategic planning in the region. In socio-economic terms every cubic meter of water has an opportunity value and choices have to be made on how best to exploit that value. One of the greatest gains in terms of releasing water can therefore be made by ensuring that water is used for purposes which gain benefits as near as possible

to its opportunity value. Various approaches to this goal are being tried in countries worldwide and the Middle East is at the forefront of research and implementation in some fields, e.g. improving the efficiency of irrigation[2]. Irrigation uses more than 70 percent of the region's freshwater and releasing part of that water for higher value purposes, possibly replacing it with less valuable water, would produce the greatest gains in terms of absolute water volume. There is a tendency to believe that less irrigation water will result in poorer crops; in fact the reverse may be true (Box 3).

Box 3

DOES LESS IRRIGATION WATER MEAN POORER CROPS?

Examples of yield increases and water savings with micro-irrigation (drip) compared furrow or sprinkler irrigation.

Country/Region	Crop	Yields/ha or m^3 water		Water Saved on the Farm
		Furrow/Sprinkler	Drip	
Hawaii	Sugar cane	29 t/ha	36 t/ha	56%
USA	Cotton	0.28 kg/m^3	0.54 kg/m^3	93% [a]
Spain	Cotton	2.5 t/ha	>4.0 t/ha	- [b]
Canaries	Bananas	1.7 kg/m^3	3.6 kg/m^3	109%
USA	Tomatoes	65 t/ha	83 t/ha	35%
India	Coconuts	35 nuts/tree	65 nuts/tree	60%
Jordan Valley	Tomatoes	15 t/ha	60 t/ha	50%
	Cucumbers	5 t/ha	24 t/ha	-
	Onions	15 t/ha	35 t/ha	-
	Pepper	10 t/ha	15 t/ha	-
	Eggplant	20 t/ha	70 t/ha	50%

From: William van Tuijl: Improving Water Use Efficiency in the Agricultural Sector. World Bank, Technical Paper - In Press.

[a] Increase in conversion efficiency.

[b] Not recorded.

17. Avoiding Heavy Financial Investment. Underlying absolute water gains is of course, financial gain. In virtually all countries worldwide, a high proportion of public and private expenditure goes directly and indirectly to the provision and management of water supplies. Owing to the natural water-scarce situation throughout the Middle East an even greater proportion of budgets must be allocated to water supply and distribution. By reducing water use in a controlled and orderly way, however, substantial reductions could be achieved in construction and energy costs, in wastewater treatment and in the costs of safeguarding freshwater resources.

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[2] See accompanying paper: Improving Water Use in Agriculture - Experiences in the Middle East and North Africa; by Willem Van Tuijl. Draft World Bank Technical Paper, 1993.

18. Gaining Energy. Wherever water must be pumped from deep groundwater sources or transported from low to high elevations the amount of energy required is considerable. Similarly, the energy requirements for wastewater treatment and particularly for desalination are substantial. Many countries now spend a high proportion of their total generated energy for pumping and delivering water and these costs will escalate as water must be pumped from greater depths, to more remote locations and, of course, as energy generating costs increase. Obviously, if water could be used more efficiently or the demands for any particular purpose were reduced, then a corresponding amount of energy could be either directly saved or used for other purposes.

19. Gaining Time. One of the most important gains which can be made from water conservation is the gain of time. Projections of the onset of economic and perhaps social disruption resulting from a serious imbalance in the supply and demand equation vary greatly, depending on country and on the assumptions used. Most projections, however, suggest that within a single generation several Middle East countries will be facing severe economic constraints. More importantly, within just a few years, the rapidly growing demands of several of the region's major cities will have far outstripped their available water resources. Unless action is taken to make more water available to those conurbations, the amount of time and effort taken by individuals and industrial enterprises to acquire usable water will cause a major disruption in economic activity. Already there are examples of areas where the quality of life has deteriorated because of lack of access to a consistent supply of clean water. Governments are falling behind in their attempts to maintain services, partly because of implementation problems but particularly because of a lack of investment capital.

20. These issues and problems are by no means restricted to the Middle East; even normally water-rich countries are confronting major decisions regarding the magnitude of investment requirements for providing water and getting rid of wastewater. Increasing environmental degradation, the uncertainties of droughts and the possibilities of global climate change are also stimulating debate on how best to introduce effective water conservation. Most of the examples described in this paper have intentionally been drawn from countries outside the Middle East to illustrate the approaches being employed even when the imperatives are less strong. Of particular interest is the attached paper from Western Australia[3] which has been specially prepared to illustrate the strategy and experiences in water conservation of the Water Authority of Western Australia. In this, as in many other examples given, a key underlying strategy to the water conservation effort is that it gains time, postponing the need for harder choices and greater use of scarce financial and energy resources.

21. Gaining Social Stability. At the heart of all discussion concerning gains which might be made from water conservation, is recognition that ultimately water and life itself are inseparable. Any suggestion of water shortage, or the threat of disruption to water supply, promotes an immediate emotional reaction which at the extreme can lead to social unrest. Therefore any policy, practice or measure

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[3] Accompanying Paper: Water Conservation - The Western Australian Experience. By Brian Sadler. Draft World Bank Technical Paper, 1993.

which saves water and buys time before water constraints start to impinge heavily on people's well-being, must be seen as a socio-political gain.

VI. WATER CONSERVATION PRACTICES AND MEASURES

Box 4

WATER CONSERVATION (DEMAND MANAGEMENT) PRACTICES AND MEASURES

Practices

Reducing end-user demand:
- Water re-circulation and re-cycling
- Adoption of low water-use technologies

Reducing water losses:
- Reducing transpiration
- Reducing evaporation
- Reducing unaccounted for water (including leak detection and repair)
- canal lining

Substituting for fresh water
- Wastewater re-use
- Use of brackish water
- Dual distribution systems

Measures

Institutional and Regulatory Framework:
- Establish laws and standards
- Reorganizing and strengthening institutions
- Introducing decision-support systems.
- Commercialization and Privatization
- Cross-sectoral adjustments
- Drought management

Economic Incentives and Disincentives:
- Review and adjust macro-economic policies
- Introduce pricing schemes
- Provide direct financial incentives and penalties
- Facilitate establishment of water markets

Education and Persuasion
- Improve education and training
- Increase public awareness

22. Problems over defining just what constitutes water conservation and the resulting difficulties encountered in comparing experiences, was mentioned in Section III above. In this paper a distinction has been made between *practices* and *measures;* the former dealing more with the"hardware" and the latter the"software" of conservation. The presentation of items under these headings is shown in Box 4.

PRACTICES

23. Water that is withdrawn or diverted from a supply source so that it is temporarily or permanently unavailable for other purposes can be viewed as a set or *given* supply. Any management practice that conserves this supply through reduction in water use or losses, or through better matching of demands with available supplies, can be classified as a conservation practice. In addition to reducing so-called end-uses of water by municipal, industrial or agricultural water users, other practices such as the reduction of transpiration and evaporation, canal lining to prevent seepage, reducing unaccounted-for water and leak detection, would all be classified as conservation practices. Water conservation practices also should include substitution for fresh water, such as wastewater reuse, use of brackish water the installation of necessary dual distribution systems.

Reducing End-User Demand

24. Water Re-Circulation/Re-Cycling, includes all water-saving operations internal to a given process, especially re-cycling of water within industrial and thermal power plants. Perhaps the greatest savings can be achieved by re-circulation of cooling water from energy generating plants, a particular issue in the Middle East. Demands for electrical energy will continue to grow in the region with industrialization and economic growth. Such demands will be met in large part by the construction of thermal power plants. Many of these plants will exceed 1000 MW in size and their cooling water demands are likely to be substantial. The cooling system may be any combination of open-cycle or closed-cycle types, and may incorporate cooling towers. The essence of a water conservation problem at the power plant is to determine an optimal combination of the two "pure" types of cooling system. In Egypt, for example, recycling in the power sector and industry is acknowledged to be a major problem and appropriate water pricing is thought to be the appropriate measure for alleviating the situation. "Even though industrial water prices have risen ten-fold in the past two years, they are still at most only 20 percent of marginal costs...the costs of treating cooling water may be economic for the power sector if water tariffs were increased...the power sector accounts for 79 percent of industrial water consumption"[4]. In water-short areas it is clear that water conservation must be a major consideration in the design and operation of all industrial projects. The marginal cost of cooling water should be factored into the project feasibility studies.

25. Adoption of Low Water-Use Technologies in Industry. Consumptive use of water by industry is small relative to consumption by agriculture and municipalities. Thus, the savings in industrial water use are not likely to be large in absolute terms. Nevertheless, these savings are of great importance because of their consequences in terms of pollution control (less water in, less wastewater out). The purposes to which water is put in industry vary widely. Water may be an input in the classic sense and forms part of the product (e.g.

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[4] Kosmo, M., Economic Incentives and Industrial Pollution in Developing Countries, The World Bank, Environmental Department Division Working Paper, No. 1989-2, Washington, D.C., 1991.

beverage industry) or may be used to convey the product between production stages. Water is of course used for washing and cleaning throughout industrial facilities and is the most commonly used coolant where excess heat is generated by a mechanical process or chemical or nuclear reaction. In industry, therefore, technological advances may include: (i) using less water in manufacturing processes, (ii) using less water in cooling systems, (iii) reducing water losses from pipes, valves, and other plant equipment, (iv) re-condensing steam, (v) using less water for transport, washing and cleaning, and (vi) de-watering sludges prior to disposal and reusing the retrieved water. For example, water re-circulation/re-cycling practices implemented in the 1980s by industrial companies in San Jose, California (electronics manufacturing, metal finishing, paper re-processing, and food processing), led to water savings ranging from 30 to 40 percent. Average savings were about US$ 50,000 per year, with several companies saving more than US$ 100,000 per year. Payback periods on capital investment were usually less than one year[5].

26. Adoption of Low Water-Use Technologies in Municipal Water Use. Municipal water use covers a wide range of activities, involving residential (including household), commercial, transportation, and public uses. Residential water use constitutes over half the total municipal use in many communities, and household water use varies considerably according to the nature of the residence, family composition, occupation of residents etc. Most uses of household water are accomplished with the aid of some type of device, such as a tap, shower spray head, or water closet. Depending on the design of the device, more or less water may be needed to perform the same function. One of the important approaches to water conservation worldwide is to require or promote the use of devices and appliances designed for low water use. In this way, water can be saved with little or no inconvenience to the user. Household water conservation devices and appliances include aerator/flow restrictors placed on taps, shower spray nozzles restricting water flow but increasing its velocity, thermal insulation of hot water pipes, and low-water use clothes washers and dishwashers. The substantial gains which can be achieved by employing such techniques is illustrated by the experience of Mexico City. Replaced 350,000 old-style toilets with 6-liter models, saved enough water to meet the needs of 250,000 residents[6]. Benefits and costs of a city-wide plumbing retrofit program in Phoenix, Arizona, USA, are shown in Box 5. The Los Angeles metropolitan district provides another good example of gains that can be made by introducing best management practices (see Box 6).

27. Adoption of Low Water-Use Technologies in Agriculture. Water is the key input to crop production. Irrigation has, over millennia, made possible the growth of crops and indeed civilizations in areas where rainfed activities would be precarious or impossible. Nevertheless, the very irrigation systems and procedures which promoted development are now a key challenge to sustainability.

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[5] Campos, M. et al, California Industries Discover That Water Conservation Pays, in Proceedings of CONSERV 90, The National Conference, Phoenix, Arizona, USA, 1990.

[6] Postel, S., Last Oasis, 1992.

Box 5

BENEFITS AND COSTS OF THE PHOENIX, ARIZONA, RETROFIT PROGRAM OVER A 50-YEAR PLANNING HORIZON

In 1985, a benefit-cost analysis of a citywide plumbing retrofit program in Phoenix gave the following results:

Nature of benefits	US$000	% benefits
Chemical and energy cost savings	7,985	8.5
Deferral of new water supply projects	166	0.2
Deferral of water treatment capacity	3,573	3.8
Deferral of wastewater treatment capacity	9,142	9.7
Customer energy savings from water-conserving showers	73,060	77.8
Total benefits	93,926	100.0
Implementation costs	5,695	
Net effects		
Net benefit to utility company	15,171	
Net benefit to community	88,231	
Benefit cost ratio to company	2.66:1	
Benefit cost ratio to community	15.49:1	

The retrofit program was projected to produce water savings up to 10 million cubic meters or 3 percent of total water use.

Ref.: B. Dziegielewski, et al. "Water Conservation Evaluation for the Phoenix area. Technical Report, 1986.

Modern on-farm irrigation technologies can be sub-divided into three major groups: improved surface irrigation; sprinkler irrigation; and, micro-irrigation.[7] Improved surface irrigation is mainly achieved through better land levelling, the use of syphons to bring irrigation water from a head ditch into furrows, the use of flexible pipes to distribute water, and the use of buried PVC pipes with risers. A variety of sprinkler systems is available but the main breakthrough in water-saving irrigation technology came with the development of micro (drip) irrigation systems. This maintains optimum moisture conditions around the root zone by irrigating with small but frequent supplies of water. Only a fraction of the soil profile is wetted, which leads to substantial water savings (Box 3). As the pressure increases on irrigators to save water, the total area equipped with micro-irrigation systems has increased rapidly - from 0.4 million ha in 1981 to 1.1 million ha in 1986. In terms of use by crop type, fruit trees make up 55 percent, vineyards 13 percent, vegetables 13 percent, flowers 1.5 percent and industrial crops 12.5 percent. It should be stressed, however, that all modern on-farm techniques need to be carefully selected and

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[7] Willem van Tuijl, Improving Water Use Efficiency in the Agricultural Sector, The World Bank Technical Paper, In Press.

Box 6

PROJECTED WATER SAVINGS IN THE LOS ANGELES METROPOLITAN DISTRICT

Demand reduction measures	Projected savings mill.³/year	% savings over base water use	% of best management practices
Existing Conservation:			
California Plumbing Code	204	3.9	-
Retail pricing (1980-90)	194	3.7	-
Best Management Practices:			
Residential retrofit	60	1.1	29.5
Home water audits	5	0.1	2.0
Leak detection repair	22	0.4	10.0
Large landscape audits	17	0.3	8.0
Landscape regulations	6	0.1	3.0
Government office retrofit	1	0	0.5
Introduction of 1992 Plumbing Code	30	0.6	14.0
Projected retail pricing	69	1.3	33.0
Total	608	11.5	100.0

From: Dziegielewski and Opitz. Municipal and Industrial Water Use in Los Angeles, 1991.

adapted to the local physical, agronomic and socio-economic environment, as well as to the technical and managerial skills of local farmers. The latter point is particularly important as more sophisticated irrigation techniques require substantial investment and improved management of the system.

Reducing Water Losses

28. Reducing Transpiration. Only 1 percent of water absorbed by the roots is incorporated into plant tissues, the rest is transpired. One hectare of growing vegetation can transpire as much as 100 m^3 of water per day. Transpiration losses can be reduced by shifting into crops which are natural xerophytes, e.g. cacti, breeding varieties of traditional crops that transpire less, enclosing crops with a structure so that transpired water can be collected and reused or so that the humidity rises and retards the transpiration process, reducing air movement over a crop by windbreaks of interplanted rows of taller plants, or using chemical anti-transpirants. Transpiration reduction is mainly experimental today and basic research on anti-transpirants has so far not produced results for widespread use.[8]

[8] A. Arar, Water Management and Conservation Measures Under Semi-Arid and Arid Conditions, paper presented at the Regional Workshop on Methodologies for Planning and Integrated Management of Water Resources in Arid and Semi-Arid Zones, March 1990, Tunis, Tunisia.

29. Reducing Evaporation. Evaporation losses from storage reservoirs in the Middle East are very significant; estimated annual evaporation from the High Aswan reservoir amounts to about 10 billion cubic meters, the equivalent of about 13 percent of the total average annual flow of the River Nile[9]. Evaporation losses are even more dramatic from shallow reservoirs with large surface area. All attempts to reduce evaporation from water surfaces have been based on the principle of providing a surface-barrier inhibiting evaporation. To this end, liquid chemicals, wax, solid blocks, and plastic sheets have been tested. Recently, the Center for Irrigation Technology in California State University has shown that a complete covering of the water surface by duckweed (Lemnaceae) could minimize water losses through evapotranspiration. Reduction of water loss by about one third compared to open water was recorded. The duckweed cover also significantly reduced water pollution. There are several difficulties, however, with stabilization of evaporation-control layers on water surfaces subject to wind, wave and currents. This is particularly so for alcohol monolayers. It is worth mentioning at this point that seepage control is usually easier and cheaper than evaporation control. Thus, evaporation control should not be considered for a reservoir or water-distribution system until seepage is controlled.

30. Reducing Unaccounted-for Water (Leak Detection and Repair). In many cities worldwide, the most troubling water issue is unaccounted-for water -- water which is treated and pumped but not paid for. Buenos Aires and Santiago provide examples where unaccounted-for water exceeds 40 percent of total pumped water; many cities in the Middle East exceed this figure. The problem lies with illegal connections, faulty meters, unpaid bills, leaks in the distribution system, and defective connections, valves and other fixtures. Finding leaks and reducing unaccounted-for water is a long, tedious process. Nevertheless, experience shows that most water distribution systems contain numerous opportunities for cost-effective water loss reduction and this is being given high priority even in water-rich countries such as Britain (see Box 7). In Vienna[10], a leak detection and repair program reduced water use by 64,000 m^3. In 1983 a pilot program in Manila reduced water losses in one district from 50 percent to 40 percent of total production. Based on this experience, Manila embarked on a full scale program expected to reduce overall water losses to 30 percent, freeing enough water to serve an additional one million people. According to a United Nations report, if leakage in Bombay, India, which is estimated at 18-36 percent, could be reduced to 10-15 percent, the city could save 250 million liters of water every day. In Sao Paulo, Brazil, unaccounted-for water dropped from 36 percent to 31 percent between 1980 and 1985. The measures applied included installing meters in private houses, detecting leaks, updating meter registers, and improving maintenance of technical installations. As a result, the utility was able to save enough water to supply an entire system for a city with a population of 2-3 million.

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[9] Agreement between the Republic of the Sudan and the United Arab Republic for the Full Utilization of the Nile Waters. November 1959.

[10] Postel, S., 1985, Conserving water; the untapped alternative, Washington, D.C. Worldwatch Institute, Worldwatch Paper 67.

Box 7

TACKLING LEAKAGES IN BRITAIN

Britain "loses" between 20 and 25 percent of its piped water through leakages in distribution networks; individual companies lose from 15 to 38 percent. These figures represent "accounted for water" and include unmeasured water drawn off from the mains for fire fighting, flushing mains and sewers, street cleaning etc. But there are also large losses through leakages from mains and service reservoirs. A substantial proportion of the losses are from customers' own pipes.

The British Government's Office of Water Services, which oversees the National Rivers Authority and the water agencies, has now made the size of losses in the distribution system a significant factor in measuring the efficiency of the industry. The traditional measure of water supplied to the distribution system has been replaced as the key measure of comparative performance by "water delivered". In other words, the Government now expects water companies to exercise control over unaccounted for water and the Director General will publish annual figures for each company of water delivered and water lost.

One of the water companies calculated that a one percent reduction in leakage saved the company almost $100 million in potential investment costs. Britain's water agencies have recently established a Joint Leakage Control Steering Group which will publish a Code of Practice in 1993. The primary objective is to establish criteria used in judging the cost-effectiveness of leakage control measures. Under the Water Byelaws it is the customer's responsibility to ensure water is not being wasted; agencies have powers to inspect plumbing and take enforcement action if customers do not remedy defects within a reasonable period.

Source: Using Water Wisely "The Department of the Environment, British Government Publication, 1992

31. Canal Lining. There is great potential for water savings by increasing efficiency of water transmission facilities. Extensive programs have been implemented in many countries to line canals and laterals with concrete, plastic membranes, or other materials which prevent seepage and reduce transpiration from ditch-bank vegetation. At the project level, canal lining and improvements in distribution technologies can save water in the order of 10 to 30 percent[11]. However, it must be recognized that not all water lost in seepage is lost from the water system. Often seepage water enters groundwater and is available for use lower in the watershed. However, where seepage water becomes contaminated, for example by draining to the sea from coastal schemes, it is an absolute loss to the economy.

Substituting for Fresh Water

32. Wastewater Reuse has long been identified as having a significant role in alleviating the quantitative and qualitative constraints on water resources in the Middle East. So far, however, few countries of the region have established

[11] Willem van Tuijl, Improving Water Use Efficiency in the Agricultural Sector, The World Bank, 1992.

significant reuse projects that go beyond the "pilot scale".[12] In other regions, however, the potential for irrigation using appropriately treated sewage water (usually in stabilization ponds) has been widely exploited. In India, wastewater irrigation is promoted with special grants and loans and 55 percent of available sewage is reused by agriculture. In Mexico City, 100 percent of sewage effluent is used for irrigation after sedimentation and partial treatment. The city of Johannesburg irrigates 1800 ha of fodder crops with wastewater and supports one of the nations largest cattle herds with the irrigated grazing and feed. In Israel, the ultimate goal is to utilize more than 80 percent of total wastewater, most of this in agriculture. In several countries, however, farmers recognize the potential of wastewater and are not waiting for official connections; they break into sewer networks to irrigate their crops. Clearly this is a dangerous practice; in Santiago, for example, typhoid numbers rose rapidly at the beginning of the irrigation season, after 16,000 ha of vegetables and salad crops had been irrigated with untreated wastewater.[13]

33. The Use of Brackish Water. Abundant amounts of brackish water are available in the Middle East and the reuse of drainage water is not a new practice in the region. In the Nile delta, for example, the reuse of drainage water started in the 1930s and is increasingly being mixed with fresh water from the Nile branches and main irrigation canals. At present, about 3.4 billion m^3 of drainage water is reused every year and by the year 2000, Egypt plans to reuse as much as double that amount. Furthermore, achievements of soil science, plant physiology and new irrigation techniques show that, with careful management, even saline water can be used to grow a range of crops. In Abu Dhabi, forest plantations have been established using saline groundwater of 10,000 pm of soluble salts on deep sandy soils.

34. Dual Distribution Systems. Where potable water is scarce it is sometimes feasible to restrict its use for high quality needs such as human consumption, preparation of food, or some industrial processes. Less stringent needs can then be supplied through a parallel and wholly separate distribution system, with lower quality non-potable water. This second water supply may come from contaminated sources or may consist of brackish water or treated wastewater. In practice, dual distribution systems convey non-potable water to outdoor (irrigation) uses and selected household and industrial applications. There is a limited experience with dual distribution systems but, for example, in England and Wales, four out of ten regional authorities offer low-quality non-potable piped supplies in certain industrial conurbations. In Rome, the non-potable network is 500 km long with an availability of 3 m^3/s, whereas the drinking water network is 3200 km long with 21 m^3/s availability. In Hong Kong, about 20 percent of total demand is supplied by sea-water which is distributed primarily for toilet flushing (about 30 percent, of household water use). These separate

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[12] N. Khouri, Wastewater Reuse Implementation in Selected Countries in the Middle East and North-Africa, in "Sustainable Water Resources Management in Arid Countries", Guest Editor, Eric S. Schiller, IWRA/Canadian Journal of Development Studies, Special Issue, 1992.

[13] Shuval I. Hillel, Wastewater Irrigation in Developing Countries, Health Effects and Technical Solutions, Summary of World Bank Technical Paper Number 51, UNDP-World Bank Water and Sanitation Program, 1990.

systems are also used for fire fighting and urban irrigation in places where desalinated water is used for drinking, such as Eilat in Israel. Still, the use of dual distribution systems significantly increases the required capital investments. Operating costs may increase or decrease depending on the source and treatment cost differentials between the two supplies, and on the extent of the non-potable distribution system.[14]

MEASURES

35. Water conservation measures can take many forms, from direct measures to control water use (e.g. regulation or prohibition), to indirect measures that affect voluntary behavior (e.g. market mechanisms, financial incentives, public awareness programs). The mix of conservation measures will vary between countries and regions as well as over time and, as noted above, within measures the distinctions between conservation and demand management become blurred. Three broad categories of measures may be recognized: institutional and regulatory instruments; economic incentives and disincentives; and education and persuasion.

Institutional and Regulatory Framework

36. Establish Laws and Standards. Legislation provides the basis for government regulation and establishes the administrative context for water conservation programs by non-government entities and individuals. The regulatory activities comprise enforcement and monitoring of established laws, agreements, rules and standards. Regulatory functions are often weakly developed in many countries. These weaknesses may be a reflection of factors that go well beyond the water area, but enforcement of rights and standards is of critical importance for water conservation and must be attempted despite difficult issues of administrative efficiency. Recognition by all water users of the need for, and equitable imposition of, regulations and restrictions does much to facilitate monitoring of legislation.

37. Reorganizing and Strengthening Institutions. The many possible models of institutional arrangements in the water sector include[15]: government administration, regulatory and operating agencies at both national and local level, national and local quasi-governmental agencies, local public utilities, private companies owning and operating water utilities, publicly-owned agencies contracting with private firms for operation and management, river basin authorities, and many others. The institutional arrangements for water resources management have widely varying capabilities and limitations. Hence, these arrangements are not alternatives that can be compared in the abstract with a view to selecting the single "best" institution. What will work best in a given basin depends not only upon its problems and its physical and economic characteristics but also on the general management milieu that is prevalent in the country. Still, there are a number of general observations emerging from

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[14] Demand Management, United Nations, New York, 1991

[15] Evaluation of Urban Water Conservation Programs: A Procedure Manual, Planning and Management Consultants, Ltd., 1992

world experience in managing water resources. First, the most effective and efficient use of water is commonly obscured by the existence of numerous, overlapping and fragmented institutions in the sector. Second, organizations charged with water management can easily be influenced by powerful user groups. Third, water supply is often a natural monopoly at the local level but conditions may be created whereby competition is for the water market, rather than within the market. In Paris, for example, the two major French water companies compete for contracts to serve different parts of the city. Similarly, the regional water authorities in Britain "compete" in terms of service level and efficiency. In practice, such contestability is usually a feature of privatization.

38. Commercialization and Privatization. There is growing worldwide recognition that the role of government is changing from being a provider of water to a broad based manager of the national water resource. Delivery of services should be left in the hands of autonomous agencies operating on a commercial basis. Their primary role is wholesaling water to intermediaries and the retail distribution of water to end-users -- farmers in an irrigation scheme, households in a municipality, industries, etc. Delivery of water services can be either a government, public or private function and should -- to the extent possible -- be delegated to lower levels of local entities.

39. Increased private sector involvement in the delivery of water services is warranted especially for the operation of municipal water and sewage utilities. Although private companies are not necessarily more likely than a good public utility to run efficient systems, minimize waste and losses and make active use of water pricing (Box 8), in practice they have stronger incentives to do so. In order to fulfil their mandate and make profits, private companies, whether concessionaires or service operators, have to attend to pricing and efficiency questions. Good public utilities also do this, but the pressures on them are often to do the opposite. The ability of private companies to withstand public pressure is usually far greater than that of public companies or government agencies.

40. Private utility companies already account for a high proportion of supply in several countries. In France, private water supply companies serve around two-thirds of the population. In the USA, investor-owned water companies account for 56 percent of all systems. In the UK, all water treatment, supply and delivery is now fully privatized. French companies have become involved in a number of countries such as Morocco, Cote d'Ivoire, Guinea, Thailand, and Malaysia. Regulated private companies also operate in Santiago and Guatemala City. In most cases, privatization has resulted in increased urban tariffs which have curbed excessive consumption, thus inducing water conservation.

41. Privatization, however, brings its own problems. If all incentive signals are for profit motivation, then aspects of equity of distribution, services for the poor, environmental safeguards and long-term sustainability may be compromised. Experience in several countries, such as Britain, has demonstrated that as the private sector takes a greater role in the water sector, so government monitoring and regulation must become stronger. The relative roles of government and the private sector should be seen as a partnership with the same goals: effective and efficient water resource management.

Box 8

SINGAPORE'S EFFECTIVE WATER SUPPLY

The Public Utilities Board of Singapore's Ministry of the Environment, has achieved high standards of investment and operating performance for water supplies, ensuring that it can meet the needs of this growing, modern city with a current population in excess of 2.7 million. The Board maintains a 24-hour high-quality water supply to the total population of Singapore at an overall average per capita consumption of about 300 liters per capita per day. The daily demand for domestic consumption is about 160 liters per head. All water supplies are metered; there are over 807,000 meters in use and the life of a meter is about 8 to 10 years. Tariffs for water supply are based on long-run marginal costs and cover operations and maintenance costs, debt service, contribute to the Government's Consolidated fund, and provide for expansion. An extensive and rigorous leak detection and waste prevention program is carried out by the staff of about 50 people. In addition, the PUB conducts a major water conservation program. In 1990, in response to prolonged dry weather, an advertising campaign was introduced, which effectively reduced consumption from about 1.1 million m^3/day to about 977m^3/day within one month. This was a specific campaign, but the PUB has been using pricing as a means of reducing demands for some time. A 5% water conservation tax is levied on all domestic consumption in excess of 20m^3/month, and 10% surcharge is levied on consumption by all non-domestic consumers. The PUB was rated by the Swiss-based World Competitive Report as one of the best water supply institutions in the world.

Source: The World Bank, FY92 Performance Review of Selected Water Supply and Sanitation Institutions.

42. Cross-Sectoral Adjustments. While privatization and complementary market mechanisms can help provide the incentives for water conservation, cross-sectoral shifts of water from low-value to high-value uses are highly political issues that usually involve direct or non-direct government intervention. Because irrigation water uses generally have relatively low marginal value products and are by far the largest consumptive users of water, it is this sector which is asked to adjust when water becomes scarce [16]. However, if a significant volume of water is to be transferred from an area where entire communities have been built around irrigated agriculture, then secondary economic and social effects must be carefully considered. Although cross-sectoral shifts may allow conservation of substantial volumes of water, they usually raise several measurement and conceptual problems as well as political issues. Sometimes a water conservation agreement may lead to a cross-sectoral shift in a true win-win partnership, as shown in the case of the Metropolitan Water District and the Imperial Irrigation District in California (Box 9).

43. Drought Management. Fostering water conservation during drought comprises two important tasks: convincing consumers that it is in their interests to conserve water, and providing them with information on how to do it. Experience from past droughts, however, offers some guidance regarding the selection of specific drought response measures. Most drought episodes were managed on an ad hoc basis and a number of actions were often taken to avert the threat of a water

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[16] K. William Easter, Intersectoral Water Allocation and Pricing, in "Country Experiences With Water Resources Management" edited by Guy Le Moigne et al., World Bank technical Paper Number 175, 1992

Box 9

AN INNOVATIVE COOPERATIVE WATER CONSERVATION PROJECT IN CALIFORNIA, U.S.A.

A water conservation agreement exists between Southern California's Imperial Irrigation District and the State's Metropolitan Water District. The Irrigation District is the largest in the U.S., serving approximately 200,000 hectares of land and delivering more than 3,000 million cubic meters of Colorado River water for irrigation. The Metropolitan District delivers an equal amount of water to some 15 million people, primarily for municipal and industrial uses. Under the conservation agreement the Metropolitan District pays to construct water conservation measures in the irrigation area in return for the use of the conserved water. Both parties gain from the cooperative venture; the irrigators get investment for new facilities and the urban areas get additional water supplies.

The water conservation program being funded under the agreement consists of an assortment of structural and non-structural measures, including lining of canals, construction of regulating reservoirs and interceptor canals, installation of non-leak gates and provision of automatic controls for the distribution system. The program is expected to conserve over 130 million cubic meters of water per year. The Metropolitan District will finance the cost of the program, estimated to be \$233 million, and in exchange, will be authorized to divert water from the river amounting to the volume of water conserved. The average amortized cost of the diverted water is estimated to be \$0.10 per cubic meter.

This innovative program clearly represents a win-win partnership involving different types of water users. It takes advantage of the fact that urban users can usually better afford to pay for water-saving improvements, even in this case in an irrigation service area. The Metropolitan Water District is better able to meet municipal and industrial needs for an expanding population while also providing for irrigation system improvements to benefit the irrigators. Here, synergy has replaced confrontation between rural and urban interests.

shortage. Public appeals for voluntary conservation are almost always used as the first response to drought, and in some cases the reported reductions are as high as 20 percent[17]. The specific drought management strategies should rely, to the extent possible, on providing a feedback on conservation efforts and providing economic and social incentives for conservation. One of the innovative ideas of an Emergency Drought Water Bank is illustrated in Box 10 and examples of the relative effectiveness of drought response measures in California are presented in Box 11. This shows that not all measures are equally effective, some have no significant impact and some have different impact on different sectors. Clearly the package of measures must be tailored to specific circumstances; a key lesson from water conservation experience.

44. Introducing Computerized Conservation-Support Systems. There are several possibilities for a wider use of computerized systems increasing the efficiency of water conservation practices. Especially important are short-term forecasting systems enabling better estimation of future water demands. For example, large volumes of cooling water may be saved providing there is a reliable operational forecast of air temperatures. In agriculture, accurate predictions of evapotranspiration can result in reduced irrigation water applications, thus saving energy and input costs for pumping as well as helping to maximize the

[17] Consumer Response to Drought, Planning and Management Consultants, Ltd. Carbondale, Illinois, USA, 1988.

Box 10

EMERGENCY DROUGHT WATER BANK SET UP IN CALIFORNIA, U.S.A

A complex system of water storage and conveyence facilities in California permits the movement of water from the north (which receives three quarters of the State's precipitation) to the south, where two-thirds of the State's more than thirty million people are concentrated. The massive network of interconnected Federal and State facilities, including storage reservoirs, pumping plants, hydroelectric generating plants, and canals and pipelines, is capable of conveying in excess of 14,000 million cubic meters of water annually. A significant benefit of this water infrastructure is the flexibility that it provides in meeting the State's water needs during periods of lower or higher precipitation. As the State grapples with the six-year drought, an Emergency Drought Water Bank has been established which provides a mechanism for supplying the critical water needs for urban and agricultural areas throughout the entire State. The Water Bank enabled water to be purchased from various sources (e.g., from farmers who had fallowed crop land) and transferred to the neediest urban and agricultural areas. Clearly, without the interconnected plumbing system, a State-wide Water Bank would merely be an elusive concept.

efficient use of irrigation water. An example of this conservation measure is provided by the AGRIMET network (see Box 12).

Economic Incentives and Disincentives

45. The Influence of Macro-Economic Policies on Water Use. At the macro-economic level[18], policies affecting exchange rates, import protection, taxes and subsidies, inflation, interest rates and price fixing for key goods, determine the *incentives for the production* and consumption of goods and services that differ widely in their "water-use intensity". Macro policies can either support or frustrate the achievement of water conservation at the sector or user level. The encouragement of more efficient practices, and even raising agricultural water prices, will fail if state subsidies reinforce the prevailing cropping pattern and farm practices. The promotion of water-intensive sectors like iron and steel, petrochemicals, and pulp and paper is deeply embedded in the industrialization strategies of many countries. Even if water charges could be raised to efficiency levels, their effect on water use is often buffered by an array of counter-signals: subsidies on other key inputs such as energy and raw materials; protection against imports; soft budget constraints; shortage of investment funds for water-efficient processes; and many others. The importance of potential changes in the structure of agriculture and industry on the demand for water is evident in many developing countries.

46. Pricing Schemes. One of the objectives of a sound water policy should be to create incentives for the efficient use of water. Pricing water withdrawal and use is the most direct way of encouraging water conservation and its reallocation to higher value uses. Pollution charges, based on the volume of wastewater produced should be seen as an indirect but important method of raising the cost of using water, also encouraging resource conservation. In principle,

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[18] Evaluation of Urban Water Conservation Programs: A Procedures Manual, Planning and Management Consultants, Ltd., 1992

Box 11

EFFECTIVENESS OF DROUGHT RESPONSE MEASURES IN CALIFORNIA

1. Residential Sector	Outcome
Carpinteria: Conservation literature sent with bills, toilet kits made available	Significant saving (22%)
Oceanside: Education programs, water kits and conservation literature with bills	Significant reduction in use (12%)
Palm Springs: Conservation literature and education	No change
Santa Cruz: Ordinance restricting use	11% savings during drought
Paradise: Restrictions + rationing	38% savings
Piedmont: (i) Comprehensive water management plan passed	10% savings
(ii) Program to detect & repair leaks	7% savings
(iii) Water rationing	67% savings

2. Commercial Sector	
Various cities: Conservation literature sent with bills, education programs and water kits made available	No significant change
Various cities: Water rationing	Up to 15% saving
El Cerrito: (i) Comprehensive water management plan passed	No effect
(ii) Detection + control of leaks	Savings 19%
(iii) Water rationing	Reduction of 7% in water use

3. Industrial Sector	
Carpinteria: Conservation literature sent with bills, toilet kits made available	No significant savings
Monterey: (i) Moratorium on installation of new hooks ups to	11% saving
(ii) Water rationing	No change
Santa Cruz (urban): (i) Ordinances to restrict water use	33% savings
(ii) Water rationing	No change
Santa Cruz (suburban): (i) Ordinance to restrictwater use	No change
(ii) Water rationing	Significant savings (11%)

Ref: Consumer Response to Drought. The Metropolitan Water Board of Southern California, June 1988.

there are two ways in which water prices and wastewater charges may be established; one is through the interaction of supply and demand in an open market; the other is through administrative decisions.

47. In many parts of the world, there is public opposition to the use of pricing and water charges by government agencies, based on the assertion that water is a natural gift and also that prices are regressive and thus discriminate against lower income families. Certainly, unified payments for water-related services represent a disproportionately high amount of a poor family's income. However, it has been shown in a number of studies that even the urban poor or small-scale farmers are willing to pay for water, providing the supply is reliable and the quality of service is fully acceptable (see Boxes 13 and 14). Indeed, studies have shown that poor people tend to be exploited greatly by

Box 12

AGRIMET - A COOPERATIVE AGRICULTURAL WEATHER INFORMATION NETWORK

Since 1983, the U.S Bureau of Reclamation and other agencies have used a data information system, "AgriMet" (from Agricultural and Meteorological system), which employs a network of automatic weather stations to provide real-time weather data for modeling site-specific crop water use. The AgriMet network, located in the Pacific Northwest region, consists of 46 coordinated weather stations located throughout the region. To model local crop water consumptive use, each AgriMet station monitors and transmits via satellite the parameters required in calculating a daily local reference evapotranspiration. Crop water use models are run daily to translate local weather data into evapotranspiration information for crops at each station. Crop water use information is then published daily during the irrigation season in local newspapers, as well as through on-farm irrigation management programs of the U.S. Department of Agriculture (USDA), State water resource agencies and private consultants. AgriMet partnerships throughout the region now include many of the region's public and private electric utilities, land grant universities, USDA's Cooperative Extension, Soil Conservation and Agricultural Research Services, and other State and local water resource agencies and organizations.

Accurate predictions of evapotranspiration needs can result in reduced irrigation water applications, thus saving energy and input costs for pumping as well as helping to maximize the efficient use of agricultural water. While it has been difficult to quantify the water savings achieved in this program, they are estimated to be in the range of 5 to 7 percent. Energy savings for pumping may be even higher.

informal water markets and would be far better off paying reasonable sums for good supplies from official sources.

Box 13

HIGH COST OF WATER FOR URBAN POOR

In 1988, it was estimated that over 100 million of the developing world's poorest people lived in urban squatter settlements and depended on traditional sources of water. These supplies are becoming increasingly contaminated with human waste, industrial effluent and agricultural pollutants. As a consequence, the poorest people have to purchase safe drinking water to meet their basic needs.

In a number of studies, the urban poor have been shown to pay high prices for water supplies and to spend a high proportion of their income on water. For example, in Port-au-Prince (Haiti) the poorest households sometimes spend 20 percent of their income on water. In Onitsha (Nigeria) the poor were estimated to pay 18 percent of their income on water during the dry season, and in Ukunda (Kenya) the urban poor spend up to 9 percent of their income on water. In Jakarta (Indonesia), of the 7.9 million inhabitants, only 14 percent of households received water through direct connections to the municipal system. Another 32 percent bought water from street vendors who charged around U.S.$1.5 to U.S.$5.2 per cubic meter, depending on the distance from the public tap. *In some cases, households purchasing from vendors pay as much as 50 to 60 times more per unit of water than households connected to the municipal system.* All these findings make a strong case for extending reliable public water supply even to poor communities. The poor would willingly pay for the improved service.

48. The use of block payments based on a "step" principle in which a minimum requirement level is nominally priced, while increasing volumes are priced more

Box 14

CAN POOR FARMERS AFFORD TO PAY FOR IRRIGATION?

Information on communal and private irrigation systems in various countries in Asia shows that even very poor farmers often pay high fees for good quality irrigation services. In Bangladesh it is not uncommon for a farmer to agree to pay a quarter of his dry-season irrigated rice crop to the owner of a nearby tubewell who supplies the irrigation water. In Nepal studies of farmer-managed irrigation systems have revealed that farmers contribute large amounts of cash and labor to pay the annual costs of operation and maintenance of the system. For example, in six hill systems studied in detail, the average annual labor contribution for maintaining the system was sixty-eight man-days per hectare. In one thirty-five hectare system, annual labor contributions were approximately fifty man-days per hectare, while a cash assessment averaged the equivalent of over one man-month of labor.

These observations show that although the payments are large, the gains that farmers perceive they make from irrigation must be even greater. Although many of these water users are very poor in an absolute sense, they are prepared to pay these irrigation costs; they are still better off than they would be without access to irrigation.

heavily can safeguard the poor, conserve water, and raise funds for the water service (Box 15).

Box 15

INCREASING BLOCK VOLUMETRIC WATER CHARGES IN ISTANBUL

Water and sewerage in Istanbul are managed by an autonomous agency the Istanbul Water and Sewerage Authority (ISKI). Only limited financing is available for water and sewerage investments from central government agencies and the municipality. ISKI has been obliged, therefore, to finance most of its investment and operating costs from charges to customers. The issue has been how to raise the necessary funding, while assuring equity in providing the basic water needs of the population, including in particular those of lower income households. ISKI has effectively used the practice of increasing block volumetric water charges for households to meet these dual objectives. Charges were set in 1987 as follows:

Customer category	Basic rate (US$/m³)	Consumption (%)
Households		
(0-7.5 m³/month)	0.26	4
(above 7.5 m³/month)	0.53	45
Offices	0.88	12
Industry	1.24	38
Average	(0.68)	

Households are thus cross-subsidized by industry; water charges up to a minimum to meet basic health requirements (set at 7.5m³ per month) are kept particularly modest. Affordability calculations indicate that low-income households would spend about 2.7 percent of average monthly income on water and sewerage. The principle of full payment by consumers for investment and operating costs has been accepted. This system has worked because consumers are metered; tampering with meters has not been a serious problem. Still ISKI faces major problems in the process of billing and fee collection; billed water amounts to only about 65 percent of water consumed. Improvements in fee collection is essential to offset rising investment costs. Despite these difficulties, the ISKI model of block volumetric water charges has been adopted by four other large municipalities in Turkey.

49. Setting water prices and wastewater charges by administrative decisions, underlies most of the water pricing schemes in existence. In this case, the questions of primary importance are how the price is to be administered, how high it should be, and to what extent the price (charge) should be varied in time and space. For optimal allocation of resources, which is optimal from the water conservation point of view as well, the price water users pay for their marginal units of water withdrawal, consumptive use, and wastewater disposal services, should reflect the marginal costs of supplying those units. The practical implementation of this principle is still limited, although there are some encouraging examples pertaining mostly to municipal water use. Applying this principle requires that the consumption of water be measured (by metering) and charges are volumetric, proportional to the amount consumed.

50. Cost Recovery. An issue that is closely tied to any discussion of water pricing is cost recovery. Without adequate water charges to cover operation and maintenance costs plus the cost of the original investment, the rest of society is subsidizing those receiving water. Generally, cost recovery is considered too late in the planning process and expectations concerning fee collection are often unrealistic. In this context, it is worth noting that the Middle East region has the highest median cost of water supply and sanitation in the world[19]. For example, in 1985 the capital costs of house connections in urban areas reached a median of $300 per capita. This was about twice the costs in the Americas ($160), much higher than in Africa ($106) and more than five times the cost in Southeast Asia ($60). There is a general realization that the region cannot afford to expand sector coverage, in addition to maintaining existing coverage, without improving productivity and recovering a substantial portion of costs.

51. The effective use of pricing schemes presumes a response to price changes by consumers as measured by the elasticity of demand; the percentage by which the quantity demanded changes for a 1 percent change in price. As shown in Box 16, price elasticities estimated for various user groups in a number of countries were significantly different from zero. This demonstrates that, as would be expected, significant economic gains can be made from efficient water pricing (Box 17). The rapid impact of water price on user behavior patterns can be employed to great effect and social benefit, as clearly demonstrated by the management of water supplies during severe drought conditions in Botswana (Box 18).

52. Among household consumers, elasticity depends on the existence of a margin of "discretionary" water use (typically for outdoor purposes) and the availability of flow-reduction devices. In agriculture, elasticity exists where the farmer has sufficient choice over quantities grown, the choice of crops, the methods of application, etc. In industry, the elasticity of demand depends on the scope for using water-saving processes, recycling, reuse of treated effluent, etc. The impact of charging higher water fees for industrial users is demonstrated by the case of the Indian fertilizer company (Box 19).

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[19] UNDP - World Bank Water and Sanitation Program, Annual Report 1990-1991.

Box 16

PRICE ELASTICITIES FOR URBAN WATER SUPPLY

Country	Location	Reporting Year	Type of Elasticity	Estimated Price Elasticity
Australia	971 households in Perth	1985	Overall	- 0.11
Australia	315 households	1983	In-house Ex-house	- 0.04 - 0.31
Canada	Urban demand Eastern Canada	1972	Winter Summer	- 0.75 - 1.07
Canada	Municipal demand Victoria, B.C.	1972	Winter Summer Year-round	- 0.58 - 0.00 - 0.40
England & Wales	411 firms in Severn-Trent	1981	Year-round	- 0.30
Finland	Municipal demand Helsinki	1981	Year-round	- 0.11
Sweden	69 domestic in Malmo	1982	Year-round	- 0.15
U.S.A	2159 households Tuson, Arizona	1983	Year-round	- 0.26

Box 17

ECONOMIC GAINS FROM EFFICIENT MUNICIPAL WATER PRICING

Few water supply utilities employ pricing procedures that conform to strict guidelines of economic efficiency. Often flat fees are charged for water services and, if meters are employed, constant volumetric rates are used. Usually these rates are calculated using the utility's average delivery cost, ignoring any scarcity value for the water resource used. Economic theory suggests that volumetric water fees that are based on long-run marginal cost would produce economic surpluses. Furthermore, efficiency could be improved by adjusting these rates for seasonal shifts in supply and demand. A recent study of the municipal water system in Vancouver, Canada, has confirmed this. Using estimated residential and industrial demand curves and long-run marginal cost, a simulation model measured changes in economic welfare. By using long-run marginal costs, the simulation accounted for the scarcity of water resources. The model also accounted for all costs of implementing the new policy, including the installation of household meters. A gain in aggregate consumer surplus of 4% was estimated when seasonally variable price was used to allocate water efficiently.

53. Fairness and Acceptability. If pricing schemes are to be effective vehicles for demand management, they must be perceived as fair, and importantly,

Box 18

MANAGING SCARCE WATER SUPPLIES IN BOTSWANA

Water conservation is integral to the culture of the people of Botswana living in a semi-arid environment. Building on this public awareness, the Ministry of Mineral Resources and Water Affairs and the Botswana Water Utilities Corporation have developed one of the most successful water supply authorities in Africa. Established in 1970, the Utilities Corporation serves the principal urban areas and must be financially self-supporting. The Corporation and its parent Ministry have consistently introduced and operated commercially-oriented tariffs and charges, and have not been deterred from raising charges significantly where and when necessary. In 1985/86, during a particularly severe drought, in addition to imposing restrictions on the use of hosepipes, and mounting a large publicity campaign to conserve water, water prices were sharply increased. This increase succeeded in suppressing demand to the point where all consumers could continuously obtain a minimum quantity of water necessary for basic needs. When the drought was over and supplies had returned to normal, the pre-drought water price was re-introduced. The Corporation used the price elasticity of demand for water to limit supplies, instead of resorting to inefficient, disruptive and often inequitable closing off of supplies for certain hours, or days. Closing off water supplies rarely achieves anticipated savings as users store water for expected shut-off periods then release the stored water to clean and replenish containers once supplies return.

Source: The World Bank, FY92 Performance Review of Selected Water supply and Sanitation Institutions.

Box 19

WATER FEES SAVE WATER IN INDIA

An Indian fertilizer company, Zuari Agro-Chemical Limited (ZACL) at Goa, halved its water consumption, from a designed need of 22,000 cubic meters per day to 11,000 cubic meters per day, in the six years between 1982 and 1988. This reduction occurred in response to the high price of water for industry and to government pressure to reduce industrial effluent discharge to the sea. In 1990, water consumption in ZACL was 10.3 cubic meters per ton of nutrient, only 40 percent of the water consumed in another fertilizer unit, Indian Explosives Limited (IEL) at Kanpur. The significantly lower consumption in ZACL is mainly a response to the higher price of water in Goa, twelve cents per cubic meter compared with one cent per cubic meter in Kanpur.

should be generally acceptable to the public[20]. The tendency is to view prices and charges that are uniform across all customers in a class (residential vs. industrial, for example) as fair, even where underlying costs are not uniform. Conversely, prices which vary from customer to customer within the same user class (elevation surcharges or prices differentiated by political jurisdiction) are frequently seen as unfair. Large increases in the level of prices or charges are often unacceptable, except where the public has already been convinced of the necessity of such increases.

54. Provide Direct Financial Incentives and Penalties. Other economic incentives important for water conservation, include subsidies, tariff concessions and tax incentives for investment in effluent treatment plants and recycling equipment installed by a single water user or a group of users. At the household level, municipalities may offer rebate to contractors or direct

[20] Demand Management, United Nations, New York, 1991

payments to homeowners for modification of water use levels or patterns, in return for a payment, usually in the form of a rebate or user credit[21]. In order to qualify for an incentive payment, water use modifications should be continuing and verifiable. Most common user incentive payments are provided for: voluntary acceptance of a limit on the amount of water that can be used in a specific billing period; voluntary acceptance of flow restrictors which limit the rate at which water can be withdrawn; and, less water-intensive lawn and garden landscape design (landscape subsidies). In industry, firms can be encouraged to reduce water use by levying a surcharge on all water used in excess of a base amount. If the base amount is set equal to the water requirements of the firm, provided all water saving processes and methods are in use, then the firm will pay a penalty only if it fails to adopt all possible water-saving practices. The level of the surcharge determines the amount of water savings to be expected, as the firm makes investments in order to avoid paying the extra charge.

55. Facilitate Establishment of Water Markets. Local water markets almost invariably emerge where private interests or individuals control particular water supplies or assets and can deal directly with their customers[22]. Examples include the sale of irrigation or domestic water from individually-owned tubewells; the provision of domestic water by private tankers in areas poorly served by public supply; and exchange or sale of irrigation turns between farmers along a common channel. However, in all these cases some basic preconditions of a legal and physical nature must be met: sellers must have legal title to their water and the freedom to sell. Likewise, there must be the physical means to make water transfers possible. Most of the evidence on the evolution of surface water markets has been derived from the western states of the USA. However, the tradition of selling excess water exists in many other societies. For example, the markets for groundwater in Gujarat, India, have existed for almost 80 years and are typical of others in South Asia. Owners of wells, to all intents and purposes, have ownership rights over the water they draw, and sell surplus water to other farmers. Although the typical transaction is on a temporary basis, there are a number of large scale water dealers selling large quantities to regular buyers through a highly-capitalised pipe network.

Education and Persuasion

56. Behavioral Changes in Water Use. As stated above, the essential element of demand management is influencing choice and inducing change in behavior. There are, of course, major differences in the behavior of water users, not only between different types of users but also among those in the same water use category. Several studies have indicated that it is routine and traditional practice, more than conscious decision making, which controls much of this behavior. If there are no external forces applied, incentives or disincentives, such as price increases or water shortages, there is little reason for individuals or societies to change behavior. Institutional and regulatory measures can be used to require changed behavior, economic incentives can be used

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21 Demand Management, United Nations, New York, 1991

22 A Strategy for Managing Water in the Middle East and North Africa, Water Resources Management Unit, Technical Department EMENA, The World Bank, 1992.

to induce different behavior, but communication with water users and the general public are critically important steps in educating and persuading them to alter water use habits. Water users are far more likely to acquiesce in reforms causing, for example, an increase in the price of water, if they are fully informed about the problem and encouraged to make a commitment to long term solutions.

57. The programs and measures described in the accompanying paper on experiences in Western Australia[23], demonstrate most forcibly that the main thrust of all demand management programs must involve a carefully orchestrated social dimension. The Australian case study emphasizes water conservation as a technical and social problem, but points out that the technical aspects are relatively universal and transferrable. Indeed there has already been a two-way transfer of technical experience between Australia and the Middle East. However, the study makes the important point that social aspects are specific to local cultures and circumstances and represent the more complex part of water conservation. The case study illustrates the basic principles of social intervention: development of a water conservation ethic or culture; marketing strategies for promoting conservation practices and measures; and, the importance of developing commitment by consulting with and involving the public in decision making. Over the years, Western Australia has shown that public expectations are one of the imperatives for water conservation; it is the public who, by their individual decisions, will choose whether to implement water conservation;, and it is public perceptions which will decide the degree to which water conservation is fair, efficient and effective.

58. Education and Training. Many professional and social groups have an influence on water conservation by reason of their work and life habits. General education should expose children and even university students to water conservation concerns. Where public awareness of water issues is high, the interest of students in obtaining a better understanding of water conservation practices and measures should be encouraged. The most feasible way to assure better information is within the framework of continuing education programs. Vocational training of technicians and skilled workers in the area of water conservation is also necessary. Such courses must be tailored to local requirements and customs, with a clear emphasis on field demonstration (particularly so for small scale systems, on-farm water management schemes, etc.). Demonstration projects often have a catalytic effect in spreading the interest in water conservation among neighboring families or communities. The ex-post evaluation of completed water conservation programs and projects has many educational merits. Only by careful evaluation of such projects or programs can the agency, the planner, and the general public be made aware of their positive and negative aspects.

59. Public Awareness. Most water users and the general public have only a limited awareness of the amounts of water consumed in their own household or by various water use activities. In order to raise awareness, water agencies should make widely available information about typical use rates. It is important

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[23] Water Conservation -- The Western Australian Experience, by Brian Sadler. World Bank Draft Technical Paper, 1993.

because if consumers believe that they use, for example, only 50 liters per day, they will not relate to a campaign which tells them they can conserve 150 liters per day by sweeping the driveway instead of hosing it. Surveys indicate that most consumers greatly under-estimate their daily water use. This may partially be due to the manner in which water utilities measure and bill water use. In the United States and Western Europe water bills have been made much more comprehensible and recent campaigns have explained the meaning of bill items, how summer and winter rates differ and how charges are calculated. These measures are directly aimed at increasing public awareness that water conservation is important and within their own control.

60. Promotional Campaigns/Events. Social-behavioral research provides a number of guiding principles for designing an effective campaign for encouraging water conservation. For example, the campaign should effectively convey a message about the seriousness of water situations. Consideration must be given to the type of appeal, e.g. to what extent should the campaign emphasize fear or positive action. The campaign should provide social reinforcement of conservation behaviors especially at the local level. It is important that conservation efforts requested by the campaign are equitable. The means for delivering the message should make the maximum use of person-to-person communication through local media, personalities, leaders, and citizen advisory groups. Impersonal messages should be avoided. Sequential campaigning is important in order to avoid overwhelming people with "shock therapy" type conservation measures. Feedback communication is important and periodically the results of the conservation effort should be reported to the public through newspapers and radio or television.

61. The above discussion has only touched on the vast array of water conservation techniques, mechanisms, procedures, measures and practices which are being employed with varying degrees of success worldwide. It does, however, give an indication of the importance being given to water conservation and demand management, and to its legitimacy as a key to efficient resource planning and management. In summary, the Australian case study makes the point that: *"Water conservation is a whole cycle of awareness, pricing and motivation, research and development, customer consultation, decisions on conservation measures, education on application, implementation, and monitoring of effectiveness"*. The exact composition of the array will vary between countries and between user groups, and will need to be monitored and adjusted over time. Determining criteria and priorities for introducing conservation programs and "packages" will be the responsibility of government planners and water agencies, in consultation with water users, in individual countries.

VII. CRITERIA FOR RANKING CONSERVATION PRIORITIES

62. In developing a water conservation program or policy, a water agency must choose among numerous legislative, regulatory, economic and behavioral measures, each with a unique set of advantages and disadvantages. To this end, criteria are needed to determine which combination of measures will be most beneficial, resulting in a net gain in social welfare. The choice of socially relevant criteria requires judgement both on the part of government, the water agency and

on the part of other participants in the process, especially the public and their political representatives. Generally, four categories of criteria must simultaneously be considered in the process of evaluating water conservation programs or policies: political, economic, social and environmental.

63. Public Policy/Political Will. To be successful, water conservation programs should be politically feasible. Since some, such as cross-sectoral water transfers, reallocate not only water but also benefits resulting from its use, there will always be those who gain and those who lose water in the process. The key to successful conservation programs is to ensure that water losers are compensated either financially or materially or to offer them new opportunities. Similarly, pricing schemes often result in higher costs for larger, usually more affluent, water users[24]. The beneficiaries are smaller users who can now expect better access to water and a more reliable supply. If smaller users lack adequate representation in the political process, the interests of more influential citizens may be given higher priority. Generally, water conservation programs need a long-term vision of problems which will arise due to water scarcity as well as misuse of the natural resources.

64. Western Australia has developed a detailed 10-year strategy for water conservation in Perth, a long-term strategy for restructuring irrigation districts, and a strategic approach to regional- and cross-sectoral water allocation. Developing such strategies should be given high priority in country resource planning in the Middle East. Even more important, however, is the need for government and the public to consistently support the strategy. Faced with the irregularities of rainfall and drought, and the ensuing countervailing pressures and tensions, that consistent support calls for statesmanship and determination.

65. Economic Criteria. All conservation practices involve some economic costs as well as benefits. To evaluate the absolute and relative worth of conservation programs and policies, some basis for comparison is needed. The common measure is their financial value and there are several manuals available on cost-benefit analysis techniques. Sometimes, however, water conservation practices cannot be justified in strict financial terms. In Valparaiso, Chile, for example, studies on pumping treated wastewater from Valparaiso to higher elevation farms showed that costs would have been prohibitive. In other instances, if the agricultural sector is small, it may not be feasible to separate networks of pipes to transport treated wastewater. The correct way to analyze water conservation programs is to consider opportunity costs -- the net benefits foregone because water resources, including treated wastewater, being used for one service are no longer available to provide the gains for their next most beneficial use.

66. Social Criteria. Many of the most important effects of water conservation programs are of a social nature. Often the benefits are not easily assessed in monetary terms or in the amount of water saved, and may involve a chain of interactive effects. For example, investing in wastewater treatment plants may be justified even if the treated water is used for irrigation which is not in itself financially viable. If the provision of irrigation slows the drift of

[24] Water Demand Management, United Nations, New York, 1991.

people from rural areas to urban slums, or if the removal of sewage wastewater themselves have social benefits, these must be taken into account in evaluating the true economic gain.

67. There is little reliable information on actual water savings and the interaction of long and short term effects on economic gains. As a result, California's water utility industry, recognizing the need for standardization, has produced a Procedures Manual for evaluating water conservation programs. The Manual has been endorsed by the American Water Works Association (Box 20). This endorsement is a milestone in water conservation in the United States and demonstrates recognition of the vital importance of demand-side management of water resources.

<u>Box 20</u>

<u>WATER CONSERVATION PROCEDURES MANUAL ENDORSED FOR USE IN THE U.S.A.¹</u>

Since the onset of California's drought, more emphasis has been placed on the use of demand-side management of water resources in the United States. However, there is little reliable information on actual water savings, market penetration and interaction effects of long-term and short-term (drought) measures. California's water utility industry recognized a need for standardization in procedures and funded the development of a detailed procedures manual for water conservation planning and program evaluation. This publication entitled <u>"Evaluating Urban Water Conservation Programs: A Procedures Manual"</u> has been endorsed by the American Water Works Association. The Manual leads the reader step by step through the determination of the potential for water conservation, and then provides detailed concepts and procedures for the formulation and evaluation of water demand alternatives. Examples of projects described include:

* Public campaigns to educate consumers on modifying their water consumption habits;
* Promoting or mandating water-saving technologies and low water-using urban landscapes;
* Adoption of market place pricing strategies and economic incentive programs to discourage inefficient water use; and,
* Adoption of zoning policies to control the numbers of water users served by a water system.

Endorsement of the procedures manual is a milestone in water conservation in the United States. It demonstrates recognition of the vital importance of demand-side management even in water-rich countries, and illustrates the need for standardized data, procedures and evaluation.

¹ <u>Ref.</u>: Dziegielewski, B. et al. Evaluating Urban Water Conservation programs: A procedures Manual. California Urban Water Agencies, 1992.

68. <u>Environmental and Sustainability Criteria</u>. The increased focus on water conservation is also being driven by the impact on the environment of water supply projects. There is a growing understanding of ecological processes and societies are being made painfully aware that many of the past supply augmentation projects have produced some unpleasant and unforeseen results. All projects alter the natural environment. The challenge is to try to foresee the environmental consequences of proposed water development projects, but history shows that this is not always possible. There can be little doubt

however, that water conservation in all its facets, goes a long way to meeting the criteria for environmental sustainability. This should weigh heavily in preparing country water strategies.

VIII. IMPLEMENTING WATER CONSERVATION MEASURES

69. Metering and Administrative Follow-Up. The ability to successfully implement any selected water conservation approach depends on several factors. High among these is the existence of fairly accurate information on current and anticipated patterns of water use. For this a consistent methodology for collecting and analyzing data is essential. The availability of water use data, in turn, depends on the existence of measuring devices, and the way in which the metering program is administered. Meters can of course be placed anywhere in the distribution network to determine flows, usage and losses. However, because the decisions associated with water conservation are made essentially at the user level, meters should be installed at that level. Obviously meters should be maintained in good working order, checked periodically for tampering, and meter reading procedures should ensure reasonable accuracy. Opportunities now exist for installation of meters which can be read automatically. Clearly, the investment costs involved are considerable, but judged against the gains which can be made, are well worthwhile.

70. Record-Keeping, Billing, and Collection Systems. Effective analysis and implementation of water conservation policy calls for maintenance of financial records in a way that permits identification of potential or actual cost savings attributable to specific conservation practices and measures. Effective meter-reading program should be matched by an equally effective billing and fee collection process. Where bills arrive months after the billing period has ended, or where sanctions for non-payment are vague or non-existent, economic incentives provided by the pricing scheme are weakened or nullified. Thus, the effectiveness of a whole class of water conservation measures may be lost due to administrative imperfections.

71. Enforcement of Sanctions. Water agencies should have a clear understanding of sanctions available to them for non-compliance with water conservation related laws, standards and regulations. Within the framework of a water conservation policy, standard procedures should be developed and transparently implemented to avoid public accusations of water agencies acting in an arbitrary or inconsistent manner. Enforcement of sanctions will be perceived as fair as long as they are uniformly applied.

72. Consistent Public Policy. Water conservation policies are developed under the assumption that water users, confronted with various conservation practices and measures, will react so as to maximize their well-being under the new conditions set up by the policy. This is an appropriate expectation where water users believe that the policy has been adopted for a good purpose and their own long-term benefit, and where they expected the policy to be maintained and enforced. An important feature of any water conservation

policy, then, must be a consistent and long-term commitment with respect to its implementation on the part of policy-makers and water sector managers.

IX. POTENTIAL GAINS

73. Throughout most countries of the Middle East, by far the greatest demand for water is from agriculture; municipal demands come second; and industry demands the smallest quantities. This imbalance between sectors will inevitably change as municipal demands increase and as t e greater potential value-added of industrial production is exploited. With over 70 percent of freshwater being used for agriculture it is obvious that any improvements in efficiency of water use in the sector, or any alternative sources of water supply, will have the greatest impact on the supply-demand equation. Even small savings in percentage terms mean large volumes of water can be released.

74. As shown in this paper (Box 4), by introducing modern on-farm irrigation technologies, water demand for irrigation can be halved. At the same time, with efficient management yields may be doubled. These results are not theoretical, they are being achieved in many countries especially some countries of the Middle East. If such savings could be coupled with the use of treated wastewater for micro-irrigation, then the overall releases of freshwater from agriculture to municipal and industrial uses would be enormous. In addition to gains in water, considerable energy savings would be achieved by the lower need for pumping from river and groundwater sources, and in most cases this would save substantial amounts of foreign exchange.

75. Making the shift to more water efficient agriculture would, of course require substantial investment; on-farm investment for new micro-irrigation equipment, automatic metering equipment, new pipe networks, and for wastewater treatment plants and distribution networks. Some of these investment costs could come from sectors benefitting from greater access to released water, as in the case of California (Box 9), but most would have to be donor financed. It is reasonable to believe, that there would be strong donor support for strategies which improved agricultural efficiency and at the same time created a resource to be used for economic development. The rate of return on such projects would almost certainly be very attractive.

76. Saving water in agriculture should be the first priority in any water conservation strategy. However, the practices and measures employed towards achieving that goal need to be phased sympathetically to avoid disruption to the sector. Increasing irrigation water prices is important as it immediately makes farmers face up to choices of crop, whether to use transpiration-reducing devices, and whether to invest in more modern equipment. It is essential, however, when farmers are having to make these difficult decisions, that they should have the benefit not only of technical advice from research and extension, but also that the opportunities are to hand for obtaining credit and purchasing new equipment. If pressure for water conservation is applied to farmers through the introduction of the practices and measures described above, it is essential that they have the opportunity to respond in a positive way by making sound economic choices. If they are prevented from

doing so, by lack of professional advice, or credit, or seeds of new crops, or access to equipment stores, then the very principle of working with the users has been broken. All that can then be expected is resistance and possible social disruption. Developing a strategic plan *in conjunction with irrigation users* and gaining their confidence and commitment is fundamental to managing the demand for agricultural water.

77. Gains in water resources from changing demand in the municipal and industrial sectors can be significant but tend to be marginal when compared with agriculture. For example, a 10 percent gain in water from agriculture would be sufficient to supply domestic needs for several years in some countries. However, reduction in municipal demands would achieve little in purely water volume terms. However, a key element of industrial water use is industrial wastewater effluent. This can have a major impact if it contaminates freshwater reservoirs. Gains in environmental sustainability should therefore be seen as a significant out come of all water conservation practices.

78. Great efforts are now being made by research institutes and the private sector to find ways of reducing the cost of desalination. There have been technological breakthroughs in the past (e.g. in the design of reverse osmosis membranes) and further advances are likely. In addition, sources of cheaper energy are continually being sought which would bring down the costs of desalination. Buying time therefore by making full use of existing resources before embarking on heavy investment in new supply enhancing schemes would appear to be a wise strategy. All the examples above show that countries around the world are adopting this strategy, irrespective of their easy access to water. It is important to note here, however, that even if water resources became far more abundant and cheaper in the Middle East, evaporation rates and soil conditions are such that water will always have to be used with the with utmost care to avoid soil salinization and waterlogging.

79. Prioritizing the Action. A recent internal review by the World Bank looked at the possible ranking of means of increasing water supplies in the Middle East, based on the likely cost of water. Without question, water conservation ranked first above all other alternative with the cost of water "saved" varying between 5 and 50 cents per cubic meter. Reclaiming water by treating sewage effluent came second, with water costs at between 40 and 50 cents per cubic meter. Somewhat surprisingly, desalination was considered the third option, depending on the assumptions for energy prices, and the development of marginal water sources was ranked fourth.

80. This indicative analysis confirms the evidence provided by actions in many countries. Investment in costly new water is being postponed, and energy and foreign exchange are being saved by looking first to the cheapest sources of water: water released by conservation practices and demand management.

81. The Need for Further Work. It has been pointed out that even in countries such as Britain and the United States, water conservation has a long way to develop. The past emphasis on exploiting new sources of supply has left major gaps in information about the true gains which can be made from specific practices and measures in specific situations. Data, experiences and

lessons learned are now being collected worldwide, and are being brought together for comparison purposes in data banks and networks. Once the imperatives of water conservation are recognized widely throughout the Middle East, it will be important for researchers and policy makers to have access to data collections. The establishment of a database describing water conservation techniques, practices and measures employed in agricultural, municipal and industrial sectors throughout the Middle East, with indications of the impact on water savings and other gains made, would be a major asset to the Region. A Manual of Procedures for evaluating water conservation practices is available and could be modified to suit the particular conditions of the Region. Technical Assistance would be required to establish the data base. It is extremely likely that grant funding could readily be found for such an important undertaking.

Water Rights

It is estimated that by the year 2010, the exploitable water available in South Africa, including surface, underground and return flows, will be about 25.9 billion m^3, of which about 11.9 billion m^3, 46% of the total, may be demanded for irrigation. By that year, shortages or near balances may occur in at least 5 of 14 major groupings of drainage regions. In these regions, irrigation is projected to demand between 15% and 82% of the available water, at an average rate of use of 7,877 m^3/ha on 1,231,000 ha. It is further projected that total demand for the country will exceed available supplies beyond the year 2020. Presumably these projections are based on current technology and water charge regimes.

In principle, the supply of water can be increased by storing it in dams, by inter-regional transfer, or by stimulation of rainfall, while demand can be decreased through increased irrigation efficiency, reductions in wastage, and other measures. At present, however, there is no pricing mechanism that could serve to equate water supply and demand, and the process of establishing such a mechanism is not a simple one.

Under the Water Act (Act 54 of 1956), there are only use rights, and no property rights in water. Water rights are linked to land, and in most cases private transfers are possible only through sale of land. Transfer of water rights through sale or lease is prohibited without Ministerial approval. During water shortages, permits or quotas for use can be allocated, reduced, restricted, or prohibited; these controls prevent a market in water rights from developing.

About 53% of irrigation water is used in private schemes (fully financed by users), 25% in cooperative schemes (mostly with capital and interest payments postponed or loans written off), and 22% in government schemes (in which official cost recovery is generally set at full operating costs, plus two thirds of capital costs). In government schemes, political pressures have kept tariffs to 1.5-3.0 cents/m^3, or 6-12% of variable costs of crop production.

In the context of rural restructuring, it will be necessary to make significant changes to water law, and water allocation systems, to ensure that beneficiaries of a land reform program have adequate access to water to support successful farming operations. While the details of new legal and allocation systems remain to be defined, this report identifies several principles which may guide the formation of new arrangements for water use.

a. All water would have a similar legal status of being common to all, subject to state control, and subject to uniform allocation rules.

b. While the regions, under the Constitution, could have exclusive legislative rights over delivery of water, there would need to be a national framework of control over water, in order to, *inter alia*, resolve inter-regional conflicts, protect third party interests, and allow water to be used throughout the country in a way which would maximize economic and social value from its use.

c. By allowing permits for water use to be negotiable and transferrable, it is possible to establish a market that would provide incentives for water to be used to maximum economic and social advantage.

d. The initial allocation of permits could be by Authorities established on the basis of the Catchment (river basin). Catchment Authorities would have statutory representation from all groups with an interest in water use, including (but not confined to) use for urban and rural domestic consumption, agriculture (irrigation and livestock consumption), forestry, industry, mining, electricity generation, sustenance of ecological systems and the environment, recreation, tourism, and so on; in general, all statutory representatives would be elected by their groups.

e. All interested parties would submit claims, which the Catchment Authorities would review.

f. Certain allocations would be reserved in the form of untradable permits for use, e.g. allocations for domestic consumption, or set asides to maintain selected ecological conditions (such as minimum stream flows for aquatic life, or wetlands). Such untradable permits would nevertheless not be free of charge as a general rule, but provisions could be made for subsidy if desired.

g. The bulk of water allocations would be in the form of tradable permits for use, that could be renewable but subject to review at specified intervals, in the interest of allowing the possibility for re-allocation as conditions changed over time. Water undeveloped after a specified period of time would revert to the general permit allocation process.

h. Tradable permits would be issued only for net consumptive use. Any surplus over and above net consumptive use, (including, in particular, reflow into aquifers and surface return flows), would be subject to further allocation and further tradable permits. Permits would define, among other things, a minimum consumptive use, and how surpluses above this would be used.

i. Tradable permits would be subject to specific standards for reflows with respect to effluent treatment and toxic substances such as pesticide residues.

j. Ongoing trade in permits would be, in any case, subject to review by Catchment Authorities, in order to protect the interests of third parties, and enforce reflow standards.

k. In the trading of permits, the costs of water conveyance, mitigating third party effects, and ensuring reflow standards, would be in general borne by the purchaser of the permit.

l. Consumptive water use of commercial forest plantations would also be subject to permits.

(Portions of transmittal memo distributing Paper Presented at the 1993 Water Resources Seminar "Experience in Implementing the World Bank Water Resources Initiatives in Asia.")

The Urgency for a Country Water Resources Sector Strategy

Bank documents, country studies and the popular press confirm the urgent water resources problems confronting most of Asia. Physical conditions greatly limit the solutions. And the few solutions available to the borrowers require extremely difficult, but *immediate political decisions. Simply stated:*

(1) In seven years, the region will increase by 380 million people -- 90% accumulating in urban centers. In twenty-seven years (by 2020), the figure is 1.4 billion. The resulting increases in water and food demands (with implications for irrigation) are self evident.

(2) Residents and industry in the large urban areas do not even today receive water supply meeting minimum quantity and quality guidelines; expanding pollution of existing resources by raw waste discharge is universal.

(3) Data confirm that during seasonal low flows when supply conflicts arise, conditions in these countries preclude "freeing" any consequential quantities of water through demand management (users are under 'demand' management now), and only isolated instances offer opportunities through improved use efficiencies (again, essentially no flow is wasted from most key river basins today).

(4) In water constrained areas, most new water needs can only be secured in the near term by diverting from existing and halting new irrigation as large new water developments cannot be completed within this period. And for 2020, the only physically feasible sources of consequence are additional diversions from agriculture, reclamation through costly waste water treatment facilities and substantial surface water development projects. But the latter two sources will still require urgent decisions, huge investments and very effective scheme investigations, evaluations, project processing, design, construction and implementation if supplies are to be available in 2020.[1]

The borrowers must clarify their water related objectives, and devise a general strategy of actions to best manage their water and related land resources to satisfy their pending needs consistent with their objectives. Fortunately, most countries have sufficient knowledge of their situation for setting objectives and near-term sector strategy, as do the responsible CD staff. But concise unequivocal alternative policies and programs must be drafted and presented to the countries' decision makers -- and ultimately, that means the political leaders -- before the much needed strategy will be firmed up. The Bank should initiate action and serve as an expeditor, helping to

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1 Limited additional water is available from projects under construction, but several are on over-developed streams that will yield substantially less than anticipated. More importantly, some urban supplies under construction will be consumed by existing shortages and many intended for irrigation are located where the water cannot be readily conveyed to urban centers.

overcome any unnecessary delays. There is little time for further debate (there is little of substance left to debate) nor for refining studies concerning the basic problems.

Bank Preparatory Efforts

A foundation for the preparation of a country's strategy exists. The South Asia Region held a workshop July 24, 1992 to discuss how best to apply the information and recommendations of the Asia Water Resources Study, (AWRS). Among other items, the document outlined the steps for preparing a country WRSS. As requested at the workshop by Mr Wood, the SA member CDs expressed their views on the AWRS and outlined their programs for addressing broad water sector impacts. Among the outcomes of the workshop were the decisions that: (1) Water Resources Working Groups, (WRWG), should be activated in each CD, and (2) efforts should be made to formulate a WRSS for their countries. This strategy would be integrated into the broader Country Strategy.

The East Asia Region also discussed the AWRS at a senior management meeting last summer, however, scheduling conflicts and Bank reorganization caused the regional workshop to be postponed until early in the new year. Fortunately, some WRWGs are already functioning in the region; the most effective is in Indonesia.[2]

Proposed Action

The Bank's contribution to formulating a country WRSS will entail documenting the issues judged most important by the Bank staff, proposing corrective measures and then preparing a draft strategy comprising programs and potential projects to deal with these as the basis for discussions with the borrower officials. (This initial internal action is most effective for weighing the borrower's situation in the individual economic sectors in which the CD is involved and reconciling the Bank staff's views for a comprehensive water sector strategy.) Following presentation of the CDs' proposal to the borrower and discussions (in the course of several meetings), the borrower would formulate, with Bank assistance as appropriate, their WRSS. Logically, the initial task and the subsequent assistance in formulating the final WRSS would fall to the WRWG that represents the CD divisions engaged in work affecting or depending upon the borrower's water resources. The ASTES WRU would be available to support the WRWGs in the individual WRWG efforts.

Even if the borrower does not have a sense of urgency, the Bank needs an internal water sector strategy to properly guide its efforts in each country. This is particularly true with the Bank structured to pursue water projects separately within four independent economic sector divisions in each country rather than within one water resources division that would by its nature have a water sector strategy.

If the borrowers refuse to adopt an effective strategy -- theirs or ours -- it may be necessary to halt all water sector activity or at least limit activity to O&M, dam safety and pollution abatement. However, the experience to date suggests that we will not encounter such obstacles if we devise a sensible and well thought-out strategy at the onset.

An Example of Drafting a Strategy

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2 Subsequently, the East Asia and Pacific Region reached the same decisions as the South Asia Region.

The proposed approach to formulating a country WRSS, including the assumed adequacy of information to complete the strategy, was derived from other experiences and was proven through application in Indonesia.

The Indonesia CD established a WRWG over two years ago. In addition to coordinating projects in the sector, the group conducted a study of Indonesia's water resources institutions to help devise consistent reforms in proposed Bank projects. This culminated in a report on Indonesia's existing water institutions and recommendations to strengthen them, particularly, the country's water resources management capacity and procedures. Subsequently, important aspects of these recommendations were reflected in several projects, including some funded by the Bank.

A later outcome of the GOI/Bank effort was a workshop on water resources management held by GOI October 1992. This was attended by ministers, senior officials and staff from the various GOI agencies and outside participants. Expanding on the ongoing exchanges with the Indonesia CD, GOI asked the Bank to present at this workshop its recommendations to Indonesia on a strategy for the water resources sector.

Subsequently, the Indonesia WRWG drafted a strategy statement reflecting its internal discussions, past and present Bank involvements and the AWRS material. It was agreed to focus on the issues associated with the most pressing water resources problems confronting the country -- even those that may seem quite elementary. For Indonesia must deal with the most important constraints to the major problems that it confronts -- not just those of popular interest.

The Bank's proposed strategy was well received. Remarkably, the sixteen points it contained closely paralleled the fifteen actions constituting the GOI draft strategy presented independently by the GOI officials. The two statements are now being incorporated into a GOI draft WRSS document for Indonesia. GOI intends that this will serve as the basis for the priority institutional, program and project innovations and actions for the next several years. Obviously, a final WRSS will set priorities, outline specific programs and projects and schedule their introduction, noting those in which the Bank should participate.

WRSS Preparation Material

The Asia Water Resources Study documents; the Main Report and annexes A, B and C, provide information generic to the region and the sector as well as specific material on most of the regions' countries. A brief paper describing the recommended approach for formulating a WRSS has been prepared and is attached to this memo. This defines the content of a WRSS; suggests the steps to follow in its preparation and references other materials available for use in formulating individual programs and projects that will likely be included in most country WRSSs. Draft AWRS documents have been distributed and some of the other aids are attached.

Attachment A1 - Approach for Preparing Country Water Resources Sector Strategies.
Attachment A2 - Portions of "A Recommended Set of Policies and a Strategy for their Implementation."

APPROACH FOR PREPARING COUNTRY WATER RESOURCES SECTOR STRATEGIES

General

The World Bank Report 1992, "Development and the Environment" confirms the urgent need for the Asian countries (and the Bank) to have a well crafted water resources sector strategy to guide actions for improving water resources management. The severe water shortage that exist in every major urban area today is further aggravated by the impact of unrestrained pollution. Both are growing exponentially with the population while we await the inevitable drought and its human, economic and political consequences. Energy, flood protection and environmental needs weigh on the sector decisions and budget limitations constrain the choice of actions.

The Bank, if it is to serve as a leader, must move forward promptly to help deal with the crucial water related problems . Many view water supply allocation and delivery as the priority issues and it typifies the situation confronting the borrowers. Because usually, there are at most three choice to meet the major water shortages; (1) take water from agriculture, (2) render polluted water suitable for reuse and reduce flushing water, and (3) construct physical storage and transfer facilities. Further limiting the near term choices, major physical works require up to twenty-five years to execute. No approach is easy. All entail very unpopular choices.

Neither new technology nor sophisticated economic concepts will free any meaningful quantities of water in the next few decades under the physical conditions and the degree of institutional maturity found in the developing world. Indeed, only difficult political decisions to implement a 'doable' strategy can begin to meet the demands imposed on the water sector -- and that must be the relentless focus of a water sector strategy!

The Objective of a Sound Water Strategy

Ideally, every country with pervasive water management problems should already have in place a comprehensive strategy to upgrade its water resources management. But inevitably, this is rare -- or there probably wouldn't be a serious management dilemma. To be effective, the Bank likewise should have a water resources sector strategy in place to guide its country program under such conditions. Thus, the Bank has an immediate need to pursue formulation of a WRSS even if the country delays action or lacks the will or the means to do so.

The objective of the strategy should be to establish sound resources management that will meet the country's goals utilizing its available resources. The primary components of effective, sound water resources management are common to all countries -- nothing short of a comprehensive approach. The country must institute a program to collect and process the essential data; it must prepare national goals and objectives for managing the resources and allocating the water and the available funds; it must prepare detailed regional and basin water and land-use plans to guide investment and monitor adherence; it must formulate the standards and regulations and create the permanent means to oversee operations; it must organize and assign responsibilities to construct and maintain the facilities in a manner that is affordable and sustainable for the beneficiaries and the nation; and it must prepare detailed actions to survive with minimum losses when the inevitable water shortages befall the country. And underlying these actions, the country must adopt institutional reforms that utilize modern concepts for resources management, including participation by beneficiaries and other non-government entities.

Some countries have enacted legislation and adopted regulations to effect substantial reforms. Many officials and staff have formulated projects that would improve management ;

actions they strongly support. Unfortunately, political leaders either are unaware of the urgent need to provide budget to empower agencies and undertake essential projects or believe it unimportant because the Bank has not taken a strong position and given specific support in the past. Or they do not wish to grapple with unpopular issues, and that includes means of financing the huge investments and their maintenance.

Fortunately, an adequate strategy to guide near term actions can be formulated for most of Asia's borrowers based on information already available. The deficiencies in resources management are known sufficiently to define the critical programs. This is important to emphasize as the countries (and the Bank) can ill afford further delay in setting water strategy while studies are undertaken that will only marginally affect the approach to the sector problems and issues.

Features of a Water Resources Sector Strategy

A country's water resources development and management strategy should be tailored to the country's broader economic development program, introducing new and integrating on-going programs and projects.

Successful water resources management strategies have common characteristics. First, water must be viewed as a resource of limited quantity (with unpredictable seasonal and interannual variations) to be developed and managed to best meet all of a nation's social, economic, security and environmental aspirations, rather than only as an input into the individual economic sectors. Second, broad goals and specific objectives for using the resources should be clearly set out on which the strategy must focus. Third, the water related problems, issues and solutions should be clearly defined and grouped in cross-sectorial areas. Fourth, policies should be adopted (and updated as appropriate) to guide the formulation and execution of every action in the sector including the individual programs and projects to best meet the adopted objectives.

The strategy to deal with the broader water resources sector questions should be devised at the level of resources ownership; directed toward comprehensive water resources development and management. Execution should delegated to the lowest appropriate level, assuring that strategy components provide institutional capacity building at the national, provincial, local and private sector levels.

At the same time, activities in the individual economic sectors that depend on or affect the water resources should be fully consistent with the overall country water resources strategy and made conditional on satisfactory progress in meeting general water resource objectives. Multi-purpose and single-purpose projects should be framed in conformance with national and basin plans.

Environmental efforts should have a greater focus on the regulatory function. They should promote clear objectives, measurable criteria, and competent review and enforcement procedures to hold government planners, water agencies and private entities accountable for their actions, while seeking to establish complementary incentive mechanisms.

Efforts to apply concepts such as demand management, free markets and privatization should be proportionate to the extent that they are truly applicable and can help solve the problems in the specific country. The other portion of the staff resources should be directed at the difficult, unpopular, yet real alternatives to remedying the existing problems that confront the borrower.

The heart of the country's strategy must be a complementary set of programs and projects consistent with the considerations just cited. These would include:

(1) Water resources sector programs for institution strengthening, national resources framework policies and planning, basin planning and drought planning.

(2) Water resources support programs for data collection/processing systems, dam safety assurance programs, environmental regulatory programs and sub-sector O&M programs.

(3) Single purpose and multi-purpose projects for storage, conveyance, urban supply, urban pollution control, hydro, irrigation, drainage and flood protection that are consistent with water sector policies and the national/basin plans.

These three categories of programs and projects will be described in greater detail:

(1) Water Resources Sector Programs. A set of water resources sector programs should be designed that would address the nation's water resources development and management in their entirety and provide a mechanism for going beyond individual economic sectors or individual operating agencies. Tailored to the requirements of the country, consistency would be facilitated if formulated from the perspective of the four framework areas noted earlier. Example issues to be addressed in programs in the respective areas include:

(a) Institutions -- allocation policies; water rights systems and their administration; other regulatory areas; agency functions, organization and accountability; personnel policies; customer responsibilities; and agency programming and budgeting.

(b) Long-term planning -- goals, objectives and policies; scope of national, basin and project planning; planning criteria and methodologies; commitments of water for economic and non-economic uses; set-aside of resources and sites for future generations; and planning activities.

(c) Real-time management -- basin and scheme operations under normal and emergency conditions; regulatory rules, procedures, and means; and operational oversight and public awareness and participation.

(d) Financial policy -- agency/user group financing; cost allocation; cost recovery policies and mechanisms; subsidies and taxes; demand management; pollution control charges and water markets.

(2) Country Water Resources Sector Support Projects Most countries that require support in strengthening their water resources management capability must remedy generic sector-wide deficiencies that obstruct sound management. Example support programs include:

(a) data collection, processing and dissemination programs to meet all needs in planning, operations and regulatory activities;

(b) dam safety assurance incorporating both institutional strengthening activities and remedial work;

(c) operations and maintenance across sectors or in the context of basin or multi-purpose facilities; and

(d) environmental protection covering the standards and the means to enforce them.

In federal and quasi-federal countries it may be appropriate to implement a country-wide program focused on high priority areas to complement more comprehensive provincial/state programs and sector-specific activities.

(3) Multi-Purpose and Single-Purpose Sector Projects. Activities in individual sectors; water supply, waste management, hydro, irrigation, inland fisheries, navigation, drainage and flood control need to be consistent with the overall country water resources development and management plans and be conditional on satisfactory progress in meeting their objectives. Again, components should emphasize comprehensive analysis and institutional strengthening . Example programs/projects include:

(a) comprehensive support projects to strengthen an agency's institutional capacity;

(b) creation of agency and customer utilities;

(c) investment consolidation and rehabilitation programs;

(d) operation and maintenance strengthening programs; and

(e) conventional single and multi-purpose sub-sector programs/projects, including the above components as appropriate.

The success of efforts to improve water resources management hinges on the adopted policies, the strategy for their application and their timely implementation. It is urged that the initial set of policies focus on the most critical issues confronting the country and the actions judged most effective to deal with them. The policies and the associated actions should constitute an inter-related set of measures that, when fully applied, will elevate water resources management to the minimum level for the country to adequately meet its economic, social welfare, environmental and security objectives. Additional policies should be devised as experience is gained and the country moves forward.

Specific recommendations incorporated in the WRSS should yield practical actions that truly will impact the most important issues in a way that will make a difference. Several may already be introduced to varying degrees by the government and to that extent, the WRSS recommendations should offer support. It should also be noted that the policies in the near term WRSS are in addition to the more focussed policies and actions in effect or being introduced in the affected power, urban, navigation and irrigation sectors.

Steps in Preparing a WRSS

An internal consensus should be reached in each Asia region on the strategy and policies to guide CD pursuit of country programs and specific projects bearing on the water sector. The creation of Water Resources Working Groups (WRWG), in CDs of the respective regions and their charge to coordinate project formulation in the water sector and prepare CD WRSSs are the primary actions. (The South Asia Region and East Asia Region have taken this step.)

The CDs should prepare the first draft strategy to submit to the borrower before discussions with the borrower commences. This proves best for several reasons. Foremost, the staff of the various CD divisions have in-depth knowledge of their sector and its dependency/impact on the country's water resources. The strong, often different views of these staff can and should be reconciled through preparation of a draft WRSS and the associated internal debate and study before approaching the borrower. Individuals usually have conducted indepth investigations that together with other Bank materials allows a well documented basis for preparation. And regarding most countries, the Bank can easier and much faster bring the information on the conflicting demands on the resources and divergent inter-sectorial views together and prepare a draft to serve as the basis for discussion than the mix of loosely coordinated agencies found in most countries. Time is of the essence and the early development of a solid draft, free of political posturing with a balanced presentation is a critical objective. Equally, important, the Bank urgently needs a clear strategy to guide its water resources sector investments, which this can serve until the detailed final strategy is adopted by the country or in the event that the country procrastinates. This approach has proven effective and welcomed in some of our larger countries already.

Once agreement has been reached to formulate a country strategy, a comprehensive assessment of problems and issues in the water resource sector by the WRWG should commence. A summary of the principle problems and associated issues confronting the country grouped in the four areas of: (a) institutional, (b) long-term planning and management, (c) real-time operations and (d) financial will facilitate analysis and formulation of solutions best serving the entire sector. The statement of each problem should include a definition in terms of the nature and seriousness of its impact in the country, rate of change of the problem over time and the consequences over time of a delay in resolution.

Once the situation is defined, possible solutions for the problems and associated issues should be described in a concise manner. These possible solutions must have a realistic chance to effect the desired change and do it before conditions become intolerable. Wishful thinking will accomplish little here. This will weigh heavily in setting priorities and scheduling remedial actions -- for the Bank must reflect this directly in selecting the type of lending instruments, the specific project content and their schedule within the Bank's program. Setting priorities will be a critical step as funds will be the over-riding constraint and the tendency to pursue popular projects will have to be curbed.

The last step in preparing the draft is to devise a proposed strategy of actions to upgrade resources management sufficiently to resolve the key problems. Many actions will be of a policy and legislative nature. However, the Bank should also outline the principal investment actions and support these with a package of lending described earlier that will provide the incentive for adoption of a strategy and be a significant assist to the country.

Obviously, the country should adopt the strategy and thus must participate. Discussions with the country may begin as soon as the CD has an outline draft that reflects the internally agreed components. But usually substantial exchanges with the country should await a more comprehensive draft strategy and disruptions that dely its preparation should be avoided.

The finalization of a WRSS will depend on the nature of the document. Ideally and in most instances, the country will participate and help finalize a well defined strategy. This will entail considerable effort by all parties and require a period of time. If the country is reluctant, a modification of the draft can fulfil the Bank's purposes. Indeed, early stages of draft will provide sufficient insight to the situation to allow the Bank to refine its on-going program in important ways.

These steps will have to be expanded in countries with a federal system of government. Under such a system, the states usually own the resources thereby increasing the number of governments involved, as well as, the inter-jurisdictional conflicts. This will usually entail a central government framework effort on policies, regulations and coordination of interstate/federal programs with the detailed formulation of a WRSS applied at the state level.)

Supporting Materials Available

The Asia Water Resources Study report provides much of the information for preparing a WRSS. The main report groups the problems and issues generic to the region into four categories, citing examples in the various countries. It goes on to listing considerations for improving water resources management and outlines a strategy for introducing needed improvements, emphasizing the Bank's role and the actions it should take. Annex "1" to the report outlines issues and policies common to successful resources management; annex "2" presents the specific information on the problems and issues in many of the regions' countries: and annex "3" summarizes the Bank's regional involvement in the sector and the experiences with its programs and projects.

Guidelines for preparing national and basin studies and O&M projects; TORs for sector support projects such as hydromet and dam safety; and TORs for consultant specialists in these fields are available for use in formulating programs and projects likely required in most WRSSs. Several TD working papers present background information on pertinent topics including water allocation mechanisms, water rights systems, service costs, drought planning and water resources institutions.

Various CD and OED reports concerning economic sectors affecting or dependent upon the water sector will be a primary source of information on the specific countries.

In addition, the Indonesia WRMWG's proposed water sector strategy for Indonesia and related materials are offered to the WRWGs for use in preparing their country water strategies. The related documents include: Indonesia's Minister of Finance's excellent paper on Indonesia's issues, the introductory paper at the Bank's SA water conference and a memo on follow-up related to the SA workshop.

Excerpts from Discussion Paper on Sector Policies for Water Development and Management [1]

The success of efforts to improve water resources management hinges on the adopted policies and strategy for their application and their timely implementation. The initial set of policies focus on the most critical issues confronting the country and the actions judged most effective to deal with them. The policies and the associated actions should constitute an inter-related set of measures that, when fully applied, will elevate water resources management to the minimum level for the country to adequately meet its economic, social welfare, environmental and security objectives. Additional policies should be devised as experience is gained and the country moves forward.

Several policies are already being introduced to varying degrees and to that extent, these recommendations offer support. It should also be noted that the policies proposed here are in addition to the specific policies and actions in effect or being introduced in the power, urban and irrigation sectors.

Policies and Actions to be Promoted as High Priority The immediate enactment of certain policies that would lead to greatly improved water resources management may entail many related actions or require extensive work by senior officials during implementation. Nevertheless, these actions should be promoted by every means with top priority given to:

(1) Policy: Aggressively Strengthen the Water Resources Institutions.

Action: Assess present institutions, identify deficiencies and undertake, on an urgency basis, a scheduled program for improvement. This should include; separation of regulatory and operations responsibilities; establishing specialized functional units with responsibility across all subsectors; devolution of responsibilities, as possible, to the lowest governmental level and the private sector (including not-for-profit entities), and altering personnel policies to encourage staff specialization. (The following four policies are within the institutional area.)

Status: DGWRD established a Task Group to examine the institutional arrangements within its functional area. Recommended decentralization and deconcentration, cost recovery measures and turnover of irrigation schemes have been initiated. Broader organizational restructuring and regulatory actions remain.

(2) Policy: Institute a Comprehensive Water Rights System

Action: Institute a system of water rights/licensing for the use of surface and groundwater resources that fully governs both government and private developers and users with prompt recording, real-time monitoring of use and annual reporting.

Status: No effective surface rights system exists and the administration of the groundwater licensing system is inadequate.

(3) Policy: Create "Utilities" for all Services.

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1 Prepared by Indonesia Department's Water Resources Management Working Group (WRMWG) and discussed at International Seminar on Integrated Development and Management of Water Resources for Sustainable Use in Indonesia, held in Bogor, Indonesia from October 29 - November 1, 1992.

Action: Define each service in the water sector and establish water supply, irrigation and drainage entities within the responsible governmental agencies, fully complying with the "utilities" concept with specific provisions for expanded beneficiary takeover as appropriate. These should become self-sufficient organizations, fully accountable for service performance and financially and managerially isolated from the parent or other agencies.

Status: Limited use of the utilities concept is found only in the urban sector and among farmer-owned systems.

(4) Policy: Turnover Water Facilitates O&M to Appropriate Entities

Action: Provide the necessary preconditions and undertake orderly turn over of water facilities O&M to local government or not-for-profit entities.

Status: The government has set policy and launched a program to turnover small irrigation schemes to farmer entities. This has been effective in proving approaches and identifying constraints for broader application.

(5) Policy: Assign Operations to Appropriate Basin / Project Entities

Action: Institute real-time basin water quantity and quality management under all hydrologic conditions through capable entities providing real-time analysis and operating instructions to existing O&M system units as appropriate. This should comply with the principles of decentralization, maximum use of involved entities and minimal interference.

Status: This concept is being instituted in selected basins under the ISSP-II project. However, 'authorities' reporting to center are being established on other basins, counter to the decentralization policy.

(6) Policy: Secure Critical Sites

Action: Identify and set aside critical sites for future water resources development and management through purchase and lease-back with restrictions against further development of the site. Effort should be coordinated with other government agencies in securing conjunctive-use corridors for transportation and water conveyance facilities.

Status: No action

Policies and Actions Pre-requisite for Project Work Certain factors preclude the government ascertaining whether existing and new projects can meet its social, economic and environmental goals. Even if properly directed towards an adopted goal, are the proposed investments sound? The following policies would require action on issues that, if unattended, will lead to major economic, social and environmental losses, some of which have the potential for serious crises. The policies and actions in this category include:

(1) Policy: Install Comprehensive Data Service

Action: Establish and equip basic data collection, analysis, storage and dissemination unit(s) to fully support planning, regulatory and, in part, real-time operations by public and private entities.

Status: Very little data collection, processing and dissemination responsibilities are focussed within government. It is typically provided under individual projects and to a limited extent under regulatory programs. But even there agency capability is inadequate and reliable, timely data are not now available.

(2) Policy: Prepare Water Resources Plans

Action: Establish and set timely work schedules for permanent planning units to prepare and maintain national/provincial water resources framework plans with unambiguous statements on goals, objectives, policies and regulations and the programs and projects to guide water resources development and management. Initial objective should be framework plans within eighteen months and detailed plans within three years.

Status: No provincial or national plans sufficient for guiding water resources management exist. The primary line agencies have independently formulated their own agency plans.

(3) Policy: Prepare Basin Water Resources Plans

Action: Establish and set timely work schedules for permanent planning units to prepare and maintain comprehensive basin water resources development and management plans consistent with national/provincial framework plans. These should be presented in terms of programs and projects with short, near-term and long-term horizons (10, 20 and 50 years). The initial plan should be completed within 24 months and a detailed plan within four years

Status: Plans for some basins were prepared several years ago, however, they are outdated and serve no effective guidance to managing the resources.

(4) Policy: Prepare Emergency Drought Operations Plans

Action: Assign responsibility and set timely work schedule for the preparation of emergency drought plans, including the mechanism for bi-annual updating, for every rural and urban locale with large population or substantial industrial activities. Water, land and civil government units will have to cooperate in this endeavor.

Status: Existing plans are of limited use.

(5) Policy: Formulate Projects as Multi-purpose

Action: Formulate and design all projects -- storage, supply, drainage and channel work -- as multi-purpose to maximize total benefits from the resources and from the contemplated investment. A formal multi-agency committee should have review and approval powers.

Status: Most projects are pursued as single-purpose, particularly storage, supply and drainage, with no mechanism for maximizing use of the resources or the potential services.

(6) Policy: Aggressively Institute Regulatory Functions

Action: Fund, staff and equip the regulatory units responsible for administering legislation and regulations for: surface and groundwater rights; quality of river and water supply; pollution control; land-use as affecting water quality and dam safety. The organizational structure must satisfy the need for national uniformity, high level of expertise, field operational capability, assured independence and outside oversight. Effectiveness will require timely, public dissemination of reports.

Status: Surface rights remain uncertain; groundwater rights and supply quality are partially enforced while the others remain largely paper activities.

(7) Policy: Effect Project Performance Standards

Action: Establish O&M performance monitoring programs on all water projects -- storage, supply, drainage and flood control, with successful project performance set as a prerequisite to further project funding for the agency. Planned and actual performance should be published/posted within beneficiary area.

Status: No formal performance procedure exists.

(8) Policy: Separate O&M Funding from Cost Recovery

Action: Guarantee funding of comprehensive O&M for all water resources facilities and provide all funds not met by revenues from the beneficiaries.

Status: O&M funding has been increased on some irrigation projects; however its adequacy remains unproven. The continuing funding shortfall is evident on other irrigation, drainage and flood control facilities.

(9) Policy: Implement Cost Recovery of all Water Projects

Action: Institute a phased program to recover full costs of water services from the beneficiaries on all supply, irrigation, drainage, and flood control projects through fees and betterment taxes. This should be staged with the introduction of related institutional and operating policies.

Status: The recovery of a portion of the O&M costs through fees has been introduced on a limited number of urban supply and irrigation systems. Drainage and flood control are fully subsidized.

(10) Policy: Prepare Financial Overview

Action: Analyze the projected financial needs of the anticipated programs, projects and related costs in the entire water sector including administrative; sources of funding -- government and customer; the implications for the operational and regulatory functions; and a broad financing plan of priority actions for attaining the nation's goals.

Status: No comprehensive financial projections linked to anticipated projects and programs have been made.

HARYANA IRRIGATION DEPARTMENT

INSTITUTIONAL MODIFICATIONS

General

Conditions are rapidly changing in the traditional areas in which the Haryana Irrigation Department (HID) has been engaged. Though its basic responsibilities have not been altered, the magnitude of the demands in the various areas and the situation in which HID must operate have forced it to examine alternatives to its institutional arrangements and the associated policies and procedures now applied in its daily work. The adopted modifications to best accommodate these changes and to effectively meet HID's responsibilities to manage the state's water resources will be described.

Responsibilities

HID is assigned the primary responsibilities for managing the state's water resources and providing the essential services in the sector. The services responsibilities include: (i) providing bulk water supply to the urban, village and farm service areas and forestry preserves, (ii) distributing irrigation water in service areas not operated by the farmers, (iii) providing primary services for storm and agricultural drainage, (iv) collecting drainage within the farm service areas, (v) providing flood protection as justified and (vi) maintaining river channels and enforcing restrictions on the use of the channel lands. Related to these service responsibilities and its broader responsibilities as the lead department in managing the state's waters, HID prepares and is to maintain the State Water Plan for the guidance of all government and private activities. The Secretary Irrigation and Power will regulate surface groundwater uses and monitor the adherence to the regulations as issued.

Functional Focus of Activities

HID has elected to consolidate its various present and future activities into a limited number of functional areas. This will better allow orderly planning and budgeting of all its programs, accountability for performance, specialization of staff, the efficient use of personnel and equipment and improved planning for future changes in the workload and the means to execute that work. Modern communications and computer applications in all areas of work facilitate radical modifications. The primary HID activities have been grouped into the following functional areas: (i) data collection, analysis and dissemination, (ii) water resources planning, (iii) design and research, (iv) construction, (v) operations and maintenance and (vi) administration. (The regulatory functions will reside outside the department.) The activities included in each HID functional area are briefly described to serve as background for subsequent discussions and for formulating the organizational structure.

Data Collection, Analysis and Dissemination. Basic hydrological and meteorological data are essential to comprehensive water resources management, including all of HID's activities. Meteorological data is being collected by the India Meteorological Service, however, information on the quantity and quality of the state's surface and groundwaters and the analysis and dissemination of this data is a primary responsibility of HID. Some areas are currently assigned to the Ministry of Agriculture and the Groundwater Board.

Planning. Planning will include the preparation and maintenance of the state water plan. This document is to serve as the firm guide to government and private sector actions and investments within the state. It will be updated at no greater than five year intervals to reflect changes in basic data, addtional legislation, new commitments and agreed future programs and projects. Planning also includes the preparation of plans for projects and programs to meet the service responsibilities of HID. An additional assignment of increasing importance as Haryana reaches the limits of its available water is the preparation and maintenance of state-wide, regional and urban drought plans.

Design and Research. The future infrastructure needs in the water sector call for significant design work, particularly to expand agricultural drainage and urban services. Rehabilitation/ modernization of existing facilities will be a continuing design load for the immediate future. All such work, including the related field surveys and geological investigations and the preparation of specifications fall in this functional area. Minor design of routine maintenance work would fall under the services units' function.

Construction. All new construction and the rehabilitation/modernization of existing facilities entailing significant quantities of earthwork or lining, reconstruction of the channel sections, or strengthening or alteration of structures will fall under the construction functional area. This would include the final assembly of bid and contract documents, pre-qualification of bidders, administration of contracts, processing of claims and inspection/acceptance of completed work. Thus all work required to complete a fully satisfactory facility for hand over to the service units will fall within the construction area and be funded as capital expenditures. Routine repair and maintenance would fall under the service units' functions.

Water Services. All water related services provided by HID are grouped under one functional area. Providing these services, as mentioned earlier, is the most important responsibility of HID. Since all entail common technical skills and geographically overlap, the operations and maintenance of facilities, regardless of the type of service -- supply, collection, flood protection, etc. -- will be managed in common by one unit. This will greatly increase the effectiveness and efficiency of the respective service entities.

Regulatory. The recording and enforcing of groundwater use regulations is the only important regulatory function now within the Ministry, though not under HID. Surface water use regulation, in effect, falls within HID now. These are essential functions in effective water resources management.

Administration. The administrative activities which support HID management and the line units are grouped into one functional area. This allows orderly well managed assistance to be rendered to the various units and removes all distracting tasks from the line units inconsistent with their main responsibilities while focusing accountability for this support under one manager.

Organizational Structure

HID will be restructured to reflect the functional grouping of its activities and take advantage of the inherent efficiencies and increased capabilities thereby offered. As a part of this, it is intended to rename HID as the Department of Water Resources to better reflect its responsibilities. The adopted structure also reflects the current and future workload in each area and the most appropriate combination of some functions where the load is relatively light. HID functions will be carried out by 'staff" offices and various 'line' units.

Staff Offices. The regulatory water licensing 'staff' office will report to the Secretary in accordance with the principle of separating the HID operating units from the regulatory. The 'staff' offices under the HID Engineer-in-Chief include the advisory roles of: (i) programing and budgeting, (ii) legislative liaison, (iii) public relations, (iv) legal/vigilance, (v) environmental affairs and (vi) water services policy and support.

Water Planning and Data Collection Unit (WPDCU). The planning functions including: (i) the state water plan preparation, (ii) project planning and (iii) drought planning will be grouped under WP Sub-unit. Their interlinkages will permit efficient use of limited specialty staff and better assurance that all plans are kept current and reflect the latest information. The state water plan effort at a later time may be transferred to an independent agency in Haryana government, but this action is not judged feasible nor wise at this time.

The data collection, analysis and dissemination will be grouped under the DC Sub-unit. This will include quality and quantity information regarding the state's surface and groundwater. Information will be promptly published and made available to all government and public entities and individuals.

Design and Research Unit (DRU). All design of new and major rehabilitation/ modernization of existing facilities will be assigned to DRU. The design of an increasing technical nature will be achieved through establishing specialty civil engineering, mechanical and electrical engineering, specifications, geological and field investigations sub-units within this one unit. Any research into new design or construction methods will be conducted by this unit.

Construction Unit (CU). The construction of all new and major rehabilitation/ modernization of existing facilities will be the responsibility of CU. A headquarters sub-unit will process contract documents, determine the qualifications of bidders and assure statewide consistency in contract administration and claims processing. Additionally, the central materials testing will be assigned to this office. Field circles headed by a project engineer will be established where warranted by the locale's construction load. (When the construction load reduces, the field circle will be relocated or disbanded.) Each field circle would have an office engineering sub-unit to provide plan reviews, project claims processing, surveying, and quantities/payment processing. The field engineering sub-unit will be responsible for overseeing the contractor's construction progress, inspect work and provide the needed daily controls. A project testing laboratory would support the field engineering sub-unit.

Water Services Units (2). The HID statewide water sector services would be provided by two regional units -- the Yamuna Water Services Unit (YWSU) and the Bhakara Water Services Unit (BWSU). Both would be similarly structured differing only in the degree of specialization in items such as pumping and the number of circles and sub-units. The two divisions would be assisted by the earlier noted Water Services Policies and Support 'staff' Office that reports to the Engineer-in-Chief. That office would help formulate service policies, cost recovery mechanisms and amounts, generic operating guidelines and computer applications for operations and maintenance. It would also be responsible for formulating and overseeing any trunover efforts. Each services unit office would have unit support, heavy maintenance and administrative sub-units and several service O&M circles. Each circle would have support and with field O&M sub-units; all stationed strategically to efficiently carry out the units's O&M activities. Small field crews will be stationed were ongoing routine tasks will call for year-round activities. Again, the introduction of improved communications, computers and expanded means of transport will reduce the current number of offices and staff assigned to O&M tasks.

Administration Unit (AU). The AU supports all HID units, removing the many activities from their responsibilities that are otherwise inconsistent with the primary tasks of the units. Personnel, training, finance, revenues, accounting, procurement of materials and equipment, general computer services, and the motor pool will be the primary areas of assistance. Also, AU would manage all real property not intimately a part of the service facilities and would be responsible for the acquisition of all right-of-way requested by the Construction Unit for new facilities. (The Construction Unit, in consultation with D&RU and the involved WSUs, would be responsible for identifying the land needs and conducting the necessary surveys.)

Charts 1, 2 and 3 depict the organizational structure adopted for HID. The duration and the nature of intermediate actions to transition from the present to the new organizational structure will depend on several factors.

Research Topics Relating to Decentralization/Turnover
(27 - 29/10/'93)

Note: (*) research topics
(###) areas of priority

Define the proposed decentralization/turn-over

1. Objectives of service(s) to be provided
   -- irrigation supply
   -- other user supply
   -- drainage
   -- flood control
   -- non-water enterprise services (*)

2. Responsibilities of proposed beneficiary entity
   -- geographical service area
   -- operations
   -- maintenance
   -- enterprise services (*)
   -- facilities ownership/rehabilitation
   -- cost recovery (*)
   -- financing (*)
   -- administrative (*)

3. Responsibilities of government (### - 1)
   -- set national/state policies on services, cost recovery, facilities ownership (*)
   -- provide regulatory framework (including enforcement) (*)
   -- provide operational oversight (service, financial, facilities maintenance) (*)
   -- create legal/legislative framework (*)
   -- provide financing source (for start-up) (*)
   -- provide technical support

4. Role of private sector
   -- maintenance/rehab work
   -- technical assistance
   -- agricultural production/marketing support
   -- other support

5. Type of beneficiary entity -- structure, legal basis and powers (### - 2)
   -- local beneficary entity (*)
   -- local government sub-unit (*)
   -- federation of beneficiary entities (*)

Transition process -- actions, sequence and schedule

1. Articulate national/state policies pertaining to (### - 3)

-- facilities ownership (*)
-- facilities rehabilitation (*)
-- beneficiary contribution to transfer program costs (*)
-- cost recovery for services in water sector (*)
-- financing (start-up, new investment, emergency repair) (*)
-- government/public oversight (*)

2. Enact legislation, rules and regulations to provide (### - 4)
-- legal basis for the creation and functioning of beneficiary entity (*)
-- water rights system (*)
-- water quality parameters as appropriate (*)
-- oversight of entity's financial and service performance (*)
-- budget and staff for enforcement capability (*)
-- confirmation of government O&M responsibilities (*)

3. Establish necessary government units as appropriate
-- O&M
-- regulatory (water rights, water quality, financing) (*)
-- performance oversight (service and financial) (*)
-- public awareness/transfer/ training (administration and support) (*)

4. Establish beneficiary entity (### - 4)
-- public education/discussion and structure the tentative entity (*)
-- vote to establish entity
-- formally establish legal entity (*)
-- conduct organizational meeting
-- secure initial financing (*)
-- secure management and support staff
-- formulate entity's operational rules, regulations and procedures (*)
-- conduct membership orientation/training (*)
-- prepare Plan for Operation and Maintenance (*)
-- conduct staff training
-- conduct farmer O&M training (*)

5. Continuing government oversight and institutional support (### - 5)

Underlying Considerations and Determinents for Decentralization / Turnover (### - 6)

1. Degree of top officials' support/committment

2. Political will of top political leaders

3. Local customs of farmers

4. Nature of local government and services rendered

Suggestions to guide research --

1. Conduct research in both developed and developing countries

2. Conduct research on both irrigation supply (and associated users) and drainage

BANK STAFF EXPERIENCE OF STUDY TOURS AND PROPOSALS FOR THE FUTURE

- **Seminar/Study in Mexico on Transfer of Management of Irrigation Districts to WUA's (May 1993)**

- **Study Tour in Spain (July 1993)**

CORRECTED COPY

Pls disregard
memo sent previously.
Thank you.

THE WORLD BANK/IFC/MIGA

OFFICE MEMORANDUM

DATE: May 27, 1993

TO: Distribution

FROM: Herve Plusquellec, Irrigation Adviser, AGRNR

EXTENSION: 30348

SUBJECT: **Seminar/Study Tour in Mexico on Transfer of Management of Irrigation Districts Back-to-Office Report**

1. I left Washington on May 16 to lead a group of 27 Bank staff and representatives from borrowing countries who participated in the seminar on the transfer of management of irrigation districts to water users associations held in the states of Sinaloa and Sonora in the Northwest region of Mexico from May 17-20, 1993. This seminar was the fifth irrigation training activity held outside the U.S.A. and organized by the Agriculture and Rural Development Department.

2. This training differed from the previous study tours organized by AGR in the last six years (Morocco, Mexico, Middle East, and China) in several ways: (i) It focused on only one theme, the process of transfer of management of irrigation districts to water users associations and the operation and maintenance of transferred districts; (ii) it was organized as a seminar with short field visits; (iii) it was open to representatives of borrowing countries which have expressed interest in the transfer process. Only 15 Bank staff participated (out of the 25 who were officially registered by their departments, ten canceled for health, operational or budgetary constraints during the last days before departure). The 12 non-Bank staff participants came from India (Orissa state), Colombia, Jamaica, Morocco and Venezuela. The irrigation Secretary of Orissa state led the Indian delegation. I firmly believe this new format of thematic seminar/study tour with participation of irrigation agencies from borrowing countries is a highly effective training method, as confirmed by the evaluation forms of all the participants. Indeed, the participants requested unanimously the organization of a similar seminar/study tour on the same subject. The organization of the seminar by the Mexican authorities was first class and the progress accomplished by Mexico in the transfer of management of irrigation districts is remarkable.

3. The seminar started in Cuidad Obregon in Sonora state on May 17. The first day was devoted to a general presentation of the irrigation sub sector, the policy and methodology of transfer of irrigation districts to users, the objective of financial self-sufficiency, the responsibilities of the National Water Commission (CNA) and of the users through their

associations. The second day included a visit of the Rio Yaqui district (233,000 ha) and of its enterprise ("Sociedad") responsible for the management of the main system and of two associations, followed by a workshop on operation and maintenance of the irrigation districts. The third day, the group travelled to Mayo district (90,000 ha) for a presentation on that project and short field visit and then to the city of Los Mochis in Sinaloa state at the center of the Fuerte district (240,000 ha) where a roundtable on the operation and maintenance of transferred districts was held. The last day included a short visit of associations in Fuerte district and of their maintenance activities (workshop, mechanical and chemical weeding) followed by a closing meeting. During this meeting, questions were raised by the participants to clarify some aspects of the Mexican transfer approach and the feasibility of its application to other countries.

4. The seminar was attended by a large number of participants from Mexico, including the CNA delegate for the Northwest region, the CNA delegates of the two states of Sinaloa and Sonora, the chief of the three visited districts, the Board of Directors of some associations and of the enterprises of these districts, and their technical managers, and representatives of associations and enterprises from other districts: Las Delicias in Chihuahua state, Guasave and Culiacan from Sinaloa, Rio Lerma from Guanajuato state. Altogether about 80 to 100 people participated in each workshop.

5. Of the 6.1 million ha under irrigation in Mexico, 3.3 million ha are in the 79 large scale irrigation districts whose size varies between 3,000 and 270,000 ha, with an average farm size of 6 ha. The irrigation systems serving these 79 districts were built and rehabilitated by the Government. The small schemes (below 3,000 ha) are grouped into 27,000 irrigation units with a total of 2.8 million ha, of which about half were developed by the private sector. The land ownership in the 3.3 million ha of the irrigation districts is as follows:

	Private Property	Ejido	Total
Area ('000 ha)	1,439 (43%)	1,876 (57%)	3,315
Number of Producers	149,445 (29.2%)	365,806 (71.8%)	515,251
Average Size (ha)	10.6	5.1	

6. According to the 1989-1994 National Development Plan of Mexico, the Government intends to gradually transfer the responsibility of the management of the Irrigation Districts to the water users. During the 1991-1994 period, CNA objectives was to transfer a minimum of 21 Irrigation Districts covering about 1.98 million ha (facilitated by a World Bank Sector loan), or 62 percnt of the total land irrigated by the 79 existing Irrigation Districts. The transfer of these Districts, is done in two stages, the first one give producers, organized in Users' Associations, the responsibility for the operation and maintenance of lateral canals and minor drains. During the second phase, these Users' Associations take over also the operation and maintenance of the main irrigation and drainage canals as well as of the machinery and equipment required for O&M activities through the creation of an enterprise ("Sociedad").

7. Out of the 3.2 million ha in the irrigation districts, about 1.5 million ha in 36 districts have been transferred to date. This exceeds the original transfer program by about 25 per cent. 190 associations and four entreprises (Yaqui, Mayo, Valle del Carrizo, Delicias) have been created. About 80 per cent of the transferred districts are located in the northwest region where 1.07 out of 1.4 million ha were transferred at the end of 1992.

8. The Board of Directors of each association generally include a president, a secretary, a treasurer and three additional members. Each association is supervised by a committee ("Consejo de vigilencia") composed of a representative of the private sector farmer, of the "ejidal" sector and of CNA. The Board of Directors of the Enterprises are similar to those of the associations but the supervisory committee includes a representative of the state government. Each association has recruited a professional team for the operation and management of the distribution system. The manager, the chief of operation assisted by a group of water masters (one for about 3,000 ha) and the chief of maintenance are generally recently graduated engineers who were not CNA staff. The organization chart of the enterprise of Yaqui district is attached.

9. Users of the three districts visited by the group adopted a slightly different pace in their taking-over of management:

(i) The Yaqui district was the only large scale scheme which was jointly managed by CNA and 97 associations (with a maximum area of 8,000 ha) before the national transfer program was initiated. The number of associations has been reduced to 51, and it is considered to further reduce it to about 16. The office equipment of these associations has not yet been modernized. The "Sociedad" is responsible for the two main canals and drains and provide office support to the 51 associations:

(ii) The Mayo district is managed by a "sociedad" responsible for the main canal and main branch canals and by 16 well organized associations ranging from 4,000 to 8,000 ha.

(iii) The Fuerte district is divided into 11 associations ranging from 6,900 to 34,000 hectares. However, the Board of Directors of these associations have decided to consolidate the maintenance efforts at their level before creating a "sociedad" responsible of the main systems which is still in the hands of CNA.

10. The competence and effectiveness of these newly created associations is quite visible on the field. The canal systems and, even worst, the drainage system of the Mayo and Fuerte districts were in poor conditions during the time of the first Bank study tour in Mexico in 1987. Many control structures have been rehabilitated and drains have been cleared of weeds. Deferred maintenance is not completed but the back-log is quickly reduced.

11. Of great interest is the modernization process of the infrastructure which is actively promoted by CNA in participation with the associations. For example, the group visited the remote monitoring and remote control center of the high main canal of Yaqui district. The

testing of the system in view of full automated control is underway. The group visited also some construction sites where control structures are modified or newly built using long-crested weirs and constant-flow modules.

12. One of the objectives of the Mexican Government irrigation policy is reach financial self-sufficiency of users associations and "Sociedades". In the late 1980's the average cost recovery of operation and maintenance costs dropped below 30 per cent, and the level of maintenance activities was far below the sustainability level. With the transfer program, the water charges have been raised many fold. In the visited districts, the water charges range from New Pesos 23 to 25 per thousand m^3 delivered to farms equivalent to US$ 50 to 60 per ha. The water charges are collected by the associations and the revenues are shared as follows:

	Mayo District (%)	Fuerte District (%)
CNA	12	36.5
"Sociedad"	48	n.a.
Associations	40	63.5

13. The transfer of management to water user associations combined with the modernization of the physical infrastructure are setting the conditions required for the application of the new Mexican Law promulgated on December 2, 1992. This Law provides for the concession of water rights to the users through their associations and the possibility of exchanging part or totality of these rights between users of a same district or to another district with authorization of the district and CNA based on technical and other considerations such as capacity of canals and non-agricultural uses. In a first step, the water saved by a user out of its annual volumetric allocation can be sold to other users. This Mexican Water Law reflects, in essence, the new World Bank Water Resources policy.

14. One of the key issues addressed during the closing meeting oncern when designing this seminar was the transferability of the Mexican approach to management of irrigation districts to other countries where farms are in average much smaller. The chief of the Rio Lerma district indicated that the average farm size in that district is small (4.7 ha) and the average farm size of one of its largest associations, Salvatierra, (15,900 ha for 6,054 farmers - 2.62 ha/farm) is comparable to the one found in highly populated countries. The group did not have the opportunity to visit this district in Central Mexico. However, the documents distributed to the participants provide evidence that these associations are performing well: The collection rate for the year 1992-93 (ending on September 30) is about 85 per cent to date. Conveyance and distribution efficiency is increased from 56% to 61% compared to the 1991-92 year. The performance of the two associations created in 1988 in Dominican Republic of Yaqui del Norte and Azua where the average size is about 2 ha provides another example of the feasibility of the Mexico design of water associations to small farms' irrigation systems.

15. It is interesting to note that the National Water Commission has not created a new department responsible for the transfer of management of irrigation districts. All CNA staff from the Director General to the staff at regional, state, district level are involved in the transfer process. The Mexican Institute for Water Technology, a research organization, provides the support for motivation and training support through preparation of audio-visual materials. Although the Mexican farmers were receptive to the creation of water users associations (to stop the deterioration of the irrigation systems under Government management), the difficulty of organization of these associations should not be underestimated. The group was told that several hundreds meetings were required to finalize the transfer process. One of the key point of discussion with CNA was the allocation of revenue between CNA, the "sociedades" and the associations. Social scientists are collaborating with IMTA in the diagnosis process of the producers to identify social groups, and their financial capabilities which are useful information for the design of the association. The associations and "sociedades" are then trained as commercially-run enterprises.

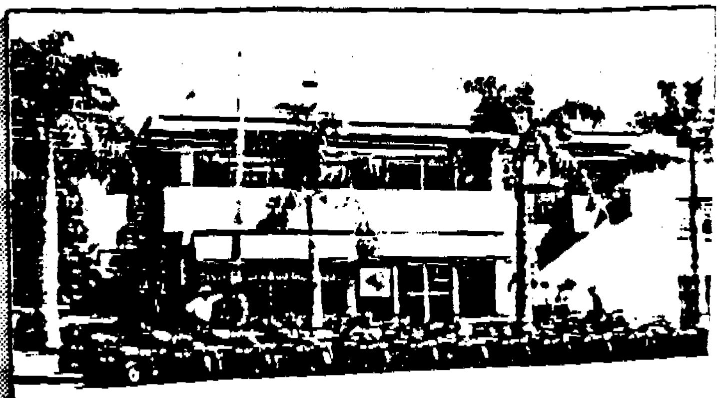
Attachments

cc: Messrs. M. Petit, G. Le Moigne, D. Steeds, F. Forno
B. Baxter, J. Simas, H. Binswanger
All participants (as per attached)
H. Azumi, A. Patorni, S. Deol

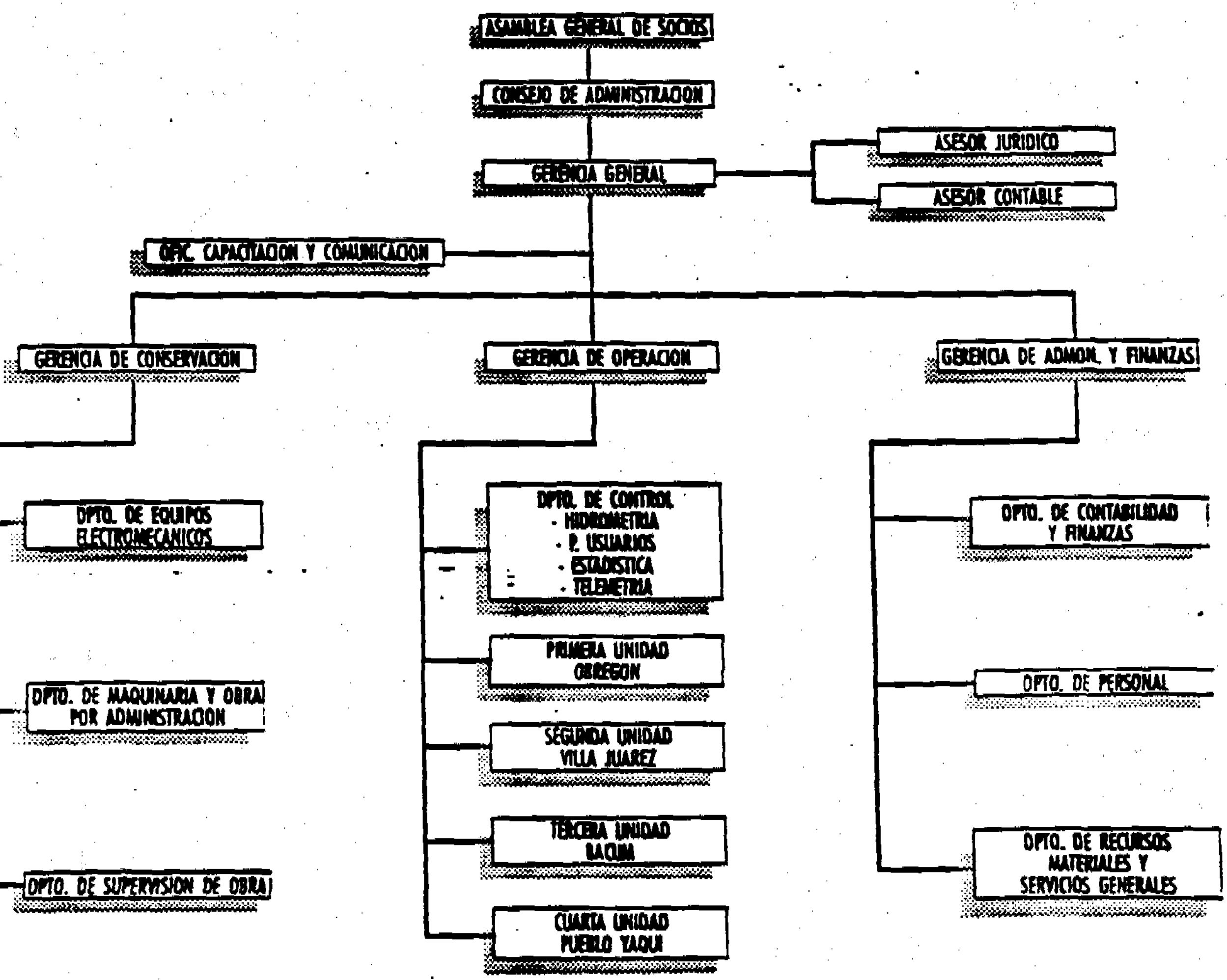
:HP\mex.bto\bv

SOCIEDAD DE RESPONSABILIDAD LIMITADA DE INTERES PUBLICO Y CAPITAL VARIABLE

Se constituye el 15 de Febrero de 1992, responsabilizándose de la operación, conservación y administración del Distrito de Riego el 1ro. de Julio del mismo año, actividades que actualmente lleva a cabo con 140 empleados entre técnicos y personal administrativo (24 % con respecto al personal que utilizaba Comisión Nacional del Agua).



Estructura Administrativa



L L - I N - 1 N O T E

DATE: 26-May-1993 01:11pm

TO: Michel Petit (MICHEL PETIT)

FROM: Michael Cernea, ENVDR (MICHAEL CERNEA)

EXT.: 35089

JBJECT: MEXICO: EXCHANGE OF EXPERIENCE IN IRRIGATION

Michel,

This follows up on our airport conversation. I just want to tell you that the Mexico irrigation experience tour, organized by AGR and Herve Plusquellec, has been a success, on all counts, in my view, and a good model for the type of field training ESD can facilitate for the regions. A strong group of engineers in the Bank were exposed to the reality of a shift from government-managed to user-managed water systems. This has shaken up some prejudices and has built up some more confidence in our abilities to foster change in the social organization of resource management systems, in this case water.

A particularly positive feature, this year was to invite some irrigation officials from several developing countries, particularly India, to join Bank staff in doing this tour.

In sum, I felt that the three days I took off to attend it well worth it. I think Herve and AGR deserve thanks from all the participants and their respective Bank Divisions.

Michael

CC: David Steeds (DAVID STEEDS)
CC: Guy Le Moigne (GUY LE MOIGNE)
CC: Mohamed T. El-Ashry (MOHAMED T. EL-ASHRY)
CC: Ismail Serageldin (ISMAIL SERAGELDIN)
CC: Surinder P. S. Deol (SURINDER P. S. DEOL)

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CC: Surinder P. S. Deol (SURINDER P. S. DEOL)

THE WORLD BANK/IFC/MIGA

OFFICE MEMORANDUM

DATE: August 10, 1993

TO: Mr. David Steeds, Division Chief, AGRNR

FROM: Herve Plusquellec, Irrigation Adviser, AGRNR

HP

EXTENSION: 30348

SUBJECT: Spain - Irrigation Study Tour

1. From July 5 to 15, 1993, I led a group of 21 Bank staff (and four spouses) participating in the Spain Irrigation Study Tour. The tour was organized, on the spanish side, by Mr. Jose Ortiz Urrutia, Vice President of the International Commission on Irrigation and Drainage and Executive Secretary of the Spanish ICID Committee, and supported by both the Ministry of Public Water (MOP), and the Ministry of Agriculture Fisheries and Food (MAPA).

2. The group spent first two days in Madrid for some general presentations by MOP and MAPA Directors on the spanish agricultural policy, the irrigation subsector, the Water Law, the organization of the Water Resources agencies with special emphasis on the river basin agencies (confederaciones hidraulicas) and the Water User Associations. During the stay in Madrid, the group visited also the irrigation training center of IRYDA from MAPA and one of the six research centers of MOP dealing with hydraulic models. The group then travelled to Eastern Spain to visit the century-old irrigation systems of Valencia, Alicante and Murcia, and the terminal facilities of the transfer system from the Tagès to the Segura river basin. This area has been visited by many irrigation experts from the United Kingdom and from the USA since 1860s because of its long tradition of irrigation institutions, (including well-established associations and the Valencia Water Tribunal) and its historical role in transfer of technology. The group then travelled to Andalucia to visit modern pressurized irrigation systems in the Guadalquivir and Guadiana river basins (Genil-Cabra and Chanza projects) and the reclamation area in the Lower Guadalquivir. Because of the extreme drought affecting southern Spain, there was no irrigation in some of the visited schemes. Some severe restrictions in urban water supply were imposed in large cities such as Sevilla. The tour was very well designed by providing a review of the irrigation sub-sector from the traditional Eastern systems to the state-of-the art fully-automated systems of local irrigation combined with fertigation as well as examples of river basin agencies and user associations. The hospitality provided by MOP and MAPA, the river basin agencies and the users associations was outstanding.

3. All participants demonstrated great interest in the main themes of the tour and in the field visits; Water Resources Policy and Institutions, users participation. About one-third only of the participants could understand Spanish. The group expressed their

appreciation to Messrs. J. Roman and J. Olivares and Ms. G. Lituma, who ensured interpretation during the field visits. A side benefit of this tour has been the strengthening of a team spirit among irrigation staff isolated in their regional departments. Non-participant Bank staff interested in detail of the visit could refer to the abundant documentation received during the tour.

4. I will limit this memo to some outstanding findings of the tour. Time permitting, a more comprehensive report will be prepared later, based on the individual reports of the participants.

a) The Spanish Water Law promulgated in 1986 does not include any provisions for water market. (Water market is indeed not recommended by some spanish experts because it may lead to monopolization by some powerful groups.) However, water resources development in Spain is not centrally planned: The different stakeholders play an important role at the national and river basin level through their large representation within the different water committees on water policy, seasonal operation of reservoirs, budgets, construction of large works. This approach represents an alternative or complementary solution to the two extreme approaches debated during the preparation of the Bank Water Resource Policy paper: Central planning and marketing mechanism.

b) The management of all the irrigation systems in Spain are transferred to water user associations about one-year after completion of construction. There are about 1,700 WUAs in Spain which are confederated at national level and also at basin level. Their size range from a few hundred ha to about 60,000 ha. All these associations have recruited technical staff to operate and manage their system. Each association elects two Boards, one for overall policy and the second one for managing the system. (The president of this Board plays the role of Project manager of the WUA's in Mexico and USA). Each Association has also the obligation to elect a three-member tribunal responsible for solving the conflicts between users or faults vis-a-vis the associations.

c) The participants who were familiar with the abundant literature on the ancient systems of Eastern Spain raised several questions on the perrennity of the traditions described by several irrigation scholars from the USA and United Kingdom. It seems that some of these traditions are loosing ground. For example, the weekly auctioning of "irrigation tickets" in the huerta of Alicante is no longer in effect (with a possible exception in Lorca sub-project)

d) The Lower Guadalquivir reclamation area offers an interesting lesson for Bank projects. The drainage system was implemented and tested several years before construction of the irrigation system.

5. About two-thirds of the participants attended the final meeting in Madrid with MOP and MAPA officials. Of the topics which were discussed by the participants, the one which called most the attention of the two ministries was the low participation of spanish experts, consulting firms and contractors in the water projects financed by the Bank and other international organizations. Several solution were discussed to change this situation such as seminars in Madrid or at Bank Headquarters. One of the participants, Mr. V. Nguyen, informed me that he met several consulting firms and one contractor at the initiative of Mr. Beltran from IRYDA on July 16 and he later informed the Moroccan Ministry of Agriculature of the expertise available in Spain.

6. In summary, the tour was, as stated by many participants, an eye-opener on the technical expertise available in Spain. Spain also offers a long and well established experience in institutions and legal aspects related to water resource developments which deserve further dissemination. The September Seminar organized by Mr. Marino offers another opportunity.

cc: Messrs. M. Petit, G. Le Moigne, A. Subramanian,
W. Ochs, H. Binswanger, M. Marino
Participants

The World Bank/IFC/MIGA
O F F I C E   M E M O R A N D U M

DATE: August 11, 1993 11:52am

TO: Graham Donaldson (GRAHAM DONALDSON)

FROM: Jose Olivares, OEDD1 (JOSE OLIVARES)

EXT.: 31729

SUBJECT: 1993 Irrigation Study Tour - Back to Office Report

1. The 1993 Irrigation Study Tour was held in Eastern and Southern Spain from July 5 to 15, 1993. Twenty-one Bank staff members participated, of which about half were irrigation or hydraulic engineers, 40% economists and 10% agriculturalists.

2. The Program included two days of policy discussions in Madrid with personnel of the Ministries of Agriculture and of Public Works; visit to the right bank and left bank water users' associations in Valencia, including attendance to the weekly session of the Water Tribunal (in continuous operation since at least year 960 A.D.); visit to the trans-basis water transfer scheme, water users' associations, and traditional and modern irrigation areas in Murcia; visit to a modern irrigation system in the middle-Guadalquivir and to a floodplain reclamation and irrigation system in the lower Guadalquivir river; and visit to high-value crop irrigation in the lower Guadiana river. A wrap-up meeting in Madrid with the central Government's agencies was held on July 15th.

3. In my view, the Tour was quite successful in the three main areas to be covered, namely, water policy and planning, water users' participation, and water distribution and application technology. I elaborate on these issues in the paras below.

Water Policy and Planning.

4. National Water Planning. Up to some 20 years ago, Spain was a highly centralized country, with every decision of a national or regional scope taken in Madrid. In the seventies and eighties, Spain went through a major devolution process, in which 17 quasi-federal communities ("comunidades autonomas"), largely along language (prime factor) and historical factors, were created. The political system is still working through the devolution process, with many powers already devolved, others in process, and others still centralized.

5. Up to five years ago, all water planning was centrally done. Then, river basin development and management authorities ("Confederaciones Hidrograficas") were created. They were entrusted with the task of planning for water resource

development, within a national indicative framework, while the central Government retained only the overall policy and coordination roles. The process is now almost complete and shortly all basin plans will be forwarded to the national Government for analysis and consolidation.

6. Up to now, the "federalization" process has proceeded rather smoothly, at least on the administrative/technical sphere. But being Spain an arid country, with water surpluses only in the North and North Western regions, I am wondering whether the cumulative demand projections of the regions, and their ensuing requests for inter-basin water transfers, will prove compatible - or even compatibilizable - at the national level. It was not clear yet at the time of our visit which mechanisms would the central Government have recourse to in order to make them compatible. We already saw a case which tends to resemble the Indian inter-State experience: the already operational Tajo-Segura trans-basin scheme is suppossed to transfer surplus water resources form the upper Taxus River basin (New Castille, now called "Castilla-La Mancha") to the Segura River, which irrigates the Murcia area. Citrus and other orchards are suffering drought damage and production of annual crops (including high-value ones for export) is not permitted; the Segura authorities are requesting an urgent transfer of 300 million m3 to tie them up till the next - hopefully wet - season, but the Taxus authorities insist there is not enough water in their basin even for their own needs [someone told us that what actually happen is that the power companies in the Taxus are lobbying very strongly to have the surplus water reserved for their own use]. As we left the country, the President of the Murcia "community" was going to visit the national Vice-president to pledge their case, ie, recourse to political pressure to address a problem for which no technical solution has been devised.

7. Water's worth and users' rights. In spite of being an arid country, where water has indeed a high opportunity cost, the Water Act, recently updated (the previous one had been issued in 1879) defines water as a national good. The nation may grant use rights to users, but these are for a single purpose and place, and cannot be transferred under any title or circumstance; water for irrigation becomes linked to the land it is supposed to irrigate. To our disappointment, there is not water rights' market in any region in Spain - albeit literature descriptions to the contrary. The last functioning one seems to have been in the traditional irrigation areas in Alicante, but even this one has allegedly lapsed after the Taxus-Segura trans-basin transfer scheme substituted more reliable "trans-basin" water for traditional water rights. Both basin authorities and water users' association executives and technical staff in all basins visited insisted transfers under any title were not allowed and if agreed illegally, they would not be actually effected by the ditch-riders.

8. Users pay the full costs of O+M, including both the local

and the upstream (regulation and management at the basin level) costs, but pay nothing for water itself. In this regards, we found an interesting case in the left bank of the Jucar River (Valencia): the water users' association refuses to pay any water costs to the basin authorities (even those related to dam operation) on the grounds that they bought their water rights directly from the King of Aragon (to whom the king of Spain is legal successor) in 1238 in perpetuity, and in their view "in perpetuity" means exactly that.

9. Water users are supposed to pay 4% of investments made by the Government ("discounted annually to allow for physical depreciation", whichever that may mean) per year over 50 years. There is a major implicit subsidy here. This works negatively in two ways: firstly, it constrains the generation of financial resources to build additional storage, transfer and regulation structures - vital for future development of the scarse water resources available. And secondly, it does not convey to farmers and other users all actual costs (let alone opportunity costs) involved in providing them with water. Whichever irrigation technification effort we saw - and we saw many - was always predicated on labor cost savings.

Role of the Water Users' Associations

10. Everywhere we went, WUA's were in charge of operating and managing the local systems, and all of them claimed to get full cost recovery and be self-financing, without any subsidy (except for the capital costs of the main works) or losses. They seemed to be properly equiped to do so, with a most lean staff (usually only an agriculturalist and one economist or accountant, plus a few technitians on the engineering side), and carrying out all non-ordinary operations with contractors.

11. The WUA's would seem to manage water bill collection pretty efficiently, with several of them charging farmers before releasing the water. This was particularly so in the most technified systems (see below), where farmes have to pay for their water before this is delivered (usually they come with cash in hand earlier in the morning, but they may also have a positive balance in their account with the WUA). All WUA's we visited claimed to have a financial surplus every year. One interesting factor helping them to ensure high collection rates is the fact that they are incorporated under public law. Under Spanish law, this gives water bills the legal nature of taxes; if somebody does not pay, the WUA has recourse to all tax enforcement tools, including suspension of water deliveries, impounding and auctioning of the offending party's goods, and even jail.

12. We ask one of the WUA's if they kept a savings fund or escrow account to afford catastrophic damage - and thus, major repairs - to the system. The answer was a model of market-oriented thinking: "No, we have them insured against such risks".

13. Irrigators' discipline was regularly described as high, but conflict resolution bodies and procedures always constitute a prominent part of the WUA's we visited. All members of each WUA's tribunal, as well as representatives to regional tribunals, are elected by water users for fixed terms, usually including rotational rules to ensure equitable representation over time to irrigators in different sectors. (Noteworthy: to be a member of the WUA's Board of Directors or of the water tribunal, one must be an actual farmer; absentee landowners need not apply). In Valencia, we attended a seating of the Water Tribunal, which has met at the Cathedral's Apostles' entrance every Thursday since 1238 A.D. (and previously, since 960 A.D., at the Mosque; the original Tribunal may have been established in Roman times). It is the oldest working judiciary entity in Europe. All procedures are conducted verbally, and in the Valencian language. We were disappointed that the only case presented that day - they are on a walk-in basis, as the clerck calls complainants from each of the eight canals, if any, to come forth - was instantly settled by acknowledgement of guilt.

Water Distribution and Application

14. As normal in these Tours, we visited several places where up-to-date technology was being utilized for water distribution and application. In my view, the most outstanting case in this year's Tour was the Genil-Cabra project, on an affluent (Genil River) of the Guadalquivir River. The system is fully on-demand. Water distribution is totally piped (underground), with pressure enough to operate sprinklers or localized application systems. Each farm has a turnout (ie, a hydrant), which is connected directly to a distribution point, where there is a water meter. [Actually, the network is not lineal as in "normal" irrigation systems, but palmated, with each farm's delivery pipe branching from the same distribution point, which serves several farms. There are no such thing as upstream or downstream irrigators]. There are no ditch-riders; farmers pass by the WUA's operations office to pay for their water and pick up the key to access their outlet and water meter. Each makes a note of the meter readings before and after irrigating; all farmers served from a common distribution point get a joint (computer-generated) volumetric bill, which they share among them in accordance to actual usage. There are no man-operated or automatic control devises within the piped system: water extraction by an irrigator is transmitted up-stream (should we rather say "up-pipe"?) hydraulically, and pumps react to pressure depression to keep the system delivering water at the required rates. Only the primary (and only) canal, which feeds the main pumping stations, is upstream controlled. We reckon this is the most (or among the few most) modern irrigation water distribution system in the world.

In summary, a very good opportunity to see a country's water policy and planning problems and solutions (technical, as well as institutional and legal), as well as be kept up-to-date on new technical and institutional developments in water management and utilization. The degree of participation of beneficiaries was most noteworthy. Incidentally, three important actors in the Indian scene attended the Tour as well, which permitted some initial discussions on the India Irrigation Study, of which I am the task manager.

CC:	Herve Plusquellec	(HERVE PLUSQUELLEC)
CC:	William Jones	(WILLIAM JONES)
CC:	Julian Blackwood	(JULIAN BLACKWOOD)
CC:	John English	(JOHN ENGLISH)
CC:	Kathryn McPhail	(KATHRYN MCPHAIL)
CC:	Dennis Purcell	(DENNIS PURCELL)
CC:	Pablo Guerrero	(PABLO GUERRERO)
CC:	Hans-Eberhard Kopp	(HANS-EBERHARD KOPP)

WATER RESOURCES MANAGEMENT
IN MEXICO

ACTIONS SUPPORTED BY BANK PROJECTS

Actions Supported:

- **Decentralization**
- **Systematic & Integral Planning**
- **Pollution Prevention**

LA2IE Bank Projects:

- **Water Supply and Sanitation (3271-ME)**
- **Second Water Supply and Sanitation**

WATER RESOURCES MANAGEMENT

IN MEXICO

DECENTRALIZATION

Enactment of State Laws:

- **15 States Enacted New Law**
- **8 States in the Revision Process**

Establishment of "Organismos Operadores":

- **Autonomous Local/State Water Utilities**
- **Financial Autonomy/Solvency**
- **Tariffs Cover O&M and Debt Service**

WATER RESOURCES MANAGEMENT

IN MEXICO

SYSTEMATIC & INTEGRAL PLANNING

Master Plans:

- **Guidelines Established**
- **TA Provided for their Preparation**
- **Seminars to Utilities and CNA**
- **CNA Reviews/Approves Master Plans**
- **Utility Involvement and Leadership**
- **Condition of Eligibility**

WATER RESOURCES MANAGEMENT

IN MEXICO

SYSTEMATIC & INTEGRAL PLANNING

Master Plan Guidelines:

- **Institutional Framework**
- **Existing Conditions**
- **Integral Planning of Future Actions**
- **Priority Actions Identified**
- **Environmental Impact**
- **Economic & Financial Analysis**
- **Recommendations**

WATER RESOURCES MANAGEMENT IN MEXICO

POLLUTION PREVENTION

- ***Accomplishments:***

  - **Polluter Pays Principle**
  - **Federal Water Charges Law**
  - **SEDESOL Sets Minimum Standards**
  - **CNA Establishes Discharge Permits**

- ***Further Actions Supported by Bank:***

  - **Water Quality Monitoring**
  - **Training of CNA's Enforcing Personnel**
  - **Training & Certification of Operators**
  - **Industrial Pretreatment Program**

LAC WATER ENVIRONMENT

WATER QUANTITY AND DISTRIBUTION

MOST HUMID REGION IN THE WORLD
RELATIVE ABUNDANCE

HIGHLY CONCENTRATED ECONOMIC ACTIVITY

URBANIZATION PROCESS
METROPOLITAN AREAS
POLLUTION PROBLEMS

INSTITUTIONAL TRANSFORMATION

DECENTRALIZATION
PRIVATE SECTOR PARTICIPATION

CONFLICTING WATER USES

WATER SUPPLY
IRRIGATION
HYDROPOWER

WATER MANAGEMENT EXPERIENCE

SECTORAL APPROACH

WATER ABUNDANCE
SINGLE-PURPOSE LARGE PROJECTS
WEAK WATER RESOURCES ASSESSMENT

WATER PLANS AND LAWS

DISPERSION OF ROLES
ADMINISTRATIVE ARRANGEMENTS FOR CENTRAL COORDINATION
CENTRALIZATION OF AUTHORITY

NEW AND INNOVATIVE SCHEMES FOR WRM

RIVER BASIN APPROACH
WATER MARKETS
POLLUTION AND USER FEES
MASTER PLANS

WATER PLANS IN THE REGION (dates)

COUNTRY	NATIONAL WATER PLAN		SECTORAL WATER PLANS		
	INITIATED	PUBLISHED	HYDROELEC	IRRIGATION	WS&S
ARGENTINA	1986	---	1979		
BRAZIL			1980	1982	
COLOMBIA	1982	---	1979		d.n.a.
CUBA	1970	---			
ECUADOR	1982	---	1980	1979	1980
EL SALVADOR	1979	1983			
HONDURAS	1979	1979		1978	
JAMAICA	1984	---			
MEXICO	1972	1975			
PERU	1977	---	1979	d.n.a.	
VENEZUELA	1968	1972			

d.n.a.: indicates the existence of a water plan which starting date is not known.
Panamá and Paraguay both have prepared irrigation water plans in 1990 and 1982
Source: ECLAC, los Recursos Hídricos de América Latina y el Caribe: Planificación, Desastres y Contaminación

VOLUME OF TOTAL WATER USE BY CONTINENT

CONTINENT	MEAN ANNUAL RUNOFF (Km3)	WATER USE (Km^3)		WATER USE (% RUNOFF)	
		1970	2000	1970	2000
		FULL	FULL	FULL	FULL
Europe	3,210	320	730	10.0	23.0
Asia	14,410	1,500	3,200	10.4	22.7
Africa	4,570	130	380	2.8	8.3
N. America	8,200	540	1,300	6.6	15.8
S. America	11,760	70	300	0.6	2.6
Australia	2,390	23	60	1.0	2.5
Total	44,540	2,600	6,000	6.8	13.0

Source: UNDTCD, Integrated Water Resources Planning, 1991.
North America includes Mexico, Central America and the Caribbean.

WATER BALANCE DATA BY CONTINENT

MEASURE	CONTINENT						
	NORTH AMERICA	SOUTH AMERICA	EUROPE	ASIA	AFRICA	AUSTRAL IA	GLOBE (LAND)
AREA (millions km2)	24	18	10	44	30	9	146
PRECIPITATION (mm/year)	645	1,564	657	696	686	803	834
EVAPORATION (mm/year)	403	946	375	420	382	534	540
TOTAL RUNOFF (mm/year)	242	618	282	276	114	269	294
POPULATION (millions 1985)	264	405	492	2,818	555	25	4,559
RUNOFF (m3/person-day)	62	70	17	13	21	215	23

North America includes Mexico, Central America and the Caribbean
Global figures do not include the Polar Zone
Sources: UNESCO 1978, Charley 1969, van der Leen 1975, and Speidel et al. 1988.

BANK INVOLVEMENT IN BRAZIL WRM DEVELOPMENT

WATER QUALITY AND POLLUTION CONTROL PROJECT

GUARAPIRANGA RESERVOIR (SAO PAULO)

WATER SUPPLY SOURCE PROTECTION
LAND USE PLANNING AND CONTROL

CURITIBA METROPOLITAN (PARANA)

FLOOD CONTROL
DOMESTIC POLLUTION CONTROL

NATIONAL COMPONENT

PIRACICABA (SAO PAULO)
JUNDIAL (SANTA CATARINA)
MANAUS (AMAZONAS)
RECIFE (PERNANBUCO)
MACEIO (ALAGOAS)

BELO HORIZONTE METROPOLITAN (MINAS GERAIS)

INDUSTRIAL POLLUTION CONTROL
FLOOD CONTROL

CONCEPTUAL FRAMEWORK

NATIONAL PROGRAM

WATERBASIN AS A PLANNING AND MANAGEMENT UNIT

INTEGRATED APPROACH

MOST POLLUTED METROPOLITAN AREAS

ALL POLLUTANT SOURCES

BENEFITS AND BENEFICIARIES

KEY INSTRUMENTS

DESIGN AND IMPLEMENTATION OF RIVER BASIN AUTHORITY

STUDY OF INTERNATIONAL EXPERIENCES AND DEVELOPMENT OF COMPARATIVE SCENARIOS

EARLY INVOLVEMENT OF STAKEHOLDERS IN THE DESIGN AND IMPLEMENTATION PROCESS

ADEQUATE PRICING POLICIES FOR RESOURCES AND SERVICES

SURCHARGE FOR WATER USES

INCREASE PROPERTY TAXES AND APPLY BETTERMENT LEVIES

INTEGRATED POLLUTION CONTROL ACTIONS WITH STRONG EMPHASIS ON ECONOMIC INSTRUMENTS

DEVELOPMENT OF RECREATIONAL PARKS AND OTHER LAND USE SCHEMES TO PROTECT CRITICAL AND DAMAGED AREAS AND PREVENT FUTURE OCCUPATION

Aquaculture Development as A Means of Large-Scale Resettlement in Indonesia: Farmer Participatory, Extension, Training, and Institutional Roles*

BARRY A. COSTA-PIERCE
International Center for Living Aquatic Resources Management (ICLARM)
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Abstract

Construction of the Saguling and Cirata dams in the heavily-populated highlands of West Java, Indonesia displaced over 40,000 persons from their homes, jobs, and traditional lands. In 1986, a project was initiated by the Institute of Ecology, Padjadjaran University (IOE-UNPAD) and ICLARM with funding from the World Bank to conduct extension, training and research to resettle 3,000 families in reservoir cage aquaculture or related industries. By 1989, floating net cage and other inland aquaculture systems in and around the Saguling reservoir (flooded 1985) employed an estimated 1,083 persons; cages produced 2,554 t of common carp *(Cyprinus carpio)* and provided an estimated 20% of the fish entering the Bandung district, an area of about 3 million persons. Revenue from fish was estimated at Rp 5 billion/year at end 1989; over twice (Rp 1.9 billion) the revenue obtained from the 2,250 ha of rice flooded by the dam.

Large-scale extension and training efforts for 2,081 persons included: (1) traditional adoption/diffusion methods; (2) formation of fish farmers associations; (3) participatory farmer research; (4) establishment of community schools in villages having the highest numbers of displaced residents; (5) farmer-to-farmer visits; (6) publishing workbooks in the local language; (7) study tours and visits to other Asian nations with relevant experiences.

Some reasons for success of the aquaculture resettlement option were: (1) a defined target group; (2) ready availability of investment capital for aquaculture from land compensation monies; (3) lack of alternative employment opportunities in the rural agricultural and human ecosystems; (4) local traditional knowledge of aquaculture and cage culture; (5) large market demands and relatively high prices for freshwater fish; (6) ready access to large urban markets via paved roads; (7) dendritic reservoir form with many deep, sheltered bays suitable for cage aquaculture; (8) cooperation between and technical assistance by government, the electric company and ecological and fisheries organizations.

Introduction

The number of new reservoirs is increasing dramatically in developing countries, mainly due to increased demands for reliable electric power, irrigation and drinking water. Costa-Pierce and Soemarwoto (1987) estimated that an average percentage increase in reservoir area in 15 Asian nations from 1987 to 2000 would be 511% (range 50 [Singapore] to 9,900% [Laos]). By 2000, the collective water surface area of reservoirs (20.3 million ha) will exceed that of Asia's natural waters (18.5 million ha).

In some cases, reservoirs have caused massive social disruption, increasing incidence of water-borne diseases, erosion, environmental degradation and other problems (Petr 1978; Hunter et al. 1983; Lelek 1984). The planned development of capture and culture fisheries enterprises in new reservoirs as alternative livelihoods for displaced persons, or for commercial aquaculture production has, however, received little or no attention. Given the facts that urbanization in most Asian nations will cause severe population pressure on agricultural lands, and will increase the need to preserve and intensify agricultural production on the remaining agricultural area, the era of consistent increases in the numbers of backyard ponds in Asia may be slowly coming to a close. Reservoir aquaculture and culture-based fisheries development may be one of the few means left for creating new sources of fish for many densely-populated nations.

An Institute of Ecology, Padjadjaran University (IOE-UNPAD)/International Center for Living Aquatic Resources Management (ICLARM) project in West Java, Indonesia to investigate the feasibility of resettlement aquaculture was successful in developing cage and hatchery integrated aquaculture, and its associated small industries in villages surrounding two new hydropower reservoirs (Sutandar et al. 1990; Soemarwoto and Costa-Pierce 1990). Within three years 1,083 persons were directly or indirectly involved in cage fish production which reached 2,554 t/year. The 3-year project trained 2,081 persons. The project background, its technical, social, and economic aspects, have been reported elsewhere (Soemarwoto and Costa-Pierce 1990).

The purpose of this paper is to describe the planning program, institutional framework, extension and training efforts conducted from 1985 to 1990 in the project; and to document the major problems encountered and effectiveness of various interventions with farming families. An analysis of success of the research and development project is attempted.

Institutional Framework and Planning Process

Funding was obtained from the World Bank as a small portion of a larger loan package to the Indonesian State Electric Company (PLN) for dam construction at Cirata. The fisheries loan was divided into local (Rp 917,441,530) and foreign currency (US$416,690) portions and administered by IOE-UNPAD and ICLARM, respectively, for the implementation of services (in January 1986, 1 US$ = 1,130 Indonesian Rp [IDR]; in September 1986 IDR devalued to 1,640).

The primary objectives of the project were to:

[1] provide research, extension, training and other support services to the West Java Fisheries Provincial Agency (WJFPA) to facilitate rapid resettlement of 3,000 families either full or

part-time in reservoir aquaculture, capture fisheries, or related industries in the Saguling (1,500) and Cirata (1,500) reservoir areas;

[2] develop a comprehensive reservoir fisheries and aquaculture development and management plan for resettlement.

It was known that, despite the large information base available in freshwater aquaculture and capture fisheries management, there were no previous experiences anywhere involving resettlement of such a large number of persons through a planned program of reservoir aquaculture and capture fisheries development. For this reason the World Bank suggested that IOE-UNPAD associate with ICLARM to assist in technical advice and project implementation.

An institutional framework was formulated from interpretations of the project document; since this document was deficient in specifically defining an overall structure for the project and individual institutional responsibilities. IOE-UNPAD was chosen as the lead agency to coordinate a multifaceted applied research program that involved agricultural economists, sociologists, demographers, anthropologists, agronomists, forestry, animal husbandry, capture fisheries, and aquaculture professionals. The West Java Provincial Fisheries Agency (WJPFA) created a special technical implementation unit (Unit Pelaksana Teknis Dinas; UPTD) with offices at the Saguling and Cirata dam sites to lead extension and training efforts. IOE-UNPAD hired fisheries extension persons to facilitate rapid transfer of applied research results to villagers, and to coordinate activities with the UPTD. ICLARM provided the services of a fulltime resident consultant scientist; and short term scientific experts in capture fisheries, aquaculture, and economics/marketing as necessary. The Indonesian State Electric Company (Perushaan Umum Listrik Negara; PLN) provided funding, coordination, and unlimited access to the reservoir areas (its property) for research and development activities.

Upon delegation of responsibilities, a planning process was undertaken by IOE-UNPAD/ICLARM to portion the workload into teams and to implement applied research activities in capture fisheries, aquaculture, socioeconomics and marketing (Table 1). Results are documented in Soemarwoto and Costa-Pierce (1990).

Two methodologies were used to disseminate an integrated management system (Maskana et al. 1990) and aquaculture technologies to displaced persons. For farmers unfamiliar with traditional aquaculture technologies in West Java, adoption/diffusion techniques (Pollnac 1982) were chosen. For farmers who knew about traditional aquaculture techniques, a farming systems research approach was used. This division of extension and training efforts was not a hard and fast one; but was very flexible. It was left up to the farmers to choose which sessions they wanted to attend. Some farmers attended sessions using both techniques.

Traditional Training Methods

A technology package for construction and management of a simple floating net cage aquaculture operation was formulated. Technology was based upon previous Indonesian and overseas experiences (reviewed by Costa-Pierce and Hadikusumah 1990).

Hands-on and formal classroom training in floating net cage aquaculture for selected residents to be displaced by the reservoir was conducted in 1982 in Lake Lido (Bogor); in 1983 (Jatiluhur); and in 1984 in a special "fisheries dike area" created by PLN before flooding of the main reservoir (Rifai 1985). In 1985, training was conducted in the Bongas area after the main part of the reservoir was flooded for 24 displaced persons by the Research Institute for Freshwater Fisheries, Bogor and the Department of Fisheries, UNPAD (Rifai 1985). Two farmers from the latter group received loans from the Bank of Indonesia. Sutandar et al. (1990) have further described the chronology of formal training efforts in floating net cage aquaculture conducted.

Economic yields and successful payback of the loans by the second year of operation by both farmers attracted a great deal of interest. The two farmers became *kader-kader petani ikan* (fish farmers facilitators) in the Bongas area of Saguling. A highly publicized visit was made to these two farmers by the Governor of West Java. These initial events created a widespread awareness of floating net cage aquaculture among Saguling's displaced people.

The West Java Provincial Fisheries Agency (WJPFA) drafted two 5-year plans for reservoir aquaculture development in Saguling (1985-1989) and Cirata (1988-1992) (Effendi 1985; 1988). The plans projected a total 6,210 t and 27.8 million fingerlings (1-3 cm) for Saguling by end 1989 (Table 2); and 6,718 t and 37.1 million fingerlings for Cirata by end 1982 (Table 3). The Saguling plan portioned 1,340 cage units (7 x 7 x 2.5 m), 100 pens, and 60 hatcheries over 26 districts surrounding the 5,600 ha reservoir. For Cirata, 1,340 cages, 96 pens, 80 hatcheries, 15 running water systems, and 160 rice-fish culture systems were planned (Fig. 1).

By end 1989, 1,236 cages were present in the Saguling reservoir and 120 in Cirata. The reservoir fisheries and aquaculture development plan estimated a carrying capacity of 5,800 cages for Saguling and 10,600 for Cirata (IOE-UNPAD and ICLARM 1989).

The WJPFA and IOE-UNPAD/ICLARM collaborated in offering a number of short courses (1 week to 3 months) for villagers at offices of village headmen. These courses were held in over 20 districts in the Cirata region and were attended by over 500 persons. Courses covered operations of running water systems, hatcheries, cages, pen systems, rice-fish culture, formulating fish feeds, and post-harvest fish processing. The curricula for these short courses are detailed in Table 4.

Fish Farmers Association (FFAs)

A Saguling Fish Farmers' Association (SFFA) was formed in late 1985, and by end 1989 had over 700 members. Leadership of the SFFA was held by the two farmers described above who successfully repaid their loans in 1986; subsequently they became the most highly respected members of the fish farming community. The SFFA was formed by the Technical Implementation Unit (UPTD) of the West Java Provincial Fisheries Agency (WJPFA), and assisted farmers with obtaining bank loans and marketing fish.

In Cirata, the Village Cooperative Unit (Korporasi Unit Desa, or KUD) took the lead in cage aquaculture development with assistance from the UPTD. In 1989, the cooperative obtained a government loan package in excess of Rp 100 million to develop cage aquaculture in Cirata.

Farmer Participatory Training Methods

A farming systems research (FSR) approach was taken by the IOE-UNPAD/ICLARM team to the extension and training aspects of the project. This approach was chosen since it was previously known that West Java has a unique cultural heritage and a large bank of traditional knowledge in many areas of cage aquaculture and integrated farming systems (for examples see Djajadiredja et al. 1980; Thornburn 1982; Costa-Pierce and Effendi 1988; Costa-Pierce and Hadikusumah 1990). Many traditional systems and much of the existing farmer's knowledge could be used directly, or modified and adapted for use.

It was decided that all adaptive research should employ the villagers (*beneficiaries*) for whom the technologies were intended from the outset; and that villagers be involved throughout the success or failures of the adaptation process. Using this approach, recipients were made active participants in both the process and in the evaluation of suitability of chosen technologies for their needs. Three floating net cage research stations were constructed in 1986-1987 to test the technology under the prevailing limnological conditions in Saguling. Cage designs were initially chosen to be identical in size, design and management to the existing floating net cages operated by farmers in the Saguling reservoir.

All on-station experiments involved the active participation of farmers in the operation and design of experiments. This was accomplished since an extensive survey of existing aquaculture practices in 1986 in the Saguling reservoir and surrounding region showed an impressive capability and diversity of detailed practical experiments conducted by farmers that, in the evaluation of project scientists, could lead to more rapid choices of promising research topics of direct value to the intended beneficiaries, e.g., the farmers themselves! Lightfoot (1987) has also pointed to the unique value of indigenous research by farmers to both on and off-station research workers.

Establishment of Community Schools

While development of the aquaculture resettlement option was the main concern of the project, it was clear from the outset that a planned applied research, extension and training program in reservoir environmental restoration and enhancement would be necessary. To accomplish this, establishment of community schools (called Pusat Penelitian Sistem Terintegrasi Tanaman, Ternak dan Ikan; or Research Centers for the Integrated System of Plants, Farm Animals, and Fish) was undertaken in villages surrounding the reservoir with the largest percentages of displaced residents.

Houses were rented for a 3-year period in villages in Saguling's northern (Cangkorah and Cipondoh) and southern regions (Awilarangan), in areas having excellent boat and road access. A house was rented in Mande to coordinate activities in Cirata.

Village schools had a permanent IOE-UNPAD staff member stationed at the site who coordinated all applied research projects, hands-on training, and relationships with the community. Villagers were employed to carry out all labor and routine tasks at the station. Village schools were the center of all collaborative activities with villagers and between the various institutions and outside villagers visiting the station. Stations were routinely visited by IOE-UNPAD, ICLARM, WJPFA, and UPTD staff members to monitor progress and discuss results internally and with villagers.

The village schools were replete with displays, photographs and extension books; along with working farm models in rabbit animal husbandry, composting, soil conservation, aquaculture and capture fisheries technologies. It was estimated that over 3,000 persons visited the four village schools from 1986-1989.

An environmental rehabilitation system was promoted at the village schools which integrated rabbit husbandry, earthworm composting, cage culture, small-scale fish hatcheries, and agroforestry/erosion control (Fig. 2) (Maskana et al. 1990).

Farmer-to-Farmer Visits

Once the Saguling cage culture industry began its remarkable expansion, the tasks of attracting new entrants was of little concern for extensionists. Indeed control of the cages in Bongas (the southern sector of Saguling) became an issue because of the area's excellent infrastructure and access to markets, seed and feed suppliers. By end 1989 over 80% of the cage culturists in Saguling were located in Bongas (Rusydi and Lampe 1990).

By mid-1988, extension efforts in cage aquaculture for displaced residents from the new Cirata reservoir was the major concern of the program.

Since, in familiar cultural settings, diffusion of innovations can occur as rapidly with informal farmer contacts as in formal courses (Kang and Song 1984), a "hands-off extension approach" was used; and farmer-to-farmer visits were sponsored for Cirata residents to go to the Bongas region, Saguling. Extension personnel were present to answer questions, give free workbooks, provide "social lubrication", and take care of personal needs.

These visits were an obvious success. By end 1989, 120 cage units (40 families) were operating in Cirata with no formal course work or extension programs having been conducted.

Information Resources

It was found that Saguling's cage fish farmers were well-educated, with 94% having completed elementary school (Rusydi and Lampe 1990). Most people could read the local dialect or the Indonesian national language. Therefore extension workbooks in the local Sundanese language, in Indonesian, and much later, in English were assembled using the applied research experiences of both on-station workers and farmers. Workbooks on floating net cage, pen, small-scale hatchery, and small cages were published (Costa-Pierce et al. 1989a, b, c, d).

Workbooks were made available free at all IOE-UNPAD/ICLARM community schools, and at UPTD offices at the reservoir dam sites. The books were used widely by extension officers and trainers in formal courses in villages. Workbooks were also available free to all members of the Saguling Fish Farmers' Association and Village Cooperative Units in Cirata.

During visits to cage culture operators in Saguling and Cirata in 1989-1990, it was frequently observed that these workbooks were among the only reading materials available in village residences. Children seemed to particularly value the "comic book nature" of the materials; to the point that, cage culture "toys" have appeared in one village.

Study Tours to Nations With Relevant Experiences

Many aquaculture technologies successful in one developing nation can be transferred to other nations with similar development circumstances after adaptive research is undertaken (World Bank 1982). West Java has a unique aquaculture history, wealth of experience and capable fisheries institutions and scientists involved in aquaculture of common carp and other species (Costa-Pierce and Hadikusumah 1990). However, it was noted that:

[a] much of the specific technology to diversify the reservoir cage culture industry and assist poorer residents [e.g., by evolving a low cost or extensive cage aquaculture, particularly for Nile tilapia *(Oreochromis niloticus)* and Chinese silver *(Hypophthalmichthys molitrix)* and bighead *(Aristichthys nobilis)* carps] is lacking;

[b] Saguling and Cirata are very eutrophic reservoirs with a large potential for "no feed, or extensive cage culture".

Transfer of modern methods and management practices in extensive aquaculture were not evaluated as a prolonged proposition or expensive exercise, since the Philippines has had a wide diversity of successful tilapia cage and pen aquaculture; and extensive cage aquaculture for the Chinese carps has been successful in lakes in China, Nepal and Singapore (Chookajorn 1982; Gonzales 1984; Guerrero 1982; Pullin 1986; Hai and Zweig 1987).

It was decided to arrange two study tours in 1987-1988 for selected scientists from PLN, IOE-UNPAD and the UPTD to transfer technology rapidly from Asian nations with relevant experiences in low-cost cage aquaculture to Indonesia (Costa-Pierce et al. 1988; 1989e).

By end 1989, 26 small-scale hapa hatcheries for an Indonesian variety of red tilapia (hybrids of *Oreochromis* spp.) were being operated by poor farmers in Saguling. Two tilapia growout operations started in 1989-1990. A number of cage operators were doing polyculture of common carp and red tilapia. Active research in tilapia aquaculture was going on in the WJFA, the Department of Fisheries, UNPAD, and at IOE-UNPAD.

Analysis of Success and Problems

Aquaculture as a means of rural development in developing nations has been sharply criticized by a number of authors (Smith and Peterson 1982), and, in general, remains an elusive goal. Main problems have been lack of start-up capital, insufficient attention to realistic economic appraisals, lack of expertise and appropriate technologies incorporating traditional knowledge (Neal and Smith 1982).

The main problems experienced in the course of this project were:

(1) *interdisciplinary nature of the efforts.* It was difficult to coordinate all the professionals needed for project implementation. Many persons

had difficulty seeing beyond the bounds of their professional training. It was felt, however, that the situation would have been even worse if the project had been led by a conventional fisheries or aquaculture research organization, rather than by an ecology institution. Ecologists, in general, have a generalist training, and are deemed more sensitive to interactions and interfaces.

(2) *vague nature of institutional agreements and responsibilities.* The institutional framework for project implementation between electric company, university, fisheries, regional and village political institutions had to be created by the project, necessitating a larger than anticipated administrative load. In addition each institution occasionally (and repeatedly) had their own interpretation of what the project agreement actually said; and, in some cases, carried out their interpretations without communication with others.

(3) *resources for whom?* When the cage culture industry began to take off, rich people from the urban centers of Bandung/Jakarta began to enter the industry. Eventually the WJPA made regulations on the cage industry specifying that only displaced persons could get permits to use the waters of Saguling for aquaculture and fisheries. The government regulation stipulated that one family was allowed to operate only 4 cages. However, the "back door route" is still being used by some rich city people to own cages in Saguling.

Rapid adoption was influenced by the inherent innovativeness of farmers in West Java. Farmers operating existing agro- and aquaecosystems in the province have an impressive indigenous knowledge and testing systems, characterized by a great deal of individual innovation. Fliegel (1984) also viewed the adoption of change as being directly influenced by the basal level of innovativeness in a society.

While it may be impossible to document all the possible factors and their interactions that led to the success reported here, some factors were important contributors, such as:

(1) *a defined, educated target group.* Lists of names with addresses of displaced persons were obtained from the electric company along with how much compensation money these people obtained. While in many cases the lists were found to be outdated or wrong, the information did assist in identifying villages with large numbers of displaced families, families who had backyard fish ponds before the reservoir, and other potential adopters;

(2) *ready availability of investment capital.* Lack of start-up capital often constrains aquaculture

development among the poor - the target group of many aid projects. All villagers in Saguling obtained compensation money; with 92% receiving less than Rp 6 million, and 8% over Rp 6 million (Suwartapradja and Achmad 1990). However, for the poorer residents compensation monies were not enough to replace homes and lands lost due to increased prices and inflation;

(3) *lack of alternative employment opportunities in both rural agricultural and human ecosystems.* The population densities increased 2-3 times from a range of 237-1,691 (pre-inundation) to 476-4,292 persons/sq. km (post) (Suwartapradja and Achmad 1990). According to Collier et al. (1977) the rice agroecosystem in Java cannot absorb more labor;

(4) *local traditional knowledge of aquaculture and cage culture.* Rapid innovation to increase net returns and improve efficiency in the cage industry has been widely observed in Saguling. Dahlman and Westphal (1981) describe the success of development assistance in terms of the "technological mastery" of a system; the autonomous ability to identify, select, and generate technological improvements and changes;

(5) *large market demands and relatively high prices for freshwater fish.* Kusnadi and Lampe (1990) noted that price fluctuations for freshwater fish observed in Jakarta were small even though strong seasonal fluctuations in fish supplies occurred. Given the increasing population density and increasing incomes of Jakarta residents, who eat about 14 kg of fish per capita/year, market demands for reservoir fish were forecast to increase further;

(6) *ready access to large urban markets on paved roads;*

(7) *dendritic reservoir.* Saguling has many deep, sheltered bays suitable for cage aquaculture (Soemarwoto et al. 1990; IOE-UNPAD and ICLARM 1989);

(8) *institutional cooperation.* Although difficult to coordinate, and necessitating an unanticipated administrative load, the cooperation and technical assistance of government, electric company, ecology, and fisheries organizations was valuable;

(9) *accessibility of extension services.* Rusydi and Lampe (1990) report that 90% of Saguling's cage culturists with one cage only participated in extension and training programs; and that 44% of all cage farmers got information from training or extension programs.

Few reported aquaculture development experiences in any developing country have met with such remarkable success in a short period of time as the cage aquaculture industry in

Saguling. The cage culture industry is in its infancy and changes will occur. For this reason, combined with some of the more unique localized factors contributing to success reviewed above, a cautious, planned approach is recommended regarding the applicability of the aquaculture resettlement option to other developing countries.

Recommendations

New methods are needed to manage the earth's overdeveloped and misused "ecofaces" (interfaces between terrestrial and aquatic ecosystems), and to develop integrated technologies to restore the environmental and social fabric of damaged ecosystems such as reservoirs and their attendant watersheds (Fig. 3). In this regard a critical research approach in integrated reservoir environmental restoration that includes as important aspects resettlement aquaculture and simple methods of culture-based fisheries may be of wide interest.

Aquaculture's role in sustainable rural development must be determined by the agenda of the intended beneficiaries. It is argued that reservoir social-environmental restoration can only be accomplished through the education and active involvement of displaced people who have an investment in rehabilitation. An integrated program using some of the tenets of farming systems research will allow enough flexibility for choices to be made on the best mix of component technologies needed to restore damaged environments such as reservoirs, and to evaluate all possibilities realistically.

Reservoirs are unique opportunities to educate people about their new environments and for formulating innovative, flexible and evolutionary ownership patterns and agreements between electric companies, research institutions, nongovernmental organizations, and communities to meet a common set of goals. Sophisticated traditional methods of aquatic and terrestrial ecosystems management exist in numerous developing nations. A step-by-step adaptation program, involving the target group from the outset, to evolve an interactive set of appropriate technologies based on traditional systems is necessary. These programs will allow ecological engineering of new environments, and restoration and enhancement of damaged ones.

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Table 1. Planning process used to complete an implementation plan for applied research in integrated reservoir fisheries and aquaculture development.

Step 1	Step 2			Step 3	Step 4
-Synthesis of project agreements and goals -Formal and informal meetings with cooperating agencies -Assignment of project staff into 3 sub-programs: *aquaculture development *capture fisheries development and management *socio-cultural, economics and marketing	-Preliminary surveys and data gathering in 3 sub-program area of the project: Aquaculture Development: *information on existing traditional and modern systems and knowledge base; production; feeds and feeding practices; systems design, economics, organization and interactions; constraints; past performance; species; rationales for use; labor use; success/failures; *secondary data from national, provincial, regional, city, village fisheries institutions, Universities, private operators, regarding specific systems to likely be of use in reservoirs; *interviews with farmers, middlemen, trips to markets, infrastructure, daily/weekly routines; problems with materials; labor; environment; technology; neighbor relations.	Capture Fisheries Development and Management: *broad environmental surveys of fisheries ecosystems and changes occurring in it; ports/harbors; industrial developments; value-added products; post-harvest traditional techniques; *main hydromorphometric, biological, limnological, climatological factors; *information on past/present fishing efforts; species; yields; gear used; catch per unit efforts; labor; routines; transportation costs/patterns; *fishermen's impression of new environments, and effects on new ecosystems from demographic, local, polluting, market, political changes.	Socio-Cultural, Economics and Marketing: *data on population sizes; income; fish consumption patterns; forms/sizes of fish eaten; cultural reactions to fish products; land use patterns; agricultural interfaces; land tenure; rapid rural appraisals; *adaptations to new reservoirs; special environment/people interactions; resource use patterns; exploitation/mining activities. *constraints and limiting factors to resource use and conservation; *availability of funds; knowledge of loans, credit; use of banks; familiarity with the concepts of loans/credit; *analyses of fish markets; market structures; distribution and transportation systems; marketing costs; middlemen; market supply statistics from all administrative levels; market price fluctuations with peak supply; market capability projections.	-Summary report on findings in each sub-program area in chapters comprising draft implementation plans for: *Aquaculture Development; *Capture Fisheries Development and Management; *Socio-Cultural, Economics and Marketing.	-Complete synthesis of 3 sub-program plans for a single implementation plan through development; -Implementation plan is subject seminar of invited experts and is revised according to changes and recommendations; -Final implementation plan for fisheries and aquaculture development as a means of large-scale resettlement.

Table 2. Five-year plan for fisheries development in the Saguling Reservoir, West Java, Indonesia.

Activity	Unit	Year 85	86	87	88	89	Total	Production (kg) 85	86	87	88	89	Total
Floating net cages	7 x 7 x 2.5 m	75	230	340	340	355	1,340	337.5	1,035	1,530	1,530	1,597.5	6,030
Pens	1 ha	35	20	15	15	15	100	63	36	27	27	27	180
Hatcheries[1]	1,500 m^2	52	2	2	2	2	60	24,128	928	928	928	928	27,840

[1]Hatchery production is number of 1-3 cm fingerlings.

Table 3. Five-year plan for fisheries development in the Cirata Reservoir, West Java, Indonesia.

Acitivity	Unit	Year 88	89	90	91	92	Total	Production (kg) 88	89	90	91	92	Total
Floating net cages	7 x 7 x 2.5 m	75	230	340	340	355	1,340	337.5	1,035	1,530	1,530	1,597.5	6,030
Pens	1 ha	27	24	15	15	15	96	156.6	139.2	87	87	87	556.8
Hatcheries[1]	1,500 m^2	20	18	16	14	12	80	9,280	8,352	7,424	6,496	5,568	37,120
Running water	100 m^2	5	4	2	2	2	15	25	20	10	10	10	75
Rice-fish	1 ha	115	15	10	10	10	160	40.3	5.3	3.5	3.5	3.5	56.1

[1]Hatchery production is the number of 1-3 cm fingerlings.

Table 4. Subject areas covered in formal aquaculture training courses offered by the aquaculture resettlement project, 1986-1989.

Aquaculture systems	Subject areas
Hatcheries	1. Site selection 2. Designs and construction 3. Broodstock selection, management, feeds/feeding 4. Spawning, egg collectors 5. Nursery pond management 6. Water quality and natural feeds management 7. Harvesting, economics, marketing, security
Small bamboo cages; Floating net cages	1. Site selection 2. Designs and construction 3. Aquaculture species production 4. Aquaculture management: seed management, feeds, feeding 5. Diseases 6. Harvesting, economics, marketing
Pen systems	1. Community organization, group process training 2. Site selection 3. Design and construction 4. Seeding and fertilization 5. Compost as feeds and fertilizers 6. Harvesting methods 7. Marketing and security
Rice-fish culture	1. Design and trench types 2. System types and sizes 3. Water quality and management 4. Feeding and fertilization 5. Integration with rice schedules 6. Integrated pest management 7. Harvesting methods 8. Economics, marketing and security
Running water systems	1. Site selection 2. Designs and construction 3. Water quality and management 4. Aquaculture species production 5. Aquaculture management 6. Harvesting, economics, marketing, security
Fish feeds processing	1. Feeds available, their composition and costs 2. Raw materials available 3. Low cost processing methods 4. Economics and marketing
Post harvest fish processing	1. Traditional methods, techniques and materials 3. Modified low cost methods 4. Storage, marketing and economics

Fig. 1. Aquaculture development plan for the Cirata Reservoir (Effendi 1988). The plan portions floating net cages, pens, hatcheries, intensive running water ponds, and rice-fish nursery systems in and around the 6,200 ha reservoir. By end 1992, fish production is forecast to be 6,718 tons and hatchery yield 37.1 million fingerlings (1-3 cm). Cirata's fish production could likely be much higher. While Effendi (1988) planned only 1,340 floating net cages, the IOE-UNPAD and ICLARM (1990) management plan found the carrying capacity of Cirata was 10,600 cage units.

Fig. 2. Integrated management system for agriculture, animal husbandry and culture fisheries development for resettlement of displaced persons from reservoir construction (after Maskana et al. 1990).

Fig. 3. Ecosystems approach to integrated reservoir restoration and rehabilitation.

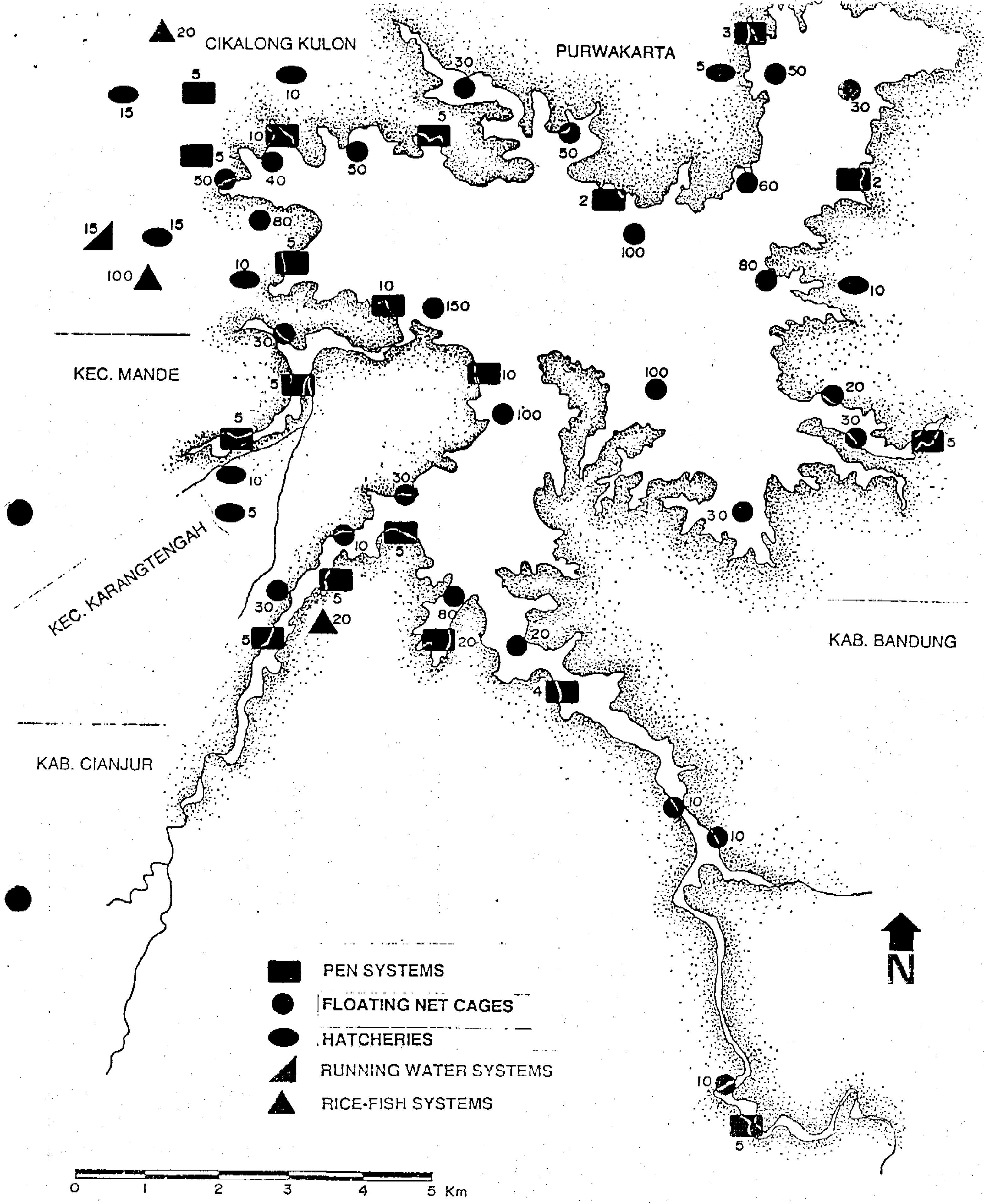

CIKALONG KULON
PURWAKARTA
KEC. MANDE
KEC. KARANGTENGAH
KAB. BANDUNG
KAB. CIANJUR
PEN SYSTEMS
FLOATING NET CAGES
HATCHERIES
RUNNING WATER SYSTEMS
RICE-FISH SYSTEMS
0 1 2 3 4 5 Km
N

Fig. 1

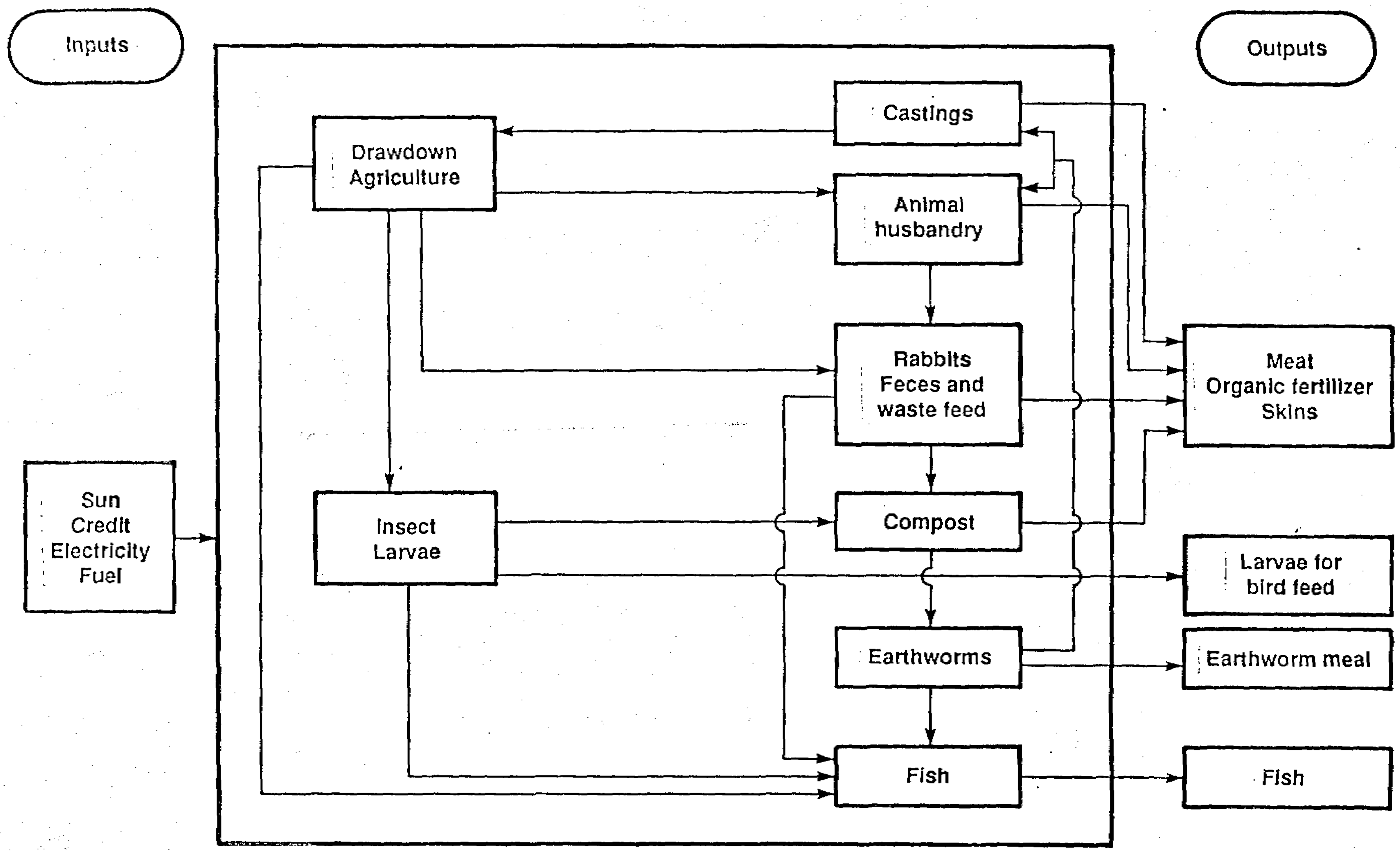

Inputs
Outputs
Castings
Drawdown Agriculture
Animal husbandry
Rabbits Feces and waste feed
Meat Organic fertilizer Skins
Sun Credit Electricity Fuel
Insect Larvae
Compost
Larvae for bird feed
Earthworms
Earthworm meal
Fish
Fish

Fig. 2

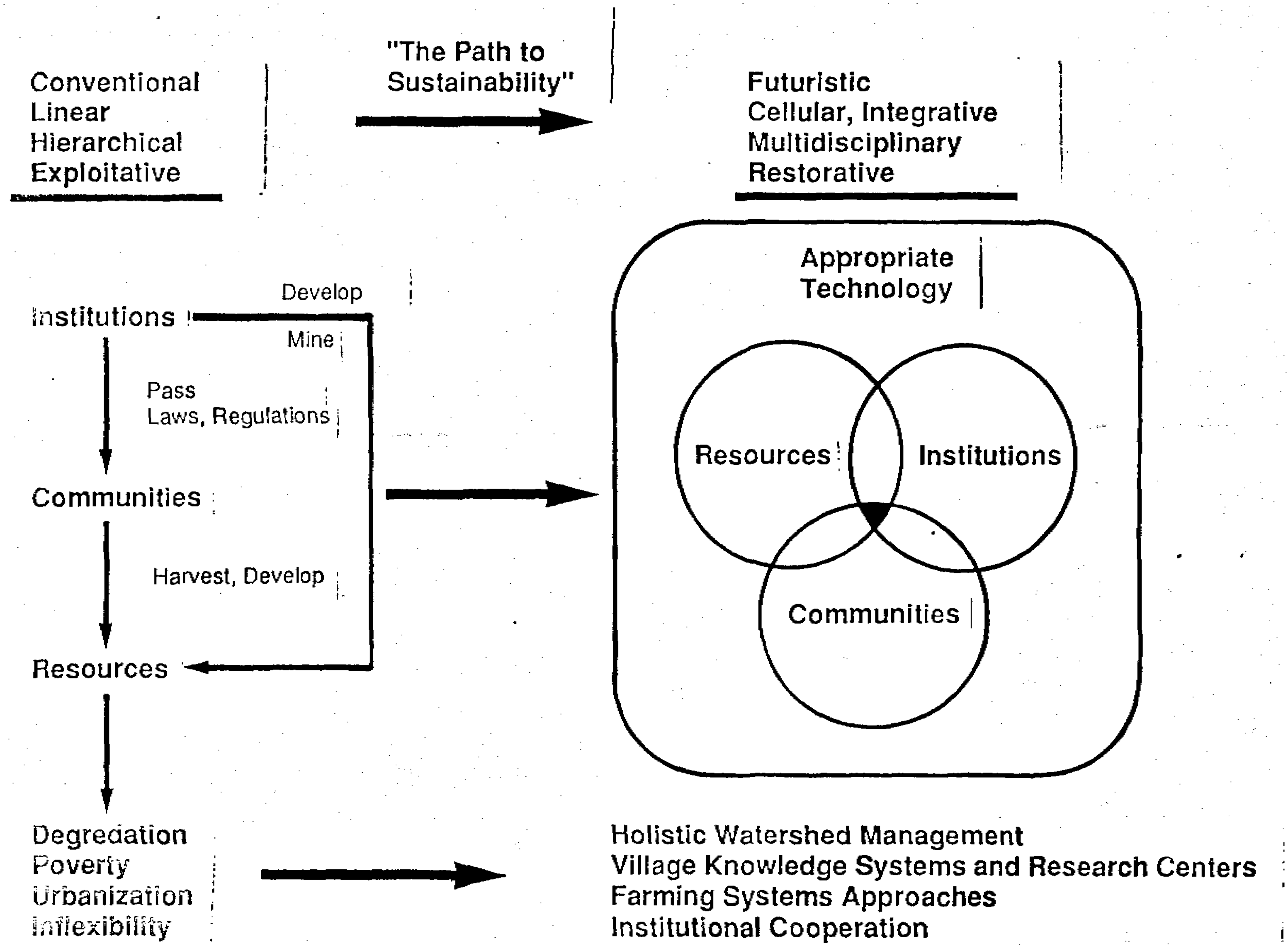

Conventional
Linear
Hierarchical
Exploitative
"The Path to Sustainability"
Futuristic
Cellular, Integrative
Multidisciplinary
Restorative
Institutions
Develop
Mine
Pass
Laws, Regulations
Communities
Harvest, Develop
Resources
Degradation
Poverty
Urbanization
Inflexibility
Appropriate Technology
Resources
Institutions
Communities
Holistic Watershed Management
Village Knowledge Systems and Research Centers
Farming Systems Approaches
Institutional Cooperation

Fig. 3

AN APPROACH TO FINANCING LARGE DAMS
CHINA'S XIAOLANGDI DAM ON THE YELLOW

by D. J. Gunaratnam
Principal Irrigation Engineer
China/Mongolia Department

Background of the Project

1. One in nine Chinese live within the Yellow River Basin, and most of these depend, directly or indirectly, on the river for their livelihood. The average annual flow of the Yellow River is almost identical to Egypt share of the Nile. Yet it supports a population twice that of Egypt, and irrigates an area twice that of the Nile. It does so in the face of the twin menaces which have characterized the river throughout history: sediment and floods. The Yellow River contains the highest sediment concentration of any river in the world— nine times of the annual silt concentration of its nearest rival. However, sediment is not the main concern of Chinese planners, although it is high on the list. Nor is the river's ability to support an ever-growing number of people, both rural and urban, and industries, and mines, and oilfields, and fisheries. The primary concern is flood control. Floods along the Yellow River have killed millions, have disrupted the lives of tens of millions, and have caused incalculable property and economic loss since the earliest civilization appeared along its banks. Planning for economic *survival* along the Yellow River is a challenging task. Planning for economic *development* is another story altogether, of which this report may only constitute a preamble.

2. Yellow River planners are undoubtedly correct in focusing their highest concerns on flood control, followed closely by sediment control. Floods may strike virtually anywhere in the basin, both in late summer due to intense rainstorms or even in the dead of winter as ice formations dam the river. Flood and sediment control are closely linked and without sediment control, effective flood control may be impossible. The aggraded lower reach is already dangerously suspended, in places more than ten meters above the surrounding plain (see figure 2). Without sediment control, the typical uses of river water—irrigation and water supply—are hampered by expensive and time-consuming desiltation.

3. **Floods in the Lower Yellow River Reach**. Reports of Yellow River floods and efforts to control them go back to the year 2297 BC. Historical records and archaeological investigations provide evidence of many major floods with some exceptional events in the years 223 AD, 1482, 1761 and 1843. Of these, the 1843 flood, with an estimated peak flow at the Xiaolangdi dam site of 35,000 m^3/s and a return period of 1,000 years, is regarded as the flood of record for the Yellow River. A reasonably accurate set of water level records is available for the site of the existing Sanmenxia Dam upstream of Xiaolangdi since 1919, and since the 1950s water levels and discharges have been measured at Huayuankou at the head of the floodplain. These records show that the highest floods since 1919 were in 1933 (20,000 m^3/s at Sanmenxia) and in 1958 (22,000 m^3/s at Huayuankou). There are essentially three flood producing areas: the area between Hekouzhen and Longmen, the area between Longmen and the Sanmenxia Reservoir, and the area between Sanmenxia and Huayuankou. Floods from the first two have been known to combine to produce the highest floods recorded. The third area has produced high floods but never in combination with the upstream areas.

4. Accurate reports of flood damage are available since the turn of this century. In the flood of 1933, the main dikes broke in 54 locations. The total flooded area was 11,000 km^2; 3.6 million people were affected and 18,000 died. Two years later in 1935, during a relatively small flood, the dikes were broken again in Shandong Province, and 12,000 km^2 were flooded, affecting a population of 3.4 million people.

5. Since 1935 there have been no accidental breaches of the main dike, but there was a deliberate breach of the dike near Kaifeng in 1938 in an attempt to stop the advancing warring armies. As a result of the breaches the water swept repeatedly through 44 counties during the following nine years, submerging 1.3 million ha of cropland and leaving 12.5 million people homeless. The Yellow River flowed out to the sea during these years via the Huai River into the Yangtze estuary. Some 890,000 people were either drowned or died of hunger or diseases. Ten billion tons of silt were carried out to

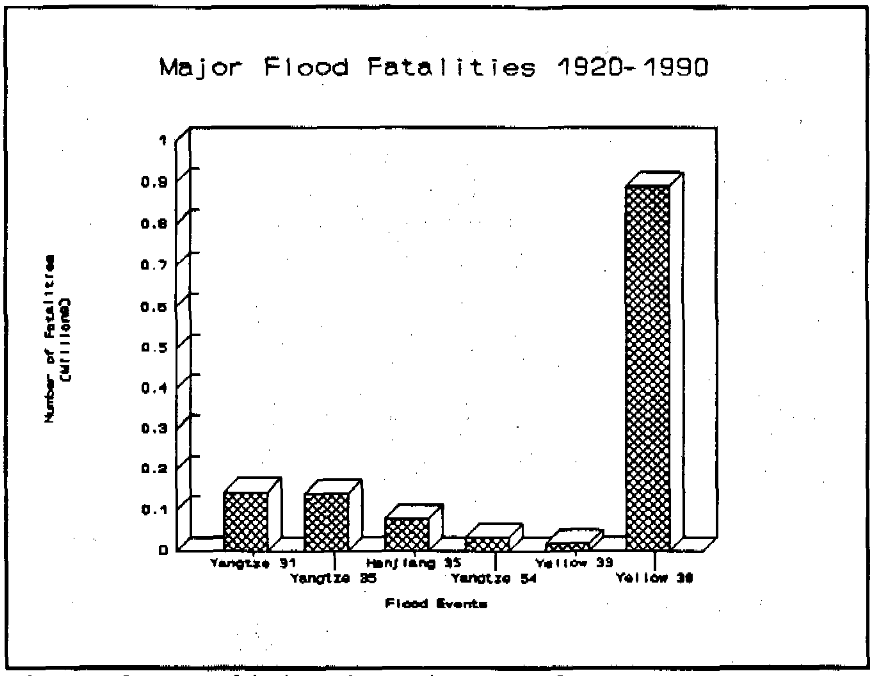


Figure 1: Fatalities in Major Floods

the plains, forming a 54,000 km^2 "silt-covered area" that could not be used for growing crops. The Yellow River's change of course caused a large amount of silt to be deposited in the Huai River channel and reduced the channel capacity. It should be noted that historically this catastrophe was about the twenty-fifth major change in river course, with outlets ranging from the present Huai River in the south to the Hai River, 1,000 km northward in Tianjin.

6. The 1958 flood was estimated by YRCC to be about a 1-in-40-year frequency. The main dikes held during this flood event, but there was serious flooding of the plains between the main

dikes. The flood detention basins at lower reach points at Beijindi and Dongpinghu were established soon after this, in 1960. Since then, the largest flood occurred in 1982, when the peak flow at Huayaunkou would have been 15,800 m^3/s, but was 14,000 m^3/s because of flood regulation by Sanmenxia dam. This flood was estimated by the Yellow River Conservancy Commission to be a 1-in-10-year peak flow. The 1982 flood caused extensive flooding of the floodplains between the main dikes. It flooded 65 percent of the plain area and damaged or destroyed the homes of 400,000 people in the floodplains. Attempts to control the 1982 flood also required the deliberate flooding of the north (old) part of the Dongpinghu detention basin, which contains 100 km^2 of cultivated land and a population of 100,000 people. However, most of the residents in this detention basin area (97 percent) live in elevated villages which are above the design flood level, so damage to housing and property in this detention basin was low.

7. Apart from the summer floods, there are also possibilities of floods from ice jams. After passing Luokou in the Lower Reach, the main stem of the Yellow River takes a turn to the northeast. There is a gain of 3° in latitude when the river reaches the Bohai Sea. According to statistics of the past 35 years, the probability of freeze-up in the lower reach is 86 percent. The morphology of the river is such that the channel is wide and shallow upstream and narrow and meandering downstream. The differences in latitude and width, as well as the variation of discharge, contribute to the complexity of ice regimes and flooding on the lower reaches of the Yellow River.

8. After mid-December, a strong cold wave often prevails, which causes the river channel to freeze. The freeze-up date in the Henan reach is generally in early January, whereas freeze-up in the estuary zone (in the reach below Luokou in Shandong Province) is in mid or late December. Because of the differences in intensity of cold air currents, the freeze-up dates, the length of the river channel under ice cover, and the ice volume in the river channel differ greatly. The earliest freeze-up date ever recorded was December 12, the latest February 17. The shortest section that may freeze is only 40 km, but the longest may be more than 700 km. The minimum volume of ice in the river channel is only several hundred thousand m^3, but the maximum volume may reach 140 million m^3. The break-up date in the Henan reach is generally in late January, and in the Shandong reach it may be in late February or early March. Thickness of the ice cover also varies from 0.1 m in the Henan reach to 0.3-0.5 m in the estuary.

9. According to historical records between 1883 and 1936, there were 21 years when dikes have breached during the ice-flood period. In 1951 and 1955, ice dams caused dike breaches in Lijin County (Shandong Province). Much land and many villages at Zhanhua, Lijin and Kenli were flooded during this disaster.

10. The principal areas that would benefit from flood control offered by the Xiaolangdi project are the floodplains between the dikes of the lower Yellow River, the Dongpinghu and Beijindi flood detention basins, and the major areas protected by the main dikes of the Yellow River. The sizes of these principal protected areas are summarized in Table 2.1.

11. **Sediment.** The annual sediment load at Huayuankou ranges from 0.4 to 4.0 billion tons and averages about 1.5 billion tons. Most of the sediment load occurs during extreme floods produced by storms in the middle region which lead to sediment concentrations of more than 400 kg/m^3. It has been estimated that during the period 1950-83, more than 50 percent of the sediment was generated by 11 major floods. Of the average annual sediment load of 1.5 billion tons, about 300-400 million tons is deposited in the lower reach of the river and in irrigation systems, and the

Table 1: FLOOD RISK AREAS IN THE LOWER YELLOW RIVER BASIN

Area	Total area (km^2)	Cultivated area (km^2)	Population (million)
Floodplains	3,544	2,228	1.47
Detention basins			
Dongpinghu	627	352	0.27
Beijindi	2,316	1,560	1.44
Beijan	106	59	0.01
Nanjan	123	68	0.00
Protected by main dikes	125,000		100.00

remainder flows out to the sea. About 50 percent of the sediment deposited is in the coarse range >0.05 mm. Some 80 percent of this coarse material comes from an area of 100,000 km^2 in the middle region of the Basin, and some 50 percent is believed to come from an area of only 38,000 km^2. The sediment runoff in parts of these areas reaches 25 $kg/m^2/year$.

Bank Processing

12. In 1989 the Ministry of Water Resources (MWR) requested if the Bank could assist the Yellow River Conservancy Commission in preparing an Water Resources Economic Model for Yellow River Basin (YRB). Simultaneously the Government requested if the Bank could assist in financing of the Xiaolangdi multipurpose dam project. The Bank's main interest in the Yellow River Basin was that there were at least 8 irrigation projects that were financed using Yellow River water but our knowledge of the basin was lacking in terms of water resources available, projected demands and proposed plans for future development on the main stem of the river.

13. **Technical Assistance for Preparation**: In 1990 Bank supported two technical assistance ($3.5 million) for funding five activities: (i) preparing a water resources economic model for YRB; (ii) reviewing the preparatory work for the Xiaolangdi Project (XP) and preparing a project brief for the project with full economic and financial analysis and assistance to prepare full tender documents; (iii) reviewing and completing the environmental impact assessment prepared by YRCC; (iv) reviewing and completing a detail resettlement plan for the project; and (v) review panel for dam safety and environment/resettlement.

14. It is interesting to note what Bank's perception of preparation activity needs (ii) to (v) were sightly different from the Chinese technical assistance request. What was finally agreed and the value added is as given below in table 2.

Table 2: Preparatory Activities Performed and Value Added

Task	MWR Request	Bank Request	Agreed in TA	Value Added (VA) through TA
1. Review Dam Designs	No	Yes	Yes	Very Little
2. Develop ICB cost estimates	Yes	Yes	Yes	Lots of VA
3. Bidding Docs	Yes	Yes	Yes	Lots of VA
4. Economic Analysis	No	Yes	Yes	Some VA
5. Financing/Financial Analysis	Yes	Yes	Yes	Lots of VA
6. EIA review	No	Yes	Yes	None
7. Resettlement Plan	Yes	Yes	Yes	Lots of VA more VA to Bank
8. Dam Safety Panel	Yes	Yes	Yes	Lots of VA
9. Environment/Resettlement Panel	Yes	Yes	Yes	Lots of VA

15. It will be noticed that Chinese request for assistance in specific areas resulted in great deal of added value. Wherever Bank requested work to be done it generally had more added value to the Bank's understanding of the project rather than to the Chinese.

16. **Investment Planning Study**. In addition to the above tasks the Bank undertook a Yellow River Investment Planning Study (YRIPS) to ensure that the investments proposed to the Bank had high priority. Chinese were not at all happy to undertake this study but after much persuasion they reluctantly agreed. A comprehensive basin-level-model (BLM) was designed and the proposed investments planned from 1990 to 2010 were tested in a consistent framework using the BLM. The results of the study (Report 11146-CHA) clearly indicated that Xiaolangdi Dam is highest priority project in the Basin with highest returns for the investments within the basin. There were also many other recommendations on demand side management and supply side requirements in terms of future investments. The Chinese quite astonished in the speed the study was carried out and in the results of the study. All previous Chinese studies had not used a consistent economic framework. As a result of the study the Chinese now have requested the financing of another upstream dam.

17. **Results of Preparation Work**. Most of the preparation work for the Xiaolangdi Project was undertaken by the YRCC Research Planning and Design Institute with the assistance of Canadian International Project Management Consultants. Between 1990 and 1993 there were about 14 Bank missions of which about 7 were specific missions for the project. During the preparation it was felt that the project was too large to be handled under one umbrella project and needed to be broken up into two separate projects: first Xiaolangdi Multipurpose Project (Dam and hydropower -- $2.0

billion) and second Xiaolangdi Resettlement Project ($ 548 million). The institutions involved in the dam and hydropower were quite different from those involved in the resettlement parts of the project. In breaking the project into two it gave the Bank a better handle in supervising both projects and paying equal attention to both the dam construction and the resettlement component. A description of both projects is given below.

Xiaolangdi Multipurpose Project

18. The main objectives of the project are to: (a) introduce flood control in the lower reaches of the Yellow River Basin to protect major infrastructure and 100 million people; (b) control siltation in the 800 km downstream channel of the river and prevent further aggradation so that levee heights need not be raised further during a period of 20 years; (c) provide water for assured irrigation for 2 million ha and water supply of 4 billion m^3/year for cities and industries; and (d) generate hydropower for supplementing the base load of thermal stations in Henan Province and the Central China Power Grid.

19. **Project Description**. The main features of the project are:

a. construction of Xiaolangdi rockfill dam, 154 m high, with a crest length of 1,370 m.

b. construction of a common intake structure, feeding nine large diameter tunnels and surface spillway for river diversion, flood handling and sediment management, discharging into a common plunge pool;

c. construction of a power station with associated six power tunnels with turbine and generators with an installed capacity of 1,800 MW (6 x 330 MVA) and associated switchyards, and transformers;

d. an environmental management component to monitor, manage and offset any negative impacts of the project;

e. training and technical assistance for YRWHDC in contract management, project scheduling, cost control, claims management, financial management, management information systems, organizational support, corporate planning and personnel management; and

f. an institutional program for MWR and YRCC to support the reform process in the water sector, i.e., in adapting to international accounting procedures, sustainable resource mobilization for water resources projects, water pricing, water licensing, effective river basin organization, and water-dispatching systems for basins.

20. Economic Assessment. Based on the assumptions contained in these cost and benefit streams, and a 56-year period of analysis, the EIRR of the project is estimated at 17.9 percent. Its net present value discounted at 12 percent (to 1993) is $895 million. Improved irrigation generates 42.5 percent of these benefits; sediment control, 8.9 percent; flood control, 23.0 percent; and power, 25.6 percent. These returns are in spite of relatively difficult to measure primary flood and sediment control benefits, and exclude any attempt to quantify the value of lives which might be lost in a major flood. The project is not rendered unprofitable by significant changes in costs and benefits: benefits will need to be 38 percent lower than estimated or incremental costs more than 59 percent higher before the EIRR will fall to 12 percent.

Xiaolangdi Resettlement Project

21. **Project Objectives**. The objective of the project is to resettle and restore and improve the livelihoods of nearly 171,000 people directly and others indirectly affected by construction of the Xiaolangdi multipurpose dam, and to minimize the effects of social adjustment to their new environment.

22. **Project Description**. The project comprises four major components:

a. residential and infrastructure reconstruction for villages and towns;

b. transfer of resettlers;

c. planning, design and institutional support; and

d. livelihood development, both agricultural and industrial.

23. **Residential and Infrastructure Reconstruction**. This component will consist of constructing 276 villages and 11 towns for the resettlers. About 38,880 new houses will be built covering a floor space of 3.8 million m^2. Almost all houses will be made of brick and will be provided with piped water supply, proper sanitation, electricity, drainage, etc. Public facilities such as schools, hospitals, clinics, cultural centers, etc. will be built to service all new villages and towns. All commercial enterprises and industrial enterprises will be reconstructed in the new sites. New infrastructure will include roads, transmission lines, communications lines, broadcasting facilities, water supply works, hydraulic stations and other special items to service the settlement areas. A total of 1,750 km of roads will be built. Every village will be serviced with electricity requiring the construction of 632 km of power lines and other facilities. Twenty seven wharfs around the reservoir will be built and 132 ferries procured. 524 km of telephone lines and broadcasting facilities will be built to guarantee that every village is well linked with communications. Seven significant facilities above county level have to be relocated including a jail, a water supply project, a hydrology station, etc. The total cost of this component is $282 million.

24. **Transfer of Relocatees.** This component makes special provisions for transfer of all salvageable materials and personal belongings, factory machinery and other goods from the present to the new sites. The transport will be contracted to local trucking companies who will move the goods at an appropriate time. A total of 33% of the people will be moved downstream to 39 host sites on

the Wenmengtan plain and three counties in Kaifeng, another 33% will move to new townships within the same county at 120 host sites, and another 20% will move back away from the reservoir perimeter within the same township to 101 host sites. The town population totalling 14% of the people will be moved to the 11 new towns created in the 8 affected counties. The total cost of this component is $8.3 million.

25. **Livelihood Reestablishment, Supervision and Monitoring**. The labor force at the moving year will be about 75,220 people (about 1.9 per household) of which about 78% are full time farmers, 11% are full time rural industrial workers, and 11% are government employees. Although farming is the predominant occupation, there is rapid transformation occurring in the economy to non-farming activities. Off-farm income accounts for 50% of rural per capita income. Hence, plans for resettlers are to have 50% farmers, 40% industrial and commercial workers and 10% government employees. This shift in employment from agriculture to industry will result in additional employment with at least one family member fully committed to a non-farm job which will result in existing incomes being exceeded in the future. The total investments for livelihood development is $265 million.

26. For *agricultural livelihood reestablishment* 10,000 ha of land will be developed, of which about 6,000 ha will be irrigated and the rest will be dryland. A total of 300 groundwater wells and pump stations will be constructed to irrigate the land at the various sites. The dryland will be terraced and improved for soil fertility. A total of 116,050 people will be involved in crop farming. In addition to crop farming there will be 530 ha of orchards (increase of two fold), 660 ha of aquaculture (an increase of five fold) and 180 ha of grazing land. A total of 37,400 full time farm jobs will be created through creating of the new farmland. The total cost is about $88 million.

27. *All Existing small industries and mines* will be relocated and reconstructed and the workers will move with these industries (costs are about $31 million). Most of the factories will continue but some of the mines will be converted to industrial enterprises. A total of 8,970 full time jobs (10,380 people) will continue in these enterprises, which are not assumed to create any new jobs.

28. *84 new and exiting county and township industries* will be established or expanded. These factories consist of 50% new factories and about 50% existing factories which will be expanded in the resettlement areas which will create new industrial employment for about 21,000 resettlers. These industries consist of fertilizer, ceramic, textile, refractory materials, brick and other plants. The total cost is about $121 million.

29. In addition to the above employment there will have to be *public employees (mainly teachers, health workers, etc.)* to serve the newly created villages. The existing public employees will also move with the townships and will number 8,540. Costs for government employment are included as part of the infrastructure development.

30. *Monitoring, supervision, and social adjustment programs* have been included as part of the livelihood program. Monitoring is at four levels including independent monitoring by a social science institution. The monitoring will be based on predetermined milestones and objectives. The predetermined milestones are specified in a little asset book given to each resettler family at the time of assessment of compensation of their personal assets. The asset book specifies in detail the cash compensation to be paid to the family based on physical assets lost and income foregone. In addition, the books give the income derived from different sources presently and the targets expected in the

new settlements. The book also gives a detailed listing of land (irrigated, dryland, etc.) that each family will receive in the new areas. Every page of the asset book has to be signed by the county/village government official and the resettler household head prior to resettlement. In addition, an international panel and international consultants have been included as part of the monitoring program. Costs for maintaining resettlement offices, managing, implementing and monitoring the program as well as its social adjustment programs are estimated to be about $9.3 million. Special social adjustment programs, for community involvement, are included for vulnerable groups such as women, elderly and children.

31. **Income Forecast for Resettlers and Host**. Industrial development investment proposals, including large-scale and TVE investments, already exceed the target number of about 21,000 new industrial jobs for project resettlers. In addition, many new jobs have already been created by even smaller investments (e.g., in commercial activities) by the resettlers themselves, using the surplus of their (thus far) rather generous housing and immovable asset compensation payments over the costs of their new settlements. These activities are usually called "sideline" activities, are categorized together with agricultural income, are private, and thus quite naturally are not well accounted for by government agencies. In sum, nonagricultural employment is quite certain to exceed official targets. Nevertheless, for purposes of total income projection, only the target of one industrial job per family has been included in the total income projection.

32. Current and projected total incomes (agricultural and industrial) for various project areas, in constant price terms, for resettler and host populations, due solely to project activities. For resettlers, the average per capita income growth is 4 percent per year, for host populations somewhat less. This is not particularly rapid compared to recent income increases in China's booming coastal areas, but it is faster than recent income growth rates of China's rural population. These calculations abstract from nonproject developments raising the general level of Chinese personal income, including, in particular, migration of working-age people to the coastal areas. In general, however, it seems fairly certain that neither resettlers nor hosts will suffer reduced incomes, beyond at most a short (1-2 year) transition period, due to the Xiaolangdi resettlement program, and that average incomes will increase faster than the local population unaffected by resettlement (see table 3).

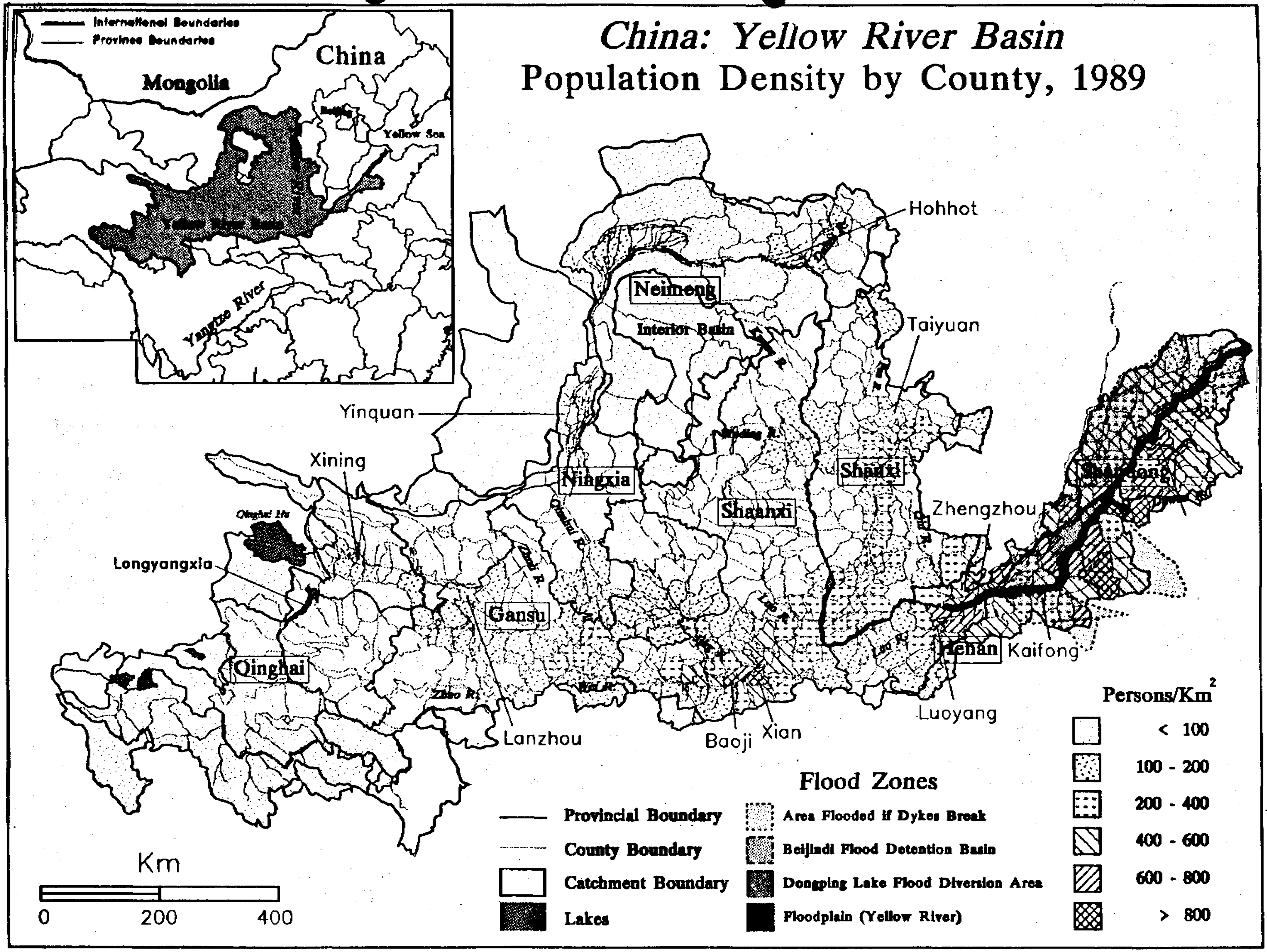
Status of Projects

33. Both projects have been appraised and will be negotiated simultaneously. International tenders for the dam are being processed. Detail plans for all resettlement programs have been prepared and about 9970 will be resettled before 1994 March. Missions were able to inspect the resettlement for about 4,000 people in 5-6 villages close to the damsite. The resettlement activities observed so far is of very high quality. Income of resettlers who were resettled in August 1992 have already risen by as much as 10-60% in August 1993.

Table 3: FAMILY INCOME PRE- AND POST-RESETTLEMENT FOR RESETTLERS AND HOSTS
(1992 Yuan/year)

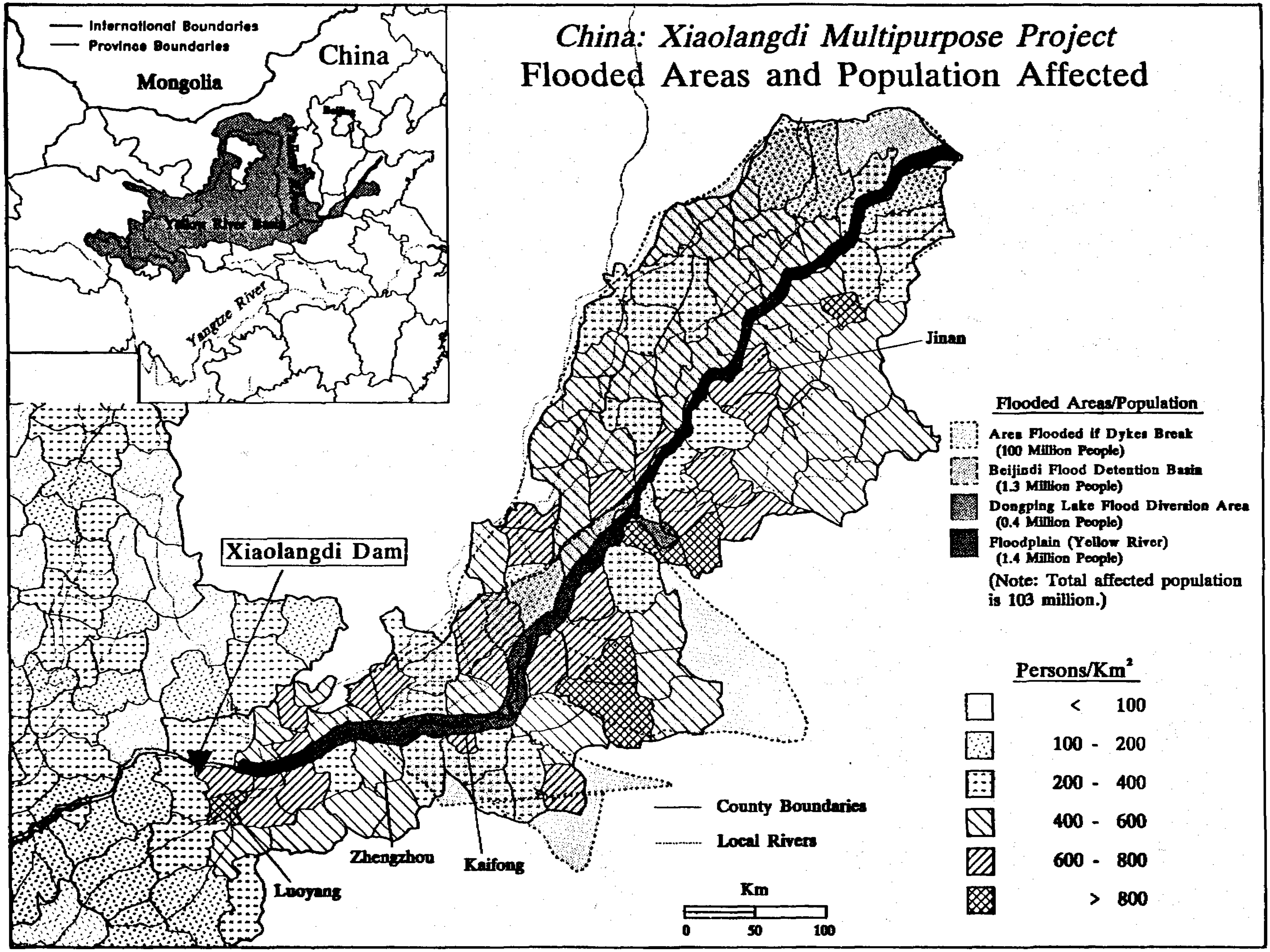
	Pre-resettlement (1993)		Income growth (% p.a.)	Post-resettlement (2010)	
Resettlers					
Houhe - Low income	2,400	(545)	5.0	6,400	(1,450)
Medium income	2,600	(590)	4.6	6,400	(1,450)
High income	3,950	(900)	2.7	6,680	(1,520)
Wenmengtan - Xinan resettler	2,850	(647)	5.1	7,750	(1,760)
Jiyuan resettler	3,787	(860)	3.3	7,400	(1,680)
Xinan - Within-township moves	3,555	(808)	3.2	6,760	(1,540)
Mengjin - Within-township moves	2,188	(497)	2.6	3,558	(807)
Within-county moves	2,188	(497)	2.5	3,511	(797)
Host Impact					
Houhe	3,542	(805)	0.5	3,848	(875)
Wenmengtan	2,816	(640)	2.0	4,138	(940)
Xinan township moves	3,378	(767)	2.7	6,050	(1,375)
Mengjin township A moves	2,188	(497)	2.0	2,758	(626)
Mengjin township B moves	3,000	(681)	0.7	3,429	(779)
Mengjin county moves	2,243	(509)	1.1	2,816	(640)

Note: Figures in parentheses denote per-capita incomes.


China: Yellow River Basin
Population Density by County, 1989
International Boundaries
Province Boundaries
China
Mongolia
Yellow Sea
Yangtze River
Hohhot
Neimeng
Interior Basin
Taiyuan
Yinquan
Xining
Ningxia
Shanxi
Shaanxi
Zhengzhou
Qinghai Hu
Longyangxia
Gansu
Shandong
Qinghai
Henan
Kaifong
Luoyang
Lanzhou
Baoji
Xian
Tao R.
Wei R.
Persons/Km²
< 100
100 - 200
200 - 400
400 - 600
600 - 800
> 800
Flood Zones
Provincial Boundary
County Boundary
Catchment Boundary
Lakes
Area Flooded if Dykes Break
Beijiadi Flood Detention Basin
Dongping Lake Flood Diversion Area
Floodplain (Yellow River)
Km
0
200
400

11

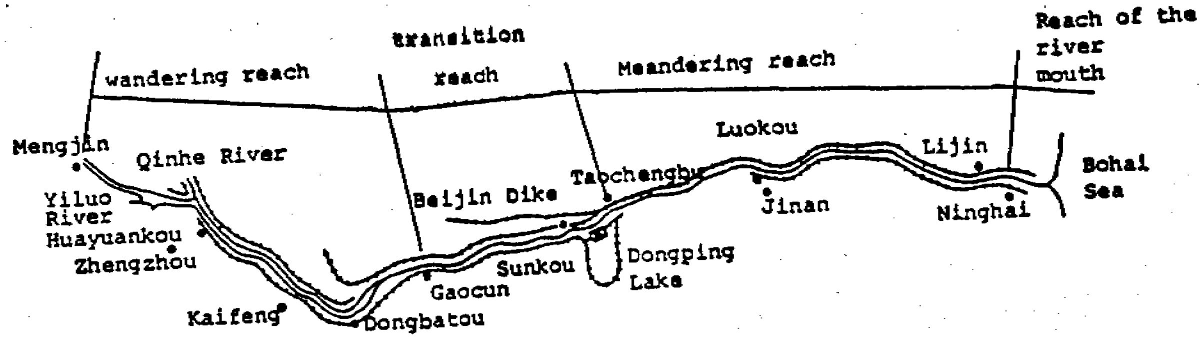
Map 1


China: Xiaolangdi Multipurpose Project
Flooded Areas and Population Affected
International Boundaries
Province Boundaries
China
Mongolia
Yellow River Basin
Yangtze River
Jinan
Xiaolangdi Dam
Luoyang
Zhengzhou
Kaifong
Flooded Areas/Population
Area Flooded if Dykes Break (100 Million People)
Beijindi Flood Detention Basin (1.3 Million People)
Dongping Lake Flood Diversion Area (0.4 Million People)
Floodplain (Yellow River) (1.4 Million People)
(Note: Total affected population is 103 million.)
Persons/Km²
< 100
100 - 200
200 - 400
400 - 600
600 - 800
> 800
County Boundaries
Local Rivers
Km
0
50
100

12

MAP 2

A: YELLOW RIVER LOWER REACH DYKES



B: CROSS SECTION OF RIVER SECTION AT SUNKOU

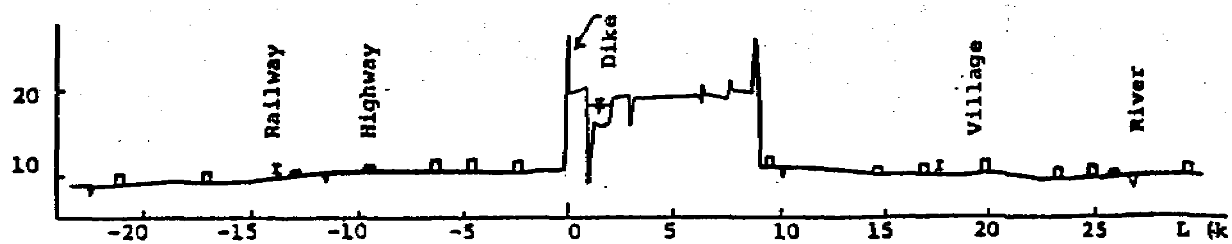
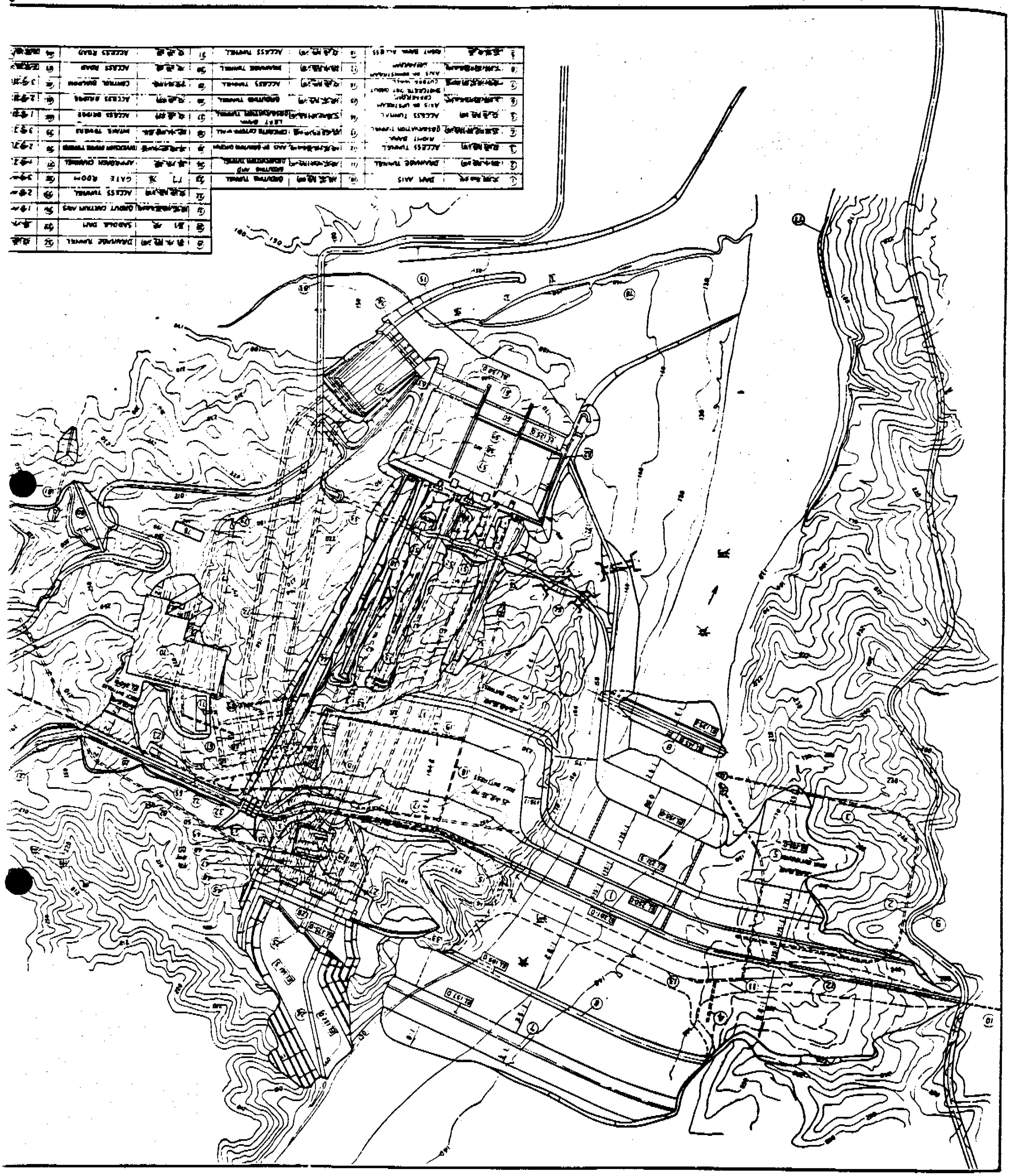
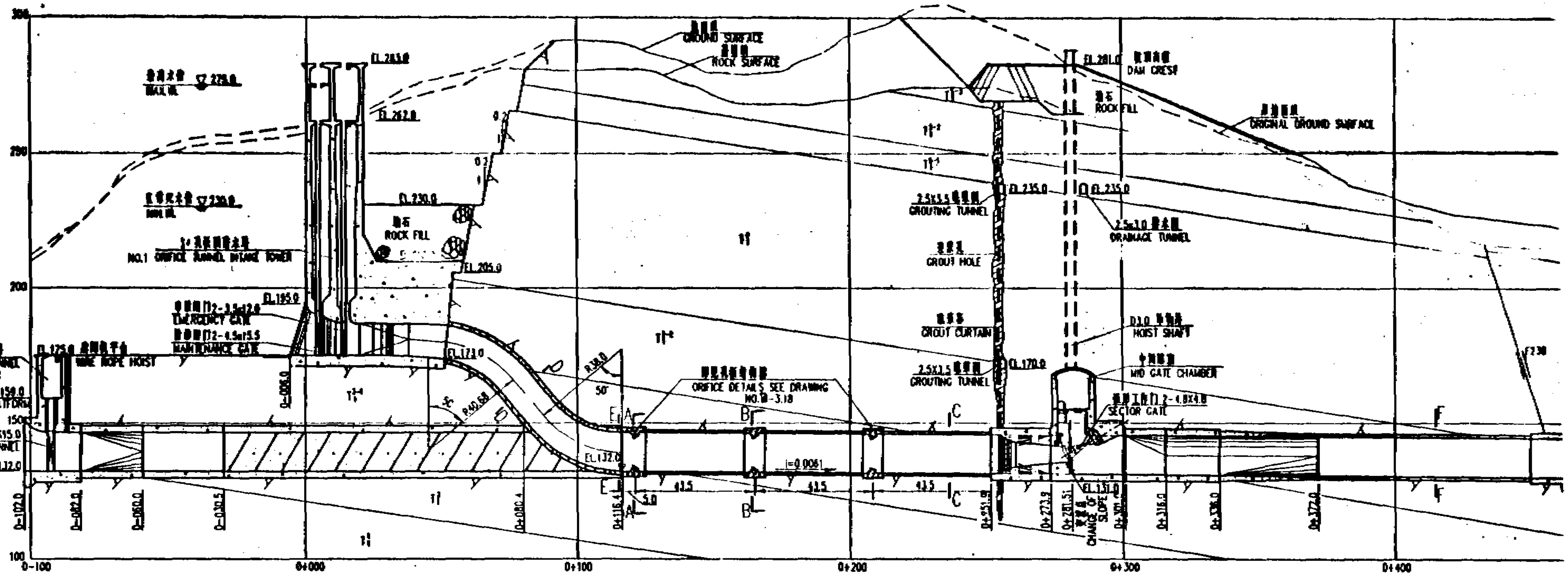


FIGURE 2

FIGURE 3





纵剖面
PROFILE

0 10 20 30 40 m
1:1000

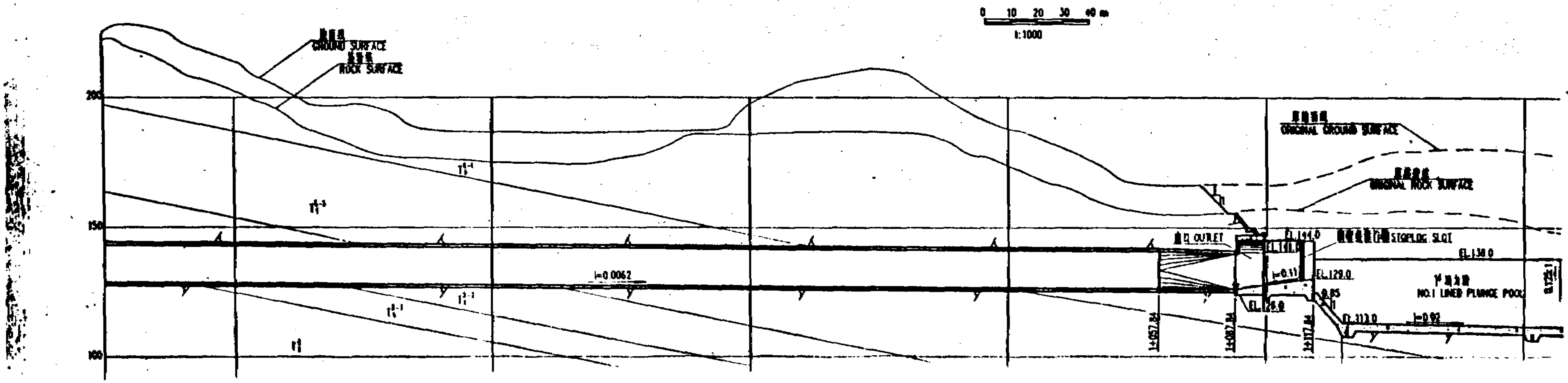


FIGURE 4

MAIN INDICES OF THE XIAOLANGDI PROJECT

Item	Unit	Amount
A. Hydrology		
Total Yellow River basin	km^2	795,000
Drainage area, upstream of Xiaolangdi	km^2	694,155
Mean annual runoff	10^9 m^3	42.32
Long-term average flow	m^3/s	1,342
Flood volumes:		
observed max., 12 days	10^9 m^3	9.19
design, 12 days	10^9 m^3	13.90
check, 12 days	10^9 m^3	17.20
Natural water levels:		
recorded lowest (Feb. 2, 1961)	m	133.44
recorded highest (July 17, 1958)	m	144.88
historic highest (August 1843)	m	150.9
B. Flood discharge at XIAOLANGDI		
50 year:		
before regulation	m^3/s	23,600
after regulation by Sanmenxia	m^3/s	17,960
after regulation by Sanmenxia and Xiaolangdi	m^3/s	9,910
100 year:		
before regulation	m^3/s	27,500
after regulation by Sanmenxia	m^3/s	19,410
after regulation by Sanmenxia and Xiaolangdi	m^3/s	9,860
1,000 year:		
before regulation	m^3/s	40,000
after regulation by Sanmenxia	m^3/s	28,000
after regulation by Sanmenxia and Xiaolangdi	m^3/s	13,480
10,000 year:		
before regulation	m^3/s	52,300
after regulation by Sanmenxia	m^3/s	37,600
after regulation by Sanmenxia and Xiaolangdi	m^3/s	13,990
Recorded max.(July 17, 1958)	m^3/s	17,000
Historic max.(August, 1843)	m^3/s	32,500

Item	Unit	Amount
B. Flood discharge at XIAOLANGDI (cont'd)		
Design:		
before regulation	m^3/s	40,000
after regulation by Sanmenxia	m^3/s	28,000
after regulation by Sanmenxia and Xiaolangdi	m^3/s	13,480
Check:		
before regulation	m^3/s	52,300
after regulation by Sanmenxia and Xiaolangdi	m^3/s	13,990
Total discharge capacity at FSL of all outlet works, excluding power tunnels, including emergency spillway	m^3/s	20,310
Maximum discharge during flood storage level	m^3/s	17,000
Maximum discharge during design flood level	m^3/s	13,360
Maximum discharge during check flood level	m^3/s	13,570
Maximum discharge during normal dead level	m^3/s	8,758
Maximum discharge during abnormal dead level	m^3/s	8,032
Maximum discharge for power generation	m^3/s	1,560
C. Reservoir parameter		
Max. water level	m	275
Check flood water level	m	273
Design flood water level	m	272.3
Min. water level	m	230
Extreme min. water level	m	220
Area at water level	km^2	272.3
Length	km	128
Length of shoreline at water level 275	km	950
Storage capacity:		
at FSL, EL 275	10^9 m^3	12.65
for flood control	10^9 m^3	4.05
for sediment management	10^9 m^3	1.05
for ice control	10^9 m^3	2.0
Sediment deposition	10^9 m^3	7.55
D. Sediment		
Mean annual volume	10^6 t	1,594
Mean content	kg/m^3	37
Recorded max. content (August 7, 1977)	kg/m^3	941

Item	Unit	Amount
E. Dam and power station		
Dam parameters:		
type		zoned earth and rockfill with sloping, impervious core
foundation		sand and gravel alluvium, maximum depth 70 m
crest elevation	m	281
crest width	m	15
dam width at FSL, EL 275	m	41.1
crest length	m	1 317
max. height of dam (above foundation)1	m	154
embankment slopes, upstream		2.0 H : 1 V (above EL 274.33)
		2.6 H : 1 V (below EL 274.33)
embankment slopes, downstream		1.5 H : 1 V (above EL 268.72)
		1.75 H : 1 V (below EL 268.72)
volume of dam	10^6 m^3	48.5
freeboard	m	6
Flood -and sediment tunnels:		
Orifice tunnels: using closely spaced orifices as energy dissipation devices		
number	nos.	3
shape		circular ID : 14.5 m
length	m	1 100 +/-
invert elevation : upstream EL 175, downstream EL 129.0 and 138.5		
max.capacity at FSL		1 632 + 2 x 1 580 = 4 792 m^3/s
Free flow tunnels:		
number	nos.	3
shape		city gate
width	m	10
height	m	11.5 - 13.5
length	m	1 000 +/-
invert elevation: upstream EL 195, 209, and 225, downstream EL 152.13, 173.79 and 175		
max.capacity at FSL		2 680 + 1 973 + 1 796 = 6 449 m^3/s
Sediment tunnels: pressure tunnels with reinforced and prestressed concrete linings		
number	nos.	3
shape		circular ID : 6.5 m
length	m	1 000 +/-
invert elevation : upstream EL 175.0, downstream EL 148.0		
max.capacity at FSL		3 x 675 = 2 025 m^3/s
Service spillway: chute type		
width	m	28
weir crest EL 258.0		
length	m	932
max. capacity	m^3/s	3,764

Item	Unit	Amount
E. Dam and power station (cont'd)		
Emergency spillway: weir, closed off by rockfill dam with impervious core.In case of emergency, the dam would be breached .		
width	m	100
weir crest 268 m, top elevation of dam EL 280.0 m		
max. capacity at FSL	m^3/s	3,000
Intake towers :		
number	nos.	10
free standing height of the towers above the substructure	m	53
total height including substructure	m	112
Plunge pool : One concrete-lined plunge pool to serve all flood- and sediment tunnels as well as the service spillway. Pool is divided into three cells by two concrete walls. Max. depth of pool 25.2 m .		
Power tunnels: pressure tunnels with reinforced concrete linings		
number	nos.	6
shape		circular ID : 7.8 m
length	m	375
invert elevation of intakes		2 at EL 190, 4 at El 195
Penstocks : steel lined, encased in rock		
number	nos.	6
shape		circular ID : 7.8 m
Powerhouse : underground,160m x 26.2m. The six generating units spaced at 26.5m. One service bay, 59m long.		
Draft tube tunnels : reinforced concrete		
number	nos.	6
shape		rectangular, 9.5 x 7 m changing to 9.5 x 13.5 m
Tailrace tunnels and channels : reinforced concrete		
number	nos.	3
shape		city gate 12 m x 19.6 m
Sediment gate at discharge of tailrace :		
number	nos.	6
openings		11.5 m x 14 m
elevation of sills		EL 130
Switchyard: conventional, outdoor, 220 kV. Overhead circuits connect the switchyard to six 220 kV and one 500 kV power transmission lines.		

Item	Unit	Amount
F. Main mechanical and electrical equipment		
Turbines :		
number	nos.	6
type		Francis, vertical shaft
rated output	MW	306
rated head at initial operation	m	112.0
max. head at initial operation	m	128.9
min. head at initial operation	m	64.9
rated head at future operation	m	112.0
max. head at future operation	m	139.2
min. head at future operation	m	86.5
max. speed	rpm	107.1
rated discharge	m^3/s	306
max. discharge	m^3/s	316
Generators :		
number	nos.	6
type		totally-enclosed, vertical shaft, synchronous, three phase
rated output	MWA	334
max. output	MWA	367
rated power factor		0.9
rated voltage	kV	18
frequency	Hz	50
rated speed	rpm	107.1
isolation class		F
Step-up power transformers :		
number	nos.	6
type		three phase, 18/242 kV, 50 Hz, 360 MWA, OFWF.
Step-up power transformers :		
number	nos.	2
type		3-phase, 242/550 kV, 50 Hz, 540 MWA, OFAF
Power bridge crane :		
number	nos.	2
hook (2) capacity	t	2 x 2 x 250
Intake towers, gantry cranes :		
number	nos.	2
hook (2) capacity :	t	2 x 400
Draft tube crane :		
number	nos.	1
hook (2) capacity	t	2 x 250

Item	Unit	Amount
G. Civil Works Quantities		
Approximate quantities for major civil construction items :		
dam, rockfill	10^6 m^3	35.8
dam, impervious material	10^6 m^3	9.3
dam, filters	10^6 m^3	2.5
open earth excavation	10^6 m^3	15.2
open rock excavation	10^6 m^3	13.1
underground excavation, tunnel	10^6 m^3	2.7
underground excavation, power facilities	10^6 m^3	2.52
concrete	10^6 m^3	2.8
prestressed concrete	m^3	37,000
shotcrete	m^3	174,000
grouting, consolidation	m	260,000
grouting, curtain	m	260,000
steel reinforcement	t	180,000

Water and Sanitation Utilities Partnership
Report # 4, November 1993

Agents of Change: Public-Private Partnerships in Urban Water and Sewerage Services in Developing Countries

Introduction

Public-Private Partnerships (PPPs) are becoming popular tools for improving urban water supply and sewerage services in developing countries. Well-designed contracts with private operators result in improved cost-recovery and commercial viability, a consumer-oriented approach to service, better maintenance, and reductions in water losses. The cases presented in this Report demonstrate how contractual models of PPP have been adapted to the unique urban environments of three different countries.

The Poor State of Water and Sewerage Services in Developing Countries

Publicly operated urban water supply and sewerage services in developing countries are plagued by a number of weaknesses. In many places, the quality of service is poor and access to service is inadequate, particularly for the poorest populations. Investments have been supply driven, planned on the basis of unrealistic estimates of demand growth, without regard for commercial viability. Technical operations are inefficient and worker productivity is low. Nonrevenue water levels are high—with leakages of 50 percent or more in many places. Cost recovery through user fees is low and operating subsidies represent a drain on scarce public resources. An inappropriate institutional framework is one of the major sources of the problem. Water and sewerage company managers lack autonomy and are not held accountable; political authorities interfere in operations and staffing decisions; and low tariffs that do not reflect the full cost of service encourage waste and inefficiency. Since operators are not dependent on consumers for their revenue, they have little incentive to serve the consumers well.

The Need for Investments

While improvements in operating efficiency would reduce or postpone the need for new investments in source supply, several large cities are facing expensive rehabilitation programs and urgently need investments in sewerage and wastewater treatment to keep up with the growth of their populations. Domestic capital markets for the long-term finance required for this type of infrastructure have historically been very thin in developing countries, although they are beginning to appear in some places. To compete for investment resources—domestically or internationally—water and sewerage services will have to become commercially viable.

The Role of PPPs in Change

Governments and water company managers face the daunting task of improving the financial and technical performance of services and making them more consumer-oriented. Many are engaging private firms as partners in this effort. In cities as different as Abidjan, Buenos Aires, Conakry, Gdansk, Johor City, Mexico City and Santiago, services that were previously provided exclusively by government departments or semi-autonomous public enterprises are now being provided through a variety of public-private partnerships. Perhaps the most important characteristic of these arrangements is that they introduce institutional changes that promote, and sustain, greater commercial viability and consumer orientation. Many governments are recognizing the need to improve cost-recovery and accountability in services, but policy changes alone are meaningless without the institutional changes necessary to implement them. Because the private operator is seen by both parties to the arrangement as clearly distinct from government, government interference in day-to-day management is eliminated, results are likely to be monitored more carefully, and compensation can be linked directly to performance.

The Advantages of Contractual Forms of PPPs

Full privatization of water services through the sale of assets, the model adopted in England and Wales in 1989, is not likely to be pursued on a large scale in developing countries in the near future. While privatization of other public services, such as power, is gaining popularity, it is not clear that private investors are willing to buy water supply distribution assets, given their poor condition, the lack of good information, and the political riskiness of the sector. Moreover, the regulatory implications of privatization constitute a considerable burden, and regulatory failure could reduce or negate the benefits. For the near term, contractual models — which include service contracts for support activities such as meter reading, management contracts that include performance incentives, lease contracts, concessions, and BOT-type arrangements— appear more promising and offer many of the advantages of full privatization. Several characteristics of contractual forms of private participation in water supply make them particularly suitable for a range of developing countries. They introduce competition and contestibility into a sector which has too often been considered a monolithic natural monopoly. Some reduce the need for price regulation and provide predictability by incorporating many of the rules governing the relationship directly into the contract. They allow for an evolution of the responsibilities and risks assumed by the private partners. Finally, in a sector that is marked by important political and social implications, they provide an opportunity for developing country governments to test the effectiveness of private service delivery and to develop credibility with both consumers and private partners.

Designing PPP to fit the Context

The contribution of the French experience in the evolution and application of several of these forms is notable, and it is not surprising that the French have played a leading role in introducing performance contracts, lease contracts and concessions in a variety of developing countries and former socialist countries. However, in adopting contractual models in developing countries, it is important to consider the local context. The French model of urban services has evolved in the unique political and social context of France in which the public-private partnership is marked by mutual cooperation and trust. Regulation of private water suppliers is very unstructured and depends on informal consumer feedback and a close working relationship between the local government and the operator. (For more information see Dominique Lorraine, "Urban Services, the Market and Politics," in *Private Financing of Public Infrastructure, the French Experience,* French Ministry of Public Works, Transportation and Tourism, 1993.) Conditions in developing countries are, of course, quite different. Local governments are often weak and lack financial resources and credibility; consumers, particularly the poor, lack a voice in decisions regarding urban services; the private sector is often distrusted; and governments may be unstable or unpredictable. PPPs must be structured in innovative ways that reduce risks for both sides. The three cases presented below represent unique solutions that fit the context in which they were adopted.

A Word of Caution

The intent of this Report is to give the reader a feel for the range of possibilities in adapting contractual models to developing country contexts. It is impossible here to review cases fully. Such arrangements are not likely to be ideal: by their nature they imply compromise. While the arrangements presented here have either already achieved some success or appear very promising, it would be a mistake to give the impression that they are trouble-free. Each has had to overcome shortcomings. Most cases of PPP in water services in developing countries are quite recent, making final evaluation of results impossible. And because of the variety of different types of arrangements, generalizations are dangerous.

Santiago, Chile: Service Contracts

Service contracts for specific support services have been used successfully in Santiago, Chile, where in 1977 the public water company EMOS began to encourage its employees to leave the company and form private firms that would bid for service contracts. Contracts for meter reading, billing, maintenance, vehicle leasing, etc., are awarded for periods of one to two years. The short contract period subjects contractors to frequent competition and eliminates the need for fee negotiation. Several contracts are tendered with different firms to deliver the same services, often in different districts of the city. This sustains competition and enables the water company to compare costs and performance on an on-going basis. As a result EMOS has one of the highest staff productivity rates among water companies in Latin America, even when the labor content of the service contracts is included.

This approach is appropriate for a developing country like Chile which has a fairly healthy environment for small and medium enterprises and a judicial system that enforces contracts fairly. While this approach eliminates the need for periodic price negotiations that exists in the case of long-term operational contracts, the water company must be capable of administering numerous contracts efficiently. The design and administration of contracts posed some problems for EMOS initially, but the company learned from its early mistakes and has developed a systematic approach to the contracting process. Contractors are now compensated on the basis of units of work completed, an approach which promotes efficiency.

Mexico City: An Innovative Approach to Operational Improvement Contracts

There is often a need for an interim arrangement prior to a lease contract or concession, during which both parties can "test the waters," or during which an important constraint in the system—whether of a financial or physical nature—can be resolved. In France, management contracts (*gestion déleguée* or *gestion intéressée*) have been used to this end. Unfortunately, management contracts typically suffer from a number of disadvantages when used in developing countries. The contractor may lack autonomy and thus cannot be held accountable for results. Management contracts tend to be expensive and incorporate few incentives to train and substitute local staff. There is rarely a realistic plan for moving to a less expensive, self-sustaining arrangement in which the contractor assumes commercial risk.

The recently tendered contracts for operational improvements in Mexico City's water and sewerage services represent an innovation in a phased contract design which provides a low-risk interim arrangement while avoiding the problems of a management contract. These contracts would introduce comparative competition in water distribution for the first time into a large metropolitan area in a developing country. (Such an arrangement exists in Paris where the two largest French water companies each operate half of the distribution network.)

The city has been divided into four districts and, following competition, contracts are being negotiated with four different operating groups. These groups represent a mix of French, British, Spanish and Mexican partners. The ten-year contracts are structured in three phases, during which the commercial responsibilities of the operators progressively increase. During the first phase, each of the contractors would establish a census of water users and eliminate illegal connections, install and maintain meters on all connections, and prepare a computerized cadastre in its respective districts. During the second phase, their responsibilities would be expanded to include more direct relations with the consumers through such activities as processing new requests for service, meter reading, and preparation and collection of bills. In the third phase, the operators would assume distribution and commercial operations, maintenance and rehabilitation.

Payment terms evolve over time as well. Initially the operators will be paid fees for units of work completed, as in a service contract. By the end of the third phase, they will retain a portion of the tariff collected from consumers as their sole compensation. At this point, the contracts will effectively have become lease contracts.

Guinea: A Donor-Supported Affermage (Lease Contract)

One of the major barriers to private delivery of water supply and sewerage services in developing countries is the low level of tariffs. While World Bank research shows that consumers are willing to pay the cost of service if it is reliable, in many places, tariffs are so low and service so poor that full cost-recovery can be phased in only gradually while service improves. This creates a mismatch between funding needs and cost-recovery capacity: in order to introduce operational improvements, large resource inputs are required at an early stage; but once improvements are introduced and better cost recovery is possible, costs may actually fall. If the central or municipal government can fund the shortfall and enjoys a good reputation for paying debts on time, it should have no difficulty in arranging an affermage contract. If either of these conditions is lacking, as is often the case, donor support may be needed until tariffs reach the full-cost level.

Guarantees are an increasingly popular form of donor support for private initiatives that depend on government policy decisions or payments for services. The World Bank has arranged guarantees against the sovereign risks (that is, the risk that a government might not honor a contract) in several industrial sectors, including the power sector. In theory, such guarantees could be applied to water supply operations. Another approach is direct donor finance of the improvements which are to be introduced under an affermage contract. The way Bank financing was used in Guinea signified an innovation in Bank lending policy to accomodate a public-private partnership.

In 1989, the government of Guinea arranged a lease contract for water supply in all urban areas of the country with SEEG, a mixed enterprise owned by two French water companies and the state. Just prior to that, tariffs were increased from 60 Guinea francs (GF) to GF 150/m^3 (equivalent to about one third the full cost of service), and the government committed to a schedule of regular increases aimed at reaching full cost-recovery by 1998. By 1992, the tariff had reached GF 420/m^3 in current value (about one half the full cost). In the interim, the World Bank, the African Development Bank, the *Caisse Centrale de Cooperation Economique*, and the European Investment Bank are financing the foreign exchange costs of operation on a declining basis, as well as rehabilitation works. The government has assumed debt service, also on a declining basis.

The innovation in this case (besides the very courageous decision taken by the government of Guinea when it adopted this approach) occurred when the World Bank agreed that inputs to be procured by the operator and financed by the Bank would not be subject to the Bank's international competitive bidding rules. This was successfully defended by arguing that the operating contract itself had been awarded following Bank's selection rules.

Conclusion

As World Bank President Louis Preston pointed out in his address to the Annual Meetings of the World Bank Group in September, 1993, a single term "developing countries" is no longer useful for describing the widely divergent clients of the Bank. The differences among these countries pose a challenge for finding effective solutions for what is a common problem among many of them, inadequate water supply and sewerage services. Contractual models of private participation are proving to be useful tools which can be tailored to the political and cultural context in many countries. New adaptations are evolving rapidly; some will undoubtedly achieve more success than others. As experience grows, it should become clearer which approaches are likely to work best in a given context. This is a challenge that will require the collaboration of governments, the private water supply operators, as well as the World Bank and other donors.

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This is the fourth of a series of reports issued by the Utilities Partnership. They are intended to be a flexible and varied means for disseminating practical and timely information. Some reports will be more journalistic in style and tone. Others will be more detailed, technical reports on specific issues. The views and interpretations expressed in this article are those of the author and should not be attributed to the World Bank, its affiliated organizations, or any individual acting on their behalf.

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IRRIGATION AND DRAINAGE

PORTFOLIO & LENDING PROGRAM

FACTS

IRRIGATION AND DRAINAGE PORTFOLIO

Region	Projects under Supervision	Overall Status
East Asia	18	1.83
South Asia	40	1.92
Middle East and North Africa	18	2.00
Europe and Central Asia	3	2.33
Latin America	11	2.45
Africa	12	2.58
Bankwide	**102**	**2.08**

IRRIGATION AND DRAINAGE PORTFOLIO

FIVE TOP COUNTRIES

Countries	Projects under Supervision (N°)
India	14
Pakistan	13
Indonesia	8
Bangladesh	6
Nepal	5
Total	**46**

IRRIGATION LENDING PROGRAM

FY 1993

Region	US$ Million
Middle East & North Africa	372
East Asia & the Pacific	337
South Asia	165
Latin American & the Caribbean	45
Total	**919**

Note: No loans to Europe & Central Asia and Africa Regions.

SUMMARY OF IRRIGATION AND DRAINAGE LENDING

FY 1994-1997

REGIONS	FY 1994	FY 1995	FY 1996	FY 1997	TOTAL
AFRICA					
No. of Projects	1	1	2	0	4
Lending in US$ millions	10	12	62	0	84
EAST ASIA & PACIFIC					
No. of Projects	4	3	1	2	10
Lending in US$ millions	515	350	80	450	1395
EUROPE & CENTRAL ASIA					
No. of Projects	0	1	0	1	2
Lending in US$ millions	0	5	0	100	105
LATIN AMERICA & THE CARIBBEAN					
No. of Projects	2	2	2	2	8
Lending in US$ millions	226	105	325	280	936
MIDDLE EAST & NORTH AFRICA					
No. of Projects	0	3	2	1	6
Lending in US$ millions	0	130	150	60	340
SOUTH ASIA					
No. of Projects	2	5	3	6	16
Lending in US$ millions	123	734	370	654	1881
TOTAL					
No. of Projects	9	15	10	12	46
Lending in US$ millions	874	1336	987	1544	4741

IRRIGATION LENDING PROGRAM

1994 - 1997

Region	Percentage (%)
South Asia	39.6
East Asia & Pacific	29.4
Latin America & the Caribbean	19.7
Middle East & North Africa	7.1
Europe & Central Asia	2.2
Africa	1.7
Total	**99.7**

AGRICULTURE LENDING FOR IRRIGATION AND DRAINAGE AS OF 11/02/93
FY94 TO FY97 PLANNED AS OF 11/02/93

Fiscal Year	REGION	Project ID	COUNTRY	Project Name	BANK/IDA LENDING	PROJECT OFFICER	APPRAISAL DEPARTURE DATE		NEGOTIATIONS	BOARD DATE
94	Africa	3NIGPA061	NIGER	PILOT PRIVATE IRRIGATION	10.2	JAMMEH	06/19/91	A	02/14/94	03/17/94
*TOTAL REGNAME Africa					10.2					
94	EAP	4CHAPA187	CHINA	SONGLIAO PLAIN ADP	205.0	JAISAARD	06/28/93	A	01/17/94	02/22/94
		4INSPA238	INDONESIA	INTEGRATED SWAMPS	70.0	VAN VOORTHUIZEN	01/11/93	A	11/29/93	02/22/94
		4INSPA255	INDONESIA	JAVA WATER MGMT	180.0	HITCHINGS	10/07/93		04/04/94	05/24/94
		4INSPA311	INDONESIA	DAM SAFETY	60.0	PRICE	10/18/93		04/05/94	05/24/94
*TOTAL REGNAME EAP					515.0					
94	LAC	6DOMPA044	OMINICAN REPUBL	IRRIG LAND & WATERSHED MANAGT	26.0	MOREAU	05/23/93	A	11/15/93	12/21/93
		6MXCPA206	MEXICO	ON-FARM & MINOR IRRIG. NETWORK	200.0	SIMAS	06/21/93	A	11/01/93	12/21/93
*TOTAL REGNAME LAC					226.0					
94	SAS	8BANPA212	BANGLADESH	RIVER BANK PROTECTION	106.0	HERMAN	06/27/92	A	02/18/94	03/21/94
		8SRIPA123	SRI LANKA	MAHAWELI	17.0	LISTER	01/03/94		05/09/94	06/28/94
*TOTAL REGNAME SAS					123.0					
*TOTAL FY 94					874.2					

AGRICULTURE LENDING FOR IRRIGATION AND DRAINAGE AS OF 11/02/93
FY94 TO FY97 PLANNED AS OF 11/02/93

Fiscal Year	REGION	Project ID	COUNTRY	Project Name	BANK/IDA LENDING	PROJECT OFFICER	APPRAISAL DEPARTURE DATE	NEGOTIATIONS	BOARD DATE
95	Africa	3MAGPA056	MADAGASCAR	IRRIGATION II	12.0	TRAPMAN/BICHARA	03/15/93 A	01/10/94	03/29/94
		3MALPA079	MALAWI	AGRIC. DIVERSIFICATION	40.0	ANSON	05/30/94	02/03/95	05/30/95
*TOTAL REGNAME Africa					52.0				
95	EAP	4CHAPA190	CHINA	YANGTZE BASIN WATER RESOURCES	210.0	REIDINGER	06/20/94	01/15/95	03/07/95
		4PHLPA208	PHILIPPINES	WATER RESOURCES DEVELOPMENT	75.0	HUSAIN	11/01/94	03/15/95	05/15/95
		4VNMPA010	VIET NAM	IRRIGATION SUBSECTOR	65.0	ROMAN	05/31/94	09/01/94	11/01/94
*TOTAL REGNAME EAP					350.0				
95	ECA	7ALBPA019	ALBANIA	IRRIGATION REHABILITATION	5.0	WARNAAS	11/22/93	03/28/94	05/09/94
*TOTAL REGNAME ECA					5.0				
95	LAC	6ECUPA075	ECUADOR	IRRIG TA	30.0	CARROLL/M	01/15/94	05/15/94	07/15/94
		6ECUPA106	ECUADOR	AGRIC CENSUS & INFO SYSTEM	25.0	GOSWAMI	06/15/94	11/14/94	03/14/95
		6MXCPA205	MEXICO	NAT'L FORESTRY DEV & CONSERV.	200.0	MOLNAR	06/30/94	01/03/95	02/14/95
		6PERPA109	PERU	IRRIG. REHAB	75.0	EMANUEL	03/28/94	09/06/94	11/08/94
*TOTAL REGNAME LAC					330.0				

AGRICULTURE LENDING FOR IRRIGATION AND DRAINAGE AS OF 11/02/93
FY94 TO FY97 PLANNED AS OF 11/02/93

Fiscal Year	REGION	Project ID	COUNTRY	Project Name	BANK/IDA LENDING	PROJECT OFFICER	DEPARTURE DATE	NEGOTIATIONS	BOARD DATE
95	MNA	5EGTPA192	EGYPT, ARAB REPU	EGYPT IRRIGATION IMPROVEMENT	50.0	KHAN	06/27/94	11/01/94	12/20/94
		5IRNPA056	IRAN, ISLAMIC	RE SISTAN IRRIGATION	45.0	GOIS	03/15/94	06/15/94	08/02/94
		5LEBPA021	LEBANON	LEBANON IRRIGATION	35.0	BARRES	02/10/94	05/21/94	06/28/94
*TOTAL REGNAME MNA					130.0				
95	SAS	8INDPA379	INDIA	WATER RES CONSOLID HARYANA	250.0	PERRY/OBLITAS	10/20/93 A	03/10/94	04/19/94
		8INDPA480	INDIA	NATIONAL HYDROLOGY	100.0	FAUSS/OBLITAS	08/01/94	12/01/94	01/17/95
		8INDPA481	INDIA	WATER RES.CONSOLID.TAMIL NADU	200.0	OBLITAS	02/15/94	06/30/94	08/16/94
		8PAKPA216	PAKISTAN	NATIONAL DRAINAGE PROGRAM	150.0	WAMBIA	09/30/94	04/15/95	05/16/95
		8PAKPA276	PAKISTAN	BALUCHISTAN MINOR IRRIG AG DEV	34.0	M.SADDINGTON	02/10/94	07/25/94	09/27/94
*TOTAL REGNAME SAS					734.0				
*TOTAL FY 95					1601.0				
96	Africa	3BURPA063	BURKINA FASO	PRIVATE IRRIGATION	45.0	MILLS	08/01/94	04/03/95	07/11/95
		3MTAPA049	MAURITANIA	IRRIG PROMOTION	17.0	OKA	05/01/94	03/01/95	07/11/95
*TOTAL REGNAME Africa					62.0				
96	EAP	4INSPA258	INDONESIA	WATERSHED CONSERVATION II	100.0	VAN DE POLL	01/09/95	09/11/95	11/21/95
		4VNMPA021	VIET NAM	IRRIGATION (MEKONG)	80.0	GUNASEKARA	06/15/95	10/01/95	12/01/95
*TOTAL REGNAME EAP					180.0				

AGRICULTURE LENDING FOR IRRIGATION AND DRAINAGE AS OF 11/02/93
FY94 TO FY97 PLANNED AS OF 11/02/93

Fiscal Year	REGION	Project ID	COUNTRY	Project Name	BANK/IDA LENDING	PROJECT OFFICER	APPRAISAL DEPARTURE DATE	NEGOTIATIONS	BOARD DATE
96	LAC	6MXCPA218	MEXICO	DAM SAFETY & FLOOD MONITORING	200.0	SIMAS	12/15/94	07/15/95	09/12/95
		6VENPA042	VENEZUELA	IRRIG SUBSCTR PROJECT	125.0	KRAMER	11/15/94	05/15/95	07/15/95
*TOTAL REGNAME LAC					325.0				
96	MNA	5ALGPA097	ALGERIA	IRRIGATION MGMT. SUPPORT (OPI)	50.0	NGUYEN	10/15/94	06/04/95	08/22/95
		5IRNPA051	IRAN, ISLAMIC	RE RESEARCH & EXTENSION	40.0	NIGHTINGALE	11/10/94	05/01/95	07/16/95
		5MYCPA174	MOROCCO	WATER SECTOR INVESTMENT	100.0	GOLDIN	05/15/95	12/15/95	01/22/96
*TOTAL REGNAME MNA					190.0				
96	SAS	8INDPA470	INDIA	WATER RES CONSOLID ORISSA	180.0	OBLITAS	08/15/95	12/05/95	01/09/96
		8NEPPA068	NEPAL	IRRIG SECTOR	40.0	VAN WERSCH	02/11/95	11/06/95	02/28/96
		8PAKPA241	PAKISTAN	NATIONAL IRRIGATION PROGRAM	150.0	WAMBIA	09/30/95	01/16/96	03/26/96
*TOTAL REGNAME SAS					370.0				
*TOTAL FY 96					1127.0				

AGRICULTURE LENDING FOR IRRIGATION AND DRAINAGE AS OF 11/02/93
FY94 TO FY97 PLANNED AS OF 11/02/93

Fiscal Year	REGION	Project ID	COUNTRY	Project Name	BANK/IDA LENDING	PROJECT OFFICER	APPRAISAL DEPARTURE DATE	NEGOTIATIONS	BOARD DATE
97	EAP	4CHAPA222	CHINA	SOUTH-NORTH WTR TRANSFER I	300.0	TAY	11/20/95	05/15/96	07/16/96
		4INSPA262	INDONESIA	JAVA WATER MGMT II	150.0	RAZA	01/16/95	07/31/95	10/10/95
***TOTAL REGNAME EAP**					**450.0**				
97	ECA	7UZBPA007	REPUBLIC OF UZBE	DRAINAGE	100.0	VAN TUIJL	10/01/95	05/27/96	06/20/96
***TOTAL REGNAME ECA**					**100.0**				
97	LAC	6BRAPA236	BRAZIL	IRRG.SUBSCT.II	200.0	KRAMER	09/15/94	04/15/95	10/15/95
		6CLMPA198	COLOMBIA	IRRIG III	80.0	JOHNSON	11/15/95	05/15/96	07/15/96
***TOTAL REGNAME LAC**					**280.0**				
97	MNA	5IRNPA059	IRAN, ISLAMIC	RE WATERSHED CONSERVATION	60.0		04/15/95	09/01/95	10/31/95
***TOTAL REGNAME MNA**					**60.0**				

AGRICULTURE LENDING FOR IRRIGATION AND DRAINAGE AS OF 11/02/93
FY94 TO FY97 PLANNED AS OF 11/02/93

Fiscal Year	REGION	Project ID	COUNTRY	Project Name	BANK/IDA LENDING	PROJECT OFFICER	APPRAISAL DEPARTURE DATE	NEGOTIATIONS	BOARD DATE
97	SAS	8BANPA233	BANGLADESH	WATER RESOURCES DEVELOPMENT	70.0	HERMAN	03/15/96	12/01/96	03/15/97
		8INDPA296	INDIA	NATIONAL WATER MGMT II	150.0	OBLITAS/PERRY	02/15/95	08/30/95	10/01/96
		8INDPA399	INDIA	UP GROUNDWATER	200.5	KHAN	01/15/95	06/15/95	09/10/96
		8INDPA427	INDIA	SUBERN II (BIHAR)	150.4	MUKAMI	05/15/95	11/15/95	01/14/97
		8NEPPA100	NEPAL	SUNSARI MORANG III	44.0	MYINT	10/01/95	07/15/96	10/31/96
		8SRIPA100	SRI LANKA	MAJOR IRRIG II	40.0	YAGUCHI	08/31/95	05/01/96	07/02/96
*TOTAL REGNAME SAS					654.9				
*TOTAL FY 97					1544.9				

TOTAL(FY94-FY97) **5147.1**

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Local level participation in land and water resources management in Rufiji River Basin, Tanzania - the case of the Great Ruaha

Jannik Boesen (TWUWS)

Introduction

Following preparation of its Water Policy and - Implementation Strategy, Tanzania is presently carrying out a Water Sector Review. As part of that, the World Bank is providing backstopping for a nationwide rapid water resources assessment, which is river basin based, and will link up with more indepth studies of priority basins, at the same time as Basin Offices and Boards will be created.

As the Rufiji River Basin Office is being established in Iringa, it is planned under the Danida/World Bank Water and Land Management Study to undertake a study of the potentials for local level (sub basin) participation in land and water resources management in the basin. The study should partly contribute directly to the concrete formulation of management responsibilities in the basin, especially with regard to the gradual development of linkages between overall basin management and local level formal and informal management institutions. Partly it should yield experiences of a broader significance, tentatively expected to be concerning the following issues:

- In a basin with few large scale, formal water users - hydropower, irrigation, urban and rural water supplies - and a very large number of small scale, informal users of/impacters on water resourcess - peasant watershed and wetlands cultivation, and furrow irrigation, livestock, and domestic uses - what institutional arrangements can combine an efficient monitoring and information system and formalized management of large scale uses and reservoirs, with the necessary minimum of linkage between the overall basin management organization and the numerous small users and their, often informal, local management institutions;
- This will include identification of land and water management functions that can be carried out by local government, i.e. Districts and Villages, and informal local institutions, and their relationships to basin management; of the degree to which, and how the water rights system should be extended to local level water uses, including its possible combination with local water management institutions; and of possible support to local land and water management institutions in improving water use efficiency, employing water user fees for this purpose as well as for cost recovery, monitoring for their own as well as for basin management purposes, and in protecting water sources;
- How to ensure participation of the many small stakeholders and their local land and water management institutions in overall basin management and at the same time raising awareness at local levels of basin level land/water interrelationships.

Background

Before 1981 the Tanzanian Water Act located water resources management, i.e. primarily allocation and management of water rights and pollution control, at central level with the Principal Water Officer, or at regional level with the Regional Water Officer, respectively for designated National and Regional "Water Supplies". Each Water Officer has a Water Board.

The 1981 ammendment to the Act opened the possibility for establishing basin offices and boards with the same functions for water bodies designated as Water Basins. A number of basins have been defined in Tanzania, but the Government has taken a very sensible course in establishing basin offices gradually, and as a demand arises.

In fact water resources management was for a long time given low priority compared to water resources development, the post as Principal Water Officer being left vacant, the water rights system to some extent redundant, and the '81 ammendment's provision for basin offices unused. It is only in the 1990es this situation has been reversed, with growing land/water use questions arising in relation to catchments, irrigation and wetland cultivation, increasing source problems for water-supplies, and especially expansion of the hydro-power network.

A Principal Water Officer is now in place, and in 1991 the first Basin Water Board and - Office were established for the Pangani River as part of a major hydro-power project. Similarly the Rufiji Basin Water Office (RBWO) is presently under establishment, with support expected from the World Bank co-financed Lower Kihansi hydro-power project.

Being closely related to the needs of the hydro-power projects, the initial activities of the Pangani Basin Water Office (PBWO), with support from Nordic donors (NORAD, SIDA, FINNIDA) and consultants, has been to rehabilitate the hydrometeorological monitoring system, establish a computerized data base and management information system, revitalize the water rights system for all larger users, start registration of traditional furrows, and begin to manage the dam in cooperation with TANESCO, the power company. A similar system is supposed to be introduced in the Rufiji Basin, where activities are expected to start from the beginning of 1994.

Local level water resources management problems

Although river basin management will be introduced in Rufiji Basin along the same lines as in Pangani, there is little doubt that it will have to be adapted to the very different conditions existing here. Rufiji Basin is some three times as big as Pangani, is much more diverse, and crosses 5 regional boundaries.

Rufiji is divided into at least three highly different sections, viz. the Rufiji proper below Kidatu, including the delta and ocean areas, highly affected by the Rufiji; The Kilombero Valley; and the Great Ruaha Basin covering Iringa Region and parts of Morogoro and Mbeya. Apart from the hydro-power plants, there are few large, formal water users, as the situation is dominated locally and basin-wide by the impact of a very large number and variety of small scale water and land uses.

There is a need therefore to look at what functions the new basin office must retain in its particular context and what functions it may leave or delegate to the Regions, which already have water resources management functions, and to Districts and Villages, i.e. the local government institutions that often cut across basin boundaries. Soil and water conservation is already addressed by the latter, to some extent on a catchment basis, as in the Danida supported soil and water conservation projects in Iringa Region. Some water resources management functions may best be left to user groups, such as the existing, informal irrigation groups. Such a devolution of functions may require enhancement of capacity at Regional, District, Village and user group levels.

Monitoring of the diverse resources in the basin and their current use, establishing and maintaining a data base, basin modelling, and reservoir management, are obvious basin office functions. Collection of the data may be done by Regions and Districts as in the Pangani case. Regulation of water use or activities affecting water resourcess by peasant farmers may best be done locally - or may have too high "transaction costs" to warrant any regulation at all, apart from what they do among themselves.

The major challenge, therefore, is to combine efficient monitoring and information management, and formalized management of large scale uses and reservoirs, with the necessary minimum of linkage between the overall basin management organization and the numerous small users and their, often informal, local management institutions.

Stakeholder involvement in Tanzania has so far been synonymous with representation through the involved ministries, but there is some acknowledgement of the importance of now including all stakeholders directly in water resources management. In practical terms it is a question, however, of how to represent and weigh, e.g. the interests of countless smallscale, ditch-irrigating peasant farmers vis-a-vis TANESCO, the powerfull national power parastatal, whose electricity supply to major towns, including Dar es Salaam, depends on Kidatu and Mtera Dam on the Great Ruaha. Other interests are those of urban and rural domestic consumers, most of whom depend on improved or unimproved surface water supply, and whose sources are often vulnerable in relation to local land/water use practices. Most difficult to involve are probably the migratory pastoralists, who use the river-system only seasonally, and those farmers whose land-use practices, through erosion, de- or afforestation, have an impact on the resources.

Often those stakeholders mentioned above, who are most difficult to involve in the formal system, are also those, whose activities are most difficult to control and regulate, whether through regulatory means or economic incentives. Simple measurement of use or impact on the resource may often be virtually impossible in practical terms. Sometimes the problem is aggravated, e.g. on the Usangu Plains, by competition for the same resources between different ethnic groups, for different uses, and with different local, informal resource management institutions. Even within the same group there may be conflicts, e.g. between men and women.

Finally it is of course a constraint in both the above respects, that awareness among local communities (and even others!) of catchment and basin interrelationships is often, and understandably, limited.

Study of local level land and water resources management and its relation to river basin management in the Great Ruaha Basin

In conjunction with the establishment of the Rufiji Basin Water Office in Iringa and the initiation of its basin monitoring and management functions, along the lines of the PBWO's activities, it is planned to carry out a study of local level land and water resources management and its relation to river basin management. In view of its pilot character and urgency it would be limited to the Great Ruaha Basin. It would be carried out for the Principal Water Offiver and the RBWO and in close cooperation with the RBWO and its NORPLAN consultants by the joint DANIDA/World Bank Land & Water Management Study.

The objective of the study is to contribute to the sustainable development, use and management of water resourcess through incorporation and involvement of local level water users, of those, whose land and water related activities have an impact on water resourcess, and of local land and water management institutions in the management of the basin as a whole. This will relate primarily to land/water use in connection with rural domestic water supplies, cattle watering by local and migratory people, small scale and traditional furrow irrigation, valley bottom and wetlands cultivation, and watershed/catchment area utilization.

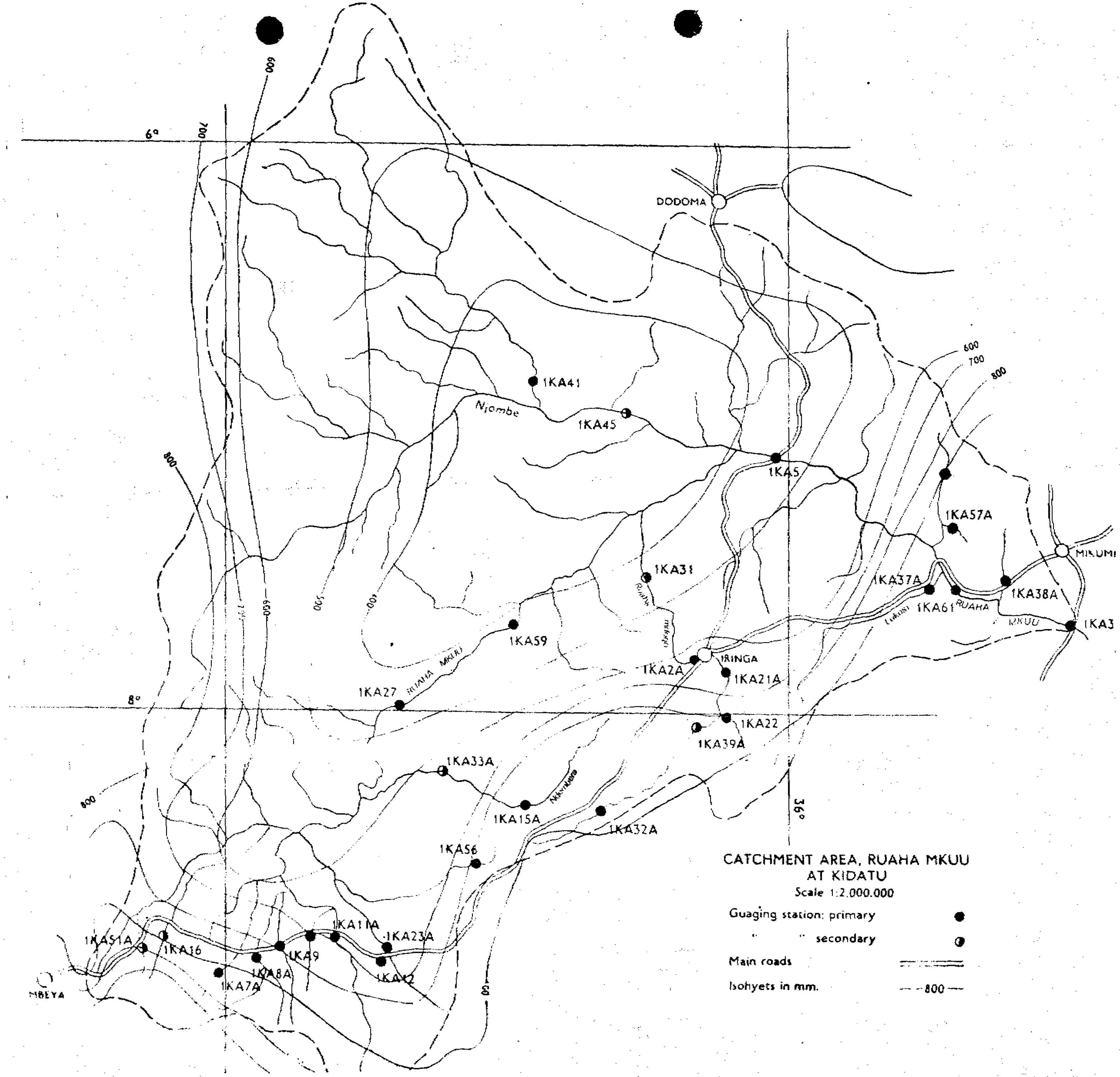
The outputs of the study will be proposals for:

- Land and water management functions that can be carried out by local government, i.e. Districts and Villages, and informal local institutions, and their relationships to basin management;
- The degree to which, and how the water rights system should be extended to local level water uses, including its possible combination with local water management institutions;
- Support to local land and water management institutions in improving water use efficiency, employing water user fees for this purpose as well as for cost recovery, and possibly other economic incentives; in monitoring water resources for their own as well as for basin management purposes, and in protecting water sources;
- Participation of local land and management institutions in basin management and raising awareness at local levels of basin level land/water interrelationships;
- Information systems and training needed to enhance the awareness and capacity of local institutions for water resources management.

The study will be comprised of four main activities:

- Rapid assessment of location, extent and socio-economic importance of small scale furrow irrigation, valley bottom and wetlands cultivation;
- Rapid assessment of land/water impacts of small scale furrow irrigation, valley bottom and wetlands cultivation and of watershed and catchment area land use, with particular emphasis on distinguishing local and basin level impacts, and identifying impacts of one activity on other activities (e.g. irrigation on domestic use);
- Analysis of the formal existing land and water management system, including the legal basis, the organizational setup, and how it actually works in relation to local level land and water use and related conflict resolution; identify constraints and possible means to overcome these, considering also experiences from PBWO;
- Identification of local informal land/water management systems,and analysis of their functions, how they perform and limitations both in terms of functions, area, and management methods; discussion of their possible involvement with the formalized management system at local and basin levels.

Reproduced for the World Bank Annual Water Resource Seminar, December 7-9, 1993.



CATCHMENT AREA, RUAHA MKUU
AT KIDATU
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" " secondary ◐
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TANZANIA WATER RESOURCES ASSESSMENT - OBJECTIVES AND SCOPE

Gerhard Tschannerl (AF2EI), Alfred M. Duda (ENVPE), and Rafik Hirji (ENVPE)

Introduction

1. Like many other nations, the United Republic of Tanzania is experiencing environmental stress and depletion of natural resources driven by socio-political and economic forces. At the government's request, the Bank sent a mission in 1992 to assess the environmental situation in Tanzania and provide support to the government as it formulated its National Environmental Action Plan. The mission identified, as part of the list of top priority concerns, degradation of the aquatic environment, widespread water-related diseases, water pollution, inadequate water supplies and sanitation facilities, and cross-sectoral water conflicts.

2. At the same time, Tanzanian officials were working with UNDP to strengthen the capability of the Ministry of Water, Energy and Minerals (MWEM) and to conduct a water sector review, concentrating on water supply and sanitation issues. As a result of the dialogue conducted among Tanzanian officials, UNDP, and the Bank, a decision was reached to broaden the scope of the water sector review to a more comprehensive water resources management orientation in keeping with the recommendations of the Bank's new Water Resources Management Policy. This resulted in the Eastern Africa Department of the Bank initiating a project to assist the government in incorporating this approach into Tanzania's planned review process.

3. In this session, perspectives of both the ministry and the Bank are presented on how to expand a water supply and sanitation sector review to include comprehensive, cross-sectoral issues that inhibit sustainable use of water resources. The first presentation by Mr. Mambali and Mr. Njau from MWEM outlines the challenges Tanzania faces in addressing its water resources management problems. Their presentation also discusses why the traditional sector review needed to be broadened and describes the participatory, interministerial process adopted by MWEM. This paper outlines the approach the Bank is taking in supporting Tanzania in this effort. The authors regard this process of preparing a comprehensive, basin-by-basin water resources assessment, using a participatory review process, and ultimately preparing a strategy focusing on priorities, as necessary for achieving sustainable use of the country's water resources as noted in the Bank's Water Resources Management Policy. The final presentation by Mr. Boesen describes the application of this comprehensive, cross-sectoral, participatory process to a targeted river basin and local initiatives for determining the roles and the participation in the process.

The Approach

4. The Bank's Water Resources Management Policy recognizes the need for sustainable use of the water environment for multiple purposes. The policy also recognizes the importance of (i) taking a comprehensive, cross-sectoral approach toward improving water resources management, (ii) implementing proper pricing policies and use of economic instruments, (iii) decentralization of water resources management responsibilities, (iv) public and stake holder participation, and (v) enactment of public policy and institutional reforms to protect environmental quality and better manage water resources. These

elements of the Bank's policy represent the key elements of the policy dialogue with Tanzania on improving water resources management.

5. One approach to a national water resources assessment is for the Bank to utilize its own resources and trust funds to prepare the assessment for a country. A more sustainable approach, and one that can build capacity and interministerial cooperation, is to have different ministries and institutions in a country cooperate as part of a larger, participatory process to conduct such an assessment themselves based on existing information. This is the approach chosen in Tanzania. The proposed Water Sector Review was expanded to include water resources management elements, an interministerial steering committee was formed to oversee the review, and representatives from external support agencies (ESAs) were involved in workshops designing the process and initiating the review.

6. This strategy encourages cooperation among different ministries and different disciplines in assembling existing information, conducting integrated analyses, and framing water resources problems and needs. Following this, priorities can be determined for action, potential complementarities can be identified between different sector policies and protection of the aquatic environment, and actions for achieving these complementary benefits can be initiated as part of a strategy. The Bank has provided funding for the Rapid Water Resources Assessment (see below) and guidance in conducting the process. In this manner, Tanzanians assemble the information, identify problems, propose cross-sectoral alternative actions for fixing the problems or meeting the needs, and involve beneficiaries, stake holders, and ESAs in formulating strategic actions.

7. The initiative is aimed at addressing institutional and regulatory reforms and concentrating on the most pressing water resources problems and needs in each river basin with the involvement of all the stake holders. It builds inter-ministerial cooperation and capacity to better manage the fragile water environment Tanzanians depend on to sustain future development. Participation by ESAs and NGOs should help focus corrective actions where they are most needed and foster coordination among ESAs and different ministries.

8. The water resources assessment can be divided into three phases. Phase 1 consists of a basin-by-basin assessment of water resources problems and needs. In Phase 2 comprehensive analytical analysis is carried out on several targeted river basins with high priority problems and needs, involving decentralization of management, use of proper pricing policies, and participation by government agencies and beneficiaries. Phase 3 focuses on the synthesis of complementary actions, funding for priority investment projects, and continued examination and updating of strategic elements.

Phase 1: Rapid Water Resources Assessment

9. A Rapid Water Resources Assessment (RWRA) is being implemented concurrently with the ongoing "Water Sector Review," carried out by MWEM. The RWRA integrates hydrologic information with cross-sectoral water and land use, water quality, ecosystems and public health issues on a river basin basis nationwide and assesses the effectiveness of existing institutions (such as policies, legislation, institutional arrangements, and coordination mechanisms) for sustainably managing Tanzania's water resources.

10. The assessment is being carried out by an inter-ministerial task force headed by the Principal hydrologist from MWEM. The task force also includes a hydrologist and computer expert; a hydro-geologist and water quality and water law specialists from MWEM; an irrigation and land use specialist from the Ministry of Agriculture; a pollution control officer from the National Environmental Management Council; a forester from the Tanzania Wood Industries Corporation; a fisheries and a wetlands and coastal zone expert from the Ministry of Natural Resources, Tourism and Environment; and a public health specialist from the Ministry of Health.

11. A start-up workshop for the Water Sector Review was held in Dar es Salaam in July 1993. The RWRA is being funded jointly by the World Bank and DANIDA. The workshop also endorsed the formation of a high level inter-ministerial steering committee for coordinating and overseeing the water sector review and the RWRA. The terms of reference for the RWRA were finalized in September 1993, a detailed work plan prepared in November, and compilation of information started thereafter. Bank staff are assisting in the RWRA through periodic discussions with MWEM and by providing inputs at critical junctures of the assessment.

12. Several important lessons are expected to result from the RWRA. At the minimum, the assessment will result in an integrated review of existing information on a river basin basis, much of which is presently expressed on the basis of regional and political boundaries. Important data gaps and data needs will be identified, and priorities for future action based on existing water resources conditions, needs and problems will be formulated. The priority issues identified in the RWRA will form the basis for formulating strategic actions for developing and managing river basin resources in a sustainable manner. The RWRA process will also demonstrate the opportunities and challenges of having cross sectoral interests working jointly in a participatory fashion with NGOs and ESAs toward broader goals of promoting sustainable management of Tanzania's water resources. Finally, the incremental and consultative approach taken by Bank staff to facilitate the RWRA is expected to serve as a useful case study to learn about better approaches to building local capacity for complex assessments, particularly in Africa.

Phase 2: Select River Basin Analyses

13. The RWRA carried out in Phase 1 is expected to provide information for undertaking detailed investigations to solve various types of water use conflicts in priority drainage basins. In the Lake Victoria basin, understanding the relationship between point and non-points source pollution discharge is necessary for controlling eutrophication in the lake and protecting the lake ecosystem and water quality from further deterioration. In the Pangani basin, the role and impact of water diversions for agriculture, changes in land use, and the consequences of untreated effluent from sisal processing plants needs to be addressed to avoid conflicts with hydropower generation, to increase flood protection and to maintain downstream water quality. River basin management interactions on the Rufiji/Great Ruaha basin can result in developing better tools for forecasting water use conflicts between upstream irrigation diversions and power generation at the Mtera reservoir and Kidatu Power stations, which last year contributed to a serious nationwide power shortage. River basin investigations are also useful to evaluate the impact of future projects, such as the Kihansi hydroelectric scheme on a tributary of the Rufiji River and the expansion of the Dar es Salaam water supply on the Ruvu River, on downstream water uses and on water quality.

14. Phase 2 of the water resources assessment consists of a comprehensive analysis and strategic planning in selected river basins. During the RWRA (Phase 1) the main areas of present and potential trouble for water utilization and conservation are being identified, which may require further analysis, planning, regulation, institutional strengthening, and this contributes to the selection of priority river basins for Phase 2 work. Since the supply of water, and often also the demand for water, are geographically confined to river basins, it is proposed that a national water resource assessment can be based on a comprehensive analysis of only the most critical river basins rather than covering the entire country. Care should however be taken that these analyses include all the major issues and are sufficiently representative of the country as a whole to allow a useful synthesis to be made in Phase 3 regarding water use regulation, pricing and incentives, institutional arrangements, etc.

15. The main river basins where a comprehensive approach is being initiated are listed below and are shown in Figure 1. The nature of this analysis varies considerably, depending on the specific conditions in the basin and on the views of the national and international institutions involved regarding the required interventions and the analytical techniques to be used for this purpose. The kind of comprehensive analysis described in the World Bank Policy Paper on Water Resources Management is proposed to be applied to the Ruvu basin.

a. ***Pangani River Basin.*** Extensive use of the Pangani for industry, hydro power, and irrigation has resulted in water quantity and quality problems for some users, particularly for domestic water supply and livestock watering for the population along its course. Studies were carried out with the assistance of Nordic countries, and a river basin organization was formed, which constitutes to some extent a model for the creation of river basin authorities in other basins. The main task now is to implement the recommendations that emerged from the work and to draw lessons for other basins.

b. ***Lake Victoria Basin.*** The drainage basin for Lake Victoria, including the lake itself, forms part of the Nile River Basin, and is shared by Tanzania with Kenya, Uganda, and Rwanda. A serious deterioration of the water quality in the lake has occurred in the last few years, mainly due to the introduction of the Nile Perch some two decades ago and exacerbated by domestic, industrial, and agricultural pollution discharges into the lake. Efforts are under way[1] to deal with this problem comprehensively through monitoring, analysis, and introduction of appropriate mitigating measures. Another problem is the occurrence of severe pollution from settlements on the shore line of the lake. With the increase of urbanization and industrialization along the lake, appropriate measures for addressing these concerns need to be taken.

c. ***Great Ruaha and Rufiji Basin.*** With rapidly increasing water demand for small-scale irrigation and for hydropower, serious water shortages are likely to occur in dry periods, mainly in years and in sub-basins with less than average rainfall. Planning and appropriate regulation of water use are urgently needed by reconciling in some way the interests of large and small users as well as the need for environmental sustainability. The participation of small-holder farmers in this process is the subject of Jannik Boesen's presentation as part of this session. A water resources analysis, at least in part of the basin, will be carried out in connection with the

[1] Assisted jointly by the Agriculture and Environment Division, Eastern Africa Department of the Bank, and the Global Environment Fund

planned Kihansi hydropower project and will include the strengthening of planning and regulatory institutions for the basin.

d. ***Ruvu Basin.*** Although relatively small in size, the basin has great importance because of the expected rapid rise in domestic and industrial water use in Dar es Salaam and the surrounding coastal areas and because of its irrigation potential. To forestall the occurrence of serious conflicts in water use in the future, the water use in the basin should be planned and regulated through appropriate mechanisms and institutional arrangements. A JICA-assisted study, which is mainly concerned with identifying the irrigation potential, is under way. In response to a request from MWEM, a comprehensive analysis, assisted by the World Bank through a Japanese Grant, is planned, including the possibility of an inter-basin transfer of water to Dar es Salaam.

16. The comprehensive analysis of the Ruvu Basin is intended to provide a framework for Government decision makers and major stake holders to identify the major problems that may arise from a laissez faire scenario and to agree on a set of appropriate measures to achieve the desired future water allocation in the basin, including water quality, environmental needs, and sewage treatment. It is proposed to use the Water Evaluation and Planning System (WEAP) developed by the Stockholm Environment Institute, Boston Center, for this purpose. The highly interactive and user friendly system employs an *integrated water supply and demand analysis* which includes *water quantity and quality*, *economic development objectives*, and *environmental constraints*. Through the scenario approach used by WEAP, *demand and supply projections* are first made for the continuation of the present situation - laissez faire - to arrive at a "Base Case." Then the system is used to explore the impact of specific demand options, supply options, and policy scenarios on the economic and environmental results.

Phase 3: Synthesis

17. The RWRA was designed as an instrument for the Interministerial Steering Committee and participants in the "Water Sector Review" to understand in a more comprehensive manner the scope of water resource management challenges they face in each river basin and connections between problems and causes of those problems. Several river basins will be chosen for more intensive analysis and initiation of participatory, cross-sectoral processes to further understand the complex challenges and chart a strategic course for action. Work has already started in several river basins with pressing problems and needs.

18. A water resources management strategy will in essence be formulated as a result of the "Water Sector Review". Priority actions will be identified for meeting water supply and sanitation needs as well as water resources management and environmental protection priorities. Some actions will need to be taken on a national basis, others on a river-basin scale with specific different actions or sectoral initiatives specified to meet particular problems and needs. Phase 3 of the work consists of implementing the results of the strategy development process catalyzed by the RWRA and the Sector Review. These would run the range from establishing consistent water rights systems to formulation of guidelines and implementing mechanisms for water allocation, water pricing, cost recovery, incentives, and other measures. Water pollution standards and regulatory mechanisms would be established in the context of national environmental protection objectives. A better and more comprehensive legal framework may need to be

created, and alternative plans for public investment will need to be formulated to address priority needs and problems identified in the process.

19. Hydrologic information is often insufficient for analytical work with the desired accuracy, and sweeping assumptions many have to be made. Part of the follow-up work in Phase 3 will be to improve the hydrologic network and, equally important, provide it with the means for long-term sustainability. An examination of the effectiveness of existing institutions (such as water and environment policies, legislation, agencies and coordination mechanisms) would result in actions for more appropriate training and for the strengthening of specific institutions to manage Tanzania's water resources. Actions may include the formation of additional river basins boards, such as the Pangani River Basin Board for coordinating cross-sectoral water and land use activities in the basin. In some basins, the central nationwide basin board may be an appropriate management structure, while for others needing more intensive management a decentralized structure may be more appropriate. Other recommendations may include strengthening and updating existing legislation for controlling water use and protecting the water environment, designing water quality monitoring programs, or providing training courses in specific areas, such as river basin modeling. The Economic Development Institute of the World Bank is in the process of contributing to this comprehensive approach by working with the Government of Tanzania on designing a training program in the sector.

Summary - Building on Complementarities

20. This effort with the Government of Tanzania represents one of the first initiatives to implement the Bank's new Water Resources Management Policy in the Region. MWEM had come to similar conclusions as had the Bank that a more comprehensive approach to water resource management was needed to address today's water problems and needs. We are working together to discover how to address the many water issues in a cross-sectoral, ecologically based manner. The processes being initiated stress participation, use of existing information, and self-reliance. The institutional shift to decentralized river basin boards, river basin offices that are multidisciplinary in perspective, and bottom-up participation (see Jannik Boesen's paper on the Great Ruaha/Rufiji pilot project) is significant and is based on three years' experience with the Pangani River Basin.

21. The RWRA is a necessary part of the process of identifying cross-sectoral priorities that influence water resources. Complementarities exist between certain actions of sectoral programs and projects and positive impacts on the sustainability of water resources for multiple uses. In fact sustainability can be achieved only by having different sectors compromise on their programs and target modified programs to river basins where they are most needed. This may mean a little less water diverted for irrigation so that downstream aquatic ecosystems can be sustained or that agricultural programs for erosion or pollution control should be targeted to certain priority basins. It may mean that funding for the needs of coastal zone management take precedence over certain sectoral programs so that fragile resources can be protected because of their value for tourism. The priority in different basins will be different and the Bank or ESAs cannot make a judgment on the priorities. This must be done by experts in the country in a participatory manner with stake holders. How to involve different sectoral interests in this process, how to identify complementarities between sectoral actions and sustainability of the water environment, and how to make this more comprehensive approach institutionally feasible are all being tested in this pilot effort.

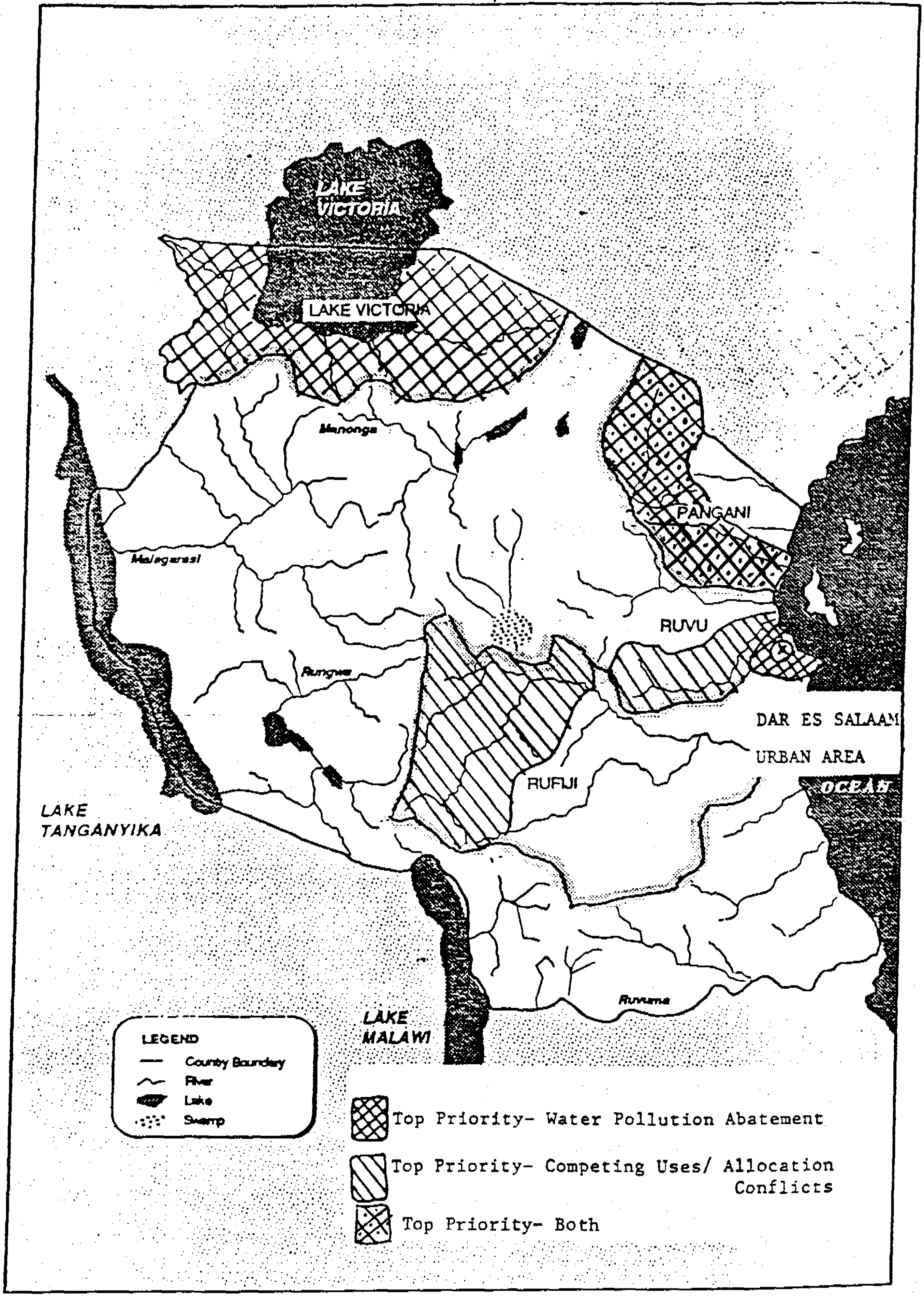

FIGURE 1. HIGH PRIORITY AREAS FOR WATER POLLUTION ABATEMENT AND RESOLUTION OF COMPETING USES

UNITED REPUBLIC OF TANZANIA

MINISTRY OF WATER, ENERGY AND MINERALS

IMPROVING WATER RESOURCES MANAGEMENT IN TANZANIA

A COUNTRY PRESENTATION AT

THE

WORLD BANK WATER RESOURCES SEMINAR

DECEMBER 7-9, 1993, RICHMOND, VIRGINIA, USA

1. BACKGROUND INFORMATION

Tanzania with an area of over 945 000 km2 including 53 483 km2 of inland waters has extensive water resources that are contained in five major river basins draining into three great lakes (Victoria, Tanganyika and Nyasa) and the Indian Ocean. This resource is unevenly distributed throughout the country. Many parts of the country experience arid and semi-arid conditions.

Tanzania has a population of 23.3 million people (1988 population census) and it is estimated that about 80% of the population live in the rural areas. Agriculture constitutes the backbone of the national economy and traditional cultivation methods continues to form the basis for most agricultural production in the country thus putting a lot of pressure on the land use.

Thus due to population increase and urbanisation over the last twenty years and extensive agricultural and animal husbandry practices, the precious resource is now under threat of diminution in both quality and quantity.

In 1971 the government of Tanzania drew up a Twenty-Year Rural Water Supply Programme (1971-1991) which set targets for developing safe water sources for every village by the year 1985 and for every individual to have water within a walking distance of 400 metres by the year 1991. The Twenty Year Rural Water Supply Programme was mostly rural focussed and neglected the urban sub-sector, which was left to deteriorate in terms of level of service, quality and quantity.

In 1986, when reviewing the Rural Water Supply Programme it became evident that the targets set for 1991 can not be met and the Programme target date was pushed forwards to the year 2002. "WATER FOR ALL BY 2002".

It is clear that the Government had a clear goal in mind but the means by which this goal could be achieved was missing. This was a Policy to guide the development of the sector. It is in recognition of this need that the Party and the Government commissioned the development and recently approved and endorsed the Water Policy on the 16th November, 1991. Highlights of the National Water Policy include beneficiary participation, sustainability and rehabilitation, community-based management, integration of water and sanitation, water resources and the wider environment, inputs from External Support Agencies (ESAs) and institutional aspects.

Other initiatives by the Government aimed at improving the service delivery to the people have been:-

- The Ministry's self strengthening Project URT/89/003,
- The evolving Strategies and Action Plan for the implementation of the National Water Policy,
- The evolving National Water and Sanitation Programme,
- The evolving joint national monitoring system with the Ministry of Health,

- The Water and Sanitation Sector Review incorporating the Rapid Water Resources Assessment.

2. WATER RESOURCES MANAGEMENT PROBLEMS IN TANZANIA

Water resources management problems in Tanzania are not unique from those of other countries in the Sub-Saharan Africa. They range from:-

- **Land degradation/soil erosion, deforestation, and mismanagement of wildlife resources,**

- **Unplanned rapid urbanisation and industrialisation;**

- **Pollution in urban and coastal areas;**

- **Poor conservation methods and pricing policies.**

  The absence of price tag for water uses has encouraged inefficient use of the resource this has led to the establishment of small and large irrigation schemes in river basins which the country is heavily dependent on power generation. The "Mtera Crisis" is a vivid example of this grave situation. Studies from the Pangani River Basin have also reviled that the Nyumba ya Mungu water levels are also falling because of excessive water abstractions for irrigation needs upstream of the dam.

- **Inappropriate institutional framework;**

  Too many institutions addressing similar issues with unclear responsibilities

- **Weak inter-sectoral co-ordination and linkages;**

- **Poor co-ordination and collaboration with riparian users on international shared waters;**

- **Poor/absence of data bases, monitoring and feed-back systems.**

- **Lack of enforcement of existing laws and regulations.**

3. HOW THE GOVERNMENT IS ATTEMPTING TO OVERCOME THESE PROBLEMS

3.1 STRENGTHENING OF THE MINISTRY FROM WITHIN

To enable it to better fulfill its role under the Water Policy, the Ministry of Water Energy and Minerals (MWEM), with financial support from the United Nations Development Programme (UNDP) and the Government of Finland, embarked on a strengthening Project to assist MWEM to internally strengthen itself. This was an institution building and an investment planning project aimed at strengthening those parts of the Ministry responsible for Organisation and Human Resources Development, Finance and Management Information Systems, Investment Planning and Project Preparation.

The Project was implemented by MWEM and the outputs were developed within the existing environment and largely using its regular staff actively supported by the International Advisers playing the catalytic role. For co-ordination purposes the Sector Advisory Team (SAT), consisting of representatives from each Division and Unit of the Ministry, the National Project Co-ordinator (NPC) and four expatriate advisers was formed, guided by a Steering Committee comprising the Principal Secretary and the Directors.

This was contrary to the expectations of the supporting agencies who thought that the development of the outputs was to be largely done by the International Advisers and through a core group of Ministry staff be responsible for their installation.

This was found to be inappropriate in an institution that is seeking to build up the capacity to be responsible for managing its own affairs in the future. The mechanisms that were laid down for the project implementation are now beginning to make contributions to the strengthening of the two institutions (MWEM and the National Urban Water Authority (NUWA) and the sector as a whole and this will be the approach in all future initiatives. The project offered a unique opportunity to take the long-term perspective, and increase MWEM's preparedness and capacity to lead and support sector development.

Lessons learned from the project include (a) a flexible and co-operative relationship between supporting ESAs and government (b) a flexible and adaptable approach to meet the changing needs and (c) learning by doing/hands-on-the job through on-the-job training leads to sustainable outputs.

3.2 WATER AND SANITATION SECTOR REVIEW

Indeed the Water and Sanitation Sector Review is timely for Tanzania in order to enable the full assessment of the status of the sector with the objectives of building on and better support a number of the important ongoing sector initiatives, and in particular, **to identify constraints**; plan specific **additional interventions** to facilitate sector progress; **improve information** and information sharing as a basis for future planning and to identify and seek the **commitment of External Support Agencies**, to support specific initiatives. However, it is important to mention here that the Review was, by design, more focused on the delivery side of water supply and sanitation services.

The whole process is fully institutionalised within Tanzania. The Terms of Reference for the review were jointly developed by all those involved in the Water and Sanitation Sector at a preparatory workshop where full consultation with, and the participation/inputs of all local actors including External Support Agencies (EAS's) took place.

The review is being carried out with full-time inter-agency team of national experts with backstopping. The team has been recruited and in place and is receiving backstopping internally and externally. In particular, the Nairobi based UNDP/World bank Regional Water and Sanitation Group has continually offered support in terms of guidance and technical backstopping.

This approach was followed for the purpose of institutionalising the process. Firstly, we will utilise the available human resource and secondly, it will act as training ground and assist in developing the capacity of other Tanzania staff to carry out such reviews in the future. In addition, and more importantly, it will create a sense of ownership of the outputs produced, ensure they are used and be responsible for follow-up.

3.3 WATER RESOURCES ASSESSMENT

To satisfy competing needs (water supply, irrigation, industry, hydropower, recreation, aquaculture etc.) for a better sustainable development there must be a proper balance between demand and availability. The Water and Sanitation Sector Review put more emphasis on the delivery side of Water Supply and Sanitation services rather than looking at it from a more comprehensive Water Resources Management.

Discussions between the World Bank and UNDP saw the need to include in the ongoing Review a Rapid Water Resources Assessment component by more comprehensively addressing the water management and environmental protection aspects. DANIDA had also indicated interest in supporting the Rapid Water Resources Assessment if so requested. This could not be accommodated within the funding levels available for the Water and Sanitation Sector Review. The World Bank and DANIDA have now put in some money to meet the shortfall and enable full assessment to take place. Tanzania has in principle agreed to carry out the assessment basin by basin and that the basin will in the future be the Unit of Study.

An inter-ministerial multi-disciplinary Task Force from the Ministries of Water, Energy and Minerals; Tourism, Natural Resources and Environment; Agriculture, Livestock Development and Co-operatives; Health and from the National Environmental Management Council has been assembled and work has started.

In addition, a Steering Committee of senior people from the stakeholder ministries and institutions has been formed to:- steer and guide the review, review and comment on the reports, ensure co-ordination and integration of sector participation during the review and ensure the sustainability of activities conducted throughout the review.

We are most pleased to observe the major departure by the Bank from the traditional practice of directing actions to that of empowering a national government to do a process and the mutual trust that is building-up between the Bank and the government of Tanzania in terms of accountability and delivery of the outputs.

This is a clear indication that the World Bank is now changing its policies towards building capacities in developing countries. This move is most welcome and we urge other multilateral and bilateral organisations to emulate this example.

CONCLUSION

The need for a comprehensive Water Resources Management Action Plan for Tanzania on a basin by basin approach and an inventory of existing water sources is desperately needed if we are to fully address the water resources management problems. This approach will provide good opportunity to bring together different ministries (as demonstrated by the ongoing rapid water resources assessment study) External Support Agencies and Non-Governmental Organisations to work together and draw up priorities and strategies for managing the water resources in Tanzania. Short of this the economic development will be impeded and adversely affect human health.

To do this it will require heavy investments. We can not afford this and we therefore appeal to the Bank and to the donor community to support Tanzania in this endeavour.

ANNUAL WATER RESOURCES SEMINAR - DECEMBER 7-9, 1993
Farmer Participation in the Irrigation Sector
Talking Notes

I. Introduction - topics to cover
   A. Lead in from Spain
   B. Why should we look at participation in irrigation?
   C. Example - Nepal Irrigation Sector Program
   D. Participation Handbook - Chapter on Irrigation

II. Why We Should Look at Participation in Irrigation
   A. It Works - examples from history
      1. Spain - Valencia since 960 AD
      2. US West - Bureau of Reclamation promoted irrigation districts
      3. Many examples of traditional - Thailand, Bali, Nepal, LAC
   B. It is Bank Policy - new Bank Water Resources Management Policy
      1. Participation of users is specific part of policy
      2. Devolution of services delivery to lower levels
      3. Cost recovery - user pays principle
      4. Board approval - member countries accept in principle
   C. Becoming High Profile Issue - pushed by outside pressure
      1. It is a governance issue - get government out of control
      2. Participation Handbook - from Next Steps for Sr. Management
      3. New USAID Policy - both a means and an end, like a religion
   D. It is Already Happening and Producing Results
      1. Mexico
      2. Nepal
   E. Beneficiaries are Our Best Natural Ally
      1. Most Direct Interest in Success
      2. Most Detailed Knowledge of Local Conditions

III. Example Nepal Irrigation Sector Program - Irrigation Line of Credit
   A. Sector Program Concept - Farmer Managed Irrigation Schemes
      1. Follow Project Cycle - involve users, keep it Nepali
      2. Farmer Participation/Institutions - first priority
      3. Demand Driven - three principles users had to agree to:
         a. Register as a legal Farmer Irrigation Association
         b. Contribute to capital costs, cash earnest money
         c. Take over all O&M
   B. Result - Good Physical Achievements, perhaps best ever in Nepal
   C. Reasons for Success
      1. High Level Policy Support - new regulations
      2. Designed as Project-scale Pilot Project - dominate sector
      3. New generation of leaders and staff responded
      4. Farmer Beneficiaries in Control - mobilized self interest
      5. TA Kept to Minimum - learning by doing, and gap filling
      6. TA closely integrated with investment and managed by Bank
      7. Sector Program designed as a comprehensive package
   D. Lessons Learned
      1. High Level Policy Support Essential
      2. Most Difficult is Government Institutions, not Farmers - system is problem
      3. Bank Procedures Not Well Suited - especially funding flows and procurement
      4. Corruption Kills - participation must be perceived as fair, honest, effective

IV. Common Threads
   A. Participation is Part of Improving Governance and Vice Versa
   B. Need Less Government Control, More Beneficiary Control

THE WORLD BANK

SEMINAR ON WATER RESOURCES MANAGEMENT

Richmond, Va - December 1993

Stakeholder participation in the formulation of strategies and water policy. The Spanish Experience

by

José Maria Martín Mendiluce

and

Ricardo Segura Graíño

Stakeholder Participation in the Formulation of Strategies and Water Policy - The Spanish Experience.

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STAKEHOLDER PARTICIPATION IN THE FORMULATION OF STRATEGIES AND WATER POLICY - THE SPANISH EXPERIENCE

By Dr. José María Martín Mendiluce (1)
and Dr. Ricardo Segura Graíño (2)

1. HISTORICAL BACKGROUND

Spain has a long tradition in water management because of the semi-arid condition of the country and the irregular flow of its rivers, that allows us to properly qualify them as "torrents".

As a consequence, water administration and management have played a very important role in the country's development.

The first written orders for water use date from XII century. The Code of Water from King Jaime (XIII century) regulates the irrigation of Valencia lands conquered to Arabs. It also establishes some principles that still remain valid:

- Water cannot be a private property; it belongs to the irrigated land and therefore, when the land owner leaves or sells the property, the right to use the water has to be transferred with the land.

- The administration of the water is the user's task. The Organisms or Authorities to administrate it have to be established by popular election. The State's task consists only of protecting these democratic organisms from outside interferences.

- When for efficiency, technical activities have to be protected by a legal disposition, the latter will not be valid if it does not represent the majority's opinion. As

1 President of Spanish National Committee on Irrigation and Drainage and Hon. Vice-President of ICID.

2 Deputy Director General for Hydrological Planning. General Directorate for Hydraulic Works, Ministry of Public Works,

water is the axis of economic development and public welfare, the right to use it has to be conditioned by everybody's claim, in a pure democratic tradition.

The second principle reflects the existence of known irrigation associations (Comunidades de Regantes) that with the help of their Governments and Juries, have administrated the use of water in peace and with justice during hundreds of years.

During more than one thousand years (since 960), a Jury (Tribunal de las Aguas) integrated by irrigators elected as Judges by the user's of every canal of Turia river (Valencia) met every thursday at noon at the door of the cathedral, to solve the quarrels (disputes) in irrigation arised in this area, and to sentence the violations (infringements) according to the ordinances (statutes or by-laws) valid from the origin; sentences are firm, and during the long history of this organization did not happen any case of disobedience, nor any appeal (recourse) to State's organizations of higher competence.

The first Water Act, redacted in 1879, keeps those traditional and basic principles and its long life is due, on one hand, to the deep sociological roots that this Law offers since the moment it legalizes many living rights settled in the National juridical conscience; and on the other hand to the fact that the law adopted a system of general and broad character rules. The Water Law was more Administrative than Institutional. Other than establishing the State's Administrative role in water development, the intention of the legislator was mainly identifying real situations and regulating them with a series of rules so they could be legal.

The basic concepts of the first Water Act (1879) are the following:

- All surface waters are public (eg. river channels, banks, etc.). All underground waters in private lands and surface waters born in private properties are private always that they do not affect public or private waters in their natural flows.

- The use of public water is a State's administrative concesion. To own underground waters it is necessary to prove that nobody is going to be prejudiced nor there exists third person's rights or public water flows.

- All concesions granted at request by the Ministry of Public Works, are decided by keeping an order of priorities. These priorities are established by the law. And in case of having several requests of the same category, preference shall be given to those which are considered more useful from a "public" or general point of view. In the concesion should appear the quantity fixed of flow granted, with the commitment of making no alteration of physical, chymical and biological conditions of water in waste discharges.

- At every moment, the State has the control of water use, river beds, banks, etc, as well as its administration. The concessions may be reviewed when there is an abuse of rights in the use of water, a waste water missuse or a deterioration of water quality. And violations can be penalized (eg. temporal or definitive suspension of the concession previously granted).

- Water users from the same river intake must form part of a Users Association (comunidad). These associations are responsible and in charge, by the State's delegation, of administrating the water withdrawals, in an authonomous regimen. The activities of these associations must be in accordance to particular by-laws aproved by users in General Assambly and afterwards by State's Administration.

The last concept, is to preserve the Irrigation Associations recognizing their efficiency and usefulness during hundreds of years.

Therefore, during the following period, the Water Irrigation Associations (Comunidades de Regantes) performed the task of administrating the water of the State's concessions, being the State's activity only that of water control at the intake.

At the end of 19th century and the beginning of the 20th century a new strategy of water use is applied in Spain because of the need of a much more active action of State on water development. When Spain lost its colonies, it faced a Hydraulic Water Policy to develop our own resources and create wealth in the metropolis. A good irrigation was one of the solutions for the country's development.

Irrigation achievements were very acceptable during the history since, up to that time, private initiatives got more than one million hectares just taking advantage of the natural and more permanent flows and using the closest lands to the river banks.

Despite of this, it was necessary to create "new water" by regulation and "new rivers" by building big canals in order to promote new irrigation development with similar conditions to the historic ones. That's why in 1902, the National Plan of Canals and Reservoirs was approved to settle the framework in which the State's management could action the water development. Since the Water Law did not include any regulation for financing water projects, it was necessary to put into action a new law (7th July 1911) on construction of hydraulic works and subsidies for irrigation.

With these two legal means, the development of water resources was newly impulsed through the State's budget which was necessary for the construction of major hydraulic works.

After some years of experience, the Government realized that Institutional Organizations did not fit the new objectives since the control of water concessions exceeded the State's activity. Therefore it was needed to accomplish a new important task: namely water planning.

To this purpose, three solutions were considered:

- To maintain the traditional task of Water Users Associations: that of water administration from their intakes and create new State organisms for the rest of the needed functions.

- To assign all the functions of water management to the Water Users Associations.

- To create a mixed system integrated by State and Users, to assume all the water management functions.

The last solution was adopted therefore creating in 1926 the Drainage Basin Authorities known as "Confederaciones Hidrográficas" with four basic concepts:

- Functional unity of water management.

- The basin as a unit for water planning and management, in order to achieve the regional economic and social development.

- To incorporate water users to the general water management, not only in water administration of their withdrawals, but also having a proper representation in the Authority Board to control investments and to promote proper planning.

- To decentralize competences being delegated to the organism by the Central Government.

These concepts, despite the time elapsed, are still in force.

The Confederations were created to involve the users (Stakeholders) in the planning, construction and management of water resources, with the very positive result of a better estimation of water schemes.

One of the prioriary tasks was the river regulation to guarantee irrigation demands. The irrigation area was developed during the "private period" much further than natural flows would reasonably allow.

This structure stays in force until 1985, date in which a New Water Act was issued. In this Water Act the "Confederaciones" remain as one of the basic Institutions of the New Organization and the role of the Water Users Associations is strengthened following the milenial tradition of "Comunidades de Regantes".

Spain has been the pioneer of this type of Basin Authorities Organizations ("Confederaciones") created in 1926. Some other countries have imitated us: U.S.A. with Tennessee Valley Authority; France with the "Agences du Basin"; Great Britain with the Basin Authorities and so on. This shows how the Spanish experience has been useful to the rest of the world.

For those interested in having a deeper look at Spanish historical background regarding legal and institutional aspects of water planning, appendix nº 1 contains one article published in the magazine of Civil Engineering (Cataluña, Valencia, Extremadura and Baleares) under the general title of "Spain and Water II" -1989.

2. PRESENT SPANISH WATER MANAGEMENT AND PLANNING OF HYDRAULIC RESOURCES

The most important innovations of the 1985 Water Act with regard to the 1879 Water Act are the following:

- It legally recognizes water as a single renewed resource through the hydrological cycle, declaring therefore all kind of waters (specifically underground water) as a public property.

- It includes Hydrological Planning as an essential tool for future activities and management of the water-field.

The new Organization introduced by the Water Act (1985) makes the water process to be as follows:

GOVERNMENT
▲
▼
MINSITRY OF PUBLIC WORKS ⟷ NATIONAL WATER BOARD
▲
▼
DRAINAGE BASIN AUTHORITIES

Stakeholders are in the Drainage Basin Authorities at the lowest "working level" and in the National Water Board at the highest advisory level.

In Appendix nº 2 it is enclosed a very complete report on the Present Spanish Water Management and Planning of Hydraulic Resources, prepared by Dr. Carlos Escartin Hernández, Director of the Center for Hydrographical Studies -CEDEX-MOPT.

In appendix nº 3, we also include a copy of the Water Act dated August 2nd 1985, for general information.

3. THE NATIONAL HYDROLOGICAL PLAN

Spain has a long and broad experience in water planning. In appendix 1, we can contemplate historical references and principles that have been used for the proposals in general Master Plans.

Appendix 4 encloses a survey presented in the XIV European Regional Conference of ICID -La Manga (Murcia)- Spain 1986, entitled "Inter-Basin Transfers: A Not Easy Task", that refers to the legal aspects and difficulties found in the process.

According to these experiences the Water Act (1985) establishes water planning at two levels: Regional and National.

Regional level of water planning which has to be developed by Drainage Basin Authorities (Confederaciones), will provide for the goals for the future of the people living in the region.

Taking the country as a unit, National level of water planning, which has to be developed by Central Government, will adjust regional planning and suggest the changes needed and the inter-basin water transfers to cover future demands.

In Appendix nº. 5, Dr. Ricardo Segura summarizes the main features and aims of the Spanish National Hydrological Plan.

Appendix nº. 6 encloses the report presented at the XV ICID Congress -The Hague - September 1993 to the Special Round Table, on the Mediterranean Charter for Water. This report gives a detailed view of the present situation of the National Hydrological Plan, now at the National Water Board, for report.

In this National Hydrological Plan, stakeholders have an active participation, firstly through their direct opinion in the correspondent Basin Hydrological Plan and finally through their representative's opinion in the National Water Board.

4. FINAL COMMENTS

Stakeholders or water users have been along the history one of the main piers of water development in Spain. They define with a long, well done historic task, the proper way to administrate public water by delegation of the State.

From 1926 they also intervene through the Basin Authorities (Confederaciones) in Water Management and Planning, and in legal improvements.

With the new Water Act (1985) their presence has recently been strengthened, reaching the maximum level through the National Water Board.

I conclude therefore emphasizing the efficient role of Stakeholders in Water Resources Development.

Madrid, December 1993

INTERNATIONAL RIVER BASIN ORGANIZATIONS IN SUB-SAHARAN AFRICA

A PERFORMANCE PERSPECTIVE

Presentation Note for Water Resources Management Seminar
Richmond VA, December 7-9, 1993

1. Background

1.1 In the Water Resources Management Policy Paper, the Bank makes two important statements relating to River Basin Organizations (RBOs), namely the Bank:

- will play a more proactive role in helping countries improve the management of shared international waters

- is ready, through technical, financial and legal assistance, to help governments strengthen institutions, such as RBOs, to address transnational water management affairs.

1.2 As part of its program to implement its new policies, the Bank is undertaking a range of actions including the preparation of regional policy papers, guidelines and papers on best practices, institution building and strategy formulation. It is in this context that the Africa Region has embarked on a review of the functions, performance and future perspective of RBOs.

1.3 It is intended that this performance study of RBOs will form one of the building blocks of the water strategy paper now in course of preparation by the Africa Region and at the same time it is hoped it will prove useful in operational work both within the Bank and among ESAs in general.

2. RBOs visited by the Bank Mission

2.1 The following RBOs and related regional organizations were briefly visited by the mission.

West Africa:

- Lake Chad Basin Commission, Ndjamena - LCBC
- Niger Basin Authority, Niamey - NBA
- Organization pour la Mise en Valeur du Fleuve Senegal, Dakar - OMVS
- Organization pour la Mise en Valeur du Fleuve Gambie, Dakar - OMVG

Central Africa:

- Kagera Basin Organization, Kigali - KBO
- Energie des Grands Lacs, Bujumbura - EGL and its parent organization Communauté Economique des pays des Grands Lacs- CEPGL

Southern Africa:

- SADC-ZACPLAN (Zambezi Action Plan) co-ordinating unit at ZESCO (the Zambia Electricity Supply Commission), Lusaka - SADC/ZACPLAN unit.

- Lesotho Highlands Development Authority, Maseru - LHDA
- Zambezi River Authority, Lusaka - ZRA
- Department of Water Affairs, Pretoria - DWA

3. **The Water Development Potentials**

3.1 All 41 countries in continental sub-Saharan Africa share the resources of international rivers and therefore the development of surface waters depends essentially on international collaboration.

3.2 Development has hitherto focused largely on hydro-electric power but, now, in southern Africa emphasis is moving towards multi-purpose projects for domestic, industrial and irrigation supplies. An Exception to this generalization is the Sudan, where irrigation has always been the priority need.

3.3 The surface waters of sub-Sahara Africa, taken as a whole, are remarkably undeveloped. Of a total power potential of some 300,000 MW., no more than about 5 per cent has been harnessed. Of the irrigation potential amounting to about 20 million hectares, only about 5 million hectares has been developed and over one third of that is in one country, the Sudan.

4. Main Characteristic of Sub-Saharan African Rivers

4.1 The major rivers have six general characteristics that influence their mode of development and have an impact on international collaboration:

i) Concentration of run-off is largely limited to mountainous and highland areas. Downstream users, often in dry climates, are thus very dependant on the actions of upstream riparians. An exception to this generalization is the humid zone of West Africa in and around the Zaire basin.

ii) The seasonal and annual river flows are subject to wide variations. Over this century, the 7 year moving average has varied by a ratio of as much as 2:1. Year to year variations in the flow of perennial rivers is in the range 3.5:1 to 10:1. These wide variations call for large storage reservoirs.

iii) Perennial water courses that form the main stems and some tributaries are very widely spaced. This imposes limitations on the extensive use of surface waters for domestic and industrial purposes. On the other hand, given large reservoir storage, the rivers can provide good poles of production for hydro-electric power.

iv) Surface waters are generally of good quality with low mineralization. Biological pollution is often high yet, essentially local.

v) With the notable exception of the alluvial plains of the Nile basin and the inland delta of the Niger, there are no extensive entities of irrigable land that are commendable from the rivers, as found in Asia. The irrigation potential, at 20 million hectares, is therefore modest and should be exploited with care.

vi) With the paucity, of good perennial tributaries, the best opportunities for water resource development generally lie along the main stems of the large rivers. Such development is lumpy and often beyond the resources of a single state. There is a need for international collaboration in project implementation, to share the "costs" of common "works".

5. The several forms of River Basin Organization and their various objectives

5.1 There are three broad categories of organizations dealing exclusively or partly with international water affairs:

- Those focussed on the development of water resources within defined river basins or part thereof. (LHDA, OMVS, OMVG, ZRA, Komati Basin and NBA)
- Those covering water and a range of other activities such as agriculture, energy, transport, fisheries and forestry (LCBC, KBO, EGL)
- Overarching organizations whose mandate includes water resource development and other activities throughout its member states (SADC and, to a lesser extent, CEPGL - which is the parent of EGL)

6. General Objectives and Past Performance

6.1 The all embracing objective of the several RBOs reviewed by the Mission is:

to promote studies and the construction of works that will lead to an integrated, economically sustainable and technically sound development of the water resources of a river basin.

As part of that role, some RBOs have a mandate to develop formulae for the equitable sharing of waters.

6.2 The performance of RBOs varies widely from almost complete failure to success. In the past the main elements for successful performance have been:

- real need for development with an emphasis on socio-economic benefits rather than on political aspirations
- well focused and technically sound objectives
- strong commitment by member states
- few country members
- emphasis on construction work rather than on planning
- active support form ESAs.

6.3 In most cases, with the notable exception of Kariba dam project on the Zambezi, it is too early to enter into any serious evaluation of benefits. For major investments such as those of the OMVS it will be many years before the overall regional impact can be judged.

The report prepared by the Mission discusses the above elements of past successes. Perhaps the most important observation is that emphasis on construction has led to commendable achievements in the implementation stages of major projects (as with OMVS dams, Kariba dam and the current phase of the LHDA) and this is partly attributable to the narrow and specific objectives characterized by a construction program. By contrast, planning involves a series of political decisions which are often unduly influenced by national interests rather than on objective consideration of the real benefits the project will generate.

6.4 Among the least successful RBOs, when viewed against the general objective stated above are the NBA, LCBC and OMVG. They have few tangible achievements to show for the efforts that have gone into these organizations over the last 10-20 years.

7. A Future Perspective

7.1 In the first few decades the objectives in the development of international rivers in Africa have been multi-purpose in the northern and southern regions and predominantly for hydro-electric power in the central regions. This trend is likely to continue but with a growing emphasis on domestic industrial and irrigation water in southern Africa. Navigation has never assumed much economic or commercial importance, except in limited situations such as the lower Niger and Zaire rivers, and is unlikely to do so.

7.2 Rapid demographic growth, poor land resources, unfavorable climatic conditions and a paucity of financial resources lead to a fragile environment in much of Africa. Environmental factors have been given prominence in the mandates of most RBOs but have often not come to the forefront having been subsumed in the general lack of progress. However, there is now a general recognition of the need for a more thorough treatment of the environmental factors (OMVS, LHDA).

7.3 The Long Term Perspective Study (LPTS) for sub-Saharan Africa carried out by the World Bank in 1989 put forward an ambitious target growth rate for agriculture of 4 to 5 per cent a year - twice what has ever been sustained in the past. The LPTS rightly stressed the need to create the right enabling environment which, among other things, demands institutional building and human resource development on an unprecedented scale. The mission, in its report, has referred to several important weaknesses in the enabling environment in which RBOs have to operate.

7.4 The ultimate objective of any RBO must be directed to the development of a specific potential to meet clearly identified needs. Wide, ambitious mandates, extending across non-water related sectors and into areas outside the river basins concerned should be avoided. Over diversification has led to dilution of effort and confused programs.

7.5 RBOs should concentrate as much as possible on projects of regional interest. They do not have any visible comparative advantage to pursue national projects.

7.6 The structure of RBOs varies considerably according to their mandate and financing arrangements. For example for the construction of "common works" a single executing agency is the preferred solution (OMVS, OMVG and ZRA). Where the works are owned by the country in which they are sited, even if jointly financed, a single executing agency is again appropriate (KOMATI). However where each riparian owns and finances the works situated on its territory it is logical to create one executing agency for each riparian state (LHDA).

7.7 Although in most cases the general structure of governance of RBOs is satisfactory, there are several instances where it is not put to good use owing to a lack of commitment by member states and a failure to provide financial support.

8. Recommendations

8.1 The report of the Mission presents a number of general and specific recommendations of which the following are the most salient:

8.2 Since most of the reliable surface water resources of sub-Saharan Africa occur in international rivers there is a strong case for ESAs to continue to give support to RBOs. There is however a case for ESAs to be more proactive and persuade decision makers that RBOs must focus on real needs and limited objectives which can be implemented within a reasonable time frame. Without clearer focus the present climate for donor fatigue is likely to persist.

8.3 The type of support required from ESAs varies widely. For individual RBOs the supporting requirements may be summarized as follows:

LHDA	-	environmental studies
OMVS	-	continued support for management studies, strategic planning and better use of the "common works" as now built
OMVG	-	planning
ZRA	-	capacity building and, ultimately, capital funding
NBA	-	complete in depth diagnostic evaluation
LCBC	-	review of mandate
	-	technical assistance
	-	human resource development in planning
KBO	-	review of objectives
	-	relative role of EGL
EGL	-	examination of its possible role as a river basin planning organization
SADC	-	continued support in its current and proposed activities in water affairs.

8.4 There is a general need for RBOs to build up planning capacity but at the same time avoiding the creation of a large bureaucracy for a function that does not offer long term employment for more than a few personnel.

8.5 Finally it is recommended that a better mechanism is established for collaboration between the ESAs involved in supporting RBOs. A concerted effort should be made to address some of the issues raised in the report in a practical manner, particularly in respect of some of the weak RBOs and those that have lost direction through an array of political considerations.

Objectives of 1981 Water Code

- Efficient allocation and use of water resources through a system of transferable water rights
- Facilitate development of hydroelectric generation through the introduction of non-consumptive water rights
- Reduce the role of government in water resources management
- Guiding Principles
  - Private property rights
  - Use of market mechanisms to more efficiently allocate water resources

Impact of 1981 Water Code

- Recognition of water rights led to increased private investment in irrigation
- Economic efficiency objective has not been met due to a lack of incentives to trade water rights
  - No economic costs for hoarding water rights
  - No discretion among marginal benefits of water usage
  - Water measured in percentages, not absolute amounts, thus subject to change
- Emerging conflicts between consumptive and non-consumptive rights holders
- Negative distribution effect
  - Those with understanding and financial means (i.e., the middle class) attained most of the government issued water rights
- Legal framework of 1981 Water Code does not address water pollution issues
  - No incentives not to pollute

Proposed Reforms

I. Amendments to the 1981 Water Code
- Economic efficiency
  - Introduction of a sunset clause on water rights not used within 5 years
  - Imposition of tax (licence fee) on water rights
- Intersectoral Coordination
  - e.g., between consumptive and non-consumptive users
- Environmental issues
- Creation of a river basin administration authority
  - Comprised of public and private sector
  - Self-financing
  - Set penalties for polluters

II. Ongoing efforts by the Ministry of Public Works
- Consolidation of water rights registry

WATER RESOURCES MANAGEMENT IN CHILE: RECENT INNOVATIONS

World Bank Support

√Bank support to be provided in the context of preparation of the Water Resources Management Project (FY95 or 96)

- Project Objectives
  - Creation of river basin management in the Bío Bío river basin
  - Water pollution control and improvement of water resources use in this same river basin

- Preparation Phase
  - Managing Japan Grant TA program to:
    a. Define the functions of the Bío Bío River Basin Authority
    b. Define its corporate structure
    c. Define its financing policy
  - Establishing a consultation and coordination mechanism for principal stakeholders in the Bío Bío river basin

- Items to be financed under the Bank project:
  - TA program to support the early years of the operation of Bío Bío River Basin Authority
  - Investments to address externalities that cannot be dealt with adequately by the private sector, e.g., pollution control, river training, flood control, water shed rehabilitation and conservation

Collaboration, Participation, and Alternative

Dispute Resolution (ADR):

Process Concepts for the Bank's Role in Water Resources

by

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Abstract

Water resources management is becoming more important to development. Seven reasons are offered for why water resources management will increasingly depend on integrative bargaining and procedures such as dispute resolution, participation, and collaboration. Many process interventions have been effective in international affairs generally and in water affairs internationally and within countries. Through a variety of means, the Bank has been an effective intervener in international inland waters. Five reasons are offered for why it has a comparative advantage as an intervener. A continuum of procedures and techniques is reviewed in light of international and national water management. Within countries, Bank-sponsored popular participation has enhanced project performance. Little participation has been sponsored at intersectoral and jurisdictional levels, and more should be encouraged. Several suggestions are offered for policy on international inland waters, within-country assessments, and management of projects and for research support.

I. BACKGROUND

The need for public participation and conflict management procedures was frequently mentioned in the Bank's June International Workshop. Many reviews of the subsequent draft policy papers reaffirmed these needs, especially regarding nongovernmental (NGO) roles, environmental assessments, capacity-building, intersectoral allocation, and international inland waters.

This background paper summarizes some concepts from the fields of alternative dispute resolution (ADR) and public participation and suggests how they could apply to the Bank's water policy. The paper focuses on what are often called "process" techniques, with special attention to water resources, environmental, and development issues. These techniques are related to each of the four themes of the water policy paper, particularly to institutions and organizations and international inland waters, and to internal bank organizations.

The ADR field has emerged in the United States and other industrialized countries from attempts to find alternatives to expensive litigation, adversarial or highly expensive means for resolving disputes. ADR has been driven by traditional fields of labor management negotiations, contract settlements, and most recently environmental and resources conflicts. Public participation has emerged from concerns about open access to government and empowerment of people. Each of these fields advocates similar process procedures and thus can be included under the general rubric of integrative bargaining or collaboration.

II. REASONS FOR PROCESS TECHNIQUES AND PROCEDURES

Changing Context of Governance

The world is changing. A renewed democratic spirit and a new ecological awareness are two of the principle forces driving change. This democratic spirit is calling us to new notions of individual freedom, transparency and accountability in decisions. The new ecological awareness reminds us of a collective responsibility and leads us to notions of holistic and comprehensive systems. With its long-term focus and its calls to include stakeholders in decision-making, sustainability has become a venue for this dialogue. Building the physical water infrastructure in a collaborative and participatory way is now an important means for building the civic infrastructure or what the Bank has called the governance environment. Water resource management, with its current debates over markets, pricing, planning, participation, and environmental assessment, is a meeting ground for these forces.

Expanding of Issues and of Stakeholder Number and Asymmetry

Water management must now integrate new ecological values and criteria of sustainability. Both require more information which, in turn, highlights additional new risk and uncertainty. Both require professionals to compare among incommensurable values and other values that are difficult to quantify. More explicit understanding of risk requires an active choosing of, rather than passive reacting to, risk by beneficiaries. All of this will push water resource professionals beyond traditional methodologies and into process considerations.

More voices with competing views of the future must be involved in water development. While the distribution of power among these parties is asymmetrical, the power to stop or delay is diffusing faster than incentives to create and cooperate. New ways to prioritize investments and manage conflicts among competing interests will be needed.

An inertia toward negative and reactive attitudes must be countered with incentives for positive and creative development and with ways to foster ownership of interested and impacted parties both in the plans and in the process of generating those plans.

Impact assessments are crucial for both informed technical and good moral decisions. To the best of our ability, we must know the consequences of our actions. However, we must move beyond being paralyzed by our understanding of such consequences. Process techniques and procedures offer a route out of paralysis toward action.

Growing Gap Between Development Needs and Available Capital

While the industrialized world debates reallocation and reapportionment within existing water systems, many in the world have little or nothing to reapportion and need new systems. At the same time capital is short. So doing more with less means, in part, being more efficient. But being more efficient confronts us with issues of distributive equity and fairness. In recent years, water managers have moved beyond the traditional structural interventions into natural systems to management of social systems and now biological systems as means for water management. Thus, cost-recovery and project performance will become even more important. Already Bank evaluations at the project level show how participatory processes can be effective in meeting these challenges.[1]

Creative alternatives and new public/private partnerships must be found to develop and allocate water use. Without strategic management of allocation, the transaction costs of managing water can escalate to unacceptable levels. Indeed, resource scarcity, whether perceived or real, can lead to violence and political authoritarianism.[2] Without operating agreements between and within nations and among users, the opportunity costs in lost economic benefits, poverty reduction, and public health could escalate to the point of social stagnation. We must begin to reinterpret our awareness of water interdependence as an opportunity to create cooperation rather than as inevitable zero-sum competition.

A key to such reinterpretation is in the way--or the processes--by which we anticipate and manage the competing and conflicting demands for the resource. Water resource development is becoming more dependent on integrative bargaining, agreement building, participation, collaborating, and using fair processes for managing conflict. To this extent, the Bank has a stake in integrative bargaining, especially in the international system, where incentives for pro-active collaboration are often weak.

Growing Water Interdependence with Weak Compliance and Incentive Systems

Water policy reviews in the Bank have been documenting how water use, its allocation and reallocation, are likely to drive development strategies. Water is central to poverty alleviation through food production and infrastructure development. A recent Norwegian report on international environmental conflict resolution (IEC) notes that "Most current IEC's are related to international rivers."[3]

As population and urbanization accentuate conflicting demands for the same resource--water--our interdependence becomes more evident. Everywhere the call for better water pricing and readjustment of agricultural subsidies is heard. But the question is how?" The reality is that agreements on agricultural prices, as shown in GATT and the EC, are difficult if not impossible to reach. Thus, it is hard to see how food security interests, to say nothing of national ideological interest, will be met.

Most of the world's largest rivers are international, and with the formation of the Confederation of Independent States the number is growing. For example, the Volga River is now international, and the Aral Sea borders on at least four states.[4] Old United Nations data states that there are over 200 river basins shared by two or more countries.[5] The Amazon basin is shared by seven nations, the Danube by more than eight, both the Niger and the Nile by more than seven, the Rhine by seven, the Zaire by nine, and the Zambezi by six nations. Almost 40 percent of the world's population lives in river basins shared by two or more countries. This area comprises about 50 percent of the land mass of our planet.[6] In the Middle East, two thirds of Arabic-speaking people depend on transboundary waters which flow from non-Arabic areas.[7] Since the structure of international compliance to water quality, environment, and other supply issues is weak, interdependence will have to be served through incentives. As the recent Oslo report states, international financial institutions with financial leverage will become critical to encouraging and leading new incentives.[8]

Current water use in several of the shared basins is generating demands that either already exceed available supply or soon will. Some of the most pronounced deficits are likely to occur in regions already ripe for high-intensity conflict, and with rivers of high flow variations, such as in the Middle East.[9] Other projected deficits are likely to occur in areas already prone to famine. Projected deficits in arid regions of the United States, despite its comparative wealth, are already causing significant political realignments.

<u>Growing Discontinuity Between Traditional Institutions and New Realities</u>

In recognition of growing interdependence, 286 international treaties concerning water were signed by 1970. By 1986 there were 324. While the rate of agreements increases, roughly two-thirds of these treaties relate to river basins in Europe and North America.[10] Few exist in the developing world, where the need is rapidly growing.[11] For example, Europe, with 48 river basins, has 175 water-related treaties, while Africa, with 34 river basins, has 34 treaties.[12] More important, most are bilateral rather than multilateral and single purpose rather than multipurpose. For example, of 18 agreements on the Danube since 1948, all but one has been bilateral.[13]

Navigation and hydropower production were the most frequent earlier purposes of treaties, while multipurpose use and environmental aspects have now become more prominent. Flood control management is a major objective in about 25 treaties. Most of the treaties relate to planning or preliminary surveys, while those relating to construction and joint operation are far fewer. Few relate to groundwater or water quality. Also, few treaties use a basin-wide approach, and most relate to specific sections of the rivers.[14] However, current agreements are beginning to reflect an interest in a comprehensive view of uses: basin-wide management, multi-sectoral development, and water quality control.[15]

Changing demographics are demanding new priorities and flexibility in water use and are straining the capacity of traditional water institutions. Almost 15 percent of the Bank's portfolio is water related, leading to overlapping secto jurisdictions within the Bank and overlapping geograp jurisdictions outside. Beyond the Bank, institutional means to achieve environmental health and development seem inadequate. In the end, no matter what organization is created, discontinuities will require more managed flexibility.

Developing of Water Resources Management as a Means to Broad Agreements

Because many of the world's rivers are regional, not global, because their related social interdependencies are so tangible and so clearly shared, and because they have such a rich history of interdependence, management of these rivers offers opportunities for cooperation built on technical needs, which could produce further positive political, social, and economic cooperation.

While often criticized as either geographical determinism or naive neo-functionalism, water resources have helped and continue to help integrate social/political groups. The earliest U.S. Supreme Court decisions establishing federal power concerned water navigation. European rivers such as Rhine, Rhone, and Danube have been steadily moving from functional agreements around water to more administrative integration. In the midst of land grabs and war, two African nations, through mediation, recently discovered shared interest in irrigation and hydroelectric power. They signed a joint non-aggression pact and teamed up to gain international financing for a water development project.[16] Although commentators like to focus on water potential to ignite Middle East conflict, it is currently one of the few areas serving as a means for parties to talk. Senior technical/administrative water officials share a technical language that can be a powerful base for communication. In addition, at some level almost all cultures recognize the sanctity of water. Water as cleanser and healer is one of the paramount metaphors of human experience. Water has a deep, almost promoridal significance and immense potential symbolic power to move people.

Changing Ethical Basis of Professionalism

The ethical basis of professionalism is moving from a traditional paternalism to a newer notion of informed consent. Throughout societies, the very meaning of professionalism is changing. Patients no longer say "Cure me"; they participate with doctors in their own diagnosis and treatment. Clergy may no longer maintain strict distinctions between the "lay" and "religious" and may no longer consider themselves the sole salvation mediators between heaven and earth. Lawyers can no longer neglect alternatives to litigation or avoid linking their individual actions to the overall state of social justice. Water professionals should not be surprised when impacted groups and beneficiaries of their works demand rights in influencing project design and locations.

Professionalism includes not only the final goods and services provided, but also the means employed to deliver those goods and services. The means by which the goods and services are delivered establish a relationship with client and partners. Process procedures are means to help professional engineers cope with these changing demands emanating from a new understanding of professionalism throughout society.

III. GOING BEYOND ZERO-SUM AND DISTRIBUTIVE BARGAINING TO INTEGRATIVE BARGAINING

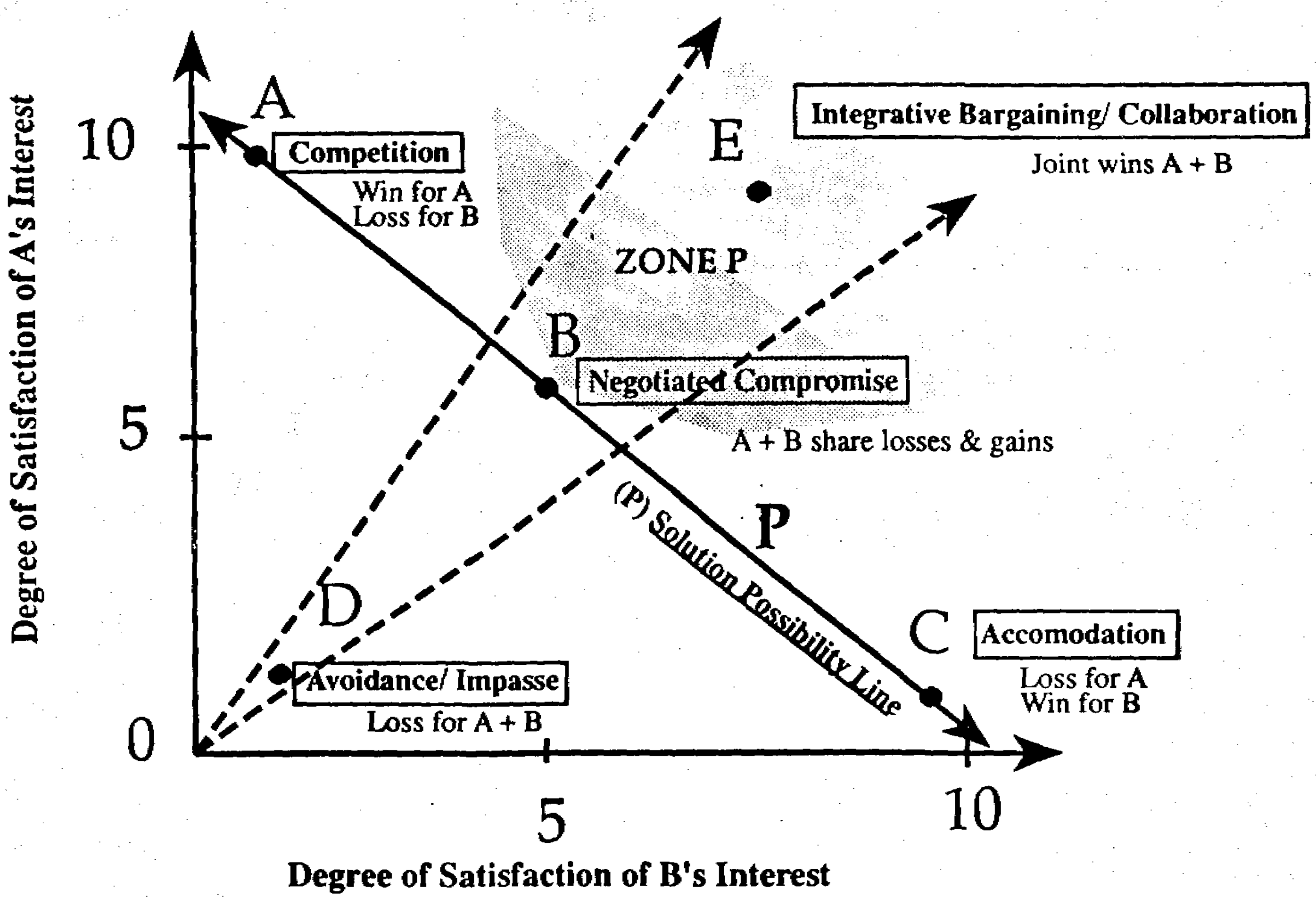
Integrative bargaining can be contrasted with positional or zero-sum approaches. It depends on identifying values and interests that underlie positions; using these interests as building blocks for durable agreements; diagnosing the causes of conflict and designing processes appropriate to these causes, and; focusing on procedural and psychological as well as substantive satisfaction of parties.

Figure 1 outlines a simple two-party dispute with various strategies and outcomes from Party A's perspective. Frequently, we view negotiating as movement along Line P which, using indifference curve analogy, could be called the solution possibility curve. Point B is a caricature of the negotiated compromise where parties share equally in losses and gains--we split the pie. Point A represents a competitive win for Party A, and point C, an accommodating loss. If no agreement or conclusion is reached, then we often find ourselves inside P at a point D, due either to avoidance or to impasse.

Interestingly, Point D is the situation in a variety of river basins needing water investments. For example, the Bank is examining the funding of Karnali Dam in Nepal, and an argument can be made that no appreciable harm will result to Bangladesh. However, if the Bank does not encourage involvement of Bangladesh, what will this do to possibilities for broader system-wide negotiations on the river?

Middle East competition has failed to deliver benefits to any of the parties and has alternatively resulted in avoidance and impasse. As an external actor with significant influence, it is tempting for an individual country to try to bring the Bank into a Point D situation so as to create benefit for one party while avoiding direct bargaining. As LeMarquand shows in Senegal, the Bank avoided such a situation, while other donors did not. German and French donors, by supporting separate pieces of the project, fostered a point B compromise in which the sharing of economic costs might be vastly outweighing gains.[17]

Figure 1. Strategies and Outcomes of Two Party (A & B) Disputes*



* Derived from concepts presented by Kenneth Thomas in "Conflict and Conflict Management," in the Handbook of Industrial and Organizational Psychology - Marvin C. Dunnett, Editor, Rand-McNally, Chicago, Illinois, 1976.

Frequently, technical professionals prematurely define solution possibility curve P, albeit for noble reasons. Too early a use of deterministic analysis can have the effect of using our expertise to "kill off" rather than create options. Point E, in Zone P, goes beyond the traditional possibility curve. Getting to point P usually requires some form of integrative bargaining and often the use of external assistance.

This zone is built on the assumptions that dispute management can be creative,[18] that negotiations are a social learning process,[19] and the rational is a necessary but not sufficient condition--we seek a reasonable and acceptable outcome. At this point, solutions emerge that were not dreamed of by any one party. When this happens, it is clear that the process of dialogue is adding significant value to the situation.

The water field can point to a variety of Point E outcomes and examples are growing. The Indus and the Columbia River treaties are instructive early international water resources examples. Using Krutilla's data, Rogers observes how the Columbia treaty, by rejecting an originally proposed Pareto optimal solution, has forgone significant benefits.[20] Mehta and others note the economic benefits from the Indus were suboptimal by some economic rationality.[21] However, in both cases the economic and other costs of no agreement--or, in planning terms, the expected cost of the no agreement--clearly outweighed benefits forgone in a suboptimal economic solution. Evaluators of both cases see the experience of negotiating and living with the treaties as contributing to more positive relationships within which to carry out water development, clearly indicating social learning. In both cases original optimal based solutions were rejected, and creative new options emerged.

Fisher and Ury call this the Best Alternative to Negotiated Agreement, or BATNA.[22] In many ways it parallels the economist's notion of opportunity costs. For example, using the Pareto improvement method, Rodgers calculates that over $2 billion of benefits have been forgiven in the Ganges-Brahmaputra without an agreement.[23] Creating incentives for parties to explicitly discuss their BATNA requires conscious design and frequently, but not always, the help of a neutral party.

Last year's interprovincial water allocation agreement in Pakistan is an example of how this notion can be applied within a country to break through traditional competitive behavior patterns, which were resulting in poor allocation. This process asked provinces to look at their individual costs with no allocation agreement. The provinces thus examined their crop loss due to uncertainty of incremental game playing and compared this against the assured production due to certainty of yearly allocation.

The point is that the most technically rational or perfect solution is not always the one that the parties find most acceptable or feasible to implement. Obviously the reasonable solution should not require a compromise of ethical or legal standards, but the degree of purity of a solution should be weighed against the desirability of agreement and the long-term impacts of a stalemate.

There are multiple satisfactory and genuinely elegant solutions to most problems. Managing conflicts and resolving disputes is not always a zero-sum game or a question of slicing up and allocating a limited pie. Obviously, slicing the pie and zero-sum gaming are present in many disputes. However, this need not be the dominant approach. Integrative bargaining seeks to create a whole, or solution, greater than the sum of its parts. It tries to create the environment in which synergy and creativity prosper. It can often result in settlements much more creative than merely slicing up and dividing a limited pie.

a. Diagnosing Causes of Conflict

If we are to more consciously design dispute management and collaborative management systems, we need a means to diagnose or describe the causes of disputes in given situations. The Circle of Conflict (Figure 2) is one way of thinking about the sources of conflict, regardless of whether they are at the interpersonal, intra-organizational, communal, societal, or international levels.[24]

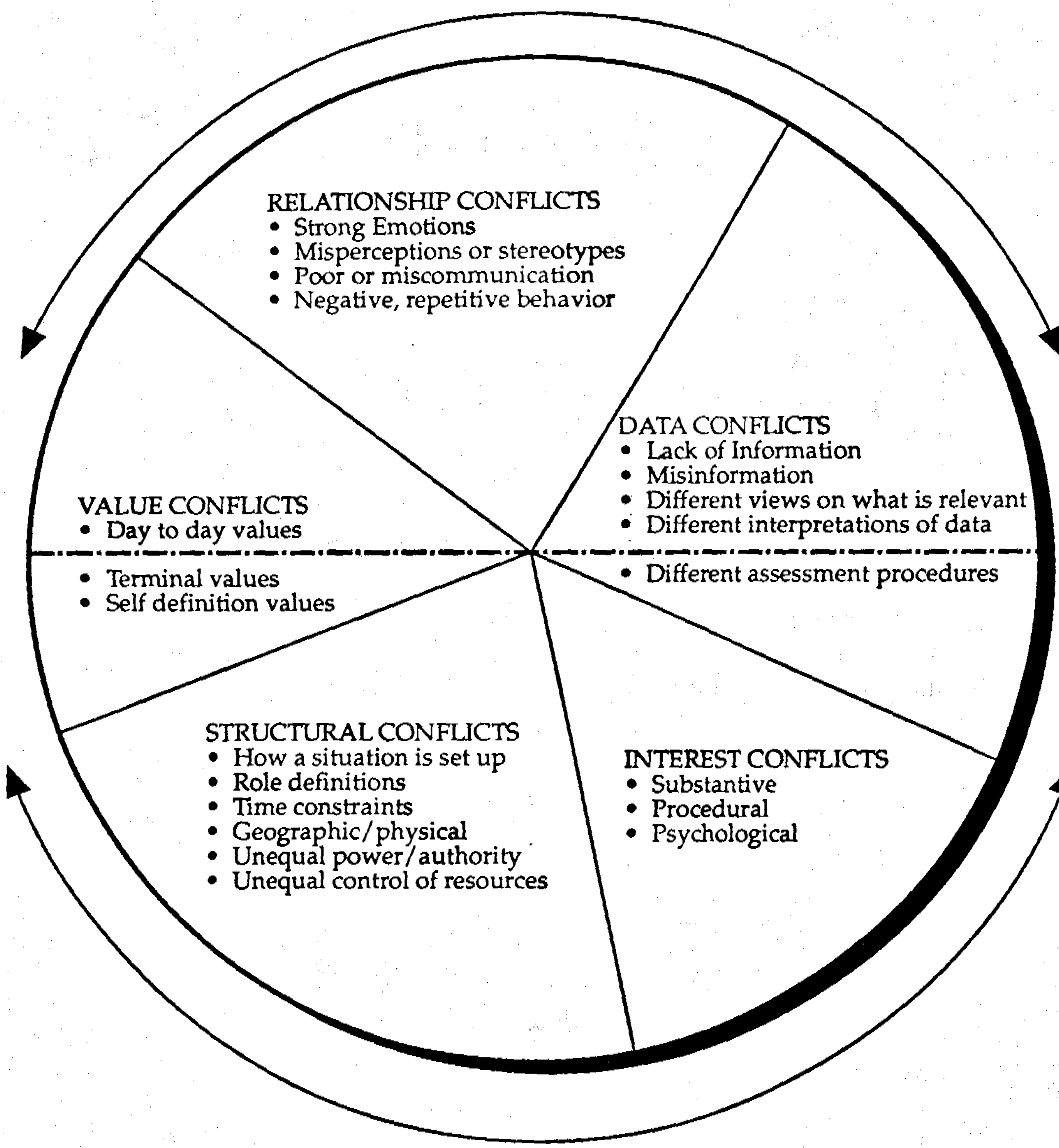
While the figure portrays causes as ideal types, any given dispute will contain pieces of each cause. But frequently one or two causes will be more dominant. The theory is that collaboration and management strategies should be based on the understanding of causes, and various intervention strategies are appropriate to different causes, as suggested outside each segment on the circle. The circle identifies five central causes of conflict:

- Problems with the people's relationships
- Problems with data
- Perceived or actual incompatible interests
- Problems with structural forces
- Perceived or actual competing values

Relationship conflicts occur because of the presence of strong negative emotions, misperceptions, or stereotypes, poor communication, or repetitive negative behavior. These problems often result in what has been called unrealistic or unnecessary conflict in that it may occur even when more objective conditions for a dispute, such as limited resources or mutually exclusive goals, are not present. Relationship problems often fuel disputes to an unnecessary escalatory spiral of destructive conflict.[25]

Data conflicts occur when people lack the information necessary to make wise decisions, are misinformed, disagree on

Figure 2. Causes of Disputes



what data are relevant, interpret information differently, or have competing assessment procedures. Some data conflicts may be unnecessary, such as those caused by poor communication between the people in conflict. Other data conflicts may be genuine in that the information and/or procedures used to collect or assess data are not compatible.

Interest conflicts are caused by competition over perceived orc actual incompatible needs. Conflicts of interest result when one party believes that the needs of an opponent must be sacrificed to satisfy its own needs. Interest-based conflicts occur over substantive issues (money, physical resources, time), procedural issues (the way the dispute is to be resolved), or psychological issues (perceptions of trust, fairness, desire for participation, respect). For an interest-based dispute to be resolved, all parties must have a significant number of their interests addressed and/or met in each of these three areas. Therein lies a major reason why process procedures became important.

Interests are based on and driven by values. However, the relative importance of many (not all) values are likely to change in given circumstances. The notion of interest thus captures the rank or salience of values in a given circumstance.

Structural conflicts are caused by patterns of human relationships. These patterns are often shaped by forces external to the people in dispute. Limited physical resources or authority, geographic constraints (distance or proximity), time (too little or too much), organizational structures, and so forth often promote structural conflict.

Value conflicts are caused by perceived or actual incompatible belief systems. Values are beliefs that give meaning to life. Values explain what is good or bad, right or wrong, just or unjust. Differing values need not cause conflict. People can live together with quite different value systems. Value disputes arise only when people attempt to force one set of values on others, often without realizing it, or lay claims to exclusive value systems that do not allow for divergent beliefs.

b. <u>Generating Value- and Interest-Based Alternatives</u>

The relationship between causes of disputes and intervention strategies is important to the water resource field. Frequently, technical agencies and engineers will consciously and unconsciously try to reduce most allocation conflicts to the level of data problems. While data availability and data sharing are critical problems in both the industrial and developing world, disputes over data are often surrogates for interest, value, and relationship conflict. This is particularly true as the uncertainties surrounding data, such as with ecological impact or development projections, become more explicit.

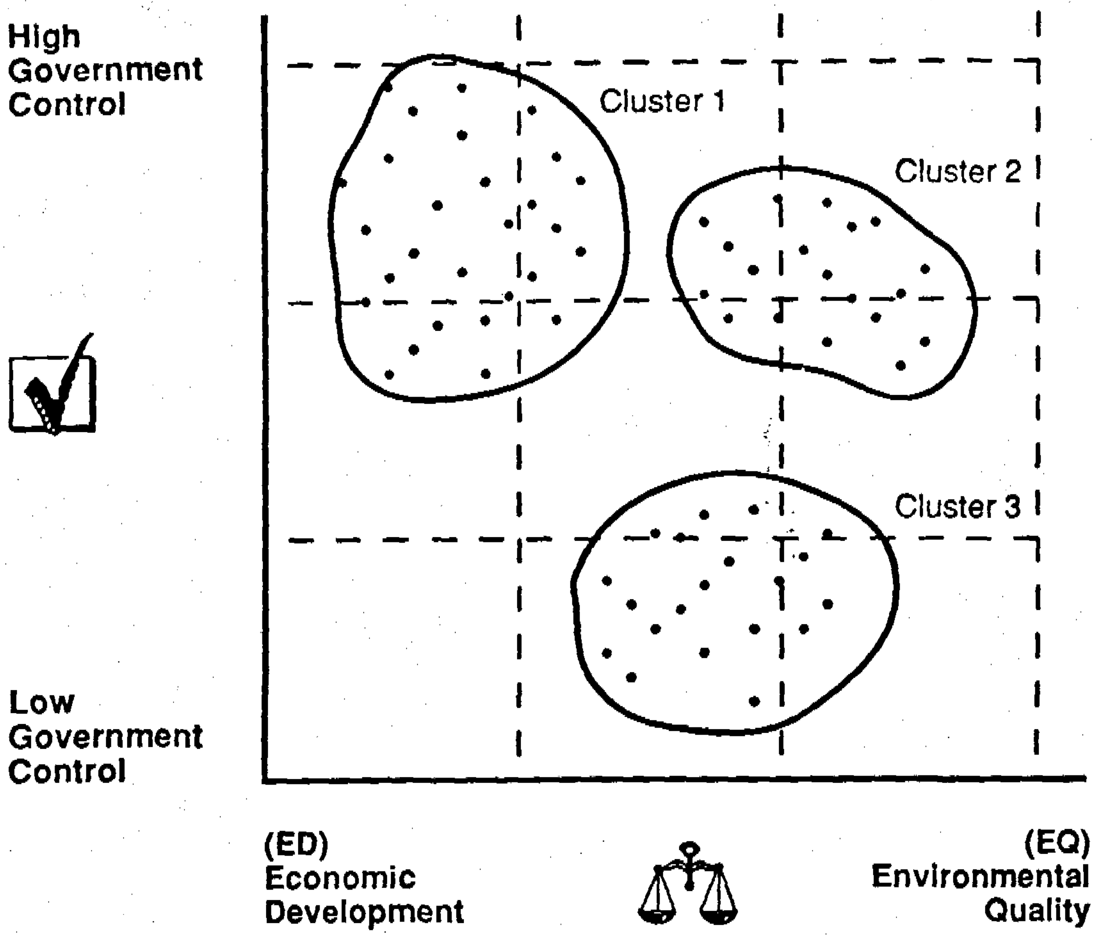
For example, some time ago, the U.S. Corps sought projections for electrical energy needs to the year 2000 in the Pacific Northwest. What they found is not surprising. One projection showed steady growth in electrical energy needs to the year 2000. This projection was done by utility companies. Another projection showed a steady downtrend to the year 2000. This projection was done by environmental groups. One or two projections were found somewhat nearer to the center; these were done by consultant groups. Each projection was done in an statistically "pedigreed" fashion. Each was logical and internally elegant, if not flawless.[26] The point is, once we know the stakeholders, we know the relative position of their projections. That is, the group, organization, or institution embodies a set of values. These values are visions of the way the world ought to be. These visions become assumptions that in turn play out into numerical results. Therefore, the trend lines go in different directions. While we probably could not know the exact number, we could tell the relative position of these projections.

The problem water resource professionals face is to foster negotiations around the assumptions and not simply the position. But how can we do this when playing the assumption game requires highly technical knowledge? What percentage of the population can understand the statistical language necessary to understand value projection? We must not call our projections objective, value-free facts when they are really an elegant extension of our values or a vision of how we think the future ought to look. So to start engineering design, the water resources planner or manager must find processes that mediate and somehow negotiate among the value-driven assumptions behind projections.

Figure 3 shows values from another perspective.[27] The bottom axis shows tradeoffs between environmental quality (EQ) and economic development (ED). The vertical axis shows tradeoffs between high government control and no government control. Both axes describe familiar perceptions of value trade-offs found in water resource development. Where would we find organizations with which the Bank deals, such as Ministry of Agriculture, environmental NGOs, irrigation districts, etc.?

For the sake of argument, take a water problem such as urban flooding. Suppose twenty agencies, interest groups, and other organizations are stakeholders. How different will the planning be if we do the following? First, we identify where such groups fell in this figure 3 by placing a dot with their name on the chart. This has been done hypothetically without including names. Once we distributed 20 dots around that chart, we would probably find various clusters. Circles are drawn around these hypothetical clusters on the figure. Having drawn such clusters, we then design specific alternatives, each of which can solve the flooding problem, for each of the three value clusters.

Figure 3
Developing Value Based Alternatives



We have asked the technical professional to understand the values, find how those values cluster, and design alternatives to serve those values. By using such a thought process, the professional can design based on values as opposed to presenting solutions that themselves include unexamined and frequently too narrow a range of values. In this way, fewer alternatives may be developed which also represent a broader range of values.

Designs which flow from such a thought process will greatly reduce the time spent on unacceptable alternatives. The point is that the technical professionals often need process procedures to understand competing values and to provide a road map for turning such competing values into the creative generation of alternatives and successful implementation.

c. <u>Elements of Durable Agreements</u>

Durable agreements depend on achieving procedural and psychological as well as content satisfaction.[28] By habit, traiing, and job description, technical professionals and agencies usually focus on the content or substance of discussion. However, technical excellence does not necessarily bestow process credibility. Indeed, professional claims of neutrality based on substantive expertise and objectivity can backfire. Even the best analysis is driven by interests and values. Often the more these professionals are immersed in the substance, the less aware they are of the values driving these assumptions. While data is crucial to agreements, it isn't necessary to agree on data to come to an agreement on action. In fact, controversial water projects will always uncover equal and opposite expert data and interpretation. The more that water development includes social assessments, environmental, and other concerns, data uncertainties will become more explicit and process more important. Procedural and psychological satisfaction will have to be explicitly managed along with the substantive--content satisfaction.

IV. BEYOND ZERO-SUM: A CONTINUUM OF PROCEDURES

a. <u>Overview of the Continuum</u>

Procedures for collaboration and dispute management can be placed on a continuum of gradually more directive initiatives by the parties toward increased involvement and to interventions by third parties that provide various types of resolution assistance. In Figure 4, Point A represents what some affectionately call the "hot tub" approach. That is, we all jump into the hot tub and somehow agree.[29] Point B represents the opposite extreme; that is, we go to war or use a highly adversarial approach. There are numerous possibilities between these points. The left of the continuum covers unassisted procedures, the middle covers assisted procedures, and the right, third-party decision-making procedures.

Most of the procedures have some elements of relationship building, procedural assistance, substantive assistance, or advice-giving as a means of facilitating resolution, but they differ significantly in degree and emphasis. Appendix B contains a description of procedures on the continuum.

As we move from point A to point B, we gradually give over the power and authority to settle to outside parties. A dividing line, point C, roughly two-thirds from A to B, shows that point at which power to resolve disputes moves out of the hands of the disputants and into the hands of an outside party.

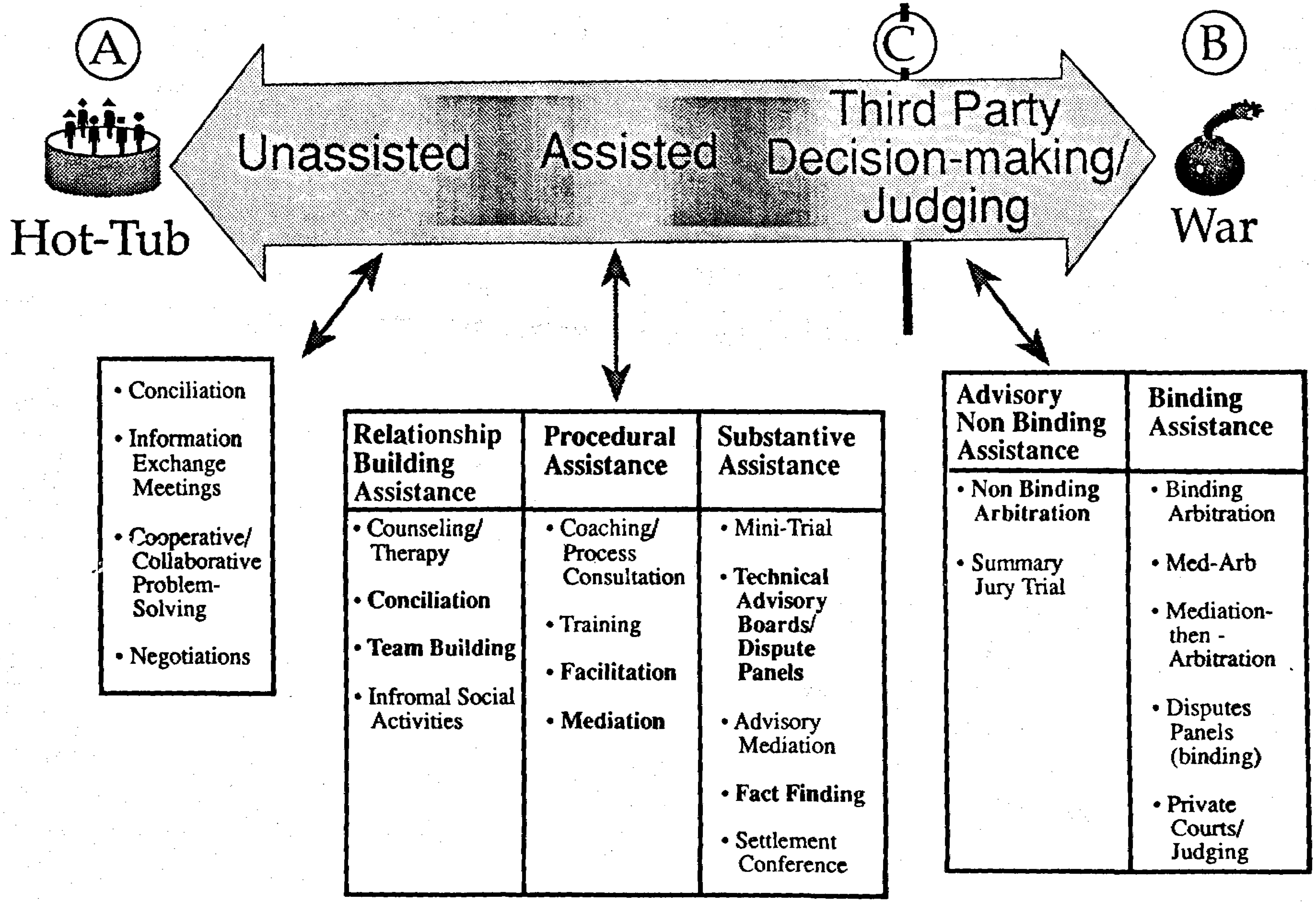
This is a critical distinction. Fundamentally different relationships and communication patterns are established by procedures to the right as compared with those the left of point C. These patterns are shown in Figure 5.

With third-party decision-making or judging, the primary communication pattern is between parties and the arbiter, panel, or judge. Each party presents a case to the arbiter judge or panel who decides. This pattern holds whether the procedure is binding or not. With assisted procedures, the facilitator and/or mediator seeks to encourage a primary and direct communication pattern between the parties. In this way, the parties can jointly diagnose problems, create alternatives, and own agreements.

Though individuals can do, unassisted, integrative bargaining, as the number of stakeholders in water resources grow, the issues become more complex, and resources dwindle, third- or neutral-party assistance is often needed. Few evaluations exist of interest based negotiations used in water resources. They show how shared interests, which seem obvious after agreement, are hard for parties to discover during negotiations without process assistance. For example, developers, oil companies, and environmentalists discovered that they shared interests of time and money in wetland use conflicts in the southern United States. Developers whose positions were to build unconstrained condos or to do offshore drilling saw that stabilizing building permits over five-year periods could mean assured profit; so too with exploratory oil drilling in the Gulf Coast. Uncertainty of project stoppage was reduced. Environmentalists, whose position was that not another inch of wetland would be used or another estuary endangered, saw that a stabilized permit situation would free their scarce resources, time and money, which could be thrown into other priority fights. Though at first skeptical, parties used assisted integrative bargaining to jointly understand their shared interests and reach agreements that allowed them to preserve their values and integrity.[30]

The major premise of these procedures is that, by separating the process of dialogue and the content of dialogue, we can better manage the discussions and promote agreement. This separation

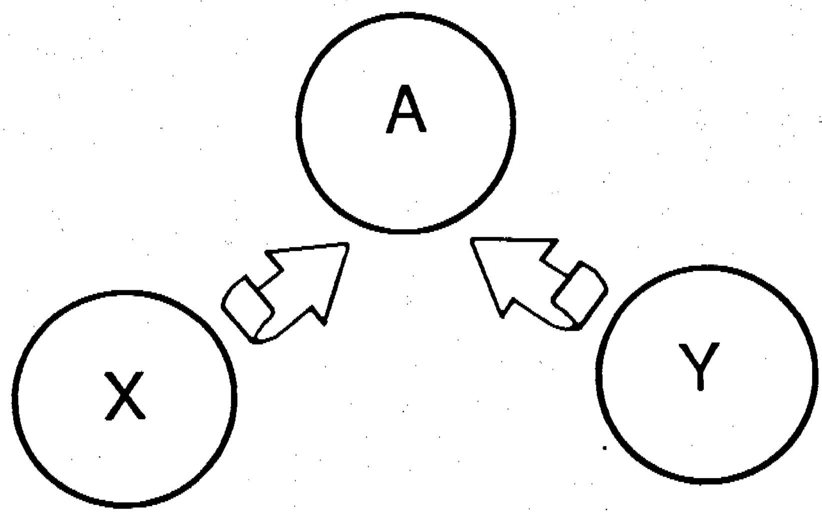
Figure 4. A Continuum of Alternative Dispute Resolution Techniques*



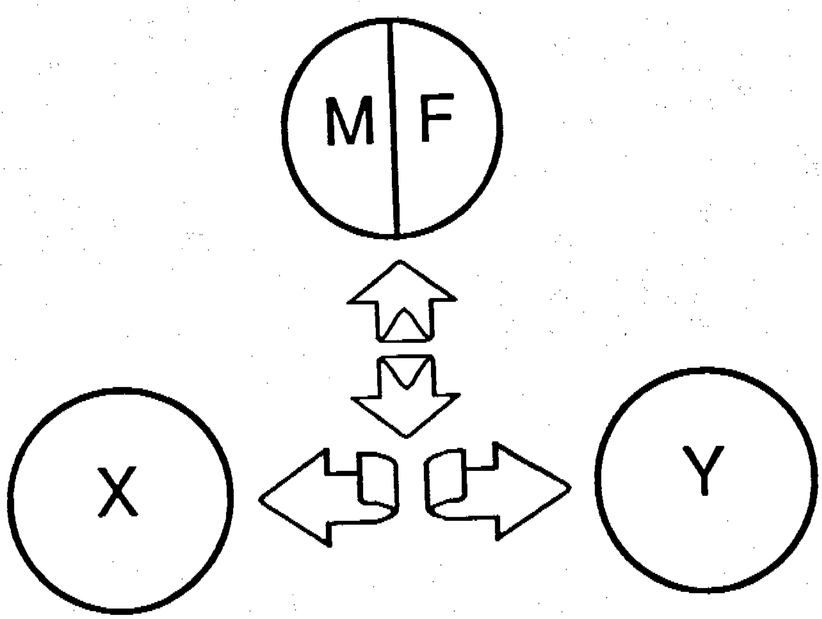
* From: More and Delli Priscoli, 1985

Figure 5
Communication Patterns

Arbitration



Mediation / Facilitation



process and content is what leads to the use of third parties, sometimes called "interveners." These third-party facilitators or mediators become caretakers of the process of dialogue in the disputes.

Much of the dispute management literature encourages the use of procedures to the left of point C. These procedures, whether done as planning or regulating, emphasize the anticipation and prevention of high-conflict situations. In the United States, the growing experience of litigation, threat of litigation, and processes to the right of point C, are themselves, becoming incentives to move to the techniques on the left. Reviews of hundreds of international mediations describe similar experience. Bercovitch finds that mediations of high-intensity international conflicts are more effective when they follow, rather than precede, tests of strength and that the best time to enter is at points of stalemate and/or exhaustion.[31] Indeed, the willingness to move to the left of Point C is an indicator of social learning spawned by experience of conflict management.

Procedures to the left ultimately allow parties more control over the outcome. These procedures enhance the probability that parties will be able to break through positions and negotiate around interests. The price for these possibilities, direct dialogue, is more frequently being assessed as less painful then the expected cost of highly adversarial battles.

Mediation developed from areas where the number of parties and issues are limited, such as in labor-management negotiations and some international disputes. Facilitation developed from multi-issue/multi-party situations such as resource controversies. However, with the growing practice of environmental mediation the terms and practice overlap.[32] Facilitators are caretakers to process. While they don't have to be outsiders, they must remain impartial to the substance discussed. They suggest ways to structure dialogue, help stakeholders listen to each other, and to encourage creative thinking.[33]

Mediators are generally outsiders to the stakeholders. Like a facilitator, a mediator primarily makes procedural suggestions but occasionally, through caucuses or other means, may suggest substantive options. Some mediators are more "orchestrators" and set the stage for bargaining. Others are more "deal-makers" and are more involved in forging the details of a settlement.[34] Studies of mediations in highly violent international conflicts find that the mediators' active participation in substance and procedure is useful.[35] Mediation can be used in more polarized situations than can facilitation to break impasse and to initiate dialogue. One study shows that from 1816 to 1960, mediations were attempted, on average, every 4.5 months in highly polarized international situtations.[36] Indeed, recent reviews of hundreds of international mediations describe a high frequency and high effectiveness of the procedure. Interestingly, mediation has been more successful in security disputes than in primarily ideological and independence disputes.[37]

Once parties begin to prepare and posture as if they will go to point B, they begin an inertia that could create the reality--adversarial battle--they otherwise seek to avoid. Legal rules of evidence and disclosure separate rather than integrate information sharing. Substantive and technical experts, on all sides of the problem, move to the background and are further separated. Fortunes are spent on information gathering to get to a point--litigation--where lawyers spend their time keeping other lawyers from learning what they know!

Similar scenarios occur internationally. Analysts have documented a spiraling of conflict that occurs as parties posture and caricature. Often substantive experts are separated and move to the background behind the political and legal. In tracing the Del Plata Basin negotiations among Argentina, Brazil, Paraguay, Bolivia and Uruguay, Cano describes how negotiation based too much on politics can drive the technical to the background and reduce the chance for success.[38] In the end, most signed agreements were negotiated by the senior technical professionals. United Nations reviews of managing international water resources echo the same point and emphasize the collaboration of experts.[39]

It could be argued that failure of the recent Salmon Summit in the U.S. Pacific Northwest was due, in part, to being convened and driven too clearly by the political. Experts in environmental mediation were used for procedural assistance to bring together representation of a variety of interests. The operating agencies, especially the Corps, became of the focus of controversy. Had the operating agencies convened (with political participation) the sessions and offered the commitment to operate according to a negotiated agreement, if one emerged, the results may have been different. Such an approach was recently used successfully to mediate operations of the Truman Dam on the Missouri River.[40]

Procedures to the left of point C have evolved in multi-party and multi-issue situations. While procedures to the right work better for ripened and polarized disputes, they have limited capacity to deal with multi-party and multi-issue disputes and to encourage the generation of creative options. This is important to water field, where the need is clearly for multi-objective and multi-party agreements. It is also important to formal Bank policy which, through OD 7.50 tends to emphasize variations of procedures to the right of the continuum, such as expert boards.

Since the 1970s, the U.N. and other international organizations have recognized this trend. The U.N. review of international institutions for managing international water resources called for use of conciliation, mediation, and procedures left of point C. However the same study's documentation reveals that many basin organizations and treaties have a variety of provisions for techniques to the right of point C, such as expert technical panels and forms of arbitration and little elaboration of those to the left.[41] A recent Norwegian analysis of international environment conflict resolution finds "most legal instruments relating to environment lack formal compulsory dispute resolution settlement mechanisms."[42]

Thus, incentives become critical. In the Indus the possibility of war (point B on the continuum) in the subcontinent was real enough to motivate use of mediation. While some argue the Middle East is another case, not all cases are so dramatic. However, the awareness of development benefits forgone and damages sustained (such as environmental) due to lack of agreements may become an incentive. This is clearly reflected in growing attempts at multipurpose water agreements.[43]

As the Oslo report notes, development banks and financial institutions will play increasingly important roles in prevention of conflict.[44] Access to capital will require review by international financial organizations, which will generate critical information about transboundary environmental and operational effects of projects. This is particularly true regarding rivers and water resources. The early participation of stakeholders, both intra- and international, will become a necessity for presenting workable plans. Thus, the leverage of financial institutions can become incentive for parties to use procedures on the left of the continuum.

The current intersectoral dialogue and three-way agreement process in California is one of the more dramatic illustrations of seeking to participate, collaborate and prevent further highly adversarial battles over water allocation. Ultimately the stakes are the reapportionment of water use among environmental, agriculture, and urban interests.

Even with a sophisticated system of water rights, laws, technical expertise and articulate public interest groups, California water development has been at an impasse (Point D in Figure 1). Going to war, courts and all-out positional bargaining has not worked. The recent drought, coupled with the impasse, raised the stakes of no agreement.[45] The three-way dialogue was developed to look at alternative water futures and to develop a consensus-based framework for future development. It explicitly encourages interest-based negotiation leading to joint solutions.

Similar patterns are developing on the Missouri River and even in humid areas of the United States, such as between Georgia, Florida, and Alabama. Recently, formal mediation was used to reach agreement on the operations of Truman Dam on the Missouri. The Truman Dam had generated controversy since it went on-line in 1981.

Hydropower interests sought increased power generation and were being thwarted by environmental interests seeking fish and wildlife protection, and by landowners seeking to reduce downstream effects of pool fluctuation. The Corps, authorized to operate the project, was challenged no matter what approach they took. Therefore, they convened a mediation process that involved representations of all the stakeholders, including senior political officials. Once again, part of the incentive was impasse. Another part was the possibility of designing an agreement. The mediator designed an interest-based negotiation, which produced an agreement that no one party had thought of before the process. It included new hydropower units and preservations of in-stream values.

The Bank has adopted procedures both to the right and left of point C as the continuum of procedures. For example, the Bank recently formed its first expert Board under OD 7.50 to examine the international aspect of a dam project involving Somalia and Ethiopia. Neither country expressed much procedural or psycological satisfaction with the process, which is often the case with procedures to the right of the continuum. However, on the Komati between Swaziland and RSA and on the Orange between Lesoto and RSA, the Bank adopted a more advisory role, similar to conciliation and team-building procedures on the left of continuum.[46] Using UNDP financing, the Bank assisted Swaziland in preparation of its plans. The process has resulted in two draft treaties now undergoing ratification. One would set up a technical advisory board, and the other, cost-sharing arrangements for the projects.[47] On the Lesotho Highlands Water Treaty, an agreement was reached between RSA and Lesotho to create two national authorities and a permanent Joint Technical Commission to build and operate a multipurpose water project. While they agreed on how to define benefits, the lack of hydrological data made it difficult to agree on annual yields of the project. So a contingent agreement was used. The parties agreed on the data that would be collected, who would collect the data, how to resolve disputes about the data, and how the benefit of the project would be calculated.[48]

Substantive assistance and third-party judging techniques are probably closest to the Bank's traditional role and self-image. After all, the Bank as a lender must evaluate according to some criteria. Also, the Bank is a center of expertise. However, as the Orange and Komati basins show, more than these techniques are likely to be needed. Water Resources allocation are likely to demand the use of facilitation and mediation techniques, and the question will be how and who?

Does the Bank substantive expert role (and image) conflict with its potential process roles? The multi-party/multi-issue facilitating approach says that reaching agreement to a point becomes more important than the substantive terms of agreement. It is not necessary to abandon all notions of objectivity to play the role. However, in such a role the Bank must become deterministic and accept the process and the possibility of agreements that it would not choose by traditional methods as long as the agreement is within some broadly defined professional bounds. The question is, what rationality will determine what bounds? Typically, professional engineers, lawyers, and economists and others begin with narrow notions of bounds, but given the inherent uncertainties of water management, will ultimately admit that the bounds are usually far wider and less determined than originally thought. The water resources field has traditionally resisted placing bounds of probability on BCR ratios and on the projected accruing of those benefits.

The willingness to be flexible and accept agreements crafted by the parties can be enough to legitimize a procedural assistance role. It may even encourage subsequent substantive assistance in response to parties' needs.

Even if the Bank adopted the flexibility described above where situations called for it, does its development objective (or interest) conflict with the capacity to either catalyze or perform facilitation and mediation? Process theory is not built on the idea of value-free objectivity, but rather on the social/psychological notion of role clarification and the process and content distinction. The reason process assistance can work is that it liberates parties to engage in content without simultaneous procedural posturing. The process assistance has a value bias--trying to help the parties reach agreements. There is a value that agreement would be good to achieve. To the degree that the Bank is an advocate for a particular substantive agreement or alternative project configurations, it could not effectively play a procedural assistance role. To the degree that it feels agreements are needed but is open to a variety of alternative approaches, including the "without project" option, it can play an assistance role. Indeed, in the Indus, once the Bank moved away from its preferred option to facilitating joint options among the parties, its assistance role became more effective.

We usually think of moving from the left to the right of continuum. But the Indus experience can be seen as a movement from right to left. The first intervention for arbitration was rejected. Then the Bank initially intervened and offered its preferred solution. This was both a procedural and a substantive role, but also had strong elements of a third party expert judging role--to the right of point C. After parties rejected this initial solution, the Bank adopted clearer procedural and substantive assistance roles--to the left of point C. India and Pakistan became more engaged in the creation of options. Once an agreed solution was produced, the Bank expanded its procedural assistance role and worked with other funding sources to facilitate the implementation of the agreement.[49]

The fact that the Bank had financial resources and the capacity to generate resources was crucial to the intervention. In studying violent international conflict, Zartman and others make the same point: effective mediation in international relations is greatly dependent on the ability to command resources.[50] Other international water resources cases confirm this experience. For example, UNEP funds were used as incentives to reluctant countries to participate in developing the Mediterranean Action Plan[51] and to help establish a working group of experts to develop the Zambezi Action Plan (ZACPLAN).[52] The Vatican used it resources of moral authority and confidentiality to promote agreement on the Beagle Channel.[53] The Italians, through ITALCONSULT, brought resources to study dangers of unconditional national projects (or BATNAS) for Riparians in the Niger Basin, which provided a common reference and substantive basis for subsequent agreements.[54] On the Nam Ngum project, United Nations and other donor financing provided a feasibility study and mobilized construction grants among adversarial riparians for mutually beneficial endeavors.[55]

b. <u>Techniques: BATNA, STN, and Interest-Based Bargaining</u>

A variety of techniques is emerging that can be used across most of the procedures in the continuum. Many are already used by the water resources field. The best alternatives to negotiation (BATNA) has been mentioned in the previous section. Single-text negotiation (STN) means developing a complete package, putting the package before parties, revising, and repeating the process. The technique helps parties to envision a whole and encourages them to work off the same sheet of music. Often, even with intra-organizational situations, it requires the assistance of a facilitator or mediator. The successful mediation of operating rules on the Truman Dam on the Missouri used STN to break impasse and generate agreement.[56] STN was the crucial technique used in developing the Camp David Accords.[57] As seen in the Niger Basin, Law of the Sea, and Antartic Minerals negotiations, it is effective for international natural resources issues.[58]

Interest-based negotiations has become the preferred technique for integrative bargaining. This can be contrasted to what is traditionally called positional bargaining.[59] Positional bargaining is a negotiation strategy in which a series of positions, alternative solutions that meet particular interests or needs, are selected by a negotiator, ordered sequentially according to preferred outcomes and presented to another party in an effort to reach agreement. The first, or opening, position represents that maximum gain hoped for or expected in the negotiations. Each subsequent position demands less of the other party and results in fewer benefits for the person advocating it. Agreement is reached when the negotiators' positions converge and they reach an acceptable settlement range.

Interest-based bargaining involves parties in a collaborative effort to jointly meet each other's needs and satisfy mutual interests. Rather than moving from positions to counter-positions to a compromise settlement, negotiators pursuing an interest-based bargaining approach attempt to identify their interests or needs and those of other parties prior to developing specific solutions. After the interests are identified, the negotiators jointly search for a variety of settlement options that might satisfy all interests, rather than argue for any single position. The parties select a solution from these jointly generated options. This approach to negotiation is called integrative bargaining because of its emphasis on cooperation, meeting mutual needs, and the efforts by the parties to expand the bargaining options so that a wiser decision, with more benefits to all, can be achieved.

Figure 6 summarizes interest based and positional bargaining in terms of costs and benefits, attitude of bargain, and occasions for use.

V. APPLICATIONS

a. Public Participation in Water Resources

Public participation is increasingly accepted as an important means to reach project ends in development activities. Secretary General of the U.N., Butros Gali notes:

> After 30 years we discover that without the participation of the People there can be no economic development. For that we need democracy.[60]

At the operational, or retail, level, Cernea and others conclude that projects with a participatory approach tend to be more cost-effective and sustainable in the long run.[61] Bank OED reports and Paul's analysis of institutional capacity-building reach similar conclusions.[62] Uphoff finds a 1:5-1 benefit-cost ratio for the participatory components of some irrigation projects in the Philippines and Sri Lanka.[63] For the Sri Lankan projects, ARTI calculated the overall return rate of 24 percent, with participatory components accounting for about half the benefits and 10 percent of the costs.[64] Uphoff also notes that participatory approach quickly built cooperation in an area with an almost 30-year legacy of conflict.

After scaling up the Philippine participatory project, which was a product of the Ford Foundation and the National Irrigation Administration, the Bank had to learn to scale back to be responsive to demand and capacity.[65]

Indeed, user participation has a long tradition in irrigation in numerous countries such as in the Mendoza Region of Argentina or Chilean water user associations. The condominial sewage systems in Northeastern Brazil shows how participation can actually create technical options that no one had dreamed of for reducing costs, provide for recoverable user fees in poor areas, and provide service to those previously thought unserviceable.[66] A Bank review of participation in the Mexico Hydroelectric Development Project notes that by investing in social infrastructure before construction of the physical infrastructure, stated traditional problems of unsettlement were avoided.[67]

But as an end in itself or at the intersectoral, framework, and/or wholesale levels of water resource development, public participation becomes more controversial. The Swedish Development Agency SIDA notes that participation can be viewed as an objective in itself; as a basic democratic right that should be taken into consideration and promoted in all development projects.[68] Preliminary findings of the Bank's participation learning process identifies reasons why even nonparticipatory governments can and have found net benefits to a participatory approach.

However, the experience of participating in decisions that affect their lives can be many times more effective in teaching those "habits and attitudes of governance" that the Bank's governance policy espouses. Indeed, the Bank's Africa Regional Office has established a task force on participation and governance.[69]

Managing the physical infrastructure and environment in a participatory way can actually create the civic infrastructure. Eastern Europe provides some recent examples. Grass roots environmental groups have been in the forefront of democratic change and have been some of the principle recruiting grounds for new leadership. Eastern Europeans grass root NGOs are also now creating sophisticated computer-based information links and data sharing networks.

United States environmental policy legislation in the early 1970s, including NEPA, brought great visibility to participation in water resources. The old agency patterns of decide, implement, and defend began to change to consult, decide, and implement. As Zillessen notes, the same transformation has been occurring in Western Europe over the last decade.[70] For example, representation of various interests conflicting over the use of France's Dordogue River came to consensus on a charter for its waters. It was the culminating event of a participatory process including officials, professionals, citizens, and others. Although regional, it clearly involved cross-sectoral interests.[71]

The current California three-way dialogue designed to produce an agreement among environmental, urban, and agricultural interests

Figure 6*
Summary of Interest Based vs. Positional Bargaining

COSTS AND BENEFITS OF INTEREST-BASED BARGAINING

Costs

- Requires some trust.
- Requires negotiators to disclose information and interests.
- May uncover extremely divergent values or interests.

Benefits

- Produces solutions that meet specific interests.
- Builds relationships.
- Promotes trust.
- Models cooperative behavior that may be valuable in future.

WHEN IS INTEREST-BASED BARGAINING USED?

- When the interests of the negotiators are interdependent.
- When it is not clear whether the issue being negotiated is fixed-sum (even if the outcome is fixed sum, the process can be used).
- When future relationships are a high priority.
- When negotiators want to establish cooperative problem-solving rather than competitive procedures to resolve their differences.
- When negotiators want to tailor a solution to specific needs or interests.
- When a compromise of principles is unacceptable.

ATTITUDES OF INTEREST-BASED BARGAINERS

- Resource is seen as not limited.
- All negotiators' interests must be addressed for an agreement to be reached.
- Focus on interests not positions.
- Parties look for objective or fair standards that all can agree to.
- Belief that there are probably multiple satisfactory solutions.
- Negotiators are cooperative problem-solvers rather than opponents.
- People and issues are separate. Respect people, bargain hard on interests.
- Search for win/win solutions.

COSTS AND BENEFITS OF POSITIONAL BARGAINING

Costs

- Often damages relationships; inherently polarizing (my way, your way).
- Cuts off option exploration. Often prevents tailer-made solutions.
- Promotes rigid adherence to positions.
- Obscures a focus on interests by premature commitment to specific solutions.
- Produces compromise when better solution may be available.

Benefits

- May prevent premature concessions.
- Is useful in dividing or compromising on the distribution of fixed-sum resources.
- Does not require trust to work.
- Does not require full disclosure of privileged information.

WHEN IS POSITIONAL BARGAINING OFTEN USED?

- When the resource being negotiated is limited (time, money, psychological benefits, etc.)
- When a party wants to maximize his/her share in a fixed sum payoff.
- When the interests of the parties are not interdependent, are contradictory, or are mutually exclusive.
- When current or future relationships have a lower priority than immediate substantive gains.

ATTITUDES OF POSITIONAL BARGAINERS

- Resource is limited.
- Other negotiator is an opponent; be hard on him/her.
- Win for one means a loss for the other.
- Goal is to win as much as possible.
- Concessions are a sign of weakness.
- There is a right solution -- mine.
- Be on the offensive at all times.

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*From Moore, 1988.

is another example of using a participatory process to reach intersectoral water agreement. In the U.S., similar efforts are beginning in humid as well as arid areas. These efforts echo pioneering participatory processes of the 1970s, such as on the Susquehanna and Delaware Rivers. Similar participants' policy dialogues have been initiated, with mixed success, on national policies such as energy strategy and wetlands use.

Participation in alternative water planning is one of the most interesting collaborative approaches to negotiating long-term cross-sectoral allocation decisions. Such planning encourages representatives of various interests to project various visions for the future, based on their values. Actions that would be taken to achieve their vision are then mapped and compared across future critical actions paths of others. Options that will be foreclosed, as well as a variety of actions that can be taken regardless of the chosen future, are described. The process engages participants in creating options, provides clearer understanding of impacts of options, and often leads to serious trade-off negotiations. The U.S. Bureau of Reclamation used such an approach in four Northern California counties to produce a series of critical path action diagrams and decision trees that provided audit traces of key decision points and assumptions at each point. The study subsequently guided intercounty water management decisions. A similar notion is used in Nicosia, Cyprus, as an aid to getting parties who do not speak with each other to talk about necessary future joint decisions such as on water supply and sanitation.[72]

The experience of the industrial west and reindustrializing east has some lessons. Because water resources management is likely to move to multipurpose and intersectoral considerations whether these considerations are handled in administrative, political, planning, or regulatory mode, participation of stakeholders becomes central. While power among the stakeholders will always be asymmetrical, the number who can stop or stall projects will grow. Without meaningful opportunity to participate in forming positive development goals, negative power will be rewarded and growth itself will stop. The same pattern is already appearing in the developing world, albeit through different institutional routes. For example, a recent harbor project in Botswana was stopped by a coalition of local people and environmentalists. Mexican and foreign environmentalist and archaeologists have delayed hydroelectric projects on the Usumacinta River.[73] A similar story is unfolding around Bank sponsored projects in Thailand. So beyond instrumental means for project development, participation could become critical to intersectoral dialogue as water policy in developing world.

In its most elementary form participation means more than simply giving information to people. It is receiving information from people, listening, and acknowledging how that information was used.

Building on Hirschman's notion of voice and project experience, Salman demonstrates the effectiveness of listening in development projects.[74] Echoing what others find in the industrial world, Cernea notes that investment priorities made by communities during participatory process are often different from the expert's solutions. As we experience the growing gap between water resource development needs and capital, investment priority setting will become even more crucial. Most likely it will have to become more participatory.

If they do anything, facilitation techniques are designed to help people listen to one another. UNICEF uses the term "animators," or people who help people explore their situation and build critical awareness of problems and possibilities.[75] By fostering conditions and processes where people learn from each other, facilitation can result in creation of new options on point E in Figure 1.

Participation can isolate extremes and create incentives for building new grounds for agreement. Extreme positions will always be present on all sides of water issues for important ethical and moral reasons. But extreme positions should not be allowed the claim of broadly based constituent support without transparent accountability. Participation can build that transparency. Frequently, the lack of meaningful participation often encourages the very situation most seek to avoid--extreme posturing, little dialogue, and no transparent accountability to constituencies.

The level of participation could be viewed as a simple scale: <u>knowledge about a decision</u> to <u>being heard before the decision</u> to <u>having an influence on the decision</u> to <u>agreeing to the decision</u>. A wealth of practical and theoretical material exist on how to achieve participation at each of these levels.

Basically the processes to the left of point C on the continuum are those used in participation. Indeed multi-party facilitation and environmental mediation have substantially been products of public participation experience. In the end, participation builds on open access to information and empowerment of people. Participation in water resources seeks to build a sense of shared ownership in alternatives, thus increasing the probability that they will be implemented. Therefore, it must be part of the early design of policy and projects. Kirmani describes what can happen on the international level when participation and the sense of ownership among riparians is not present, even with external resources. He states that the Mekong Commission is a classic example of external effort, management, and planning, with little involvements of beneficiaries. After much engineering study and technical and financial assistance, dreams and hopes have not been realized.[76]

b. Dispute Management and Water Resources Institution Building

It is possible to discern convergence on requirements for building water institutions from the fields of international organization, dispute resolution and recent experience.

The debate over building water organizations can be characterized as a dialectic between two philosophical norms; one, the rationale analytic model, often called the planning norm, and two, the utilitarian or free market model, often couched in terms of privatization.

Each of these caricatured norms implies different visions of how water institutions should change. The rational analytic view will begin with some explicit holistic notion of the resource and criteria for its use which should then guide subsequent action. This norm can be driven by grand MOP engineering design, holistic ecological systems theory, or other regional designs, many of which conflict. The norm usually leads to a high degree of explicit or conscious design. The market norm sees institutional arrangements emerging from spontaneous interaction of self-interested parties that reasonably conform in some way to Pareto optimality. This norm usually leads to less-conscious design and a more hands-off approach. The rationale analytic emphasizes concepts of water scarcity and public participation in technical decision-making processes. The market will emphasize individual freedom and public participation through buying and selling in markets.

Forming water institutions is almost always done in a broader social context and in light of previous allocation agreements. Processes used to solve redistributive issues rarely fit with rational analytic and rational choice models. Water planning is as much flexibility and managing uncertainty as discerning deterministic trends. Therefore, our experience lies between these extremes.

In the United States, numerous presidential commissions have tried unsuccessfully to establish national water policy. During the 1970s an elaborate institutional and analytical procedure evolved, only to be abandoned as its implementation was beginning. To a great degree, this structure was based on river basins and was fueled by rational analytical notions. It encouraged high-level intersectoral planning and autonomous operating levels. A mini-analytical rapprochement among engineers, social scientists, and ecologists was achieved in the form of two planning objectives and four accounts.

In the 1980s the United States approach moved toward the market norm. National economic development was effectively established again as the prime objective, with environment as a constraint, usually articulated through regulatory policy.[77] New private-public partnerships, called cost sharing, emerged. Attempts were made to use more realistic pricing--closer to marginal costs--for water through a variety of water market mechanisms. In light of the movement away from planning, recent surrogate rationale analytic planning is emerging through the environmental regulatory structure.

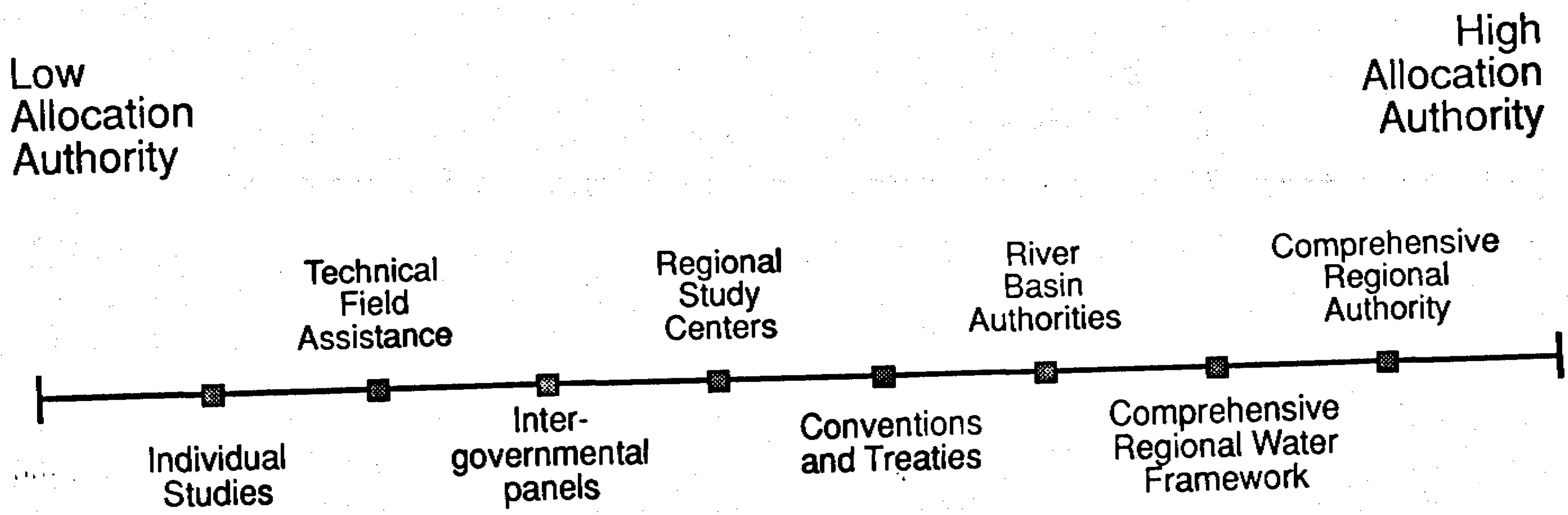
In Europe, the British moved from a public river basin planning model to far more privatization. While the river basins were smaller and were operated for fewer purposes, the system also has national regulatory oversight. Since the 1970s the French have operated a river basin system that falls somewhere closer to the center of these extremes. The major basins have committees that include representation by industry, environment organizations, and the general public. These committees, which formally represent users and are financed through pollution charges, set priorities for users over a period of 20 to 25 years.[78]

As in the United States, the EC has begun to move from single to multipurpose orientation of its river basin organization, such as the Danube and Rhine. However, the focus is far more on planning and coordination and then on allocative authorities.

Figure 7 describes a variety of institutional mechanisms and a continuum of options ranging from low allocative power/authority to high allocative power/authority. To the left of the continuum is represented allocative action based solely on individual national autonomy. To the right, the continuum represents regional, comprehensive authority for decisions in the water resources field. Moving from individual autonomy towards regional authority, a variety of approaches are noted: individual studies, regional study centers, treaties, conventions, and river basin authorities up to comprehensive regional authority. As water professionals have begun to understand water flows in light of increasing economic development, interdependence, sustainability, and population growth, the realities of the water resource push us from the left to the right of this continuum. On the other hand, legitimate and important political realities generally resist such regional notions driven by natural resource conditions.

Few comprehensive regional authorities have come into existence. The Tennessee Valley Authority is one outstanding example. On the other hand, a variety of river basin authorities have existed and do exist, along with treaties and numerous regional centers. The allocative power/authorities of water resource agencies can also be thought of as moving from low levels of planning to higher levels of allocation operation and revenue generation. Regional and comprehensive water basin authorities, while they exist, tend to be primarily concerned with planning. Those empowered with higher levels of allocative power/authority tend to focus on single purposes such as navigation. F

Figure 7.
Institution for Water Management



comprehensive authorities that cross jurisdictional boundaries exist for allocation and operating.

Nevertheless, our knowledge of water resources is pushing toward a vision of developing ways and means for comprehensive analysis and operation so we can better integrate uses. It is also calling us to integrate resources management across jurisdictions. As we begin to reach the limits of use, the flexibility of our organizations to respond to water flow fluctuations becomes crucial. This flexibility is most needed to provide new forums for dealing with political tradeoffs which cross both time and space. Nitze also notes that flexibility has been central to negotiating international environmental regimes.[79]

So what does this experience tell us? We have learned that water institutions must include multiple purposes of water, include participation of impacted groups and users, improve realistic pricing of water, encourage integrative as opposed to distributive bargaining, be flexible to react to short-term events but provide stable mechanism for long term visions, encourage meaningful allocation across sector interests but also efficient use at operating or retail levels, be driven also by nonmarket (in-stream) ecological values, and stay within reasonable bounds of distributive equity.

One major participant in the ebb and flow of water institution in the United States offers a useful perspective.[80] He notes that, to a great degree, the river basin management concept has been driven by a rational analytical model as seen in the use of words such as "coordinated" and "comprehensive." While this model might provide an ideal, no matter what shape it takes, it does not fit reality. The reality of river basin management goes beyond notions of unified administration and rational analytic models to one of facilitated dialogue and negotiation among stakeholders in the basin. It leads to cooperation and integration, not just coordination. Rodgers notes, "Approaches based on game theory . . . ranging from pure conflict to pure cooperation do not directly yield norms for decisions regarding conflicts found in international river basins . . . consequently the field has relied increasingly on process oriented approaches."[81]

Allee notes that comprehensive planning can provide a "cloak of professionalism and objectivity and potential information useful in identifying the stakes of those not well represented and in the design of more equitable plans."[82] However, the essence of river basin management becomes the process and management of facilitated bargaining among stakeholders.

After examining cases of international environmental negotiations, Oran Young, a prominent theorist in international organizations notes that building international regimes for natural resources management requires conscious design efforts beyond spontaneous intervention. He notes that "institutional design emerges as a process of steering complex bargaining toward coherent and socially desirable outcomes."[83] Among the more important lessons for success are to seize windows of opportunity that are often exogenous to the bargaining process, to go beyond traditional distributive (positional) bargaining to integrative bargaining, to mobilize leadership, and to simplify implementation. This analysis and prescription of practical experience reflected above are the main messages of assisted negotiation. They also sound like lessons from the Bank's Indus River mediation.

VI: Possible Bank Actions

Introduction

Transboundary and cross-sectoral issues will become more critical to development generally, and to water investment specifically, especially on complex MOP projects. Experience indicates that the key to successful MOP projects will be the early generation of creative alternatives and facilitating a sense of ownership among stakeholders in both the alternatives and the process by which the alternatives are generated. Waiting to react to a few detailed and narrow alternatives or until a dispute ripens means acting too late. The alternatives become hardened positions. At this point, the process options--usually on the right of continuum--have limited ability to go beyond splitting differences along line P in Figure 1. It will be in a donor's or lender's interests for early and meaningful collaboration and participation to occur in projects they will be asked to finance. The probability of implementation will increase, transaction costs will go down, the opportunities for future cooperation will go up, and the security of investments will be improved.

In our international system, which lacks a strong compliance structure and needs incentives, the Bank has comparative advantage in many of the areas experts have identified as critical to forging international cooperation. First, as cited, much successful international assistance has resulted from interventions by third parties with resources. The Bank has resources it can use to positively influence international water resources issues. Second, leadership is needed to encourage cooperation. The Bank is a leader and has demonstrated, in a variety of water resources issues, how its actions can mobilize others to act. Third, the Bank has demonstrated and has high potential to effectively use several important process techniques and procedures, such as BATNA, STN mediation, and facilitation. Fourth, simplifying implementation for agreements is critical to cooperation. The Bank has an unparalleled advising and monitoring capacity. Fifth, international cooperation often depends on seizing windows of opportunity exogenous to competing parties. Today, the interdependencies of sustainability and the growing gap between needs and money provide such a window. The Bank brings unparalleled authority to such international investment allocation.

While we like to distinguish between the technical and political, both are blurred in intra and international water allocation decisions. When dominated by the political, poor or even unworkable agreements can result. When dominated by the technical the results can be too narrow, fall short of satisfying interests, and even exacerbate political and social tensions. The search for new allocation mechanisms is ultimately the search for institutions and processes that facilitate a balance between the technical and the political. This is not new, it is just becoming more explicit and calling for more conscious design. The key is to make the technical politically creative and the political technically sound. Waiting until highly adversarial political negotiations emerge can mean acting too late. Building on shared technical language but driven by different values and interests, early technically sponsored negotiating forums can produce a range of alternatives that could enhance subsequent political negotiations.

While the Bank and other donors certainly cannot solve all the world's problems, they can assume a leadership role in encouraging and facilitating early collaborative and participatory efforts among parties that would otherwise conflict. If the experience of the industrial world is any indication, this facilitating role could be the key leadership role for the Bank in water resources. Not to assume such a role risks contributing to fragmentation among water users through a project-specific and single-purpose lending framework. It also risks making the Bank look like an unequitable bestower of political benefits. But more important, as cited in the Ganges case, opportunities for broader basin wide arrangements could be lost--and that would be a great cost. The following suggestions are offered.

a. <u>International Inland Waters</u>

1. In situations of potential or ripened intersectoral and/or transboundary conflict, the Bank could ask for assessments of the costs to interested parties of no water management agreements.

2. The Bank could encourage and support discussions of alternative water futures among interested parties in the early stages of project development and/or intersectoral policy development.

b. <u>Within Countries</u>

1. The Bank could support early participation of major stakeholders, NGOs (beyond only environmental NGOs), those impacted and others, at the intersectoral levels of water assessment. This means going beyond public information programs to active engagement of interests in the formulation of options.

2. The Bank water policy paper could explicitly state that participation in water infrastructure is an important way to meet the Bank's governance objectives.

3. The Bank could go beyond the emphasis on expert panels and actively encourage the early use of facilitation and mediation in the formative stages of water projects and water assessments.

4. The Bank could support the development of technology for the use of public access data bases in those countries seeking significant water resources loans. As many experts suggest, the Bank should also encourage and support the use of interactive software as means to describe water futures, trade-offs, and BATNA.[84]

c. <u>Within the Bank</u>

1. The Bank could provide a series of staff hands-on seminars on participation and dispute resolution techniques as applied to development. Past Bank evaluations indicate that internal attitude change is the most important factor in using participation and other process techniques. The seminars should reach management and operational levels. This process could catalyze internal debate, since ultimately internal organizational values cannot diverge far from externally espoused collaborative and participatory values. Its purposes would be

   - to expose staff to the range of process techniques and criteria for their use
   - to encourage staff to use the techniques
   - to describe how to find and select neutral and third parties.

2. The Bank could provide "one-stop" assistance location where staff can ask for assistance in designing and implementing process approaches and can be linked to a broader network of people and resources for help.

3. Following Paul's recommendation for sector-level guidance, the Bank could develop specific participation guidance for the water sector.[85]

4. The Bank could do a quantified vulnerability analysis of present and expected Bank water-related investments performance where intersectoral and transboundary conflict and potential water scarcity are involved. One way to accomplish this could be through river basin study groups, as Rodgers suggests.[86]

5. The Bank could add to OD 7.50 an explicit description of and emphasis on the use of facilitation, mediation, conciliation, and other processes early in Bank projects and in intersectoral discussions.

6. Given the importance of water to development and its cross-sectoral and jurisdictional nature, the Bank could institute in-house strategic planning capacity. It could be sufficiently distant from line operations and empowered to think beyond current categories, programs, and procedures. It could be close enough to senior management to be protected in its thinking of the unconventional. It should work to inspire and assist regional units in similar endeavors, if they so desire. It should be a process asset for other Bank units.

Research. Much useful research needs to be done in this area. The Bank could support and/or participate in research such as the following:

1. Studies of international water resource agreements which analyze how agreements develop and what the internal and external conditions are for their success.

2. Studies of the actual operations of disputes clauses and assisted negotiations under current water resources agreements and RBOs.

3. Studies of the reasons for past successes and failures of international water resources dispute management.

4. Research that relates methods of managing conflicts to the types of water resources decisions we are likely to take. For examples, how do regulatory versus planning versus free market versus assisted negotiation approaches affect water resources decisions such as design, implementation, construction, operations, and maintenance? Who is involved at what levels in these decisions? How successful have we been in looking at the social utility functions of each? What does each

approach tell us about equity, efficiency, and fairness? How does each approach generate options and trade-offs?

5. Studies that integrate theories from a variety of disciplines, such as community-building, international negotiations, alternative dispute resolution, and multiple objective planning in water resource management.

6. Studies that examine the role of current international lender and donor institutions. To what degree may they become more facilitators of agreement as opposed to evaluators and/or designers of solutions? In what ways can those institutions that deal with water improve their behavior so as to help prevent conflicts?

7. Research that discerns how our water resources experiences--namely, whether we live in humid or arid areas--in turn affects our perceptions and how such perceptions, in turn, affect both our own policies and those policies we may recommend for others.

8. Research to assess and to describe where and how intra- and international-state water issues could threaten political and social security.

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4. The Economist 1987
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17. Le Marquand 1990 and Vlachos, et al, 1986
18. Coser 1959, note
19. Lincoln 1986, note
20. Rogers 1992
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24. See Moore 1986

25. See Coser 1959 and Moore 1986

26. Delli Priscoli 1989

27. Delli Priscoli 1989

28. Lincoln 1986 and Moore and Delli Priscoli 1988

29. Moore and Delli Priscoli 1988

30. Delli Priscoli 1988

31. Bercovitch 1986

32. Bingham 1986

33. Moore and Delli Priscoli 1988

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35. In Bercovitch 1986

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58. Rosenfeld 1992

59. Moore and Delli Priscoli 1988

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61. Cernea 1985 and Nagle and Ghose 1990

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63. Uphoff 1992

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PUBLIC-PRIVATE PARTNERSHIPS

IN URBAN WATER SUPPLY

December 8, 1993

Thelma Triche, TWUWS

CHALLENGES FACING URBAN WATER SUPPLY SERVICES

- Poor quality of services

- Need for investment resources

- Inefficient use of water resources

CAUSES OF CURRENT PROBLEMS

- Lack of autonomy
- Lack of accountability
- Inadequate cost recovery

PUBLIC-PRIVATE PARTNERSHIPS AS AGENTS OF CHANGE

- A new institutional arrangement that "locks in" change

- Arms-length relationship that promotes autonomy and accountability

QUESTIONS REGARDING PPP

- Is the private sector interested?

- Can the government deal effectively with private partners?

- Do PPPs improve service efficiency and coverage?

EXPERIENCE WITH CONTRACTUAL FORMS OF PPP IN WATER SUPPLY

SUPPORT SERVICES CONTRACTS

- Short term -- 1 or 2 years

- Create lots of competition

- Require administrative capacity

SUPPORT SERVICES CONTRACTS

CASE OF SANTIAGO, CHILE

- Results: improved productivity
- Staff/connection ratio of 2.1/1000 within company
- Labor/connection ratio of 3.5/1000 all inclusive

LEASE CONTRACTS & CONCESSIONS

- Long term -- 10 to 30 years

- Comprehensive

- Lease contracts include all maintenance and some replacements

- Concessions include expansion and investments

LEASE CONTRACTS & CONCESSIONS (contin.)

- Potential for comparative competition
- Require mechanisms for tariff adjustments
- Require government capacity to monitor performance
- Require periodic capacity to renegotiate

LEASE CONTRACT

CASE OF GUINEA

- 10-year lease contract, 1989

- Mixed enterprise formed by private French companies and the State

- World Bank credit supports the contract on a declining basis

- Tariffs rising to full cost recovery

CASE OF GUINEA (contin.)

- **Results: Improvements in cost recovery and technical performance**

- **Problems: Delays in government procurement of meters**

CONCESSION

CASE OF MACAO

- **25-year concession, 1985**

- **Joint venture formed by French company, local and Hong Kong private interests**

- **High staff productivity: 2/1000**

- **Low water losses: 12 percent**

CONCESSION

CASES OF BUENOS AIRES AND CARACAS

- Buenos Aires: 30-year concession
- Caracas: No responsive bids

BUENOS AIRES

LESSONS

- Consensus building

- Political commitment

- Good technical preparation

- Adequate tariffs -- The winning bid discounted the tariff by 27 percent.

- Political and economic risks

POTENTIAL BENEFITS

- Improved cost recovery
- Reduced water losses
- Improved technical performance
- Increased staff productivity
- Investment finance
- Lower tariffs in some cases

REGULATORY ISSUES

- Competition
- Tariff setting
- Investment planning
- Performance monitoring