

Promoting Effective Water Management of the Fuyang River Basin, China: An Action Plan: Action Plan¹

Through more than 2 years of research in the Fuyang river basin, Hebei Province of China, useful information was collected on hydrological, physical and socioeconomic conditions, the legal system and institutional and policy environments. Based on the major results of the research, this report proposes action plans at national, regional, river basin and irrigation system levels, which will be carried out both in the short and the long term.

Major Results of the Research

Hydrological and Physical Conditions

Water scarcity and agricultural water use. The FRB is a water-scarce basin and its per capita water resource availability is only one-sixth of the national averages. Agriculture is the largest water consumer but the share of agricultural water use has been declining over time, from 81 percent in 1993 to 75 percent in 1998, mainly due to increasing domestic consumption.

Dropping of groundwater level. Groundwater is the most important water source in the FRB, its share over total water use was 82 percent in 1998. With the increasing demands of agricultural, domestic and industrial uses for water, groundwater exploitation increased rapidly and the groundwater table (both shallow and deep tables) fell substantially at more than 1 m/yr. in the past two decades. Due to the overexploitation of groundwater, cones of depressions have developed in all five prefectures centered in cities.

Declining of surface water discharge. According to measuring at the Aixinzhuang hydrologic station, outflows from the basin dramatically decreased from an average of more than 500 million cubic meters in the 1970s to a discharge of less than 100 million cubic meters in the 1980s and 1990s. The river basin has changed from an open basin to a closed basin.

Serious water pollution. Industry and population growth lead to more and more serious water pollution, which further sharpen the water-scarcity situation in the FRB. According to the monitoring of the Hebei Hydrological Bureau, about 70 percent of the Fuyang river is classified as fourth level. In addition to surface water pollution, groundwater pollution is also very serious. During 1995–1997 in the FRB, the most severe groundwater pollution occurred in Cangzhou and Hengshui. Groundwater quality in 100 percent and 99 percent of wells is classified as third or over-third level. In Handan, the percentage is 80 percent, in Xingtai 56 percent and in Shijiazhang 24 percent.

¹ Efforts were made to promote the implementation of this action plan, and the others; and on three priority cases action was initiated. Information about these efforts is given in volume V.

Limitation in further exploitation. According to water accounting analysis, both the depleted fraction of available water and the process fraction of available water are very high, even under the conditions of groundwater overdraft during both the normal season and the dry season. It implies that additional water for further exploitation is very limited and demand water management is very urgent for efficient water use and allocation. Water available for agriculture is expected to decrease in the future as demand for domestic and industrial water uses increases.

Legal, Institutional and Policy Conditions

Although limited water endowment is one important reason that results in expanding the water demand and supply gap, the existing legal system, regulations, management and other water-related policies add to part of the imbalance and unsustainable use of water.

Water law and regulations were always too general to be implemented and amending existing legislations and issuing necessary new legislations were very slow, which reflects sharp conflicts among various stakeholders.

The diverse functions of water use and diverse objectives and interests of many water management authorities result in various water management conflicts present in rural and urban water use, surface water and groundwater balance, water-quantity and water-quality controls.

China has been trying to reform its water management system since the late 1980s, particularly through a recent reform initiated after the mid-1990s, though the ability to implement the reform is questionable.

The planned financing system in the water sector has been gradually decentralized since the early 1980s. The major reform has been the focus on the responsibility of water management and finance between the central and local government and between the government and the farmers. With the progress of financial reform, water infrastructural investment has declined greatly.

The monitoring costs are so high that the conflicts among various stakeholders and sectors make it almost impossible to follow the national water permitting system to collect water resources fees especially for irrigation with groundwater use.

China had tried to implement volumetric water prices in the 1970s. However, volumetric water price in the field had not been implemented due to measurement difficulties. Although the central government has encouraged the local governments to reform the water pricing system, water price is still very low and the water charge collection rate is also very low.

River-Basin Management

Despite the Seven Large River Commissions being established to coordinate water allocation and flood control across provinces, the impacts of these commissions are more on flood control than on water allocation due to the limited power of the commissions.

The FRB has no special river basin management organization. Within the administrative jurisdictions, water supply and demand are controlled and managed by too many authorities that have different interests resulting in various conflicts in balancing water use in the region. About 49 of percent counties in the FRB have established Water Affairs Bureaus to resolve water management conflicts.

Several water regulations aimed at increasing the efficient use of water in the FRB were issued earlier than corresponding national regulations, which reflect the water scarcity situation and the local government's attention on economic measures in solving water-shortage problems.

Increasing conflicts, and unbalanced and inefficient water allocation among sectors and between upstream and downstream within the river basin have made integrated river basin management (IRBM) essential. Therefore, a more enforced legal and regulation system and more effective institutional settings that facilitate the implementation of IRBM at the national, regional and water-basin levels need to be established.

Property-Right Innovation of Irrigation Systems

Growing evidence shows that administrative measures alone cannot solve increasing water-shortage problems. Market-oriented water management measures such as rational water price, water market, water right transfer and property right innovation of water facilities should be emphasized and introduced into the central and local water management system.

With rural reform and the implementation of production responsibility in China, agricultural production management was transferred from collectives to the farm households, which resulted in incompatibility of collective groundwater irrigation with the agricultural production system.

Our research results show that the collectively owned groundwater irrigation system has been gradually substituted by a more market-oriented private or quasi-private irrigation system since the 1980s. Major determinants of the property right innovation in irrigation systems are the increasing water shortage problems, stresses from local population growth with declining land endowment, weakening the village or community economic power, improved human capital of the community, market development, and water finance and credit policies.

The study on property right innovation also suggests that the private and shareholding groundwater irrigation system can raise the efficient use of water. The existing government fiscal and financial policies in irrigation investment need to be revised in order to encourage the development of this market-oriented irrigation management system.

Action Plan

With the progress of the project and based on our research results, we have conducted several dialogues through formal or informal meetings with central, provincial and local water-related governments on the possible options in promoting effective water management at irrigation system, small and large river basin, regional and national levels. The Ministry of Water Resources (MWR) and local Water Resources Bureaus attached high value to our research and encouraged us to continue to do more empirical studies on water institutions, management and policy issues, such as water right, water price and integrated water management. Based on the main findings of the research and in order to promote integrated and sustainable water management in FRB and even in China, the following action plans are proposed at national, regional, river basin and irrigation district levels (table 1). Action plans at these levels are closely related; however, implementation of one level's reform cannot reach the sustainable water and socioeconomic development in another level. In addition, all the following suggestions will be made both in the short and the long term.

Except for the previous dialogues with central and local governments, dialogue among various stakeholders will be continuously carried out in the long term; proposals on promoting sustainable and effective water development will also be updated based on the change of socioeconomic, environmental and political conditions.

National Level

At the national level, due to poor implementation and enforcement of the water law, regulations and policies, insufficient irrigation investment, imbalance of water distribution and lack of interregional management, we are proposing to amend the existing water law, issuing a watershed law, a water saving law and an effective guideline for water pricing, water resources fee collection methods, etc.; build up institutional and human capacities for enforcement; increase investment for updating and maintaining irrigation facilities; and accelerate the process of transferring water from the south to the north and empower regional water commission authorities.

Regional Level

At the regional level, the main issues concerned are water management conflicts, weak implementation of national water policy, laws and regulations, inefficiency of water use and serious water pollution. We propose strengthening the enforcement of national water policies, laws and regulations through issuing corresponding implementation details; increase the water price and improve water fee collection approaches; extend suitable water saving technologies and strengthen wastewater disposal ability by introducing wastewater disposal facilities.

River-Basin Level

At the river basin level, due to fragmentation of river water management, conflicts between upstream and downstream and serious drop in groundwater table, actions on reorganizing the exiting Seven Large River Basin Commissions and establishing an integrated water management system in small river basins need to be taken. Other actions at the basin level include implementing the groundwater withdrawal permit system for agriculture, collecting groundwater resources fee, artificially recharging groundwater and conjunctively utilizing surface water and groundwater to control groundwater exploitation.

Irrigation System Level

At irrigation system level, due to existing unclear property rights, low water productivity and aging and deterioration of irrigation facilities, we propose to promote a market-oriented property right innovation and update and maintain irrigation facilities through mobilizing all possible financial and human resources.

Table 1. Main issues and proposed action plans.

	Issues	Actions	Time schedule
National	Law, regulations and policies are too general to implement; lack of enforcement	Amending water law, issuing watershed law and water saving law, issuing effective guideline of water pricing, water resources fee collection methods, etc. Building up institutional and human capacities for enforcement.	2001-2010
	Insufficient irrigation investment	Increasing investment for updating and maintaining irrigation facilities.	2001.....
	Imbalance of water distribution; Lack of interregional management	Transferring water from the south to the north; empowering regional water commission authorities.	2001-2050
Regional	Water management conflicts	Reforming water administration system, empowering water management authorities.	2001-2005
	Weak implementation of national water policy, law and regulations	Strengthening enforcement of national water policies, legal and regulation through issuing corresponding implementation details.	2001-2005
	Inefficient water use	Increasing water price, improving water fee collection approaches; extending suitable water saving technologies.	2001-2005
	Serious water pollution	Strengthening wastewater disposal ability by introducing wastewater disposal facilities.	2001-2005
River basin	Fragmentation of river water management; conflicts between upstream and downstream	For seven large river basins, River Basin Commissions should be reorganized and empowered for full river water control and coordination rights; for small river basins within provinces River Basin Commissions should be established and also empowered with full river water control and coordination rights in the river basin.	2001-2003
	Serious drop in groundwater table	Implementing groundwater withdrawal permit system for agriculture; collecting groundwater resources fee; artificially recharging groundwater; conjunctive utilization of surface water and groundwater.	2001-2003
Irrigation system	Unclear property right and low water productivity	Promoting market-oriented property rights innovation.	2001-2003
	Aging and deterioration of irrigation facilities	Updating and maintaining irrigation facilities through mobilizing all possible financial and human resources.	2001-2005

Improving Water Management in the Ombilin Upper Subbasin of Inderagiri River Basin of West Sumatra Province, Indonesia: An Action Plan

Introduction

This report contains the summary of the results of the study and the action plan for the short and long term. The presentation consists of:

- Major indications from the physical and socioeconomic settings.
- Issues related to integrated water management: A recount from the Ombilin river water accounting, assessment of the impacts of the Singkarak HEPP construction, and performance assessment.
- Water institutions in Indonesia: A brief overview.
- The policy and institutional context of river basin management in Indonesia.
 - Water resources management policy reform.
 - River basin and its management in Indonesia.
- Improving water management in the West Sumatra Province: An action plan.
 - Options.
 - Strategies and an action plan.

Major Indications from the Physical and Socioeconomic Settings

There are several indications from the assessment of physical and socioeconomic settings.

- First, the pattern of water uses varies among the three major rivers and lakes. At the Ombilin river, water is used for irrigation, industry, electric power generation, and domestic water supply. In two other major rivers, water is mainly used for irrigation and domestic water supplies.
- Second, the development of the Singkarak Hydroelectric Power Plant (HEPP) has reduced significantly the outflow of water from the Singkarak lake to the Ombilin river, which has affected the quantity of water flowing in the Ombilin river. It has, in turn, affected the availability of water for various uses along the Ombilin river, which indicates the competitions of water uses between the Singkarak HEPP and water users along the Ombilin river.

- Third, based on the available data, rainfall water was less than evaporation in dry months at the downstream part of the Ombilin river as the source of water to fulfill the demand for various users.

Issues Related to Integrated Water Management: A Recount of the Ombilin River Water Accounting, Assessment of the Impacts of the Singkarak HEPP Construction and Performance Assessment

The results of the study and discussions on the Ombilin river water accounting, assessment of the impacts of the Singkarak HEPP construction, and performance assessment came to the following conclusions.

- The discharge flows of the Ombilin river, which originates from the Singkarak lake, has been reduced significantly since the operation of Singkarak HEPP. The average outflows from Singkarak lake to the Ombilin river before the operation of the Singkarak HEPP was 49.6 cusecs and in the normal dry season the outflows from the Singkarak lake was 15.0 cusecs. With the operation of the HEPP the discharge flows from the Singkarak lake to the Ombilin river is regulated to be 2 cusecs in the rainy season and 6 cusecs in the dry season. However, the water balance and river water accounting showed that, in aggregate terms, the availability (supply) of water in the river still exceeded the need (demand for various uses).
- The reduction of the discharge flow at the Ombilin river has affected downstream users. Among the numerous stakeholders from various sectors, irrigators are the main and largest group consuming water of the Ombilin river subbasin. Therefore, though the development of Singkarak HEPP has brought about different consequences on different stakeholders irrigators have been affected severely. The cost of operation of waterwheels has been increased and the number of waterwheels for irrigation has gone down by around 20 percent. The productivity of irrigated rice reported has decreased. In addition, water quality for domestic water supply has declined but the cost for water purification has increased.
- The matrix of stakeholder importance and influence reflects the reality that irrigators constitute a less-influencing, interest group despite the fact that they are the main and largest users of basin water. Consequently, policy and program interventions related to the basin water management oftentimes did not represent the interests of irrigators since the decision makers are almost completely separated from the users. In other words, water consumers have generally not been involved in the process of decision making related to the basin water management. The exclusion of stakeholders in decision making is one of the consequences of the absence of water management institutions in the field. Since no formal or informal institution exists for basin water management, there is no mechanism in the field to facilitate stakeholder participation in both water management and decision-making process. Moreover, no legally recognized laws and regulations on water allocation and regulation are in place to protect stakeholder rights on water or to ensure that the water need of each stakeholder is fulfilled without sacrificing the needs of others.

- The results of performance assessment suggested that the performance of irrigated agriculture has declined during the last 5 years. The result of the trend analysis shows that there is a significant reduction in most performance indicators facing the waterwheel irrigation systems. A sharp decline has been in the aspect of relative water supply and relative irrigation supply that, in turn, has brought about reductions in the output. As a result, the overall performance of irrigated agriculture has declined markedly. However, the overall performance of the studied FMIS is still much better compared to the studied Government-Managed Irrigation Systems (GMIS). The recent conditions can be attributed to the absence of water management institutions in the Ombilin river subbasin under a growing inter-sectoral competition for water. With regard to irrigation water management, a major point raised is that the existing irrigation technology (particularly traditional water wheel) is no longer suited to the recent condition of water scarcity. Finally, there are still chances to increase the performance of irrigated agriculture in the area of the Ombilin river subbasin by establishing institutions for managing water in the basin, and by using advanced irrigation technology to cope with the problem of increased scarcity of water.

The results of the case study clearly indicated the need for managing water in an integrated manner, which implies the need for the development of institutions for this purpose.

Water Institutions in Indonesia: A Brief Overview

- Present Indonesian water institutions, to say the least, are not in an established state. Rapid changes in the politico-economic arena in the last two and a half years render many old water institutions and arrangements irrelevant; yet, a needed new institutional arrangement has not been established to replace the old one. Since real opportunities for betterment came only less than a year ago with the establishment of the newly elected government, it remains to be seen if the spirit of reform would have any impacts on the improvement of water institutions.
- In many ways, it is necessarily based on the old laws and regulations. Some changes have been effected by the new government, but the crux of the issues has not been tackled. Old laws and regulations imply a very strong presence of government in almost any aspect of WRDM with limited public accountability. Moreover, the culture of the new order regime that espouses government domination provided disincentives, or perhaps even made it undesirable for the government to set up a clear institutional arrangement on WRDM: for the government can fix any problem. The latest development toward greater popular participation in political decision making and increasing relative water scarcity imply that gaps and inconsistencies in water laws and regulations must be filled and mended.
- Given increasing relative water scarcity, clear institutions on water rights and allocation are instrumental in anticipating the future water management situation. They should be able to guide policy formulation toward an efficient, equitable and sustainable WRDM based on river basin/watershed integrated and comprehensive planning. Key concepts for such a pattern of WRDM in Indonesia are still to be developed and agreed upon. Pusposutardjo (1995) notes that the term, “water resource” is not known in Indonesian

formal water institutions, which only refer to water and/or source of water; let alone the concept of sustainable water resource development and management. Moreover, greater roles of water users in the management of water resources at the basin level are required. Perhaps government domination should be appropriately reduced to providing information for management institutions based on partnership to make right decisions.

- Specifically, there is a clear need for a) an integrative and comprehensive basin-based planning of WRDM; b) an agreement on the conceptual bases for sustainable basin-based planning of WRDM; c) an adequate basin-based data for basin-based planning; d) clear rules on water right and allocation; e) a basin-based management structure based on equal partnership among the stakeholders including government authorities; and f) clear objective criteria for decision making.

The Policy and Institutional Context of River-Basin Management in Indonesia

Water Resources Management Policy Reform

The Government of Indonesia is currently reforming its water resources and irrigation management policy. This section attempted to present the reform principles, which closely related to the improvement of river-basin management, especially in the West Sumatra context. There are four objectives of the reforms, namely (BAPPENAS 2000):

- Objective No. 1. Improving national institutional frameworks for water resources development and management.
- Objective No. 2. Improving organizational and financial framework for river basin management.
- Objective No. 3. Improving regional water quality management regulatory institutions and implementation.
- Objective No. 4. Improving irrigation management policy, institutions and regulations.

Among those objectives, the first and the second objectives are closely related to the improvement of water allocation from the source and river basin management. One of the five sub-objectives² in the first objective clearly mentioned the involvement of stakeholders (including the private sector) in the river basin management and decision making. The proposed reforms in this sub-objective cover three areas, namely:

- Issuing government regulations which emphasize the participation of stakeholders (public agency institutions, community, and private) in the water resources development and management.

²These five sub-objectives are: a) the establishment of a national water resources management coordination framework; b) adoption of a national policy for water resources management; c) involvement of stakeholders (including the private sector) in the river-basin management and decision making; d) improvement of national water-resources information and decision-support systems; and e) improvement of national hydrological and water-quality data collection and management system.

- Amending the ministerial regulation to: a) include stakeholder representatives in the provincial- and basin-level water management coordination committee (*in Indonesian language called the PTPA and PPTPA*); and b) merging the provincial water management committee (*PTPA*) with the provincial irrigation committee.
- Establishing functional PTPA and basin-level water management committee (PPTPA) with stakeholder representation in key river basins in the 12 provinces.

The second objective contained three sub-objectives one of which is the improvement of the provincial regulatory framework for river basin and aquifer management. This will be the basis for the development of effective water management institutions at the provincial and basin level.

River Basin and Its Management in Indonesia

The Government of Indonesia started to recognize the river basin as the unit of water management in 1982 through the enactment of Government Regulation No. 22/1982.³ As a follow-up of this regulation, in 1989 the Public Works Ministerial Regulation No. 39/PRT/1989 was issued to specify the 90 river basins in Indonesia.⁴ The objective of this ministerial regulation is to ensure that conservation and use of water in the basins are conducted in a holistic and integrated manner. It was only in 1990 that the Public Works Ministerial Regulation (No. 48/PRT/1990), which specified the authority for the management of water and the river basin, was enacted. Out of the 90 river basins, 73 basins are managed by provincial governments, 15 basins fall under the management of the Ministry of Public Works, and 2 basins⁵ under the management of a public corporation. Therefore, the incorporation of the idea of river basin management into policy and action is relatively new to Indonesia and the management framework—other than in those two basins under public corporation—is not yet developed.

In other provinces of Indonesia, the idea of river-basin management is newly introduced. As the responsibility for water management is fragmented between several government agencies a provincial water management committee (in Indonesian language abbreviated as PTPA) was supposed to be set up in all provinces.⁶ In West Sumatra, the PTPA was set up in 1994. The characteristics of this committee are as follows:

- Its main function is to assist the Governor in coordinating water management at the provincial level.

³Article 4, Chapter III stressed the use of the river basin as the basis for water resources management.

⁴It should be noted that the Public Works Ministry was abolished this year and its function has been merged into the Ministry of Settlement and Regional Development (MSRD). This merging involved the reorganization of MSRD and the name was changed as the Ministry of Settlement and Regional Infrastructure Development. The adjustment of the laws and regulations related to water management is underway within the framework of the policy reform.

⁵These two basins are the Brantas river basin in East Java under the management of Jasa Tirta Public Corporation, and the Citarum river basin in West Java under the Otorita Jatiluhur Public Corporation.

⁶This is based on the Public Works Ministerial Decision No. 67/PRT/1993 on the Provincial-Level Water Management Committee.

- The specific tasks are: a) data collection, processing, and preparing materials to be used to formulate provincial policy on water management coordination; and b) provide consideration and/or advise the Governor on matters related to water supply, wastewater drainage and flood control.
- The members of the committee are the staff from agencies related to water management (other stakeholders are not considered as the members of the committee).

There was no specific budget allocated for this committee, so that the activity was much more on an ad hoc basis. When there were problems related to water supply, drainage or flood, a meeting of provincial staff would be held but it was not very clear whether the meeting was a PTPA meeting or just a meeting related to the performance of a general government task.

The government regulation related to the provincial PTPA also has an article, which states that the Governor could set up a basin-level water management committee (PPTPA) to assist the PTPA in performing its tasks. However, so far this committee has not been set up in any of the six river basins located in the West Sumatra Province. As the conflicts over water allocation and use tended to increase in West Sumatra, as illustrated with the case of the Ombilin river, clearly, there is a need to develop a framework for river basin management in the province. The case of the Ombilin river can be used as the pilot activity to develop the framework and capacity for integrated water resource management at the basin level.

Improving Water Management in West Sumatra Province: An Action Plan

The discussions in the preceding sections have indicated that there is a need to develop effective water management institutions. Improving water management in the Inderagiri subbasin (especially in the basin under the Ombilin river) would take more effort and a longer time because an organization for river basin management and frameworks for water rights are not yet developed.

Options

A number of options can be considered in order to solve the problems in the short and the long term. Efforts to develop an effective water management institution have already started. The proposals for these are as follows:

- In the short term, the problems faced by the users need to be solved by reviewing the existing water allocation rules, especially by releasing more water from the Singkarak lake to the Ombilin river.
- The handling of water allocation matters needs to be done systematically. For this all stakeholders have proposed setting up a kind of water board consisting all of them and giving them authority to regulate water allocation especially from the Singkarak lake.
- The technology for lifting water for irrigation both with waterwheels and diesel pumps needs to be adjusted to meet the needs of the local environment. The porosity of soil is

high and there is a need for 24 hours of water supply. The waterwheels are suited to this environment very well but the water level in the river is not sufficient to continue operating it efficiently with the current technology. With regard to pumps, the farmers indicated that they have difficulties with the cost of pump O&M and are thinking of the possibility of using electric pumps for lifting water from the river.

- It has also proposed that the electricity company provide a special discount for electricity charge for the domestic water supply company and the farmers who will use the electric pumps for irrigation as a “good neighborhood policy.”
- In the long term, the government needs to take initiatives to set up a coordinating body (water board) which can effectively regulate and enforce the water allocation rules, for which the national water resources policy has provided a legal basis.

Strategies and Action Plan

The efforts to implement the options required a number of steps to be taken. These range from reviewing the legal basis, formation of working groups to carry out the jobs, and pilot action. A list of proposed action plans is presented below:

- Reviewing all the water-related laws and regulations at the provincial level and adjusted in accordance with the direction of the new national water policy.
- Drafting and issuing a Governor Decision for the setting up of a Working Group that will be in charge of reviewing water-related laws and regulations and the setting up of a coordinating and/or operating body for river (sub)basin management by using the Ombilin river subbasin as the pilot site.
- Reviewing the possibility of charging a surface water use tax and use the income generated from this to finance the operation of the coordinating body and river and watershed maintenance.

Detailed Action Plan and Progress

This section presents the action plan and its short term (2001) and medium term (2002 - onward) implementation.

Short Term (2001)

Dialogues on the National Water Management Policy Reform and the resulting implication for improvement of water management in West Sumatra in general and the Upper Subbasin of the Inderagiri river basin in particular were conducted twice. The first was together with the discussion of the results of this study, attended by the staff from the national level. The second was in the first week of June in line with the initial discussion on the implementation of Northern Sumatra

Irrigation and Agriculture Development Project funded by the ADB and a grant from the Government of the Netherlands for improvement of irrigation and water management.

Discussion of Brantas river basin management experience

Plan for visit has been made but not yet realized. The staff of Provincial Water Resources Development Service Office who attended the workshop in Malang has shared his experience.

Development of commitment of the provincial government for improving water management in West Sumatra.

- Formation of working groups for reviewing the provincial water-management regulation.
- Government Policy Paper on water resource management.

The commitment is there but there is a difficulty for this since in the last 6 months the Government of West Sumatra Province has been trying to reorganize the structure to be in line with the policy of decentralization and autonomy. They expect to finalize the new structure this month.

Reviewing and revising provincial regulation on water management.

A draft has been produced, but not yet discussed with the stakeholders, and is awaiting the new structure of the provincial government.

A visit to Brantas river basin organization by key decision makers and members of the provincial assembly.

Not yet realized.

Public consultation and revision of the draft of the provincial regulation on water resources management and approval by the provincial assembly.

Long Term (2001 Onward)

Preparing a draft of academic paper for reorganizing and strengthening of provincial- and basin-level water-management committees (PTPA and PPTPA).

Public consultation on the draft of the academic paper of PTPA and PPTPA.

Revision of the academic paper and adoption of the concept as Governor Decree.

Development of a concept for the management of an information system (MIS) and decision-support systems (DSS).

Establishment of MIS and DSS section under PTPA and its operational units at each PPTPA level.

Reviewing the stage of water management at other river basins in West Sumatra and the development of a list of priority basins where PPTPA will be established.

Preparation for the establishment of PPTPA at the upper subbasin of the Inderagiri (Ombilin river).

Establishment of the PPTPA for the upper subbasin of Inderagiri (Ombilin river).

Drawing lessons from the upper subbasin of Inderagiri (Ombilin river) experience.

Establishment of PPTPA for other priority basins.

Concluding Remarks

This report has presented the action plan and progress so far in West Sumatra, Indonesia. The plan and action to improve water resources management in West Sumatra are part of the national effort to improve water management. West Sumatra Province currently has made an initial effort to implement the Northern Sumatra Irrigation and Agriculture Development Project (NSIADP) funded by a loan from the Asian Development Bank. There is also available a grant from the Government of the Netherlands through the World Bank. The basic idea of both projects is to support the Government of Indonesia in implementing its New Water Resource Management Policy.

At the same time, the Government of Indonesia is also implementing the policy of decentralization and autonomy to the regional government. In this framework, both provincial and district governments have to adjust their organizational structures. This process tended to take a longer time in West Sumatra, which creates some uncertainty to the government officials that, in turn, is weakening their attention on the specific issues of development, in this case of water-resources management. It is expected that the reorganizing of the provincial and district government can be finalized this month. After that initiative, the improvement of water management in West Sumatra can be accelerated.

Improving the Water Resource Management in the East-Rapti River Basin of Nepal: An Action Plan

Policy and Institutional Context

Macro Policy and Institutional Context

The baseline document of the ninth five-year plan (1997-2002) of Nepal puts forth the necessity of moving beyond the sectoral policies and developing an overall water resource policy to function towards managing the growing inter-sectoral water use competition. Accordingly, the Ministry of Water Resources has been in the process of formulating a “National Water Resource Strategy” from a comprehensive approach. Such an approach can be operationalized only when it takes the form of a comprehensive policy for guiding the development and management of water resources in various uses. Water resources can also have far-reaching environmental implications in the process of its development, management and utilization pattern. Therefore, consistent with the water-resources development policy, the ninth five-year plan has also brought about an environment and water source protection and conservation policy. The policy emphasizes the protecting of natural water sources by institutional development, and minimizing soil erosion, landslide and pollution levels through maximizing people’s participation. It also stresses the need for establishing data banks at central, regional and local levels to analyze and monitor the existing and potential scenario and thereby assisting in effective environmental policy and program development.

The Environmental Action Plan of 1994 provided some guidelines for both integrated water management and maintaining the water quality at the river-basin level. Although the revised Environment Protection/Conservation Act (EPA) came in 1998/99, the task of formulating working rules and defining accountability of government line agencies to implement the Act is yet to come. Related to minimizing the effect of industrial wastage on water quality and others, effluent standards for five various kinds of industries were published in the official gazette of April 30, 2001. According to EPA, industries established before this date are required to acquire certificates within 6 months from the concerned ministry to run the industry and keep the pollution level of the final effluent discharge below prescribed limits. In the case of new industries, it is mandatory that they be required to install the cleaner device and run the industry as per the standards set for final discharge. The National Conservation Strategy (NCS) was also endorsed by the government as a policy in 1988, which is implemented under the direction of the National Planning Commissions (NPC). One component of the implementation also addresses industrial pollution control.

Similarly, the irrigation sector has been the major consumer of the water resources in Nepal. The Ministry of Water Resource (MOWR) is the apex government body to develop the overall irrigation policy, whereas the Department of Irrigation (DOI) is an implementing agency of irrigation policy working under the MOWR. DOI implements the programs through its regional and district-level offices. The early investment policy and programs in irrigation that focused merely on development of physical infrastructures and ignored user participation have indicated the significant pitfalls in the schemes’ unsustainability. As a result, the first irrigation policy of 1992 and its revised version of 1997 emphasized the active participation of beneficiary users at all stages of project implementation as well as operation and maintenance including decision making, cost sharing and other related activities.

The present activities of DOI are primarily based on recommendation of the Irrigation Master Plan of 1988, irrigation policy of 1992 and the 20-Year Agricultural Perspective Plan (APP) of HMG/Nepal that was adopted in 1995. In order to come out of the vicious circle of existing food deficit and to increase food production in the country, the APP has given top priority to groundwater development policy mainly through shallow tube wells in Terai.

Basin-Level Policy and Institutional Context

Some of the water-resource-related macro policies stated above indicate concern that signaled at least the awareness developed with the central-level authorities that an integrated approach be incorporated in water resource development policies and programs. Some initiatives have also been taken by the government to delegate some authority to the water-resources-management-related district committees. These committees can be expected to be involved partly in river water-management tasks. For example, the Irrigation Act of 1999 has formed a district-level Irrigation and River Control Committee (IRCC) consisting of seven members, with the Chief District Officer (CDO) as chairman and the head of the District Irrigation Office as member-secretary. Article 15.6 of the Act has made it mandatory for the IRCC of relevant districts to execute joint meetings on problems related to irrigation and river control management and activities if the river is designated as part of more than one district.

Under the provision made in Water Resource Regulation of 1993 (bylaw-2, Law-8), the District Water Resource Committee (DWRC) has been formed with CDO as chairman and Local Development Officer (LDO) acting as the member-secretary. The responsibility of DWRC is to give legitimate status to the users association by registration. The institutional section of the District Development Committee (DDC) helps DWRC in relevant document/record keeping. In these basin districts, district-level organization of National Irrigation Water Users' Federation (NIWUF) also exists. The federation formed under the provision made by the Water Resource Act of 1992 has only a very recent history of development and, therefore, it would obviously take time to consolidate pertinent issues and pick up the river-basin approach.

Salient Characteristics of the Physical, Socioeconomic and Institutional Environment of the East Rapti River Basin

Physical Characteristics

Chitwan and Makwanpur districts occupy about 58 and 42 percent of the basin area (3,222 sq. km.), respectively. Diversified landforms and soil types as well as dissected hilly terrain slopes and mosaics of alluvial plains are found formed by the action of the East-Rapti river. Where settlements occur, they reflect areas with stable soils and varied water availability for irrigation. The dominant land-use and land-cover are under mixes of warm temperate, subtropical hardwood and coniferous trees (62.25%), followed by lowland type agriculture (18.31%), upland type agriculture (8.42%), shrubland (3.67%), grassland (3.61%) and others including settlements like urban, swamps, rock outcrops and sandy/gravel river banks (3.74%).

The river is 122 km long and flows westward to join the bigger snow-fed river Narayani. Although the annual average rainfall in the basin is high (1,866 to 2,233 mm), about 85 percent of the total occurs from June to October. The water accounting study indicated that it is an "open

basin” where only 53 percent of available water is depleted in a dry year and the remaining 47 percent occurs as utilizable outflow. Only 6 percent of available water is process-consumed. With more than 60 percent area, forests consume the bulk of available water. Non-beneficial consumption is only 5 percent. Agricultural water productivity is also very low (US\$ 0.09/m³) indicating great scope to enhance water productivity in the basin. A large number of irrigation infrastructures are developed, particularly in the downstream valley with external support at different times in the past.

Socioeconomic Characteristics

The basin includes 36 village development committees (VDCs) in Chitwan and 23 VDCs in the Makwanpur district. VDCs refer to the lowest administrative unit of the government in Nepal. With 536,031 of the total population in 1991, 63 percent resides in Chitwan and 37 percent in the Makwanpur part of the basin. They belong to diverse ethnic communities such as Bramhin and Chhetri (38%), Mongols (29%), indigenous (15%), lower cast (7%) and others (11%). Over the last four decades, particularly the lower part of the basin has received most of the Bramhin and Chhetri in-migrants from the surrounding hills. Rural agriculture is the major occupation of 67 percent of males and 87 percent of females. Of the population residing in Bharatpur, Ratnanagar and Hetauda municipalities an average of 25 percent is urban. The annual population growth rate is above the national average of 2.38 (CBS 1999). With some variations, literacy rate of those in the age of 6 years and above, increased by 19 percent in Chitwan and by 14 percent in the Makwanpur district between 1981 and 1991. Hilly people are deprived of literacy compared to their plain/valley counterparts the reason being that females in the hilly areas appear to have minimal access (19%) to education compared to females (81%) in the plains.

Population nearly doubled during 1971-1991. Although the relative concentration of poverty-stricken population is more in the hills, yet acute poverty is found more in the plains. Compared to Chitwan, the Makwanpur district is severely stricken by poverty as indicated in water-related literature. Child deprivation, gender discrimination, disadvantaged groups, accessibility and status of food production have been the keys to poverty. Overall, the population of the disadvantaged group is relatively high, whereas their man-land ratio is extremely low compared to that of the community of the superior Bramhin caste in the basin.

Although 75 percent the population, mostly smallholders (<1.0 ha/household), depend on farm income, yet productivity of most of the crops has remained stagnant. Medium to big landholders have a tendency to lease out part of their land and engage in off-farm employment for income. The average number of off-farm employment per household is 4.1 and the average family size is 7.4.

Institutional Characteristics

Since the hydrological boundary of the basin is designated as part of two districts, this mismatches with the scope of government agencies to work beyond the administrative district boundary. But when such cases arise, the existing mechanism is that a joint meeting of both DWRCs be held to resolve the case for concurrence of both districts. This mechanism seems to provide only a near-term solution to the affected resource user groups as the members of DWRC have other kinds of priority work in their respective offices. Besides, this ad-hoc mechanism does not underlie a clear concept of long-term basin water resources regulation or provide an appropriate approach for integrated development and management of the water resources in the basin.

The District Irrigation Office (DIO) is the government line agency with overall responsibility for development and management of surface irrigation. For the current, ninth, five-year plan (1997-2002) period, DIO in Chitwan has targeted, among others, to complete seven approved new irrigation projects under the Second Irrigation Sector Project (SISP) of the Department of Irrigation with credit assistance from the ADB. The investment process includes information dissemination in the district, application filing, double-stage ground surveying and project ranking, approval of high ranking irrigation projects by the project steering committee after their final selection from district and regional appraisal committees, preparation of a detailed design report including cost estimates, and execution. Users are required to share 15 percent the project cost of which 30 percent has to be deposited in advance to begin the project execution.

The Groundwater Irrigation Program (GWIP) office located in Parsa, Chitwan, a separate entity working directly under the Groundwater Resource Development Committee of the Department of Irrigation, has the mandate to develop groundwater irrigation facility in Chitwan and in 19 other districts of Nepal. The GWIP implements the program as prioritized by the APP national objectives to boost agricultural production by investing in developing groundwater resources. With 60 percent subsidized-GWIP-support, farmers developed 197 shallow tube wells (STW) during 1998/99. After the complete withdrawal of subsidy from 2000 onwards, the scope of GWIP has been narrowed down to work as a facilitator in the areas of technical and training, backstopping the user groups. The main reason for the nonsubsidy was ADB's forcing of the government to stop the subsidy that would help create user awareness to improve self-reliance and develop a feeling of resource ownership.

In the irrigation sector per se, more than 200 water user groups have been registered in the DWRC. Traditionally, they have been operating in a locally organized mode and also keeping records of their contribution for resource management. A separate water users' federation also exists in the Eastern-Chitwan valley for consolidating regional efforts to approach agencies for assistance.

Agricultural System and Irrigation Development

The basin comprises both hills and valley systems with unique biophysical environments suited to diverse agricultural and allied enterprises. Until the early 1950s, a large part of the valley was under dense forest and popularly called the "malaria hell." A small number of scattered *Tharu* and *Daria* in the valley floor and *Chepang* and *Magar* in the slopping hills were the indigenous communities. The former lived on traditional wetland rice cultivation, animal rearing and fishing, whereas the latter survived on collecting wild food and fishing. Another social sect, Bramhan, Chhetri, including people of other castes lived higher up in the hills. They cultivated both upland crops like maize and millet and grew irrigated rice by making bench terraces where they could trap water from the nearby ravines.

When the government cleared a significant part of forest for planned resettlement under the Rapti Valley Multiple Development Project for those who suffered from famine, there was in-migration at a massive scale from the surrounding hills after malaria eradication began in 1953. The valley now experiences diverse and intensive agricultural systems by communities of mixed culture, traditions and values. Rice, wheat, maize and oilseeds are the major crops of the basin. Besides traditional crops, commercial vegetable is emerging as a new opportunity for creating cash flow with the farmers, particularly in the valley floor. Growing of rice crops receives highest priority for irrigation even though topography and water acquisition offer high constraints. The

Central Bureau of Statistics (1991) reported that 49 percent of households had access to irrigation and 41 percent of the agricultural area was irrigated in the basin districts.

Including both registered and unregistered, altogether 334 irrigation systems, mostly indigenous, have been recorded in the basin. Unique features of indigenous systems are that they have developed strong local institutions to enable them for collective action of water acquisition, allocation and dispute management for sustained agricultural production. The Legal Code of Nepal, 1963 has made provision for them to possess de-facto use rights of acquisition, construction and use water for irrigation from natural springs and river-water sources. The water use rights are automatically inherited by the male offspring.

According to HMGN policy on the irrigation-sector program, East-Rapti Irrigation Project (ERIP) of DOI/MWR invested in ADB loan assistance of US\$10.5 million in rehabilitation and improvement of 72 FMIS in East Chitwan valley during 1993-98. Altogether 8,516 hectares including both already irrigated and new areas received financial support. Besides, the project constructed huge (18 km long) dykes along the bank of the river, farm roads, culverts, bridges, afforestation, and also provided training to user associations for strengthening their institutional capabilities.

Key Issues Related to Agricultural Water Management

The findings, from stakeholder analysis, of their perception on water use, assessment of irrigation systems performance, water accounting and institutional studies of the basin arrived at the following conclusion and emerging issues:

Spatial Scarcity of Water for Irrigation

Being an open basin with 47 percent of utilizable outflow even in the dry years a significant number of irrigation systems still face water scarcity. However, the concept of the open basin gives a clue to the effect that the renewable groundwater reserve should be high and that there is no danger of depleting nonrenewable groundwater. Process documentation of ERIP infrastructural intervention indicated that the intervention ended up with perverse incentives and disregarded the users' active participation in key aspects of construction works. As a result, the situation of water scarcity remained in many irrigation systems because of faulty designs and nonincorporation of the indigenous technology.

Farmers then moved to exploring groundwater resources on their own in an attempt to secure a conjunctive use of water and save crops from failure due to draught or unreliable canal water supply. Water use efficiency and crop productivity are expected to be significantly higher where farmers have made conjunctive use of water. Owing to the complete withdrawal of the subsidy policy, the government program also failed to attract communities for developing STW from 2000. Despite an 84 percent subsidy in DTW, it has also achieved only insignificant progress because of both heavy costs involved and complex post-construction management activities. Now the private-sector investment has gained momentum in the development of groundwater resources.

Water Quality and Industrial Water Discharge

Makwanpur and Chitwan are among the hotspot industrial districts. Although industrial pollution standards have been published in the official gazette, the industries have not followed the rules and the government agency has not enforced them to do so. As a result, the river ecosystem, the Royal Chitwan National Park (RCNP) situated along the river downstream, and indigenous fishing communities have been adversely affected by untreated industrial wastewater disposed in the river. Although the textile industry drains wastewater at night, river water is still much polluted where water is used for various domestic purposes. This brings the issue of water quality in the river due to poor wastewater management by related regulatory agencies.

Necessary activities such as creating willingness with the industries for establishing pollution-treatment plants, monitoring of the river-pollution level, development of a low-cost pollution-control program, policies for providing them with necessary support for technical assistance, training and subsidies and the use of treated sludge for manuring have not been promoted. Government efforts in this direction would help conserve biodiversity, sustained environmental development and also help disadvantaged ethnic communities downstream who make a living on traditional fishing.

Increasing Soil Erosion and Sedimentation Problem

The basin witnessed major monsoonal floods in 1950, 1955, 1970 and 1993 resulting in the loss of a large number of lives and properties including sweeping of irrigation infrastructures and disruption of natural surface and subsurface hydraulic networks. The change in the river course and the damage of the canal structures by these floods have also created major water-right issues among users of several irrigation systems. After each flood event, water users had to invest substantial amounts of resources to improve and rehabilitate the irrigation structures.

In order to minimize such environmental problems and maintain water sources, conservation and management of natural vegetation cover upstream is a must. So far as the management is concerned, three forest types such as community forestry, leasehold forestry and government-managed forestry exist in the basin. While a large part of the forest in the basin is under a government-managed system, local communities have a tendency to increase private forests at the cost of the government forests.

The Decentralized Act and new forestry legislation of 1983 and 25-Year Forest Master Plan provided the legal foundation for handover of government forest to local communities. Except for a few cases and despite community willingness to take over the government forest, this has not progressed as envisaged in the policy. Since forest management has far-reaching influence on sustaining water sources, maintaining river water quality and regulating river flow downstream, sincere efforts from existing related institutions appear to have been insignificant in the basin.

Data limitation Problem

Sound planning begins with consistent and timely data that are collected adequately from reliable sources, tools and physical boundary defining the data scale. So far, relevant physical, socioeconomic, and institutional data can be obtained only on a district basis that does not reflect

basin perspectives. Earlier studies suggested that even with the available district-wise data, problems related to ensuring data quality have constrained a lot on the data analysis and the attendant implications.

Shortcomings of the Existing Institutional Arrangements

In view of our observations, coordinated and balanced growth of the water sector in this basin has been hampered more by institutional deficiencies than by sheer resource shortages. These institutional deficiencies/shortcomings are given below.

Unstable Government Policy in Developing Groundwater Resource

As the government withdrew the subsidy policy in shallow tube wells, when the implementation was at its full swing, the cessation of subsidy adversely affected the target that was set by APP. While approaching the end of 4th trimester budget release time of the year, the government has not released even the 3rd trimester fund to GWP in Parsa, Chitwan that has unnecessarily delayed the work of deep tube well installation.

Violation of Irrigation Policy in Developing Surface Irrigation Infrastructures

In the case of the huge ERIP intervention program of the government to rehabilitate and improve surface irrigation infrastructures, independent project impact assessment studies and many WUAs have seriously criticized the project performance to be poor in terms of user involvement in decision making, supervision and completion of construction works. Although the irrigation policy advocates top priority for a fully participatory approach, the implementation aspect has, to a great extent, failed to capitalize this concept in the basin.

Inability to Enforce Rules

In the case of industrial use of water, pollution standards have been published in the official gazette but the concerned government department has not yet enforced the industries to abide by the rule. The government officials still play a kind of quasi-formal role of negotiator between industry and the affected party only if they receive complaints from the latter. Protection of wildlife and environmental conservation of RCNP in the downstream, a site of World Heritage and tourism, require that safe and adequate water flow be maintained in the river. Untreated industrial discharge drained directly into the river might have affected the quality of water and aquatic creatures conserved by RCNP. It became a tripartite issue of resource-sharing as some irrigation systems, although in small amounts, also divert water to croplands from the river near RCNP against the interest of the latter that, in turn, has affected the water quantity during the dry season required by flora and fauna of the RCNP. The issues will remain unresolved unless some mechanisms of monitoring and sanctioning system of water quality, quantity and water allocation in the river come into force. The objectives of informal arrangements like meeting of representatives of WUA and RCNP, if any, are short-lived and resolve only immediate specific problem and, hence, do not constitute broader perspectives that otherwise would serve as a rule-in-use for minimizing multi-sectoral conflicts.

Lack of a Precise Policy for Appropriate Institutional Arrangement

From the basin water resource perspective, DWRC, IRCC, and district branches of NIWUA appear to be the closest government and users' institutions in the district. The Water Resource Regulation Act has not laid down a legal basis to make these institutions accountable for basin-level planning and integrated water-resources development. In other words, a precise policy has yet to come for appropriate institutional arrangements to cope with multi-sectoral use of basin water. To date, the water resource policy has addressed the resource mainly from a utilization point of view. More important aspects of water resources conservation, management and establishment of water rights across the sectors have not yet received due priority. The DWRC work is mainly limited to the issue of legitimate right to the WUA and IRCC for irrigation and related flood-control activities.

Contradictory Acts for Multiple Use of Water

A significant part of the East-Rapti river occurs within the jurisdiction of the National Sanctuary and Wildlife Conservation area. On the one hand, the Wildlife Conservation Act of 1982/83 prohibits diversion of the river water from any of its sources for any other uses, and also restricts the use of any explosive or toxic materials in the river water and on the other, some of the indigenous irrigation systems, near the conservation area, have been utilizing river water since long and claim a stake over water rights as provisioned by the National Legal Code of 1963. It appears that when these rules were formed the fact was not realized that the same water source would be equally important for other sectors and that the absence of such rules would create conflicts across the water-use sectors.

Proposed Action Plan for Improving Water Resource Management in the East Rapti River Basin

From the above shortcomings with the existing institutional arrangements, it appears that they are inadequate to address the emerging issues in the basin. Hence, the development of an appropriate institutional framework needs to be worked out involving all stakeholders, create new organizations and/or redefine functions of existing organizations. Step-wise short-term and long-term action plans are proposed below (table 2) in an effort to help develop effective water-management institutions in the basin.

Table 2. Short- and long-term action plans.

Problem/Issue	Short-term action plan (one year)	Long-term action plan (3-5 years)
1. Address problem of water scarcity to increase water productivity	Identification of water-scarce and water-abundant areas to implement institutional measures to increase the water productivity through stakeholder participation.	1. Delineation of water-scarce and water-abundant areas within the river basin and initiation of institutional measures to increase water productivity in water-scarce and water-abundant areas.
2. Institutional issues associated with conjunctive use of water.	Initiations of appropriate institutional mechanism among stakeholders to allocate and use both surface water and groundwater for agricultural purposes.	2. Development of institutions at the user level to increase the productivity of both surface water and groundwater in the river basin.
3. Water quality and industrial water discharge	<ol style="list-style-type: none"> 1. Measurement of water quality in the Rapti river (collaboration with Cooperative Management Centre [CMC] activities of SATWQM). 2. Identification of water-pollution sources and significantly polluted area and its effect on various water-use activities and water productivity. 3. Measurement of water quality in selected areas and identification of the stakeholders' role in checking pollution at the local level. 	<ol style="list-style-type: none"> 1. Increase stakeholders' role in the management of water pollution at the local level. 2. Development of an institutional mechanism and its enforcement to check pollution through stakeholder participation. 3. Effective measures taken by industrial enterprises to reduce pollution. Compensation by the polluter for the loss caused by pollution.
4. Soil erosion and sedimentation problems	<ol style="list-style-type: none"> 1. Promote interagency stakeholder consultation for finding strategies for watershed management in the basin and appropriate basin-management institutions. 2. Identification of watershed-management problem areas, stakeholders and required actions for implementations. 	<ol style="list-style-type: none"> 1. Watershed management plan, formulation and implementation 2. Development of an institutional mechanism to implement necessary actions through stakeholder participation.
5. Data limitation problem	Setting up an Information Management Center for the East-Rapti river basin at IAAS, Tribhuvan University, Rampur, Chitwan.	Develop a Comprehensive Data Bank in such a manner as to make it readily accessible for related agencies and data analysis.
6. Strengthening the institutional role of district-level agencies for river-basin planning.	<ol style="list-style-type: none"> 1. Facilitate increased role of the District Development Committee (DDC) in water resources planning in the district within the concept of river-basin planning. 2. Enhance the water-resource planning capability of the DDC. 3. Organize periodic consultation between concerned stakeholders (DWRC, DDC, irrigation and river control committee and line agencies of both districts). 	<ol style="list-style-type: none"> 1. Encourage DDCs of both districts to develop a joint action plan for water-resources development in the river basin. 2. Help DDCs of both districts to implement part of the integrated water-resources management plan.

Activities for the Short-Term Action Plan

Address problem of water scarcity to increase water productivity

- Documentation of existing institutional arrangement for water sharing in the water-scarce area.
- Organize stakeholders' meeting to develop water-sharing arrangements and resource mobilization.

Institutional issues associated with conjunctive use of water

- Identification of existing arrangements for conjunctive use of groundwater and surface water.

Water quality and industrial water discharge

- Identify stakeholders and their activities which contribute to water pollution.
- Measure levels of industrial water pollution at important sites within the areas of river basin.
- Identify sites and water-use activities that are significantly affected or likely to be affected by industrial water pollution.
- Identify various measures that stakeholders can implement to reduce water pollution by organizing stakeholder consultation.

Soil-erosion and sedimentation problems

- Identification of watershed areas through stakeholders that require immediate attention for protecting against environmental hazards, such as landslides, soil erosion and floods.
- Development of a watershed management plan through local stakeholders.

Data-limitation problem

- Develop and design data requirement, methodology and storage systems.

Coordinate the institutional role of district-level agencies for river-basin planning

- Organize interaction between the water resources planning entities in the district.
- Assess the water-resources planning and management capability of the DDC and other related district agencies.

Activities for the Long-Term Action Plan

Address problem of water scarcity to increase water productivity

- Explore and compare areas in terms of water availability for different uses within the basin.
- Determine water-scarce and water-abundant zones and prepare geo-reference maps of the areas.
- Facilitate the development and institutionalization of existing water-use practices.
- Assist in promoting linkages between WUAs and related district-level agencies for developing zonation plans and effective service delivery.

Institutional issues associated with conjunctive use of water

- Develop water-sharing arrangements between surface water and groundwater users.
- Evaluate the potentials and constraints of existing local-level institutions for consumptive use of water.
- Strengthen the institutional capability of users in the productive use of water.

Water quality and industrial water discharge

- Assessment of pollution effect on various water-use activities including health and the environment.
- Create awareness among stakeholders about the possible industrial hazards.
- Encourage stakeholders to design and implement appropriate measures to reduce water pollution.
- Devise an institutional mechanism to monitor water pollution through stakeholder participation.
- Develop an institutional mechanism to reduce pollution.
- Encourage stakeholders to work out a compensation package to discourage pollution.

Soil-erosion and sedimentation problems

- Assist stakeholders in 1-2 sites to develop activities to conserve the watershed.
- Assist stakeholders in the implementation of watershed-conservation activities.
- Encourage stakeholders to institutionalize the watershed-conservation activities in the river basin.

Data-limitation problem

- Organize basin-level data in hard copy and digital format.
- Support basin-level planning by providing necessary data to concerned agency.
- Disseminate basin information to users at various levels (policy/planning, implementation, research and academic).
- Update basin-level data periodically.

Strengthening the institutional role of the district-level agencies for river-basin planning

- Assist DDCs and other line agencies to develop water resources for the river basin in a coordinated way.
- Establish linkages between the DDCs, line agencies, users and other stakeholders to implement a water-resources plan for the river basin.
- Strengthen the capability of DDCs to monitor water-resources development activities in the river basin.

Concluding Remarks

This proposal presented the emerging water-resources-related issues, existing gaps in policy and institutions, as well as short- and long-term action plans considering the East-Rapti river basin as a pilot basin for initiating the effort towards developing effective water-management institutions. The activities for proposed action plans underlie the institutional framework with the ultimate objective of consolidating and strengthening the existing district-level water-resources-development-related government and water user organizations for their coordinated efforts. The proposed basin approach for conservation and utilization of water resources is expected to serve at least as a forerunner of the future national effort on improving water-resources management. The proposal appears timely in that the government has already issued and implemented the Local Autonomy Act (1999) by which local-level institutions have been empowered with more autonomy than before and the Water Resource Act (1992) has also spelled out the need of inter-sectoral approach to be an effective way for sustainable water-resources development in the future. This implies that these Acts have rendered an enabling legal environment for the successful implementation of this study at the basin level.

Development of Effective Water-Management Institutions at the Upper Pampanga River Basin, Philippines: Action Plan

Considering the results of the diagnostic study, an action plan aimed at improving the water management in the UPRB is hereby proposed. Essentially, the action plan will focus on the following:

Advocate the Establishment of the Upper Pampanga River Coordinating Council

Programs related to water resources management at the UPRB were found to be sporadic. For this reason, interventions to whatever water-related problems or issues are dealt with by some specific agencies/sector but not by others. As a consequence, the problem becomes cyclical or recurring simply because of the piecemeal approach of solving the problem. The establishment of a coordinating body, which can be called the Upper Pampanga River Basin Coordinating Council may be in order. In this connection, therefore, a proposal will be prepared and sent to the concerned agencies for their initial reactions and comments.

Once the proposed coordinating council gets positive support from the various stakeholders at the UPRB, meetings with concerned officials representing the different stakeholders/sectors will be scheduled to flesh out the details of the proposal.

Improvement of the Irrigation System Performance

A pilot area will be selected to serve as a demonstration site for the efficient utilization of water for agriculture. This will be done in coordination with the irrigation district officials of the National Irrigation Administration-Upper Pampanga River Integrated Irrigation System (NIA-UPRIIS). Basically, an irrigators' association (IA) will be identified, based on a set of criteria and this will serve as the pilot IA/area.

As soon as the IA has been chosen, a benchmark survey involving the officers and members of the IA will be conducted. This survey will serve as a basis for determining the current socioeconomic conditions and the organizational (IA)-related factors of the identified IA. It will likewise attempt to draw firsthand information on the farming practices of the respondents, particularly those relating to the management of irrigation water. While some items of information to be taken are similar if not the same as those obtained during the diagnostic study, the necessity of conducting a benchmark survey is premised on the fact that the results of the benchmark survey will be utilized later for evaluation purposes.

Attempts will also be made by the research team to assist the IA in coordinating and/or lobbying for the immediate rehabilitation of heavily silted canals and the provision of water-control structures within the pilot area. Mobilization of the identified IA will also be done with the end in view of motivating them to do minor repair and maintenance works of the irrigation canals/facilities.

Regular monitoring and evaluation of all activities pertaining to the foregoing will be done.

Strengthening the IA and NIA Capabilities for Effective O&M of the Irrigation System

Refresher training course(s) for farmers will be conducted on topics like improved rice production, water management and financial management among others. Likewise, the NIA-UPRIIS field personnel will be given opportunities to attend trainings/seminars on values reorientation, and supervisory and technical-related topics.

The officials of the IA will be encouraged to meet with the turnout service area (TSA) group leaders to discuss matters of prime importance to the association. With these frequent/regular meetings of the IA officials, the rules and regulations concerning not only matters relating to water allocation, distribution and utilization but also on vital concerns of the association as well are hoped to be formalized (written) and strictly enforced.

Meanwhile, the NIA officials are expected to review the existing policies of the agency primarily on ISF rates, and the ISF and MTO incentives given to IAs. Remedial measures should be proposed to the NIA (Central Office) management when deemed necessary. The possibility for NIA to forge a close linkage with the other stakeholders (e.g., DENR, DA, LWUA and NPC) in the basin should also be explored.

Initiate the Development of a UPRB Database

The diagnostic study has bared significant information, which may serve not only the purpose of the present study, but also other interested parties. Since the research team will attempt to gather primary and secondary data to characterize/describe the current condition of the watershed at the UPRB, all the data gathered so far and those that are yet to be gathered can form part of a database that may be developed for the UPRB. All interested agencies can have easy access to, and be able to retrieve, the needed data from this database.

Support the Anti-Water-Pollution Campaign of the LGUs

In support of the campaign of local government units against water pollution, the research team can coordinate with appropriate agencies/units of the university in order to come up with print/broadcast materials.

Water quality will also be analyzed in coordination with the DENR and the Department of Chemistry, College of Arts and Sciences of CLSU.

Problem	Activities	Expected output	Time frame	Who
1. Water shortage during the dry season	Establishment of a pilot area for a) efficient water management <ul style="list-style-type: none"> • Identification/ selection • Coordination with stakeholders • Benchmark data gathering/ TNA • Physical rehabilitation • Instrumentation • Training • Implementation, monitoring and evaluation b) effective water-management institutions <ul style="list-style-type: none"> • Strengthening of IAs' capability for O&M of the irrigation system thru trainings <ul style="list-style-type: none"> - Values reorientation - Financial management training - Role of women - Policy formulation • Strengthening of NIA's capability <ul style="list-style-type: none"> - Values reorientation - Supervisory training - Technical training • Policy reforms/implementation <ul style="list-style-type: none"> - Water distribution - ISF and MTO incentives management • Strengthening linkages among stakeholders • Reorganization of NIA personnel Watershed characterization and management <ul style="list-style-type: none"> a) Characterization b) Management of existing watersheds 	<ul style="list-style-type: none"> • Pilot area selected • Coordination meeting conducted, districts, O&M plan, rehabilitation plan provided to the research team • Baseline information & TNA • Rehabilitation work undertaken on the pilot area • Installation of control and measuring devices • On-farm training conduct research teamed among IA members and officials in the pilot area • Pilot area established, report • At most, 4 batches of training of IA members and officials within the pilot area • Increase in functionality rating of IAs within the pilot area • IAs within the pilot area ready for IMT • Improve O&M services <ul style="list-style-type: none"> - Increase in yield - Increase in ISF collection - Increase on farmers satisfaction on NIAs services • IA rules and regulations formalized, ISF and MTO revised • Quarterly coordination meeting of stakeholders • Reorganized NIA personnel • Description and evaluation of the current condition of the watershed • Coordinated reforestation program of various stakeholders 	February 2001 March 2001	NIA, Research Team NIA, Research Team
			March – April 2001 April – May 2001 April – May 2001 May – Dec. 2001	NIA, Research Team NIA NIA, Research Team NIA
			June – Dec.2001	Research Team
			May – Dec. 2001	NIA, Research Team
			March – Dec. 2001	NIA
			July – Dec. 2001 March – Dec. 2001	RET, NIA, IA
			June – Dec. 2001	NIA, Research Team other stakeholders NIA
			April – Dec. 2001 March – Dec. 2001	Research Team
			April – Dec. 2001	LGU, NIA, RACO of CLARRDEC DENR, CLSU
			June – Dec. 2001	NIA, LGU, DENR
2. Water quality	Massive information campaign Monitoring of water quality at strategic locations within the basin Coordination with NIA, LGU, DENR in the implementation of existing policies, laws and regulations	<ul style="list-style-type: none"> • 1-minute spot or radio through the DWNE, 1 comic-type publication, bill boards • Monthly monitoring of water quality of inflow and outflow points in major river locations • Quarterly coordination meetings, reports on violation and actions taken 	April – Dec. 2001	LGU, NIA, RACO of CLARRDEC DENR, CLSU
			June – Dec. 2001	
			March - Dec. 2001	NIA, LGU, DENR
3. Lack of an IWRM approach	Preparation of concept paper to form a UPRB Coordinating Council Presentation of concept paper to various stakeholders Finalization of concept paper Organization of the council including their TOR Development of basin IWRM plans Implementation, monitoring and evaluation of the plans	<ul style="list-style-type: none"> • Concept paper • Concept paper presented to various stakeholders • Concept paper finalized • UPRB Coordinating Council, TOR • Short-, medium- and long-term plans • Report 	September 2001	Research Team
			November 2001	Research Team and various stakeholders
			December 2001 Jan.-February 2002 March 2002 June onward	Various stakeholders Council Research Team

Deduru Oya River Basin, Sri Lanka: Action Plan

Introduction

During the diagnostic phase of the Deduru Oya basin study, two problematic areas related to the management of land and water resources in the basin were identified. Since the identification of these problems was made through a participatory process in which various stakeholders in the basin took part in joint analysis of the problems, they were fully convinced of the needs for interventions to solve them. The land- and water-related problem areas identified in this study were:

1. Low productivity of land and water resources
2. Problems related to long-term sustainability of land and water resources

As prioritized at the stakeholder meetings, these two areas and institutional changes are included in this action plan, in that order.

A. Low Productivity

Low-cropping intensity and low yields in minor irrigation schemes in the basin are the main problems that need attention. Similar problems are also observed in the performance of agro-wells in the basin. Comparatively higher performances are observed in lift irrigation systems, but they too have potential for further improvement. Temporal and spatial variations in performance are reported from major and medium irrigation schemes, but formal institutional mechanisms are available in these schemes to address performance-related problems. Therefore, it is not proposed in the short run to intervene in the management of these irrigation schemes. The magnitude in terms of geographical spread and the number of schemes is high in the case of small tanks, agro-wells and lift irrigation schemes. Therefore, improvement of agricultural performance in these schemes will definitely contribute to increase overall agricultural production in the basin. It is noteworthy that these three categories of irrigation schemes are small in size ranging from 10 to 80 acres (4.05 to 32.4 ha) in most of the cases. The beneficiaries under these systems are mostly economically disadvantaged poor smallholding peasants. Since there are about 2,500 small tanks and 2,000-2,500 agro-wells and lift irrigation schemes in the basin, the number of families depending on them is remarkably high.

Both water and non-water factors contribute to the low productivity in these systems. In small tank systems, cropping intensity is low even in the *maha* (wet) season due to sporadic water shortage. However, it revealed that productivity in the small tank systems could be increased through the introduction of new technologies and efficient management of scarce water resources. In most cases, the agro-wells are underutilized. This is mainly due to reasons such as marketing problems, problems associated with cropping systems adopted by farmers, etc. Some lift irrigation schemes in the basin perform extremely well while some performances are very low. Non-water factors significantly attribute to the low cropping intensity and low yields under agro-wells and lift irrigation schemes. It was understood through stakeholder consultations that cropping intensity

and yield could be remarkably increased in agro-well schemes and lift irrigation schemes through appropriate institutional and technological innovations.

Constraints for Interventions under Action Phase

Due to the limited time period of the study, it may not be possible to implement all the interventions in the basin successfully. Therefore, the activities the stakeholders consider as the most essential will be attempted in the short run in the basin.

Strategy Proposed for Improving Productivity in Three Types of Irrigation Schemes

A program to increase the agricultural production in small tank systems, agro-wells and lift irrigation systems needs to be pilot-tested in a selected sample using participatory action research. The parties that should be involved in this action research include the Department of Agriculture (DOA), the Department of Agrarian Services and the Farmer Organizations (FOs) in the case of small tank systems. The Agriculture Development Authority, the Department of Agriculture and individual farmers are required to participate in the agro-well program. The individual farmers and the Department of Agriculture would be the main actors with regard to the lift irrigation schemes.

The lessons learned through this pilot project can be replicated in the other schemes in the long run. However, IWMI cannot decide the mode of implementation in both the short and the long run. It has to be decided collaboratively by all the parties that would be involved in this action-research program.

Table 1. Activities proposed to be tried out in small tank schemes.

Activities	Responsible actors	Time required
<ul style="list-style-type: none"> • Awareness session on the need of intervention 	<ul style="list-style-type: none"> • IWMI researchers with Department of Agrarian Service (DAS) at its committee meetings. Commissioner of DAS will be briefed on the program prior to holding meetings at the Agrarian Services Committee. 	<ul style="list-style-type: none"> • Two weeks
<ul style="list-style-type: none"> • Selection of six agrarian services divisions in which small tanks are located (representative divisions) 	<ul style="list-style-type: none"> • Deputy Commissioner of DAS. IWMI researchers will facilitate. 	<ul style="list-style-type: none"> • Two weeks (March 2001)
<ul style="list-style-type: none"> • Identification of problems that need solutions 	<ul style="list-style-type: none"> • Divisional Officers of the DAS with farmer leaders. IWMI researchers and officials of the DOA will provide technical assistance. 	<ul style="list-style-type: none"> • One month (March and half of April 2001)
<ul style="list-style-type: none"> • Development of strategies to address the problems 	<ul style="list-style-type: none"> • Divisional Officers of the DAS with farmer leaders. Technical assistance will be provided by IWMI researchers and officials of DOA. 	<ul style="list-style-type: none"> • One month (March and half of April)
<ul style="list-style-type: none"> • Implementation of feasible strategies in small tank schemes 	<ul style="list-style-type: none"> • Farmers, DAS, DOA. IWMI researchers will document the implementation process of new strategies. Also a joint effort will be made to identify the institutional changes required to continue and sustain new strategies. 	<ul style="list-style-type: none"> • <i>Yala</i> season 2001.

Table 2. Possible interventions for agro-well schemes.

Activities	Responsibilities	Time frame
<ul style="list-style-type: none"> • Classification of agro-wells in the selected sample Agrarian Services Divisions based on their performance (poor, moderate and well-performing in terms of cropping intensity and yields) 	<ul style="list-style-type: none"> • DAS, DOA, farmers. IWMI will provide technical support. 	<ul style="list-style-type: none"> • Two weeks (parallel to work in small tank systems)
<ul style="list-style-type: none"> • Identification of reasons for low performance 	<ul style="list-style-type: none"> • DAS, DOA, farmers. IWMI will provide technical supports. 	<ul style="list-style-type: none"> • Two weeks (parallel to work in small tank systems)
<ul style="list-style-type: none"> • Implementation of feasible strategies to improve cropping intensity and yields and also to identify new changes in the institutions including farmer behavior in agriculture under agro-wells. 	<ul style="list-style-type: none"> • DOA, DAS and Agriculture Development Authority and farmers. IWMI researchers will document the process to learn lessons for replication in other areas in the basin. 	<ul style="list-style-type: none"> • One cultivation season (yala 2001)

Table 3. Possible interventions for river lift irrigation schemes.

Activities	Responsibilities	Time frame
<ul style="list-style-type: none"> • Preparation of inventory of river lift irrigation schemes. 	<ul style="list-style-type: none"> • Divisional officers of DAS. Individual farmers/farmer groups and DOA. IWMI researchers will provide technical assistance 	<ul style="list-style-type: none"> • Two weeks. Last two weeks of March 2001
<ul style="list-style-type: none"> • Classification of river lift irrigation schemes in terms of cropping intensity, cropping patterns and yield, etc. 	<ul style="list-style-type: none"> • -do- 	<ul style="list-style-type: none"> • Along with the first activity.
<ul style="list-style-type: none"> • Organize a mutual learning program from well-performing lift irrigation farmers. 	<ul style="list-style-type: none"> • DAS, DOA and well-performing and poorly performing farmers. IWMI researchers will provide facilitation. 	<ul style="list-style-type: none"> • Two weeks at the end of April 2001

Problems of Long-Term Sustainability

Several problems that have endangered the long-term sustainability of land and water resources in the basin were identified in this study. They include:

1. Excessive sand mining in the riverbed and tributaries.
2. Brick-making on the river reservations.
3. Other developments in the river reservations.
4. Pollution of water in the river and its tributaries.

5. Unplanned groundwater extraction.
6. Undesirable development activities and interventions including deforestation in the catchment areas of small tank systems.

During the remaining short period of the ongoing study, a program can be initiated to make people aware of these problems and to draw up plans to address them. The action for long-term solutions will be initiated through the existing institutional mechanisms in the basin area. The relevant reforms on laws, regulations and other institutional changes can be attempted while implementing pilot-project activities intended to be implemented by WRS in future.

The possible short-term interventions to initiate action in this regard are the abovementioned six items detailed below:

Excessive sand mining in the riverbed

Joint awareness sessions will be held with the participation of Divisional Secretaries, *Pradeshiya Sabha* Chairmen and representatives of the Geological Mines Bureau. These meetings will be used to develop strategies to initiate some action to establish suitable methods for allowing people to do sand mining. These strategies will include changes on permit system, identification of critical locations that have to be avoided when mining, monitoring system required and the responsibilities of each party, etc. These proposed meetings will be held in six sample DS Division areas in which excessive sand mining is done.

Brick making on the river reservations

A separate series of strategic planning sessions will be held with *Pradeshiya Saba* staff and the staff of agencies at DS level to analyze the impact of brick making on the riverbanks and identify solutions acceptable to both parties, the agencies responsible of protecting riverbanks and the brick makers. The participation of the public health inspectors attached to the *Pradeshiya Sabhas* and the staff of the Medical Officer of Health will also be obtained at these meetings. These sessions will be held in the six DS divisions selected for other interventions. The outputs that can be expected from these sessions will include, better understanding of the implications of unplanned brick making on the stability of the riverbanks, the contribution of brick making to the mosquito problem, etc. The possibilities for brick making without serious harmful impacts on the environment will be explored at these meetings.

Other Development in the River Reservations

Clearing of forest cover and cultivation activities in the riverbank areas could also be observed in this study. This problem can be discussed at the DS-level Agricultural Committee (DSAC) meetings held in each DS division. At present, the problems related to river reservations are not discussed at DACs. The DSACs can work out a program to study the magnitude of this problem in their jurisdiction and discuss with the encroachers and propose suitable solutions for the long-term sustainability of the river reservations.

Pollution of Water in the River and Its Tributaries

The major cause for water pollution in the river and its tributaries is the unplanned urbanization process. For example, one main tributary of the Deduru Oya (Maguru Oya) in the Kurunegala town area has been polluted due to discharge of sewage and wastewater directly into the tributary. These types of problems are observed in other townships too. At present, a project for the improvement of stormwater drainage is being implemented in Kurunegala with financial assistance from the ADB. It is not known whether this project would address the problems related to wastewater and solid waste management. IWMI researchers can discuss this matter with the implementers of the stormwater management project in Kurunegala town. The possibility of including a program to manage the wastewater and solid waste will be explored in these discussions. The National Water Supply and Drainage Board (NWSDB) will be contacted to explore the possibilities for testing the water quality in the Maguru Oya. The zone Manager of the NWSDB will be the key person for this action. Similarly, a program will be drawn up with sample Pradeshiya Sabhas and Town and Urban Councils in the basin to arrest surface water pollution due to sewage, wastewater and garbage disposal.

Unplanned Groundwater Extraction

The necessity of a methodology for deciding the intensity of agro-wells in the given subwatershed will be discussed with authorities in each DS division. This may lead to enhance their knowledge on the requirement of a proper plan for groundwater extraction.

The methodology developed by IWMI with the technical assistance from the University of Peradeniya for the North Central Province can be discussed with the authorities concerned to enlighten them on this aspect. This will help them to develop a database on groundwater potential and make appropriate decisions on groundwater extraction.

Undesirable development activities and interventions including deforestation in the catchment areas of small tank systems

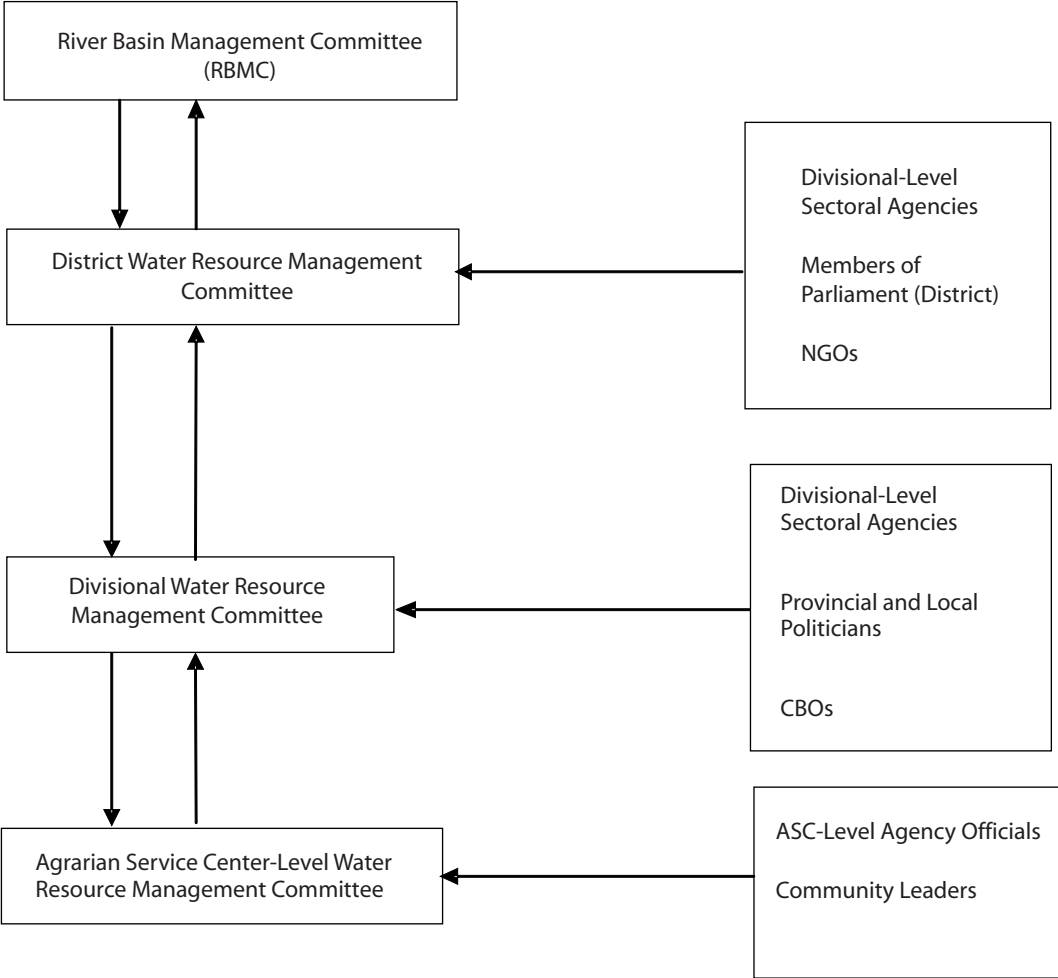
Deforestation and encroachment of small tank catchments for settlement and cultivation purposes have endangered their long-term sustainability. Cultivation in tank beds and foreshore areas is also a major problem in many of these tank systems. A program can be envisaged for the protection of tank ecosystems in a sample of small tanks with the involvement of the DAS and Divisional Secretaries. DSAC can be used for planning and implementing this program with the participation of NGOs and Community-Based Organizations.

Interventions for Institutional Change

To effectively carry out the short- and long-term activities related to management of land and water resources in the basin, certain changes on the institutions at macro level and basin level are required. The Water Resources Secretariat has proposed institutional changes required at the national level for sustainable management of water resources in a river-basin context. These changes include the establishment of an apex body of three types of new institutions with new mandates. These three institutions include National Water Resources Authority, Water Resources

Council and the Water Resources Tribunal. Further, the new institutional changes suggested by the Water Resources Secretariat include the establishment of river-basin organizations for a single basin or several basins in the country depending on the specific requirements. Need for building linkages among different agencies working at DS, District, Provincial and Central Government levels was intensively discussed during stakeholder consultation in phase 1 of the Deduru Oya study. Most of the key stakeholder agencies recommended linking existing coordination committees in the basin to the river-basin organization. The only structural change they recommend was to establish a river-basin organization. The other changes recommend included functional changes of the existing coordination committees. The coordination mechanism suggested by the stakeholders is given in figure 1 below:

Figure 1. Suggested organizational structure of the Deduru Oya basin.



The proposed institutional changes in figure 1 will be discussed with the members of the different committees mentioned therein. The awareness creation on the new functions required to be incorporated into the existing coordination committees will be the main activity of the researchers at different coordination committee meetings. The functional changes that will be discussed are as follows:

- Explore possibilities to include natural-resources management as one of the mandatory functions of the coordination committees.
- Attempt to encourage line agencies to collect and provide relevant information to the committees to make decisions.
- Identify the level of capacity of the coordination committees to carry out functions related to integrated water resources management (skills and lack of authority, etc.).
- Attempt to develop a mechanism for improving communication among different levels of the committees concerned.
- Attempt to develop an M&E system to measure the effectiveness of different water-resources management agencies.

The IWMI research team will attend coordinating committee meetings to initiate the agencies concerned to draw up plans and implement integrated water resources management activities in an action-research mode.