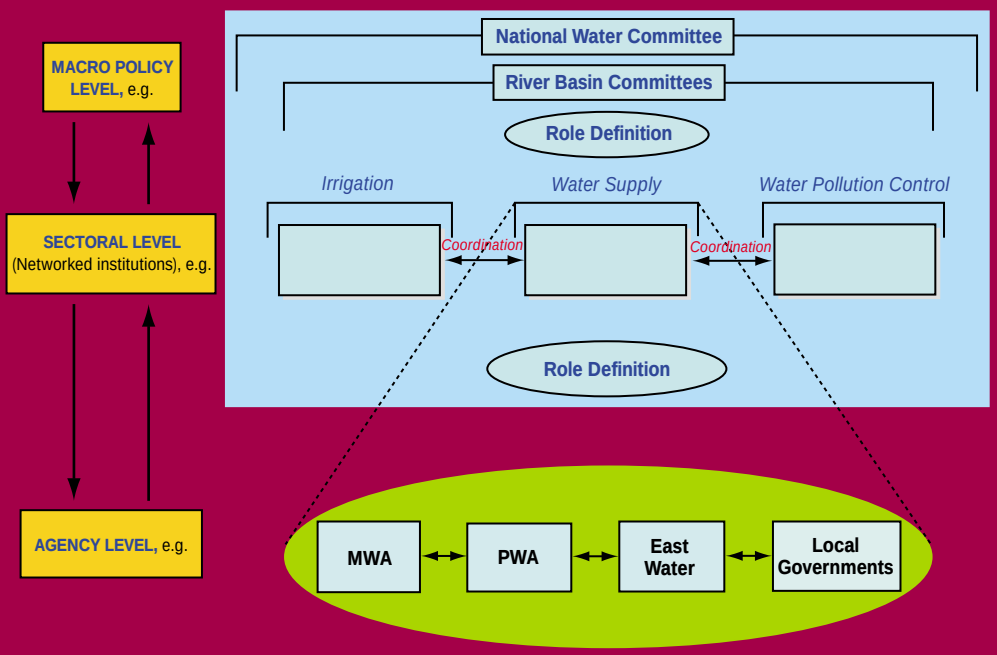
GOOD PRACTICES ON STRATEGIC PLANNING AND MANAGEMENT OF WATER RESOURCES IN ASIA AND THE PACIFIC

Water Resources Series
No. 85



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ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

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This publication was prepared by Mr. Ti Le-Huu of the Water Resources Section, Environment and Sustainable Development Division of ESCAP in cooperation with various national water resources experts participating in the implementation of the project on “Capacity-building in Strategic Planning and Management of Natural Resources in Asia and the Pacific”. The views expressed are those of the authors and do not necessarily reflect the views of the United Nations or of the Governments of the countries concerned.

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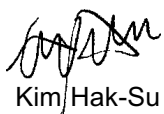
FOREWORD

Good practices on strategic planning and management of water resources development in Asia and the Pacific are included in this publication as a contribution of the Economic and Social Commission for Asia and the Pacific (ESCAP) to the implementation of the Johannesburg Plan of Implementation (JPOI) of the World Summit on Sustainable Development in the region. The JPOI identified the implementation of integrated water resources management plans as a priority, for which Governments were urged to establish integrated water resources management plans by 2005.

The good practices are selected from the outcomes of the project on "Capacity-building in Strategic Planning and Management of Natural Resources in Asia and the Pacific" implemented by ESCAP during the period from 2000 to 2004, with funding from the United Nations Development Account. The project was designed to address the priority identified at the nineteenth special session of the General Assembly in the implementation of Agenda 21, when it called for the initiation of "a strategic approach for the implementation of all aspects of the sustainable use of freshwater for social and economic purposes, including, inter alia, safe drinking water and sanitation, water for irrigation, recycling, and wastewater management, and the important role freshwater plays in natural ecosystems." The project was thus aimed to promote the application of strategic planning and management approaches to the integrated management of water resources in the region. The presentation of good practices on strategic planning and management of water resources development in this publication is intended to illustrate the importance of the application of the strategic planning and management approach in the development of integrated water resources management plans. Apart from the good practices, the publication also compiled relevant experiences on the application of strategic planning and management approaches to the development of integrated water resources management plans for possible application.

The publication is thus aimed primarily at providing examples of practical application of the strategic planning and management approaches to the preparation of integrated water resources management plans at various levels. In that context, it is aimed at assisting decision-makers, planners and practising water resources experts in their efforts to enhance the effectiveness in the formulation and implementation of strategic plans for water related organizations for integrated water resources management. The publication is also intended to serve as a reference for planners and practising professionals working in other sectors when dealing with water resources development and should be used together with the Guidelines on Strategic Planning and Management of Water Resources, published by ESCAP in 2004.

The implementation of the project, including the preparation of strategic plans in the good practices of this publication, was carried out under the direct supervision of Mr. Ti Le-Huu of the Water Resources Section, Environment and Sustainable Development Division of ESCAP, who is also responsible for the preparation of this publication.



Kim Hak-Su
Executive Secretary
ESCAP

PART I:
INTRODUCTION TO THE APPLICATION OF STRATEGIC PLANNING AND MANAGEMENT TO WATER RESOURCES

A. INTRODUCTION

1. Background

The following brief description of activities undertaken in the three phases of the implementation of the project on "Capacity-building in Strategic Planning and Management of Natural Resources in Asia and the Pacific" during the period from 2000 to 2004 illustrates the circumstances in which the good practices of the application of the strategic planning and management approach to the development of integrated water resources management (IWRM) plans were developed in the region.

a. Phase I of the application of strategic planning and management (SPM) into water resources management

Under phase I of the project, which took place in 2000 and 2001, efforts were made to review achievements in water resources management in the region, including those of ESCAP to form the basis for preparing a set of guidelines on strategic planning and management of water resources development. Important achievements made by the ESCAP secretariat identified in the review included the results of studies on "Integration of Water Resources Management into Economic and Social Development Plans in Asia and the Pacific" and "A Synthesis of Experience from the FAO-ESCAP Pilot Project on the Formulation of National Water Visions to Action". These results together with international experiences and inputs from invited water resources experts in the region were compiled to form the first draft of the Guidelines on Strategic Planning and Management of Water Resources, which was discussed at the Regional Workshop to Finalize the Guidelines on Strategic Planning and Management of Natural Resources Development, held in Bangkok in December 2001.

At this regional workshop, the expert group also identified the overall framework for the introduction of SPM into the national development process taking into account the application of SPM at the national/basin, sectoral and organizational levels. In that context, the expert group identified priority purposes of the application of SPM, key elements or components of SPM, and initiation and implementation of SPM at these three levels. In order to ensure adequate preparation for the subsequent phases of the project, the expert group also identified priority follow-up activities at the subregional level as well as possible coordination of regional efforts on this subject.

b. Phase II of the application of strategic planning and management into water resources management

During phase II, the draft Guidelines was then used for training at five workshops for South-East Asia (July 2002), Central Asia and the Pacific (August 2002), South Asia (September 2002) and North-East Asia (October 2002). In addition, the draft Guidelines was posted on the website of ESCAP to encouraged interested water resources management experts to contribute to improving its applicability. In order to increase the applicability of the Guidelines for the preparation of integrated water resources management plans, several suggestions were solicited participants of the five subregional workshops to form the basis for the introduction of a new chapter on "Monitoring Outcomes of Strategic Planning in Water Management: Using Indicators Effectively" in the draft Guidelines, which was then posted on the ESCAP website in July 2003.

As part of the process on networking building on application of SPM to water resources management, the five subregional workshops were organized in cooperation with subregional counterparts as follows:

a. The subregional workshop for South-East Asia in July 2002 in cooperation with the Mekong River Commission Secretariat (MRCS) in Phnom Penh, Cambodia. The number of participants was 40, including 21 officials from eight countries of South-East Asia, namely Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Thailand and Viet Nam, 19 experts from the Global Water Partnership (GWP), International Water Management Institute (IWMI), the MRCS and ESCAP.

b. The subregional workshop for the Pacific in August 2002 for both the energy and water sectors in cooperation with the South Pacific Applied Geoscience Commission (SOPAC) in Sigatoka, Fiji. 22 participants, including 18 officials from 12 countries of the Pacific, namely Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga and Tuvalu, three experts from SOPAC and an ESCAP Consultant participated in the Workshop on water resources.

c. The subregional workshop for Central Asia was held in cooperation with the Inter-State Commission on Water Management Coordination (ICWC) in Cholpan Ata, Kyrgyzstan, and was attended by totally 49 participants, including 25 officials of ICWC from the five countries of Central Asia, namely Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan; 13 officials representing the local organizers and the Scientific Information Centre of ICWC; and 12 international experts representing six international organizations working in the subregion, namely Canada International Development Agency, Swiss Development Cooperation (SDC), United States Agency for International Development (USAID), the World Bank, the Asian Development Bank (ADB) and IWMI.

d. The Subregional Workshop for South Asia on Application of Guidelines on Strategic Planning and Management of Water Resources in cooperation with IWMI and the Interim National Water Resources Authority (INWRA) of Sri Lanka in Colombo from 10 to 13 September 2002. The subregional workshop was attended by totally 25 participants, including 20 officials from the eight countries of South Asia, namely Bangladesh, Bhutan, India, Islamic Republic of Iran, Maldives, Nepal, Pakistan and Sri Lanka; two participants representing the local NGOs, one international expert provided by the Department of Foreign International Development of the United Kingdom and two officials of IWMI.

e. The subregional workshop for North-East Asia was organized in cooperation with the Ministry of Water Resources of China in Beijing from 22 to 25 October 2002, which consisted of two parts: the International Forum and Subregional Workshop for North-East Asia on Application of Guidelines on Strategic Planning and Management of Water Resources. The Symposium was attended by totally 55 participants, including 11 foreign participants and 44 senior Chinese officials representing various Departments of the Ministry of Water Resources and the four major river basin commissions. The international participants included senior officials from Mongolia, Russian Federation and invited experts from UNESCO, World Bank, IWMI, Stanford University, Australia and the United Kingdom. The workshop was attended by 14 officials, including the international participants.

In all the subregional workshops, the participants discussed details of the Guidelines for water resources and various aspects of the application to the Guidelines to water resources management, including practicability of such application to the formulation of policies and strategies of water resources management as case studies at the country level.

c. Phase III of the application of strategic planning and management into water resources management

Based on the interest generated at the subregional workshops, subsequent consultations were made with the focal points of interested countries. Case studies were then arranged for seventeen countries during the period from 2003 to 2004 for the development of strategic plans as follows:

a. Central Asia: Case studies were made for the five countries, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, within the framework of the Inter-State Commission on Water Management Coordination (ICWC) and in cooperation with ICWC Scientific Information Centre (SIC) for downstream areas of Syrdarya and Amudarya including whole Ferghana Valley. In addition, the Guidelines were also adapted using the experiences of these case studies for subsequent training of water resources engineers in the subregion. In this connection, one seminar was held in November 2003 in Tashkent in cooperation with SIC, IWMI, SDC and the United States Department of State to map out detailed application, a workshop to discuss the draft strategic plans in April 2004 in Tashkent and the training seminar was organized by SIC in November 2004.

b. North-East Asia: Case studies were conducted for two river basins in China (Haihe and Huaihe) in cooperation with the Ministry of Water Resources of China and for overall water resources management in Mongolia in cooperation with the Ministry of Environment of Mongolia. The final workshops were held in October for these two countries.

c. Pacific: Case studies were carried out for the Nadi River basin in cooperation with the Department of Land and Water Resources Management of Fiji and for the Laloki River basin in cooperation with the Water Resources Management Branch of Department of Environment and Conservation of Papua New Guinea. The final workshops were held in Nadi in September 2004 for Fiji and in Port Moresby in October 2004 for Papua New Guinea to discuss the draft strategic plans for the respective river basins.

d. South Asia: Case studies were conducted in Pakistan and Sri Lanka in cooperation with the Pakistan Council for Research in Water Resources (PCRWR) and the Interim National Water Resources Authority (INWRA) of Sri Lanka, respectively. The final workshops were held in Islamabad in February 2004 to discuss the draft strategic plan for PCRWR and in July 2004 to review the draft strategic plan of INWRA.

e. South-East Asia: Case studies were conducted for the following countries: the Lao People's Democratic Republic on strategic plan of the Water Resources Coordination Committee (WRCC) in cooperation with WRCC; Malaysia on strategic plan for the Selangat River basin in cooperation with the Malaysia Water Partnership and the Department of Irrigation and Drainage; Myanmar on strategic plan for the coordination of water resources sector: establishment of the national water resources committee in cooperation with the Irrigation Department; Philippines on strategic plan for the National Water Resources Board (NWRB) in cooperation with NWRB; Thailand on strategic plan for the water sector – Department of Water Resources in cooperation with the Water Resources Association of Thailand; and Viet Nam on strategic plan for the Vu Gia-Thu Bon River basin in cooperation with the Institute of Water Resources Planning of Viet Nam. Six workshops were organized to discuss the respective draft strategic plan in July 2003 in Putra Jaya, Malaysia; September 2003 in Bangkok, Thailand; in December 2003 in Vientiane, the Lao People's Democratic Republic; in

July 2004 in Manila, Philippines; in August 2004 in Da Nang, Viet Nam; and in September 2004 in Yangon, Myanmar. Subsequently, the Ministry of Agriculture and Rural Development of Viet Nam decided to hold a workshop to establish the Vu Gia-Thu Bon River Basin Organization on the basis of the strong recommendations of the case study and the related provincial authorities.

2. Lessons from the application of SPM to water resources

The key results and outcomes of the project "Capacity-building in Strategic Planning and Management of Natural Resources in Asia and the Pacific" in the water sector can be summarized in the following three aspects: important achievements of the project, key obstacles in application of SPM, and important lessons learned and best practices.

The important achievements of the project can be described in three main aspects: tool development, interest generation, and practical application of the methodology.

a. Tool development

The development of the Guidelines marked an important step in the application of strategic planning and management approach to water resource, since it was the first time that a specific set of guidelines were specifically developed for the water sector and derived mainly from the practical experiences of the region. This fact can be illustrated by the translation of the Guidelines into Chinese, Russian and Vietnamese by the respective technical agencies. In addition, several enquiries were addressed on the guidelines on application to water resources management in the forestry sector in Malaysia and to the development of integrated river basin management modules for the UNESCO-IHE Institute for Water Education.

b. Generated interest in SPM

The interest generated by the project on SPM of water resources was higher than expected in terms of the number of requests for case studies, which was higher than the project could deliver, although the actual number of case studies was much higher than the original number of case studies planned for the project, 17 in comparison with 10. Of particular interest was the decision of the Vice Minister of Water Resources of Uzbekistan to immediately apply the concept at the subregional workshop.

c. Best practices of SPM

The seventeen case studies on the application of SPM to the water resources sector were conducted for the practical purpose of formulation of related policies and strategies at all the levels as recommended at the regional and subregional workshops: national (Myanmar, Thailand, Sri Lanka, Mongolia), basin (China, Fiji, Malaysia, Papua New Guinea, Viet Nam and five countries in Central Asia), sectoral level (Pakistan) and organizational (the Lao People's Democratic Republic and Philippines). Out of these case studies, the momentum generated by the application for the case studies in Fiji, Myanmar and Viet Nam proved the immediate impacts of the project, in terms of immediate actions taken by the agencies concerned.

B. PRINCIPLES ADOPTED FOR APPLICATION OF SPM TO WATER RESOURCES

Throughout the implementation of the project on "Capacity-building in Strategic Planning and Management of Natural Resources in Asia and the Pacific", it was recognized that water resources development planning is a continuing process and the introduction of SPM into the national development process would thus need to be integrated into the ongoing efforts to improve water resources development planning. In that context, the principles for application of SPM to water resources were drawn up on the basis of the importance or necessity of SPM, key elements or components of SPM, and initiation and implementation of SPM.

1. Necessity of SPM for water resources development

Throughout the implementation of the project on "Capacity-building in Strategic Planning and Management of Natural Resources in Asia and the Pacific", all participating experts and institutions recognized the importance and necessity of the adoption of SPM approaches in water resources management to ensure effective integration of water resources management into the national development process, to achieve efficient allocation of water resources against competing uses and to achieve consensus building and sustainable results of development. It was further recognized the importance of SPM in promoting good governance in water resources management and in capacity-building and improvement of management to cope with the increasing scarcity of water resources in the subregion. The participating experts also identified different priorities for the application of SPM to water resources at the national, sectoral and organizational levels.

a. At the national level

Priority 1: (1) to provide frameworks and directions for: overall development, water sector and organizations, (2) to facilitate coordination among: agencies, sectors and stakeholders, (3) to improve implementation: funding, accountability monitoring, resources mobilization and HRD.

Priority 2: to bridge the present and future: to identify problems, to overcome present weakness, to respond to uncertainties and to enhance flexibility.

Other: to share water among sectors and regions, and to achieve the targets within timeframe.

b. At the sectoral level

Priority 1: (1) to take into consideration different institutions, stakeholders, agendas of the different sectors (e.g. forestry, environment, lands, mines, protected areas) and encourage their participation, (2) to achieve expected outcomes within anticipated timeframe, (3) to identify common objectives and shared vision.

Priority 2: (1) to enable rapid development competing from limited resources, (2) to provide criteria for allocation of limited budget, (3) to provide guidance to tangible expected outcomes, (4) to coordinate long-term/short-term activities.

Other: (1) to improve legal framework from the many laws, (2) to re-audit performance, (3) to conserve water resources for sustainable use, (4) to address different target groups with different ability to pay.

c. At the organizational level

Priority 1: (1) to establish effective action plan, (2) to identify clear goal, (3) to create partnership to achieve mission.

Priority 2: (1) to establish success indicators, (2) to strengthen internal environment.

2. Key elements/components and issues of SPM

Through the process of application of SPM approaches to water resources management, the participating experts identified the following elements/components and issues as priority at the national, sectoral and organizational levels of water resources management:

a. At the national level

Priority 1: (1) ***Element***: clear vision based on shared concerns, (2) ***Driving forces***: additional food requirements, additional area for irrigation, flood protection, and water needs for agriculture and domestic and industrial, (3) ***Issues***: policy reforms, (4) Elements of SPM should cover technical, social, financial and environmental aspects.

Priority 2: (1) ***Issues***: institutional reforms and mechanisms, public participation and resolution/prevention of conflicts/differences.

b. At the sectoral level

Priority 1: (1) cross-sectoral approach, (2) relations between subregional and national priorities: transboundary water resources.

Other: (1) issues/problems, (2) fair allocation – explicit water rights, (3) restoration of water quality, (4) rational satisfaction of users, (5) environmental action and maintain natural equilibrium, e.g. watershed management, (6) decision-makers: to involve political masters and non-technical decision-makers, (7) participation of civil society.

c. At the organizational level

Priority 1: (1) Options of SPM: key steps and its example (country case), (2) Various approaches on SPM (collaborative, accountability), (3) Shared vision.

Priority 2: (1) SPM compare “conventional”, (2) Glossary of key terms (vision, goal, objective, target).

Other: (1) Related government structures (level of administration, sectors, nature of water, etc.), (2) SWOT, (3) Environment, sanitary, land issues.

In addition, the participating experts also recommended to address the following key issues in the process of application of SPM: politics, commitment, consensus building, and cultural diversity.

3. Initiation and implementation of SPM

The experiences of the application of SPM approaches to water resources management of the project on “Capacity-building in Strategic Planning and Management of Natural Resources in Asia and the Pacific” pointed out the importance of initiation of SPM processes at the national, sectoral and organizational levels as well as the need to maintain the momentum generated by the

initiation. The participating experts of the project recommended the following key elements to be carefully examined as part of the principles to be adopted for the application of SPM to water resources.

a. At the national level

Priority 1: (1) *Political and decision-makers*: willingness, commitment and concerns, (2) *Implementation mechanisms*: coordination, integrated into budgeting plans, strong auditing, monitoring and evaluation and team assignment, (3) *Capacity building*: training, HRD and experiences build up.

Priority 2: *Legal basis for SPM*: set up, enforcement and consultations.

b. At the sectoral level

(i) Triggering of SPM

Priority 1: (1) to base on initiatives of political and other groups at important benchmark events such as the World Water Forum, Agenda 21, etc. (2) to provide training and awareness programmes.

Priority 2: to promote political will.

Other: (1) to identify and give authority to a central coordinating body, (2) to identify champions, (3) to integrate SPM into policy directives.

(ii) Maintaining momentum of SPM

Priority 1: (1) to provide accountability and incentives, (2) to ensure cyclical/periodic review/reporting.

Priority 2: (1) to carry out the SPM process at national level, (2) to build consensus among knowledge base, (3) to implement identified tasks, (4) to include local perception.

(iii) Supporting measures

Priority 1: (1) to publicize successful case studies, (2) to be sufficiently flexible to incorporate necessary changes.

Priority 2: (1) to include financial auditing, (2) to provide legal support.

c. At the organizational level

Priority 1: (1) to provide “incentives” for the decision-maker of key actors of water stakeholders (such as political promotion, fund/budget), (2) to monitor performance indicators and accessible information, (3) to enhance public demand and appreciation.

Priority 2: (1) to promote educational awareness, (2) to provide incentive/promotion.

Other: (1) to identify champions, (2) to initiate at political platform, (3) to discipline offending, (4) to narrow the knowledge gap and enhance understanding of the future vision of the SPM process, (5) to pay special attention to great difficulties affecting a paradigm shift from traditional approach, (6) to persuade by using a clear vision and goals.

C. CONCLUDING REMARKS ON APPLICATION OF SPM TO WATER RESOURCES

At the Concluding Workshop of the project on "Capacity-building in Strategic Planning and Management of Natural Resources in Asia and the Pacific", held in Bangkok in November 2004, the participating experts recommended the following points to be considered in the application of SPM approaches to water resources management.

1. Contribution of SPM approaches to the development of IWRM plans

SPM approaches were recognized as instrumental to the application of the concept of IWRM to support the socio-economic development process. While IWRM is acknowledged as a process, SPM was recognized as a powerful tool to enable priority activities of water resources management to be effectively integrated into the socio-economic development process through the following aspects:

- SPM enable priority actions to be strategically implemented.
- SPM is a process based on the scenarios analyses for the future, allowing uncertainties of the future to be incorporated into the planning process.
- SPM helps to regularly assess persisting issues.
- SPM promotes accountability, especially the core groups mainly responsible for the implementation of SPM.

It was considered that application of SPM to IWRM is the only choice to meet the urgent needs of socio-economic development when countries face serious water issues. It was also recognized that the application of SPM to development of IWRM plans would facilitate the mobilization of political will and commitment of key stakeholders, promote resolution of conflicts and ownership, and enable development of practicable plans of action. The participating experts also drew up the following experiences of their application:

- SPM can help train new generations of water professional who would understand the challenges multidisciplinary approach needed for IWRM.
- SPM helps dissect major issues into manageable issues/matters.
- SPM develops capacity to understand the pressing issues in terms of socio-economic aspects and other frameworks.
- SPM helps establish a core group comprising members from different agencies.
- SPM promotes pilot river basins.
- SPM is the effective tools to attract the assistance from donors and shows clear areas of responsibility, where stakeholders are participating.
- SPM can provide catalytic elements for change management and transform transitional institutions to think in terms of real time situation.
- Political will/government support and financial resources are needed for a successful SPM.
- SPM helps in raising awareness among various stakeholders.

2. Expectations from SPM

The participating experts in the Concluding Workshop mentioned above also identified the following expectations from the application of SPM approaches to water resources management as a possible checklist:

a. Change in mindsets

Successful application of SPM approaches to water resources management is expected to result in the change of mindsets in the following areas:

- Development concept: *socio-economic*
- Water concept: *IWRM, water utilization, ecological rehabilitation, flood mitigation*
- Implementation: mobilization of support and commitment of policy decision-makers
- Foundation of water management: improvement in the understanding of the "reality" of water management systems as the basis for integration to form the basis to see how things actually work, i.e. going beyond institutional and other frameworks
- Efficiency of water resources management: change in mindsets to conserve water resources

b. Mechanism of work

- Use SPM to develop network: SPM can be used as a tool generate consensus building, such as possible guidelines to develop action plans for food security and poverty alleviation
- Strategic Plan of Management of Water Resources: must take into cognizance Water Resources assessment within a river basin. In many countries, economic development is based on administrative land. What are areas of collaborative planning that can be developed, particularly economic, among stakeholders
- Increase networking through partners and among stakeholders
- Better decision-making in the process of water resources management
- Task force for collaboration is also essential
- Integration of IWRM to national social and economic development strategy and action plan
- To set up new legal institutions, needed for better management
- Building up of an effective coordinated block of all water related organization
- Improved water resources management structure of the Government

c. Implementable programme of action

- Ownership and sense of belongings of plan of actions developed by each basin
- Coordinated manner between social, economic and environmental aspects
- SPM should help us in identifying priority actions also at sectoral level
- The devil is in the details; having good SPM should help us go into the details of what to do
- Collaborative planning to achieve IQRM focusing on elemination of side effects due to sectoral focus

- To use the limited resources (water, human, money, etc.) in the best way
- Identification of areas need to be developed/improved

d. Mobilization of commitment for support and participation

- Instill in every stakeholder's mind/citizen on future scenario based on vision developed by them
- Enhance organizational effectiveness of the water resources coordination system and promote capacity-building
- Set up and develop the water market
- Civil society involvement in water resources management

PART II:
EXAMPLES OF GOOD PRACTICES

D. STRATEGIC PLANNING AND MANAGEMENT OF WATER RESOURCES IN THE HAIHE AND HUAIHE RIVER BASINS OF CHINA

Water Resources and Hydropower Planning and Design General Institute
Huaihe Water Resources River Basin Commission
Haihe Water Resources River Basin Commission
Ministry of Water Resources
China

Introduction

The gross domestic product (GDP) of China increased substantially in the early 1990s, with industry and manufacturing contributing a large proportion of this growth. The rate of GDP growth was recorded at 6.5 per cent from 1960 to 1970, 9.7 per cent between 1977 and 1985, and 8.7 per cent in 1996 and 1997. The growth rate in foreign trade was equally impressive during the same periods at 14.3 per cent, 15.2 per cent and 7.6 per cent, respectively.

In the Five-Year Plan (2000-2005), the Government of China has set the objectives of developing and maintaining a high quality of life for all. In the process of developing the management of its strategic plan, the Government has specified the following five goals:

- Achieving an average economic growth rate of 7 per cent annually, which will translate into a per capita GDP of RMB 9,400 by 2005;
- Optimizing the industrial infrastructure, and strengthening international competitive capacity;
- Increasing research and development expenditure to more than 1.5 per cent of GDP, and improving education;
- Controlling population growth to keep it within 1.33 billion by 2005, improving the eco-environment and conserving resources; and
- Achieving an average annual per capita income of about 5 per cent, and improving health and social welfare.

These development goals clearly require support from the water sector, which comprises a number of agencies with resource development and management functions related to water resources. The sector is largely structured around the various uses of water, such as hydropower, irrigation, water supply, fisheries and wastewater. These water subsectors have developed their programmes with the aim of providing the support required for China's development objectives. These programmes, however, do not consider the potential for interaction between the policies and plans of the subsectors, because no agency was given overall responsibility for water resources management or coordination of water development.

1. China water sector

China is located in south-eastern Eurasia and covers an area of 9.6 million km^2. Affected by ocean-land distribution and topographic conditions, China is characterized by a monsoon climate. South-eastern China is pluvial while the north-western region is dry with the main period of rainfall being concentrated in the summer season.

China has a large number of rivers, totalling some 50,000 with catchments larger than 100 km^2 and 1,500 rivers with catchments larger than 1,000 km^2. Most of the rivers are located in south-eastern China. In addition, the country has about 2,300 lakes larger than 1 km^2 in area, with a total water area and volume of some 71,790 km^2 and 709 billion m^3, respectively.

The average annual precipitation amounts to about 6,200 billion m^3, equal to 648 mm, which is 20 per cent less than the world average. Runoff amounts to 44 per cent of total precipitation; that is, China has an annual runoff of 2,712 billion m^3, equal to 284 mm. In a moderately dry year (1 in 4 recurrence) runoff falls to 2,549 billion m^3, while in an extreme drought year (1 in 20 recurrence) runoff amounts to only 2,359 billion m^3. The total average groundwater resources are estimated at 829 billion m^3, but the estimated overlap between runoff and groundwater is 718 billion m^3, giving an average total volume 2,820 billion m^3 of water resources.

Total annual water resources amount to 2,840 billion m^3, accounting for one-sixth of the global total; however, per unit area is 83 per cent of the world average. The per capita amount of water resources is 2,210 m^3, equivalent to one third of the world average. Water resources per *mu* (cultivated land) amount to 1,440 m^3, equivalent to about half of the world average. Water resources are, in fact, scarce in China.

Although the total amount of water is more than adequate, distribution is uneven, in terms of both location and occurrance. Water distribution does not match land resources and fertility allocation. In southern China, total area is 36 per cent of the country, population is 54 per cent, cultivated land is 40 per cent and GDP is 56 per cent, while the water area is 81 per cent of the total. In northern China, the area is 64 per cent, population is 46 per cent, cultivated land is 60 per cent, GDP is 44 per cent, but water amounts to only 19 per cent of the total.

In the Yellow, Huaihe and Haihe River basins, the total area is 15 per cent, cultivated land is 35 per cent, population is 35 per cent, GDP is 32 per cent, but water is just 7 per cent of the total, and the per capita water resources is only 457 m^3. In this region, there is the most critical conflict between water supply and demand. The monthly distribution of the flow of the rivers closely follows the pattern of rainfall: about 60 to 80 per cent during the wet season, especially in northern China, where rainfall is more concentrated.

The two processes of natural water inflow and water demand do not occur in harmony. Water is an important factor affecting balanced development among the different regions, populations, resources and environments in China.

Despite the uneven distribution of water resources, they are able to support economic and social development in China through the optimization of water resources allocation, both in terms of location and occurrance.

2. Scope of the study

Strategic planning and management (SPM) aims to maximize the benefits to China through its water resources planning and management function. This study considers the component plans of SPM in China as specified in the draft policy, including:

- The principles of water resources management
- Water resources development and management
- Public involvement
- Financial support for water resources development and management
- Water allocation and quality management
- Data and information management
- Capacity-building and human resources improvement

SPM is carried out on the basis of a careful review of past development. In particular, it considers the issues related to the Haihe and Huaihe River basins, including flooding and water logging, water shortage, ecological deterioration and water pollution. The formulation of the development and management strategic plans follows a consultative process in order to obtain the views of the stakeholders as well as the Government of China and its agencies.

3. Water resources potential and challenges in the Haihe River basin

Although the Haihe River basin is facing a water resources shortage, it has much potential for supporting socio-economic development by efficient water usage and allocation (e.g., diversion), particularly in the irrigation and water supply subsectors.

So far, 32 large-scale reservoirs and 190 medium-sized reservoirs have been constructed within the Haihe River basin, covering more than 85 per cent of this mountainous basin area and providing a total reservoir volume of 29.4 billion m^3. More than 18,000 water diversion and pumping projects have been completed. The large projects include the Beijing-Miyun Water Diversion Project as well as the Water Diversion Projects from (a) the Luanhe River to Tianjin (and Tangshan), (b) the Qinglong River to Qinhuangdao, (c) the Yellow River to Hubei Province, (d) the Yellow River to the northern part of Shandong Province and (e) the Yellow River to the northern part of Henan Province. A total of 1,200,000 motor-pumped wells have also been constructed.

In 1998, the actual gross water supply within the whole basin was 43.2 billion m^3, including 26.5 billion m^3 of groundwater (rated at 61 per cent), 11.2 billion m^3 of local surface water (26 per cent), 5.1 billion m^3 of Yellow River diversion water (12 per cent) and 400 million m^3 from other sources (brackish water, seawater and treated wastewater) (1 per cent). When classified according to the different water consumption sectors, 2.6 billion m^3 was for urban domestic (6 per cent), 140 million m^3 for improving city river and lake environments (0.4 per cent), 7.05 billion m^3 for industry (16.3 per cent) and 33.41 billion m^3 for agriculture (including irrigation, rural living, forestry, livestock and fisheries) (77.3 per cent).

However, water resources exploitation is at a very high level: groundwater is over-extracted, downstream reaches are dry, and water diversion is needed from outside the basin. In addition, several other problems face the water sector, including unusual rainfall patterns in some years, high evaporation rates, flooding and drought in the basin.

Being an over-developed river basin with limited water resources, the most important challenges facing the Haihe River Basin Water Resources Commission (HRWRC) in carrying out its coordinating role include:

(a) The need to strengthen the legal framework for effective and harmonious integration of water resources management, development and protection activities into the socio-economic development process of the basin, especially to meet national priorities;

(b) The need to enhance and consolidate the existing systems as well as provide a foundation for operating, maintaining and rehabilitating facilities safely, reliably and efficiently in order to protect the investment for public benefit; and

(c) Prioritize the capacity-building needs in order to enhance the organizational capacity and effectiveness of the water resources coordination system.

4. Water resources potential and challenges in the Huaihe River basin

The Huaihe River basin is situated in eastern China at longitude 112°-121° east and latitude 31°-36° north, between the Yangtze River and the Yellow River with a total area of 270,000 km^2. The runoff of surface water changes greatly from year to year. The mean quantity of surface water

resources is 66.1 billion m^3, while groundwater totals 40.6 billion m^3 and net water resources amount to 96.1 billion m^3. In 2000, withdrawals of water resources totalled 61.2 billion m^3, with exploitation reaching 63.7 per cent.

The water in the Huaihe basin is heavily polluted. The stretches of the river with a water quality worse than class IV is 69 per cent of the total river length, causing water scarcity in the affected areas. The Huaihe basin is also threatened by severe flooding during the monsoon season.

I. Key national components of the integral strategic planning and management of water resources development in the Haihe River basin

1. Summary of goals linked to the socio-economic development goals

a. Overall socio-economic development context of China and the Haihe River basin

China is currently undergoing a dual transition from a rural to urban/industrial society and from a command to a market economy in order to integrate into the global economy and promote economic growth. Forces promoting this transition are political and macroeconomic reforms implemented through policy and legal decrees in the areas of (a) state-owned enterprises (SOEs), (b) finance, (c) decentralization, (d) labour markets, (e) government and (f) trades.

The implementation of these reforms is affecting social trends including (i) changes in population growth, (ii) urbanization, (iii) rising income and income disparities, and (iv) rising consumption of goods and services. Those social trends and economic reforms combined with natural and historical conditions have various impacts on water resources and the institutions that manage them. Complex technical, social and management solutions are required for addressing the growing water shortages and pollution.

According to the tenth Five-Year Plan (2001-2005), the economic growth rate is expected to reach 7 per cent; that is, GDP will be RMB 12,500 billion in 2005, in which the shares of agriculture, industry and service sectors will be 13 per cent, 51 per cent and 36 per cent, respectively. The population growth rate is expected to slow to less than 0.9 per cent in 2005 with a total population of some 1.33 billion. The development targets for the main related provinces are given in table D.1.

Table D.1. Related provincial development targets

Province	2000 GDP	2005 GDP	2000 GDP/P	2050 GDP/P	2000 Economic structure	2005 Economic structure	Overlapping area/ province area (%)	Overlapping area /basin area (%)
	(RMB billion)		(RMB per capita)					
Beijing	246.1	370	22 300	31 900	58.3	2.7:37.3:60	100.0	5.2
Tianjin	163.9	264	17 940	28 000	46.0	50.0	100.0	3.7
Hubei	502.0	754	7 560	10 000	16.1:50:33.9	12:50:38	91.4	53.6
Shanxi	164.0	230	5 085	6 800			37.8	18.5
Shandong	854.2	1 315	9 580	14 100	14.8:49.5:35.7	11:49:40	19.7	9.7
Henan	512.6	770	5 440	7 800	22.6:47:30.4	20:45:35	9.3	4.8

The population of the Haihe River basin is 118 million, representing 10 per cent of the national total, of which the urban and rural populations account for 24 per cent and 76 per cent, respectively. The average density is 371 persons/km^2, which is 3.47 times the average national

density. Moreover, there are large differences in density between provinces (cities) in the basin, ranging from 56 persons/km^2 to 784 persons/km^2. At present, there are two municipalities directly under the central Government, five provinces and an autonomous region, including 65 regional administrative districts (Beijing and Tianjin comprise 36 districts and counties), all of which are at the regional level and 235 administrative districts at the county level.

Cultivated land in the Haihe River basin totals 163 million *mu*, which is 11 per cent of the national total. Of this area, dry land accounts for 158 million *mu* and irrigated fields for 4.79 million *mu*. The effective irrigation area is 102 million *mu*. Cultivated land per capita is 1.38 *mu*, equal to the national average value. From 1949 to 1993, cultivated land decreased by 23.2422 million *mu*, hence 14 per cent of present cultivated land, or an average annual decrease of 520,000 *mu*, hence 0.3 per cent of present cultivated lands. Therefore, cultivated land should be valued. Moreover, the remaining undeveloped 40 million *mu* can be developed.

In Haihe, the total value of agricultural output is RMB 97.5 billion, while total food yield is 45.4 million metric tons, accounting for 10 per cent of the national total. Food per capita is 385 kg. The gross value of industrial output is RMB 644 billion (of which RMB 270 billion is from village/town enterprises that account for 36.4 per cent), representing 15 per cent of the national total. The total value of industrial and agricultural output combined is RMB 742 billion, while overall per capita income is RMB 6,285.

The Haihe River basin is rich in mineral resources such as coal, petroleum, gas, steel, aluminium, gypsum, graphite and sea salt. For example, coal reserves are some 202.6 billion mt, which is nearly 30 per cent of the national coal reserves; annual extraction is 28 million mt, or 20 per cent of the national figure. Moreover, the Huabei, Dagang and Shengli oilfields as well as part of the Zhongyuan oilfield are in the Haihe River basin, with 1.5 billion mt of oil reserves and 36 million mt of annual output.

The Jing-Guang, Jing-Jin, Jing-Ha, Jing-Hu, Jing-Bao and Jing-Yuan railway lines cut through the Haihe River basin. According to available but incomplete statistics, in Beijing City, the volume of passenger traffic is 110 million persons per year, while the volume of freight traffic is 460 million mt. Along the Bohai Sea, there are the ports of Qinhuangdao, Tanggu and Huanghua, among others, with 109 berths and a handling capacity of 140 million mt. The air transport centre is Beijing, with airports in Tianjin, Shijiazhuang, Qinhuangdao, and Xingtai and Changzhi, accounting for 4.16 million passengers and 2.98 million mt of freight traffic annually.

The vast Huabei Plain, with its good climate and abundant sunshine, is one of the main grain producing regions. The food crops comprise mainly wheat and corn, plus Chinese sorghum, rice, millet and beans. Industrial crops are cotton and oil plants. In 1993, the total value of agricultural output was RMB 94.47 billion, and the average grain yield per *mu* was 292 kg. Currently, productive power is weak with the exception of a high output in the alluvial plain and Yellow River diversion irrigation region. The Haihe River region is also rich in fruit, and its forestry productivity and stock-raising can be developed further, combined with water and soil conservation. Moreover, there are 3 million *mu* of saline-alkaline wasteland and many reservoirs, and the low-lying lands should be developed.

b. Opportunities and threats for water resources development from the perspectives of the Haihe River basin and related provinces

With more than 18,000 water diversion and pumping projects having been completed, including large projects such as the Beijing-Miyun Water Diversion Project, the Water Diversion Project from Luanhe River to Tianjin municipality and Tangshan City, and the Water Diversion Project from the Yellow River to the northern part of Henan Province.

In 2000, the actual gross water supply for the basin was 40 billion m^3, including 26.3 billion m^3 of groundwater (about 65.8 per cent), 13.6 billion m^3 of surface water (including diversions, accounting for 34 per cent) and 100 million m^3 of water supplied from other sources (brackish water, seawater and treated sewage). Overall water consumption by sector is 5.2 billion m^3 for domestic consumption (some 13 per cent), 6.6 billion m^3 for industrial uses (some 16.5 per cent) and 28.1 billion m^3 for agricultural uses, accounting for 70.3 per cent of the total.

With this demand/supply balance, the annual water flow rate to the sea decreased from 24 billion m^3 in the 1950s to 6.7 billion m^3 in the 1990s. The reduced flow has caused serious sedimentation in the river mouths and estuaries.

For the past 10 years, basic water demand for socio-economic development could only be satisfied by over-extracting by some 5-7 billion m^3 of groundwater and re-using nearly 3 billion m^3 of untreated sewage water. The shallow groundwater over-extraction area is presently about 44,000 km^2; however, in some 10,000 km^2 of the sediment area the shallow groundwater resources have dried up. The deep groundwater over-extraction area is 56,000 km^2. The total over-extraction area of both shallow and deep groundwater resources in the whole basin is estimated to be 89,000 km^2, accounting for 69 per cent of the plain area of the basin. Consequently, environmental and geological problems, such as land subsidence, have been induced in the areas of extreme over-extraction.

Due to the excessive utilization of surface water resources, many rivers dry up in most seasons or are now dry throughout the year. In addition, over-discharging of pollutants into the rivers has left much of the remaining water seriously polluted. An example from 1998 best illustrates the serious water situation. During that year, total precipitation was 175.3 billion m^3 (equivalent to 551 mm in depth) and the gross volume of water resources amounted to 35.5 billion m^3, which represents an average year. However, the water resources utilization ratio was 90 per cent, and the total water flow to the sea (including untreated sewage) was 4.3 billion m^3.

c. Vision statement of the Haihe River Basin Water Resources Commission

By consulting representatives from HRWRC, the Ministry of Water Resources and some of the provinces concerned, the following vision statement for HRWRC has been determined:

> "Towards a most modern, reliable and efficient water resources management system to protect, manage and develop the World's largest complex water transfer system to achieve sustainable well-off life in the Haihe River basin."

The highest organ of the Government is the National People's Congress (NPC). Of nine special committees established by NPC, two are of particular importance to the water sector: the Environment and Resources Protection Committee, and the Agricultural and Rural Affairs Committee. The Chinese People's Political Consultative Conference (CPPCC) is the highest advisory body in the country, meeting on an annual basis and consisting of more than 2,200 representatives from all social sectors. Its primary function is political consultation, democratic supervision and participation in, and deliberating on State affairs.

Executive power is exercised by the State Council. Under the State Council are the functional organizations such as ministries and commissions. According to the official government structure, provincial level departments and bureaus of water conservation, and community level water conservation stations and water users associations are vertically integrated with the Ministry of Water Resources. However, they also report and depend on the provincial governments especially in relation to administration of laws and importantly for funding. This form of decentralization may be defined as "delegation" where the central government transfers responsibilities for decision-making and administration of public functions to local governments.

The “principled laws” that guide the activities of the ministries in water resources management or environmental protection are based on well-established scientific doctrines and China’s own blend of water administration law, enforcement and jurisdiction. These well-meaning principles (such as water allocation based on watershed or polluter pays principles) increasingly conflict with the economic interests of the provinces. Those administrative bodies (whose financial viability depends on provincial budgets) empowered by law to enforce rules and regulations at the local level (such as water bureaus) are often under pressure to act in the interests of the local government to the detriment of sound water or environmental resource management and planning. Thus, vertical relationships between ministries, departments, bureaus etc. have been challenged by stronger alliances between the local governments and these local administrative bodies.

In an effort to improve holistic planning for water resources, coordination among ministries, commissions and lower level government entities is effected through “leading groups” (coordination committees) or interdepartmental agreements. The main functions of the leading groups are to:

(a) Examine and approve the comprehensive planning of large river basins

(b) Examine and approve the important principles and policies of national water and soil conservation work as well as the important problems of key control projects

(c) Resolve major water resource allocation problems among various sectors

(d) Handle and coordinate major water affair conflicts between provinces

The only standing inter-ministerial committee in the water sector at the national level is the State Flood and Drought Control Relief Headquarters. During times of emergency, this office reports directly to the responsible vice-premier. A temporary coordinating committee may be established for a particular purpose (e.g., related to a specific basin or programme or issue), and if so, is chaired by the appropriate ministry. Provinces may also establish leading groups for specific programmes or issues within their jurisdiction, although again this practice may now be discouraged. As at the central level, provincial planning commissions are responsible for reviewing and approving programmes and projects, and may play an important role in resolving wider coordination difficulties.

In practice, there is considerable overlap between the different ministries, and inconsistent and fragmented responsibilities are a major issue. While legislation calls for integrated and comprehensive management, in practice, different ministries and agencies are primarily responsible for implementing specific acts of legislation; thus, inconsistencies and conflicts arise between different agencies in the exercising of their respective mandates. This is probably why resource conflict mediators and interprovincial water allocation planners such as leading groups were set up in the first place. However, the political process of decentralization (which has undoubtedly helped to boost China’s economic growth) has taken away this high-level planning perhaps because it is viewed as being too centralized.

In addition, with the intensification of competition between provinces due to (a) increasing economic activity, (b) population growth and (c) new imperatives of regional responsibility systems, local governments have had to acquire planning/management rights to natural resources in order to sustain economic growth. Micro planning and management at the regional level, limited by administrative boundaries, is thus the current reality in the water sector. Certainly, ministries have retained significant input into planning and management, but as central government revenue and public expenditures have shrunk, but they are constantly constrained by the limited resources available for public investment in national priorities and nationwide externalities such as large water transfers, wastewater treatment plants etc. These key projects may have a far greater significant impact on growth across provinces than their counterparts in each province. In addition, given the nature of water resources as a unitary good, multiple planning and regional management may have negative effects on economic growth.

Apart from inter-ministerial leading groups, other mechanisms designed to improve water resources management include the river basin management groups.

The Water Law recognizes the basin as the logical context for devising solutions to water resources management problems. How best to coordinate activities based on hydrological boundaries with those based on administrative boundaries is a perennial issue in water resources management. Among the issues that have arisen are the following:

(a) The River Basin Commissions (RBCMs) are commissions in name only, having no separate governing board or corporate status. RBCMs are departments of the Ministry of Water Resources and perform those functions that the ministry delegates to them. RBCMs find it difficult to enforce provisions of basin plans on other sector ministries and provincial governments, and the functions that they perform overlap with activities undertaken at the provincial and local levels;

(b) RBCMs in principle help resolve conflicts between jurisdictions and sectors, and ensure that multiple uses are served according to established priorities. However, these functions are hampered by an absence of formal agreements on interprovincial water allocation, pollution limits, and other matters. Only in the case of the Yellow River has water been allocated among the provinces and, even here, provisions for varying river conditions are inadequate. RBCMs may propose and (to the extent that they undertake the real-time management of multipurpose facilities) enforce allocations; however, most storage and diversion facilities are controlled by local or sector entities, and these may be operated in ways that are inconsistent with the provisions of RBCM plans. Only during times of flooding do RBCMs exercise predominant authority over other entities under the State Flood Control and Drought Relief Headquarters;

(c) The administration of land, groundwater and water quality is typically handled by agencies at the provincial and local levels. The transfer of aspects of groundwater administration to the Ministry of Water Resources and the provincial water resource bureaus may facilitate integration of groundwater and surface water administration, but conjunctive management as well as the integration of land and water, and water quantity and quality, all remain illusive within the basin context. Little effort is made to consolidate plans covering each aspect within comprehensive county, provincial or basin plans; and

(d) In principle, RBCMs prepare basin development and operating plans, and undertake other tasks in full consultation with the provinces, sectoral ministries and other stakeholders. In practice, there are few formal consultation mechanisms, and the main directives and decisions affecting RBCM activities are received vertically from the Ministry of Water Resources.

2. Legal and institutional framework

a. Legal and institutional context

In 1954, the first Constitution was promulgated and was the foundation document for the socio-economic management of the country. It provided the basis for a multi-sector economy as well as the conditions for the education, culture and health of the Chinese people. Thereafter, the second Constitution was enacted in 1975, the third in 1978 and the fourth in 1982. Since 1982, the Constitution has been revised four times in accordance with the changing domestic, regional and global environment. In March 2004, the Constitution was revised in order to meet the real needs of the Chinese people in the current economic environment.

The first Water Law was formulated by the State Council and adopted by the National People's Congress Standing Committee in 1988. It was revised in 2002 as both the water resources conditions and water utilization situation had changed considerably. The Water Law sets out a legal framework for development of the water sector. The development of further legislation or a decree on subsector activities is urgently needed as well as the necessary legal documents to make the law effective. External assistance is also required by water subsector agencies in the drafting of regulations covering the operation and enforcement. A prerequisite for success in this area is capacity-building throughout the water sector, which traditionally focuses on development rather than management and regulation.

In addition, other laws related to water include the Flood Control Law, Water Pollution Protection Act, Water and Soil Conservation Act, Environment Protection Act, Land Management Act. The Flood Control Law was enacted to (a) prevent and control flooding, (b) alleviate calamities caused by flooding and water logging, (c) maintain the safety of people's lives and property, and (d) safeguard the smooth progress of construction modernization. The Water and Soil Conservation Act was formulated for the purposes of (a) preventing and controlling soil erosion, (b) the protection and rational utilization of water and soil resources, (c) the mitigation of flood, drought and sandstorm disasters, (d) the improvement of the ecological environment and (e) the development of production. The Water Pollution Protection Act was enacted in 1996 to (a) control water pollution and protect the environment, (b) guarantee the health of the people and (c) promote the modernization of construction.

The Water Law grants the State Government the right to apply water licences and fees for water use. The Water Administrative Department of the State Council is in charge of the organization and implementation of water licensing and fees.

The State Government has adopted an approach that combines river basin management with district management. The Water Administrative Department of the State Council, which is supported by national laws and administrative decrees, is responsible for the integration of management and supervision of national water resources including important rivers and lakes defined by the State. It is also in charge of the exploitation, utility, efficient use and protection of water resources. The Ministry of Water Resources is responsible for integrated management and supervision of national water resources.

The provincial, municipal and county level governments are in charge of the integrated management and supervision of water resources within their districts, according to the Water Administrative Department.

The relevant departments of the State Council are responsible for the exploitation, utility, efficient use and protection of water resources. The provincial, municipal and county level governments are in charge of the exploitation, utility, efficient use and protection of water resources within their districts.

HRWRC, as an administrative agency of the Ministry of Water Resources, is authorized to undertake water resources management and supervision and is supported by national laws, administrative statues and the Ministry of Water Resources.

b. Current situation and perspectives of the legal and institutional framework

The Ministry of Water Resources is a Water Administrative Department of the State Council. Other relevant departments include the State Environment Protection Administration, the Ministry of Land and Resources, the Ministry of Construction, the State Forestry Authority, the National Development and Reformation Committee, the Ministry of Communications, the Ministry of Public

Health, the Ministry of Finance and the State Meteorology Authority. The Ministry of Water Resources grants its seven river basin administrative institutions the authority to manage the water resources within their regions.

As a subordinate body of the Ministry of Water Resources in the Haihe River basin and northern part of Shandong Province, HRWRC is empowered to administer the above-mentioned areas with regard to (a) managing the water resources and river course of the local basin, (b) control and develop important water conservancy projects, (c) undertake planning, management, coordination, supervision and advancement of river control, and (d) ensure all-around development, utilization and water resources protection.

HRWRC comprises a water administration and management department, an hydraulics and hydropower administrative department (flood prevention and drought prevention office), a department of water and soil conservation, a water resources protection bureau, an hydrology office, the Haihe River lower reaches administration bureau, the Zhang-Wei south channel administration bureau and the Zhanghe upper reaches administration bureau.

It should be noted that there is no clear river basin law or regulation that sets out standards for how a river basin administrative agency should carry out water resources management and supervision, despite the functions explicitly defined by the Water Law.

Development of clear legislation, regulations and guidelines is one of the primary means by which HRWRC can play its coordinating role within the water resources sector of the Haihe River basin. The process must be handled in an open and cooperative way, involving the stakeholders at the central, provincial and local levels. HRWRC has already gained some experience in this aspect, but further capacity-building for policy analysis and development is required. Legislation and institutions need to be supported by detailed implementation plans that indicate agency responsibilities and, where necessary, further capacity-building to allow implementation to be successfully carried out.

c. Strengths and weaknesses of the current legal and institutional framework

Enforcement measures and detailed rules and regulations are lacking for the Water Law, Law of Water and Soil Preservation, Law of Environment Protection and Flood Control Law. In addition, some connection problems exist between local rules and regulations and the administrative management system. Some local rules and regulations are not in accordance with those of the State, and there are no special procedures for the inspection and coordination of enforcement measures at the local level. When enforcement measures are introduced, prior opinions are not sought from HRWRC, which makes it difficult for HRWRC to maintain control.

Although the water legislative position, legislative supervising authority and legal duties of HRWRC are defined in the existing Water Law, it is not specific. There are no effective management measures for ensuring the performance of the river basin plan, such as water resources development, allocation, supervising management, basin control, project approval, and engineering investment. Even if a project is in violation of the law, RBCMs are not granted the authority to take effective measures for preventing illegal activities, and the performance of the basin plan also fails to be effective. Thus, it is clear that the corresponding detailed rules and regulations for water resources management need to be formulated, such as those concerning water quantity and quality, and flood control. At present, the following problems require urgent attention:

- The fundamental nature, position and responsibilities of RBCMs, and authority to enforce the law.

- The relationship between the river basin management and administrative sectors.
- The management principles of the river basin and the basic management system.
- Policy measures for promoting the comprehensive development of the river basin.

Despite its title, the existing River Basin Council is only an agency of the competent water administrative department of the State Council. In fact, management is not carried out by the officials of the relative departments and sections. At present, following the establishment of the flood control headquarters and water resources protection agency, a great deal of successful experience has been gained.

Although the RBCM departments are mainly administrative institutions and deal with few enterprises, their institutional expenses are allocated by the financial department; however, the amount provided is less than the half of actual expenditures. Without sufficient financial support, an RBCM will be unable to handle its responsibility.

While an RBCM is in charge of some water supply and hydropower projects it has no authority to decide on the water and electricity prices. In effect, the charges for water and electricity are much lower than their costs; however, neither compensation for resultant losses nor starting and development funding are provided by the Government.

The management model that takes the river basin as a basic management unit for water resources will be unable to achieve efficient impact unless the management model used for water project funds provided by the State is the same as that used for a river basin. Together with the reformation of the State planning system, financial support by the central Government for such projects will be greatly reduced.

The current institutional problem in the water sector is related mainly to the lack of coordination between agencies within the sector and with those of other sectors, as well as the loose communication and coordination between the national agencies and their provincial counterparts.

The first step is to assess the present institutional set-up at the provincial and river basin levels, and to conduct a diagnostic study of each targeted river basin. The findings of these studies could be used as a basis for designing a river basin management body tailored to the development mix in each basin.

d. Haihe River Basin Water Resources Commission mission statement

The mission statement suggested by the water sector is “Protect, manage and develop water resources to achieve good living standards in the Haihe River basin”.

As with the overall vision statement, the words have specific meanings. Protect refers to the need to ensure the continued supply of high-quality water resources. Manage refers to the water resources management activities, including access to water resources and the right to utilize water resources, and managing those institutions with responsibilities related to water resources. Develop refers to converting water resources to new uses and to a mature condition for the purpose of improved quality of life.

The Circular of Functions and Duties of the Haihe River Water Resources Commission, No. [1994]24, published on 16 March 1994 by the Ministry of Water Resources, defines the rights and duties of HRWRC. Although broad, the list of rights and duties is mainly directed towards actions, such as “planning, managing, coordinating, supervising and serving” as follows:

- Supervise the enforcement of the Water Law and the Water and Soil Conservation Law, and formulated policies and regulations for the river basin;
- Work out medium- and long-term water resources development plans for the Haihe River basin, formulate a comprehensive plan and specialized plan together with the relevant departments and provincial government, and supervise enforcement of the plan after approval;
- Organize water resources monitoring and assessment in an integrated manner, formulate a long-term water supply and demand plan and a water distribution scheme, and undertake the supervision and management of water resources protection;
- Manage the river, lakes, river mouth and key river course in the basin, and examine construction projects;
- Formulate flood control plans for the river basin, supervise the flood control plans of trans-provincial rivers, coordinate the daily work of flood and drought control in the river basin, and supervise safety and construction in flood areas;
- Mediate water affairs among departments and provinces;
- Organize prevention, supervision and all-around control in areas where loss of water and erosion of the soil is serious;
- Examine the project suggestion report, feasibility plan and preliminary design of projects directly under the central authorities as well as local joint project;
- Be responsible for the comprehensive development of the river basin and the management of important trans-provincial water conservation projects;
- Direct the work of rural and urban water conservation, water conservation project and electrification project management; and
- Undertake other work as required and authorized the Ministry of Water Resources.

3. Strategic plan goals

a. Overall Haihe River Basin Water Resources Commission goal

The overall HRWRC goal is to achieve consensus building and sustainable development of the water resources in the country, particularly in the priority areas identified by the Government. Within the context of this overall goal, an attempt will be made to achieve the following three integrated water and resources management (IWRM) main mission goals:

- **IWRM Goal 1**: To improve and modernize the legal and technical framework for managing, developing and protecting water and related resources in order to meet the needs of current and future generations;
- **IWRM Goal 2**: To enhance and consolidate the existing systems and foundation for operating, maintaining and rehabilitating facilities safely, reliably and efficiently in order to protect public investment; and
- **IWRM Goal 3**: To enhance the organizational capacity and effectiveness of the water resources coordination system.

The three mission goals are linked to the three priorities of the country mentioned at the beginning of the report, in terms of ensuring high economic growth, poverty alleviation and a strong framework for sustainable development.

b. Haihe River Basin Water Resources Commission Mission Goal 1

To achieve this mission goal, the Ministry of Water Resources will work in cooperation with all key ministries and stakeholders towards effectively managing, developing and protecting water and related resources for agricultural, municipal, industrial, rural, hydropower, recreational, fisheries and wildlife purposes.

The Ministry of Water Resources and the Haihe Basin Commission will pursue coordinating roles aimed at improving water and related resource management, development and protection activities. The framework for such coordinating roles would include:

(a) Legislation to improve integrated and comprehensive water resources management, including flood control, irrigation, urban and rural water supply, water pollution control and treatment;

(b) Legislation to strengthen the authority of the Haihe River Basin Commission to implement integrated and comprehensive water resources management. The Haihe River Basin Commission should be given more implementation authority to ensure sustainable water use, rather than just design and planning;

(c) Formulating comprehensive water resources plans, including surface water and groundwater, water quantity and quality, water use and protection, economic and environmental water use etc., which should get approval from the State Council and should act as guidelines of management activities;

(d) Formulating policy and strategies to improve the water resources planning systems of the country, with emphasis on river basin water resources planning systems;

(e) Formulating policy and strategies to improving the efficiency of water use; and

(f) Promoting integration of applied sciences and technology into water resources management.

c. Haihe River Basin Water Resources Commission Mission Goal 2

Under this mission goal, the Ministry of Water Resources and the Haihe Basin Commission will focus on operating, maintaining, and rehabilitating existing water resources facilities so that they continue to provide project benefits. These facilities provide power and water supply delivery systems that serve agricultural and municipal users, in addition to recreation, fisheries and wildlife benefits, and flood control. Ensuring that the facilities are safe, cost-effective and reliable will assist the agencies concerned to operate them as effectively and efficiently as possible in order to provide project benefits while also protecting public health, sustaining environmental values, and providing timely and economical services to customers. This will protect the public investment.

To enable this goal to be achieved, the necessary legislation for ensuring safe and reliable water related services should be promulgated. At the same time, certain agencies should be endowed with the responsibility for maintaining the safety and reliability of such facilities.

d. Haihe River Basin Water Resources Commission Mission Goal 3

In order to achieve the above mission goals, HRWRC needs to be strengthened to make it more effective. The strategies for achieving the goal should include:

(a) The formulation of a reform plan for the Haihe Basin Commission to adapt to the increase in authority and the changed situation, with the focus on managing water resources in an effective and integrated manner. The reform plan will be presented to the Government for approval;

(b) The establishment of an information management system to facilitate management;

(c) The preparation of five-year Action Plans, based on the priority water resources management issues at the national level and river basin levels; and

(d) The preparation and implementation of a capacity-building plan for HRWRC, based on the requirements for achieving the Action Plan.

4. Implementation, monitoring and evaluation

a. Identification of indicators and benchmarks for performance measurements, and the expected timeframe and necessary resources

Implementation would be carried out based on the clarification of the strategic planning and management process.

(i) Human resources development

It is necessary to strengthen the River Basin Commission, set up a water resources coordinating committee, and develop the right skills and competencies to match the strategy, giving recognition to the fact that the Chinese people are the best source of ideas for their future. Moreover, confirmed leadership, creative teamwork and organizational culture are important to the successful implementation of strategic plan management.

Consequently, it will be necessary to:

(a) Build an organization around the critical strategic elements;

(b) Mobilize and allocate resources to match the strategic plan;

(c) Establish administrative systems, policies and procedures in accordance with the strategic plan;

(d) Develop a personnel reward system linked to achievement and the overall strategy; and

(e) Recognize that the most important job of leadership is to establish and instil confidence in the strategic plan management, and to ensure that everyone in HRWRC follows it.

Because of the complexity of strategic planning, it will be necessary to seek financial support, both at home and abroad. Only if HRWRC treats fund-raising as a fundamental part of the operation, and approaches it in a professional and systematic way, will strategic planning have any chance of becoming financially secure. As the Ministry of Water Resources has appointed HRWRC as the leading institution in the promotion and coordination of water resources development for the benefit of the river basin population, its duty is to treat fund raising not as an auxiliary issue, but as an essential component of the overall operation.

Financial security means that funding must be sought and obtained in a flexible manner from diverse sources at various levels, including the central Government and, in particular, the Ministry of Water Resources, local governments, communities and associations, involved enterprises as well as international organizations. It is clear that a subsidy from the central Government will play a crucial role, while local governments would provide of counterpart funds. Financial assistance contributed by other institutions or organizations will be in a variety of forms, such as cooperative scientific research, transfers of project results at a preferential price or even free of charge. As for seeking overseas funding, this would take a similar course. In addition, HRWRC responsibility would include the identification of reasonable targets for funding and in-kind services during the process of strategic implementation as well as deciding on how the funds and services should be used.

With regard to financial management, HRWRC is accepted as the core authority in charge of all relevant issues. Its functions are clearly defined by the central Government, particularly the Ministry of Water Resources, and bolstered by local government at different levels. The major duties performed by HRWRC are to (a) put forward the overall budget needed, (b) determine the framework of fund-raising and clarify the contribution percentages from different financial resources in the foreseeable future, and (c) establish and carry out efficient financial monitoring systems over the strategic planning period.

(ii) Action plan

Three levels of action by HRWRC will be necessary, as described below.

(1) First level

The first level includes the reasonable allocation of water resources, water conflict reduction and the establishment of a consolidated information system.

(a) Reasonable allocation of water resources. Water resources include surface water, groundwater, treated wastewater, brackish water and fresh seawater etc. Water use involves many aspects, such as domestic urban and rural usage as well as production and eco-environment usage. Optimized water allocation will be achieved via water allocation, coordination of water supplies and usage, unification of water quantity and quality, and real-time regulation and preference of the benefits. The mutual relationship of economic structures, economic development and water resources must be handled correctly via administrative, economic, technical and legal measures. Reasonable water resources allocation can ensure that limited water resources produce full benefits.

(b) Water conflict reduction. The River Basin Commission should coordinate the relationship between the provinces concerned, and between the different water-use sectors. By establishing an information sharing system, such a relationship can be formed based on mutual respect and trust. Using market mechanisms and establishing a compensatory mechanism are also important ways of reducing water conflicts.

(c) Establishment of a consolidated information system. On the one hand, the province will provide basic hydrological and water use information to the River Basin Commission. On the other hand, the River Basin Commission should provide information to the province and the public. This system will not only reduce water conflicts but also improve water use efficiency.

(2) Second level

As detailed below, the second level of action includes water conservation and improved water-use efficiency, the use of seawater in coastal areas, the construction of a south-to-north water diversion project and the protection of groundwater resources.

(a) Water conservation and improved water use efficiency. At present, the industrial water saving level in Haihe River basin is very high, and the average water consumption quantum for every RMB 10,000 output value has been reduced from 160 m^3 in the early 1990s to 51 m^3. The water reuse rate is about 80 per cent, which is 40 per cent higher than the average national level. The efficiency of industrial water consumption can only be improved by adjusting the industrial structure and arrangements, limiting the high level of water consumption in production, adopting water-saving technology and gradually increasing the ratio of new technology industries.

Use of irrigation water in the basin is about 30 billion m^3, which is 70 per cent of the total water supply. The comprehensive irrigation quantum is some 296 m^3/*mu*. The water-saving irrigation area is 40 per cent of the total irrigation area, and it is planned to increase the percentage to 70 per cent in 2010. Together with the process of urbanization, domestic urban water use will be steadily increased. Domestic urban water saving will be realized mainly by popularizing water-saving appliances, raising the water price, reducing seepage losses in the running water conveyance pipe network, developing repeated usage and enhancing public awareness of water saving.

(b) Use of seawater in coastal areas. Haihe River basin has an approximate 900-km coastline. Therefore, the use of seawater is an important way of mitigating fresh water shortages in coastal cities in the future. At present, seawater is only used for cooling by the electric and chemical industries in Tianjin, Qinhuangdao and the coastal areas of Shandong Province. The use of freshened seawater lags far behind. Together with the continuous progress in seawater usage technology and the reduction of freshening costs, the use of seawater will have a bright future. Freshened seawater will eventually undergo even wider production.

(c) Construction of a South-to-North Water Diversion Project. The project being established is of strategic fundamental infrastructure for solving the water shortage problem in Haihe River basin. The two largest cities, Beijing and Tianjin, and the northern China plain are intake areas of the East Route and the Middle Route of the South-to-North Water Diversion Project. It is related to the domestic water supply as well as economic development and improvement of ecological environments in those areas. An analysis of the present and future water resources demand and supply in the basin shows that merely developing efficient water use and the potentialities cannot thoroughly change the water shortage situation and the worsening trends in the ecological environments. The water diversion project is necessary to meet water demand.

(d) Protection of groundwater resources. The groundwater resources of China, especially in the Haihe River basin, play a vital role in water resources that have served China well. The Haihe River basin has large areas where both shallow and deep aquifers are greatly overexploited. Approximately 28 per cent of the total groundwater used is from deep confined aquifers where the recharge is very limited. The heavy overexploitation of groundwater resources causes huge environmental damage – subsidence, seawater intrusion, salinity degradation, pollution, and falling groundwater levels. The economic consequences of these effects are great. The serious pollution of surface water and surface water scarcity has driven the increasing use of groundwater during the past few decades. Groundwater quality, especially in the deep aquifers, is far better than the surface water quality. However, increasingly serious pollution of the shallow aquifers is now encouraging the growing use of deep groundwater resources.

The very serious and largely irreversible falling groundwater levels throughout the northern China Plain demands a major programme of groundwater management planning to reduce groundwater use to sustainable levels. The groundwater management strategy proposed will require a huge effort; however, the consequences of not doing so will have serious long-term side-effects, such as effectively destroying the groundwater-dependent agricultural base, massive subsidence and seawater intrusion, virtual elimination of groundwater as a water source for many cities and countless households, and the loss of “insurance” water for future generations. The fundamental objective proposed is to reduce groundwater use to sustainable levels by 2015. A broad range of technical, institutional and management actions are required to achieve this goal. The key actions required are:

(a) The definition of all significant groundwater usage areas as Groundwater Management Units and the determination of the sustainable yield;

(b) Preparation and implementation of groundwater management plans as per the programme described here;

(c) Allocation licensing to be linked to sustainable yield assessment;

(d) Allocation licensing only to be undertaken by one department;

(e) Licensing of well construction drillers;

(f) A River Basin Groundwater Database needs to be developed;

(g) A groundwater pollution prevention strategy needs to be prepared;

(h) A review by the Ministry of Water Resources of the adequacy of regulations required to implement the proposed groundwater management reforms;

(i) The introduction of realistic groundwater prices; and

(j) The preparation and introduction of a major education programme on groundwater processes and the need for groundwater management.

(3) Third level

The third level comprises the improvement of water resources institutional management, and integrated planning.

The improvement of water resources institutional management should involve:

(a) The establishment of a high-level River Basin Coordinating Committee or Council in the Haihe River basin, chaired by a Vice-Premier with the Ministry of Water Resources as Vice-Chairman, and comprising: (i) the mayors and governors of the constituent municipalities, provinces and autonomous regions, (ii) the Vice-Minister for Water Resources and the Vice-Ministers of SEPA and the other key "water" agencies – the Ministries of Agriculture, Construction, Finance, Communications, the National Development and Reformation Committee, and the State Meteorology Authority; (iii) the Commissioner or Director of the respective RBCM; and (iv) representatives of key civil societies such as water supply companies and water user associations;

(b) The Haihe River Water Resources Commission should be charged with the responsibility for: (i) determining water resources allocations (surface and groundwater) for the provinces (real-time, and dependent on the water held in reservoirs and seasonal conditions); (ii) the development of broad policies and programmes promoting sustainable water resources management, particularly with the respect to flood control and drought relief, groundwater management, water resources protection and pollution control, and the promotion of increased water-use (especially irrigation) efficiency; and (iii) comprehensive basin development planning;

(c) Granting the River Basin Councils the necessary legislative support and authority to ensure essential coordination and enforcement of its allocation, policy and programme decisions in the municipalities, provinces and autonomous regions;

(d) Confirmation by law of the River Basin Councils as the primary water resources management agencies in the Haihe River basin (with specific flood control responsibilities) to ensure the enforcement of council decisions on the allocations, policies and programmes in consultation with the municipal, provincial and autonomous region governments. It can be strengthened with the appropriate expertise where necessary to provide administrative and technical secretariat support for the River Basin Council; and

(e) Adoption by the River Basin Councils of the strategic planning and management methodology required to determine the policy, programme and project priorities required to accelerate the basins towards achievement of sustainable development.

With regard to integrated planning, the River Basin Commission should prepare an integrated planning guide to the water resources development and protection at the province level.

(iii) Mechanisms for reporting, monitoring and evaluation

(1) Coordination framework

The ministries and agencies responsible for the management, exploitation, development and use of water and water resources include:

(a) The Ministry of Water Resources. Responsible for integrated management and supervision of national water resources as well as the exploitation, development, use and protection of water resources in China. It is also responsible for monitoring, control, promotion and reporting on the implementation of activities related to water and water resources.

(b) Ministry of Agriculture. Responsible for the exploitation, development and use of water resources in agriculture.

(c) State Forestry Authority. Responsible for the exploitation, development and use of water resources in forestry.

(d) Ministry of Communications. Responsible for the management, exploitation, development and use of water resources in the field of communications. In addition, the ministry is responsible for collection of hydrological data and hydrographical surveys for navigation.

(e) Ministry of Construction. Responsible for the management, exploitation, development and use of water resources in the municipal areas, town water supplies, urban drainage and wastewater treatment.

(f) Ministry of Public Health. Responsible for the management, exploitation, development and use of water for rural domestic consumption and health care.

(g) State Environment Protection Administration (SEPA). Responsible for ecologic environment protection and wastewater discharge management.

(h) Ministry of Land and Resources. Responsible for hydrogeology surveys.

(i) HRWRC. Empowered to exercise authority of water administration in the above-mentioned areas. Responsible for managing the water resources and river course of the local basin, according to the rule of management in unity and rank. Responsible for controlling and developing important water conservancy projects comprehensively. Ensure efficient planning, management, coordination, supervision and servicing. Undertake river control, and all-around development, utilization and water resources protection.

The above ministries and agencies would need to coordinate with the local authorities in the detailed determination of responsibilities and scope of activities within their sectors.

(2) Licensing of water use and water resources development activities

The State Council has issued Decree No. 119 on licensing water catchments. The Decree determines that the Ministry of Water Resources will implement this licensing system and the different scales of water catchment licences to be issued by water administrative institutions.

The water administrative departments should approve important medium-scale water uses. The Ministry of Water Resources or the River Basin Commissions should be responsible for approving the water catchments of individuals and organizations wishing to use water from the Yangtze, Yellow, Huaihe, Haihe, Luan, Pearl, Songhua, Liaohe, Jinsha and Han Rivers, international rivers, State border rivers, inter-province rivers indicated reaches, provincial border rivers and lakes, inter-provincial regions and water quantities beyond the set quota. The water administrative departments of local authorities should be responsible for approving other water catchments.

Permission for large-scale water resources development activities should be sought from the Ministry of Water Resources, SEPA and NDRC, and final approval given by the State Council. Applications for large-scale water resources development activities should be accompanied by a feasibility study and environmental impact assessment. Smaller-scale water resources development activities should apply to the water administrative departments and local government authorities.

The Ministry of Water Resources and SEPA need to prepare guidelines on the preparation of feasibility studies and environmental impact studies, respectively, in accordance with the Environmental Impact Evaluation Law. The ministry also needs to monitor and control the development of water resources.

All water resource development projects, particularly the construction of dams, irrigation schemes, and the diversion of rivers and streams, should go through a public consultation process with the local population. When a water resource development project is expected to have an impact on the natural or social environment, SEPA, the Ministry of Water Resources and local authorities need to:

(a) Issue a project notification to inform the public through newspapers, public notices and other means and, depending on the type of project, determine the duration for such a notification; and

(b) Organize public hearings in the relevant location. The developer or representative should attend the public hearings and provide a detailed explanation and information on the proposed mitigation measures. All costs associated with the public hearing will be the responsibility of the developer.

(3) Monitoring and evaluation

The Ministry of Water Resources, HRWRC and local authorities are responsible for the monitoring and evaluation of the implementation of measures provided in relative regulations and decrees and will report to State Council on a regular basis.

There are three types of monitoring and evaluation: (a) regular evaluation; (b) monitoring with prior notice; and (c) evaluating without prior notice.

(iv) Indicators

(1) A reduction in the number of water conflicts

(2) A reduction of water pollution and the improvement of water ecosystems, particularly wetland ecosystems

(3) Water productivity

II. Integrated strategic plan for the Huaihe River basin

1. Overall social-economic development context of the Huaihe River basin

The Huaihe River basin spans 35 prefectures and 181 counties in the five provinces of Hubei, Henan, Anhui, Shandong and Jiangsu. In 1997, the population was 160.43 million, with an average density of 594 persons/km^2, which was 4.8 times the national average of 122 persons/km^2. That made it one of the most densely populated regions in China.

The Huaihe River basin has a cultivated area of 183.26 million *mu* (12.22 million hectares). The main crops are wheat, rice, corn, yams, beans, cotton and rape. In 1997, the total agricultural output was RMB 284.4 billion (US$ 34.35 billion) or RMB 1,812 (US$ 218.8) per capita, which was significantly higher than the national per capita average of RMB 1,345 (US$ 162.4). These figures clearly indicate the basin's key role in national agricultural production. The main agricultural yield of the basin is grain. In 1997, the grain yield was 84.96 million metric tons, which accounted for 17.3 per cent of the total crop yield in the basin.

The Huaihe River basin is one of China's developing industrial regions. In 1995, the gross value of industrial output in the basin was RMB 763.4 billion and a GDP of RMB 541.2 billion (US$ 92.2 billion and US$ 65.4 billion, respectively). GDP per capita was only RMB 3,398 (US$ 410), which is lower than the national average of RMB 4,810 (US$ 581). The main industrial sectors in the Huaihe River basin are coal, power, food, light industry and textiles.

2. Opportunities and threats for water resource development from the perspective of the Water Resources Council

Following the serious flooding in 2003, the State Council gave high priority to harnessing the Huaihe River. Investment has been greatly increased in order to guarantee the completion of important engineering construction works. The ability to prevent flood disasters is being promoted. Investment in environmental protection has also been increased, and the authority of the State Environment Agency has been strengthened with regard to controlling pollution in the Huaihe River basin. Integrated water resource management is taken into consideration during policy-making.

The main challenges are flooding and water logging, water pollution and water scarcity. A combination of climatic conditions and topography makes Huaihe River basin vulnerable to widespread, prolonged and devastating floods. While flooding event probabilities remain outside the control of society, protection against damage can be enhanced. Unfortunately, this is no easy task in the Huaihe River basin due, in part, to the climate and topography; however, an additional factor is that of the historical pattern of settlement in the plains and the extreme population density, which requires extensive infrastructure. Economic losses caused by flooding and water logging are shown in table D.2.

Table D.2. Economic losses caused by flooding in the Huaihe River basin

(RMB x 10^8)

Year	1991	1992	1993	1994	1995	1996	1997	1998	Average
Jiangsu	235.00	19.87	55.70	1.04	10.32	30.33	55.12	26.70	54.3
Anhui	249.00	5.20	6.88	4.21	91.00	137.95	16.85	130.50	80.2
Shandong	11.53	27.90	75.02	44.91	29.39	47.68	40.53	56.30	41.7
Henan	38.00	9.00	4.56	16.55	7.89	70.67	2.92	40.30	23.7

Surface and groundwater quality has been seriously degraded due to the lack of effective pollution control, combined with rising population and industrial operations, especially during the 1980s and 1990s. Causes of pollution from point sources include rapid urbanization, industrial development, rising population and the growth in the number of township and village enterprises and livestock operations in rural areas. Diffuse releases of nutrients and pesticides from agriculture are also becoming important sources of shallow groundwater and surface water contamination. Pollutants of concern recorded by SEPA from point sources include parameters for organics such as COD and BOD, phenols, ammonia nitrogen and inorganics such as heavy metals, while non-point source pollutant parameters include non-ionic ammonia, TP, TN and COD.

This dramatic decline in surface and groundwater quality continues despite efforts by regulatory authorities, including SEPA, and the Ministry of Water Resources, to improved control of the obvious sources of pollution such as state-owned enterprises as well as attempts to close small highly-polluting town and village enterprises. The current surface water quality status is such that most rivers and lakes fail to meet the standards required for the designated beneficial uses of the water. In 2002, the river stretches with water quality equal to, or worse than class IV was 69 per cent of the total river length.

In general, the water shortage problem in Huaihe basin is not particularly serious. However, despite the region's monsoon climate, with its greater variability in precipitation, water shortage problems occur in some dry years. Therefore, as a result of socio-economic development combined with water pollution, water shortage problems will become serious in the future.

3. Vision Statement of the Huaihe River Water Resources Commission, Ministry of Water Resources

This Vision Statement expresses the long-term objectives of the water sector. HRWRC, under the Ministry of Water Resources, represents the ministry in the management of water resources in the Huaihe River basin. As proposed by working group members for the Huaihe sector, the main vision statement of HRWRC states: "To provide adequate safety to the people and economic production systems by 2010, recover the main river ecosystems for people and aquatic life by 2020 and provide a sustainable water supply to support sustainable socio-economic development of the Huaihe River basin".

Some of the reasons and thinking behind this statement are worth elaborating. Flood safety refers to the establishment of a comprehensive system to prevent flood disasters. Water supply safety means having enough clean water to supply to different water-use sectors. Ecology safety refers to water development that is harmonious with the ecology. All three aspects guarantee the sustainable development of the basin.

4. Legal and institutional framework of the Huaihe River basin

The Huaihe River basin has no local laws. All laws in China concerning water, such as water law, flood prevention law, water and soil conservation law, among others, will protect and control river basin water resources development and conservation. According to the local situation, local government and river basin commissions can formulate some ordinance.

China has long focused on flood control and irrigation, but in the past 50 years the problems of urban and industrial water supply, water pollution control and protection of aquatic ecological resources have also become major issues.

The Government now recognizes the great importance of making the best possible use of available water in non-flood periods as well as the continuing importance of better flood management.

It also recognizes that in order to achieve this objective, a marked change is required in the existing institutional pattern related to water resources management, which is now highly fragmented between national, basins and provincial local interests and agencies. To do this, a new institutional system needs to be established that recognizes that the salient approach must be based on planning where the entire river basin is the controlling, unit, with the national and provincial local governments working in coordination to achieve optional water utilization within the basin. This would include both surface water and groundwater.

The Ministry of Water Resources has the primary responsibility for overall management and development of the nation's water resources and is well skilled and qualified to address the myriad problems. However, in an operational sense, its specific functions for flood protection and water management are implemented through the seven established River Basin Commissions.

In addition, the ministry's authority is limited in many critical areas, given the high degree of autonomy of China's provinces and overlapping jurisdiction of other ministries and agencies, particularly in the areas of urban water supply, groundwater management, pollution control and operation of reservoirs for hydropower. The result is that the current water management system is somewhat confused, not cohesive, and fraught with opportunities for over-allocation, which has been confirmed by the grossly depleted groundwater resources.

The River Basin Commissions are, in general, weak compared with the economic and political strength of the provinces. Institutional fragmentation from the central government downward explains a large part of this, since it does not allow planning and day-to-day operational management to be effectively realized over the entire river basin. It is suggested, therefore, that the provinces' pre-eminence over natural resources management and development within their borders, should be formally recognized, subject to "technical" oversight by the respective river basin commissions, particularly their responsibility for the management and use of their respective shares of interprovincial surface and groundwaters.

At the river basin level, the institutional challenge is to bring the provinces together with the key "water" agencies, so that they all have a direct role in governance to ensure sustainable development of the river basin as a whole.

The mission of Huaihe River Basin Commission includes the following aspects:

(a) On the basis of strengthening construction measures, also strengthen non-construction measures to promote synthesis capability in flood prevention and disaster reduction. It is planned to treat the river course, open up new floodways and strengthen the levees on the both banks. Considering the use of detention areas is one of the most important components of the flood control project system in the Huaihe River basin. There are nine detention areas in the basin with a total storage capacity of 8.61 billion m^3;

(b) Guarantee clean water supplies for urban and town areas, not only for the domestic and industrial sectors but also to ecological water. As for agriculture in the basin, consideration should be given to different water sources unification, while irrigation guarantee probability should not be increased; and

(c) Take effective measures to save water and control pollution. Water saving and water pollution control are preconditions of water resources development. It should promote Water-use efficiency should be promoted in agriculture. By water saving, discharges of sewage water from urban areas will be reduced. Encourage the industrial sector to implement cleansing production, and the control of pollution from polluting sources.

5. Strategic plan goals

Integrated water resources management in the Huaihe River basin should coordinate many sectors, such as those concerning water resources, construction, water-borne transportation, ecology protection, energy development, water development and water pollution control, among others. Water resource management should focus on the basin level and include unified basin planning.

With integrated water resources management, the Huaihe River Basin Commission will be able to achieve the general goal, i.e., sustainable water resources use in support of sustainable basin development. Within the context of this overall goal, the Commission will attempt to achieve the following three main mission goals.

a. IWRM Goal 1

Establish a comprehensive flood prevention system, clean water supply system and water protection system. To achieve this goal, the following legal and institutional measures will be taken:

(1) Improved implementation of the Law on Water and Water Resources

Formulate a new water law that emphasizes water basin management and give the River Water Resource Commission legal status. The Ministry of Water Resources will work in cooperation with all key ministries and stakeholders towards effectively managing, developing and protecting water and related resources for agricultural, municipal, industrial, rural, hydropower, recreational, and fish and wildlife purposes. The Ministry of Water Resources and the Huaihe River Basin Commission will pursue a coordinating role aimed at improving water and related resource management, development and protection activities. The framework for such a coordinating role will include:

(i) Introducing legislation to improve integrated and comprehensive water resources management, including flood control, irrigation, urban and rural water supply, water pollution control and treatment etc.; and

(ii) Introducing legislation to strengthen the authority of the River Basin Commission to implement integrated and comprehensive water resources management. The River Basin Commission should be given more implementation authority to ensure sustainable water use, not only design and plan jobs.

(2) Improvement of the flood prevention planning system

Flood prevention planning has been undertaken in China, but with advances in socio-economic and scientific development, flood prevention planning should be modified. It should mainly emphasize harmonization with flooding and the use of non-construction measure.

(3) Improvement of the water resources planning system

China is now formulating comprehensive water resources planning, including surface water and groundwater, water quantity and quality, water use and protection, economic water user and environmental water users etc. The new water resources plan should receive approval from the State Council and should provide guidelines for management activities.

After several years, water resource planning should be amended according to the changed conditions.

(4) Promotion of applied sciences and technology integration

New concepts and new technology should be used in water resources management, water saving, water use and water protection.

b. IWRM Goal 2

Strengthen administration and make full use of market mechanisms to enhance and consolidate existing systems and the foundation to operate, maintain and rehabilitate facilities safely, reliably and efficiently in order to protect public investment.

Under this mission goal, HRWRC will focus on operating, maintaining and rehabilitating existing water resources facilities, so that they continue to provide project benefits. These facilities provide power and water supply delivery systems that serve agricultural and municipal users, in addition to recreation, fish and wildlife benefits, and flood control. By ensuring that facilities are safe, cost-effective and reliable, HRWRC can assist the agencies concerned to operate them so that they provide project benefits while protecting public health, sustaining environmental values, and providing timely and economical service to customers and, thus, protect the public investment.

For this mission, the related agencies will be assisted in conducting oversight reviews as well as planning to ensure timely operation and management procedures, including control and communications systems for the continued safe and reliable operation of existing facilities. In this connection, it is expected that the related agencies will be able to verify reliability, improve maintenance practices, and identify and implement risk reduction actions.

(1) Ensure effective operations of facilities

It is important that related agencies comprehensively review, update and implement Standard Operating Procedures and related operating guidance to ensure that existing facilities provide project benefits in a safe and reliable manner.

(i) Strategies for achieving this goal

HRWRC will, through the implementation of related laws and development of regulations, encourage all operating agencies to use appropriate tools, technologies, innovations and research to operate facilities effectively, including internal auditing systems.

(ii) Programme evaluation and performance improvements

Establishment of indicators and monitoring of incidents will be necessary for effective evaluation of performance improvements.

(iii) Performance measures

Report on emerging issues in the operation of existing facilities in the water sector in 2005, and propose a strategy for improving the efficiency and effectiveness of existing facilities in 2006.

(2) Effective participation by the public

Participation of the public is essential in enhancing the benefits of existing facilities and minimizing the risks and impacts of disasters. In addition, effective public participation will result in better investment strategies in terms of resources mobilization and investment scheduling.

(i) Strategies for achieving this goal

The following approach is necessary. First, develop an awareness and consultation strategy that will (a) identify target groups and their information needs, appropriate and cost-effective means of providing information and creating awareness, (b) identify modalities and an action plan for consultation with stakeholders regarding draft policy and legislation, and other important consultation topics, and (c) identify awareness and consultation roles of central government agencies and HRBC in relation to all major target groups.

The next steps are to carry out awareness and consultation responsibilities according to the agreed strategy, play an awareness and consultation role at the river basin level, and develop and implement national guidelines for dam safety.

(ii) Cross-cutting relationships

As the overall coordinating body in water resources management, HRWRC will assist other agencies in the development of the above strategies and guidelines, including establishment of an appropriate mechanism for the implementation of the strategies and guidelines.

Programme evaluation and performance improvements: Detailed indicators will be developed to monitor the implementation of the related strategies and guidelines.

(iii) Performance measures

Establish working groups on public awareness and participation.

c. IWRM Goal 3

The goal is to enhance the organizational capacity and effectiveness of the water resources coordination system. HRWRC needs to be strengthened to make it an effective organization and enable it to achieve the above mission goals. Under this mission, the service provided to clients will be improved, particularly for top decision-makers in the water sector and the Government. In addition, its leadership role in the coordination of water resources management, development and protection will be strengthened, and support will be provided for an innovative and growing workforce able to respond to diverse needs. To improve the business approach, it is essential to involve decision-makers and employees of HRWRC in the formulation and implementation of this strategic plan and the subsequent monitoring and evaluation.

Strategies for achieving this goal

(a) Preparation of an Action Plan for two- and five-year periods. The Action Plan will be based on the mandate of HRWRC as well as priority water resource management issues at the national level and in the river basin. It will be necessary for the Action Plan to emphasize the need to integrate a more balanced view of sectoral perspectives in the programmes of investment and operations of all water-related agencies. HRWRC will present the Action Plan to the Government for approval.

(b) Prepare and implement a capacity-building plan for HRWRC, based on the requirements for achieving the Action Plan.

(c) Conduct training needs assessment for IWRM training in HRWRC and the provinces in the river basin. Prepare a coordinated training plan to address the priority training needs, drawing on the training modalities identified in the project and the available training budget. Present the training needs assessment and plan to HRWRC for approval.

6. Implementation, monitoring and evaluation

a. Identification of indicators and benchmarks for performance measurements and expected timeframe and necessary resources

Having established a strategic plan management process, the various aspects of implementation are considered below.

(1) Human resources development

In developing human resources, it will be necessary to align the organization and develop the necessary light skills and competencies to match the strategy. It is vital to recognize that people are the best source of ideas for the future, and that they form the foundation for creating good leadership and teamwork as well as the organizational culture needed for the successful implementation of strategic plan management. Thus, the following steps need to be taken:

- Build the organization around the critical strategic elements
- Mobilize and allocate resources to match the strategic plan
- Establish administrative systems, policies and procedures that are in accordance with the strategic plan
- Develop a personnel rewards system linked to achievement and the strategy plan
- Recognize that the most important job of the leadership is to establish and have confidence in the strategic plan management and to ensure that everyone in the HRWRC follows it

(2) Funding for the future

Because of the complexity involved in strategic planning, it is necessary to acquire financial support both at home and abroad. Only if HRWRC treats the raising of funds as a fundamental part of the operation, and approaches it in a professional and systematic way, will strategic planning have any chance of becoming financially secure in the future. Since the Ministry of Water Resources has appointed HRWRC as the key leading institution in the promotion and coordination of water and water resources development for the benefit of the river basin's population, it is unquestionably the duty of HRWRC to treat fund raising as an essential component of the overall operation, and not just as an auxiliary issue.

Financial security means that funding must be sought and obtained in a flexible way in order to take the advantage of diverse sources, including the central Government and the Ministry of Water Resources in particular, and local government, communities and associations, involved enterprises, international organizations and so on. It is certain that the central Government subsidy will play the most crucial role. Local government contribution will be in the form of counterpart funds. Donations contributed by other institutions or organizations will take many forms, such as cooperative scientific research, transfers of the project outcome at a preferential price or even free of charge etc. As for bursaries from abroad, these can be provided in similar forms as above.

In addition, HRWRC is responsible for identifying a reasonable goal for funding and in-kind services during the process of strategic implementation, especially with regard to what these funds and services should be used for, and how long it may take to reach this level of contribution.

With regard to financial management, HRWRC is accepted as the core agency in charge of relevant affairs. Each of its functions is explicitly defined by the central Government, and in particular

the Ministry of Water Resources, and supported by local governments at the different levels. The major duties to be performed by HRWRC are:

(a) Putting forward the overall budget

(b) Detailing the amount of funding needed to cover all projected expenditures

(c) Determining the organization of fund-raising in order to clarify the contribution percentage from each financial resource for the foreseeable future

(d) Establishing and implementing efficient financial monitoring systems for the strategic planning period

(3) Indicators

The indicators include:

(a) The decrease in the number of water conflicts

(b) The reduction in water pollution and improvement in water ecosystems, particularly wetland ecosystems

(c) Water productivity

b. Action plan

The River Basin Commissions will undertake activities that are categorized in three levels according to priority.

(1) First level

(i) Coordination

The River Basin Commissions need to strengthen coordination with the provinces concerned and between themselves.

(ii) Information

Establish a consolidated information system. This will require the provinces to provide basic hydrological and water use data to the River Basin Commissions, while the River Basin Commissions should provide information to the provinces and the public. This consolidated information system will not only reduce water-use conflicts but also improve water-use efficiency.

(iii) Reasonable allocation of water resources

Water resources include surface water, groundwater, treated wastewater, brackish water and freshened seawater. Water use involves many aspects, such as domestic urban and rural usage, production usage and eco-environment usage. Optimized water allocation will be achieved via water allocations based on time and area, coordination of water supply and usage, unification of water quantity and quality, real time regulation and preference of benefits. The mutual relationship of economic structures, economic development and water resources must be handled correctly via administrative, economic, technical and legal measures. Reasonable water resources allocation can ensure that limited water resources produce full benefits.

(iv) Water pollution control

The Huaihe River system was heavily polluted due to population growth and the increase in the number of township and village enterprise, without much attention being given to sewage and wastewater treatment. The River Basin Commissions will be granted authority to coordinate with the Environment Agency in taking effective measures to control point source and non-point source pollution.

(2) Second level

(i) Construction and non-construction measures for flood control and water-logging

This level involves three main actions:

(a) Reinforcement of the reservoirs along the Huaihe River. There are 5,100 reservoirs in the mountainous/hilly region of the Huaihe River basin, of which 35 are large-scale reservoirs with a total storage capacity of 17.86 billion m^3 and a controlled area of 32,300 km^2. They account for 40 per cent of the total mountainous region. However, most reservoirs were built during the 1960s when the "Great Leap Forward" occurred and design and construction standards were sacrificed in the interests of expediency. Dangerous reservoirs should be adapted to ensure that the reservoirs play a greater role in flood control in a safe way;

(b) The use of detention areas. This is one of the most important components of the flood control project system in the Huaihe River basin. There are nine detention areas in the basin with a total storage capacity of 8.61 billion m^3. Among them, the Mengwa, Chengxihu, Chengdonghu and Wabuhu detention areas are located in the middle reaches of the Huaihe River and have a total storage capacity of 6.57 billion m^3. They can reduce the flood discharge by 20 per cent and weaken peak flow very effectively. There are 19 floodway areas; these can be used to increase the discharge to the downstream stretch of the Huaihe River. An analysis indicates that floodways can divert discharge by 30 to 50 per cent during minor flooding and by 50 to 70 per cent during serious flooding; and

(c) Improve the levee flood standard on the Huaihe River. It is planned to improve the river course and open up new floodways to strengthen the levees on both banks.

After flooding is regulated by Hongze Lake in the upper and middle reaches of the river, the normal flood outlets in the lower reaches are first into the Yangtze River (mainly as a flood diversion outlet) and then into the sea through the general irrigation channel. In addition, when Huaihe River floodwater does not meet Yishusi floodwater, the former can enter the sea through the New Yi River after being diverted by the Huaishu River. When a mega flood occurs, all the above mentioned strategies will have to be employed. If an emergency occurs at the Hongze Lake and Lixia River levees, water has to be temporarily diverted from the north of the general irrigation channel.

(ii) Water resources projects

This aspect involves:

(a) Establishing the three cross-basin water transfer projects – the east and middle south-to-north water transfer projects and the diversion from the Yangtze River to the Huaihe River are cross-basin water transfer projects. The eastern south-to-north water transfer project can solve the water scarcity problem in areas along the Great Channel in Jiangsu, Anhui and Shandong Provinces. The middle south-to-north water transfer project can solve the problem along the upper reaches of the Huaihe River in

Henan Province. The diversion project from the Yangtze River to the Huaihe River can solve the problem for the Huibai area;

(b) Construction of water diversion and bailing projects for using local water resources. Henan Province plans to construct a water diversion project with a discharge capacity of up to 23 m^3/second. Anhui Province plans to construct the Wuhe-Huaihe diversion to irrigate 110,000 hm^2;

(c) Construction of urban and town water supply projects.

(iii) Irrigation and water-saving projects

In the Huaihe River basin, irrigation and water-saving projects mainly include large rebuilt irrigated areas, and the alteration of middle and lower production farm areas. During the tenth water resources planning exercise, in order to optimize of water allocation and integrated management, the Huaihe Water Resources Commission should pay close attention to strengthening the management of irrigated area construction.

(iv) Water and soil conservation projects

According to the outlines of national water and soil conservation planning and the ecology construction planning, the Huaihe River basin will focus on: (a) establishing a monitoring network as well as use small watersheds as units to ensure comprehensive harnessing; (b) strengthen water resources protection; (c) introducing water resource protection planning and water resource function zone planning; (d) establishing a water resource protection information system; and (e) establishing a water source protection zone in the city.

(3) Third level

(i) Improvement of water resources institutional management

The improvement of water resources institutional management will involve:

(a) The establishment of a high-level River Basin Coordinating Committee or Council (RBCC) for the Huaihe River basin, chaired by a vice-premier from the Ministry of Water Resources as vice-chairman. The members would comprise the mayors and governors of the constituent municipalities, provinces and autonomous regions, the vice-minister for water resources and the vice-ministers of SEPA and the other key "water" ministries – agriculture, construction, finance and communications – as well as the National Development and Reformation Committee, the State Meteorology Authority, the Commissioner or Director of the respective RBCC, and representatives of key civil societies such as water supply companies and water user associations;

(b) Mandating the Huaihe River Water Resources Commission with responsibility for (i) the determination of water resources allocations (surface and groundwater) for the provinces (real-time and dependent on the water held in reservoirs and seasonal conditions), (ii) the development of broad policies and programmes promoting sustainable water resources management, particularly with regard to flood control and drought relief, (iii) groundwater management, water resources protection and pollution control, and (iv) the promotion of increased water use (especially irrigation) efficiency; and (v) comprehensive basin development planning;

(c) Providing the River Basin Council with the necessary legislative support and authority to ensure the essential coordination and enforcement of their allocation, policy and programme decisions in the municipalities, provinces and autonomous regions;

(d) Confirmation by law of the River Basin Council as the primary water resources management agency in the Huaihe River basin (with specific flood control responsibilities), to ensure the enforcement of council decisions on the allocations, policies and programmes in consultation with the municipal, provincial and autonomous region governments. This will be strengthened with the appropriate expertise, where necessary, for providing administrative and technical secretariat support for the River Basin Council; and

(e) Adoption by the River Basin Council of strategic planning and management methodology to determine the policy, programmes and project priorities required to accelerate the basin towards achievement of sustainable development.

(ii) Mechanisms for reporting, monitoring and evaluation

The coordination framework comprises ministries and agencies responsible for the management, exploitation, development and use of water and water resources. These ministries and agencies include:

(a) The Ministry of Water Resources. Responsible for the integrated management and supervision of national water resources, the exploitation, development, use and protection of water resources in China, and monitoring, control, promotion and reporting on the implementation of activities related to water and water resources.

(b) The Ministry of Agriculture. Responsible for the exploitation, development and use of water resources in agriculture.

(c) The State Forestry Authority. Responsible for the exploitation, development and use of water resources in forestry.

(d) The Ministry of Communications. Responsible for the management, exploitation, development and use of water resources in the field of communications. In addition, the ministry is responsible for the collection of hydrological data and hydrographical surveys for navigation.

(e) Ministry of Construction. Responsible for the management, exploitation, development and use of water resources in the municipal field – town water supply, urban drainage and wastewater treatment.

(f) The Ministry of Public Health. Responsible for the management, exploitation, development and use of water for rural domestic consumption and health care.

(g) The State Environment Protection Administration. Responsible for ecologic environmental protection and wastewater discharge management.

(h) The Ministry of Land and Resources. Responsible for hydrogeological surveys.

(i) The Huaihe Water Resources Commission (HWRC), which is empowered to exercise authority on water administration in the above-mentioned areas, will (i) manage the water resources and river course in the local basin, (ii) be responsible for controlling and developing important water conservancy projects comprehensively, (iii) ensure efficient and effective planning, management, coordination, supervision and servicing, and (iv) improve river control as well as all-around water resources development, utilization and protection.

The above-listed ministries and agencies will coordinate their efforts with the local authorities in order to determination details of responsibilities and the scope of activities within their sectors.

(iii) Licensing of water use, and water resources development activities

The State Council's Decree No. 119 on licensing water catchments authorizes the Ministry of Water Resources to implement this licensing system. Water catchment licences are issued by determined the scale of the water administrative institutions concerned.

The water administrative departments should approve important medium-scale water uses. The Ministry of Water Resources or the River Basin Commissions should be responsible for approving the water catchments of individuals and organizations wishing to use water from the Yangtze, Yellow, Huaihe, Haihe, Luan, Pearl, Songhua, Liaohe, Jinsha and Han Rivers, international rivers, State border rivers, inter-province rivers indicated reaches, provincial border rivers and lakes, inter-provincial regions and water quantities beyond the set quota. The water administrative departments of local authorities should be responsible for approving other water catchments.

Permission for large-scale water resources development activities should be sought from the Ministry of Water Resources, SEPA and NDRC, and final approval given by the State Council. Applications for large-scale water resources development activities should be accompanied by a feasibility study and environmental impact assessment. Smaller-scale water resources development activities should apply to the water administrative departments and local government authorities.

The Ministry of Water Resources and SEPA need to prepare guidelines on the preparation of feasibility studies and environmental impact studies, respectively, in accordance with the Environmental Impact Evaluation Law. The ministry also needs to monitor and control the development of water resources.

All water resource development projects, particularly the construction of dams, irrigation schemes, and the diversion of rivers and streams, should go through a public consultation process with the local population. When a water resource development project is expected to have an impact on the natural or social environment, SEPA, the Ministry of Water Resources and local authorities need to:

(a) Issue a project notification to inform the public through newspapers, public notices and other means and, depending on the type of project, determine the duration for such a notification; and

(b) Organize public hearings in the relevant location. The developer or representative should attend the public hearings and provide a detailed explanation and information on the proposed mitigation measures. All costs associated with the public hearing will be the responsibility of the developer.

(iv) Monitoring and evaluation

The Ministry of Water Resources, HRWRC and local authorities are responsible for the monitoring and evaluation of the implementation of measures provided in relative regulations and decrees and will report to State Council on a regular basis.

Three types of monitoring and evaluation are required:

(a) The number of water conflicts, such as those concerning the allocation of water and pollution transfer, will provide the statistics and constitute the most important indicators for evaluating the action plan;

(b) Water quality, expressed by water class, will be an important indicator for monitoring the progress of water pollution control; and

(c) Water supply safety and water productivity will be evaluated to test the efficiency of water projects and the ability of water systems to support economic growth.

III. Summary of water resources management goals linked to the socio-economic development targets of China

1. Overall socio-economic development context of priority areas and priority socio-economic goals

China's GDP has risen substantially since reform and opening of the market. It was earlier projected by the National Development and Reform Commission that GDP would increase at the rate of 7 per cent annually during 2001-2005, and that the average GDP per capita would be RMB 9,400 in 2005. The population is projected to reach 1.33 billion in 2005. Social and economic development will place much greater pressure on the water sector.

2. Opportunities and threats facing water resources development from the perspective of the Ministry of Water Resources

Since the great flood in 1998, the Government has been paying much closer attention to integrated water resources management, which is mainly reflecting in the following areas. The status of the water sector as an infrastructure and base domain has strengthened in China. Investments in the water sector by both he central and local governments have increased. In addition, a new facet – the water sector for society and society support for the water sector – has been formed in principle.

Social and economic development provides good conditions for construction in the water sector. With socio-economic development and the increase in individual financial capacity, the demand being placed on the water sector is also increasing. After the entry of China into the World Trade Organization, the country will experience an inflow of advance technology, overseas capital and new concepts of water management, giving many advantages and opportunities to the water sector. In addition, water savings among the public have strengthened.

Although great progress has been made, serious challenges still face the development of the water sector, particularly in the areas detailed below.

The gap between water supply and demand in China has become steadily wider. Currently, the annual agricultural water shortage in the whole country is about 30 billion m^3, and the annual average total area of farmland affected by drought is 20 million hm^2, resulting in a grain yield reduction of between 10 billion kg and 25 billion kg, or even as high as 50 billion kg in years of serious drought.

The annual shortage of urban and industrial water is about 6 billion m^3, resulting in an industrial output reduction of RMB 230 billion. Of the 660 cities in the country, more than 400 suffering water shortages, affecting 160 million people. In addition, more than 24 million rural inhabitants are without access to an adequate drinking water supply. In particular, in the plain areas in the lower reaches of the Yellow, Huaihe and Haihe Rivers, the average per capita water use is only 332 m^3 while the annual water shortage is up to 18 billion m^3, ranking them among those with the most serious water shortages in the whole country.

Serious threats of flooding still exist in China. The country's flood control system is still inadequate, with low standards and low capacity for flood control. Most of the current embankments along the major rivers only meet a flood prevention standard of a 10-year to 20-year flood. Of the cities at and above the prefecture level, only 17 per cent reach the originally defined flood prevention

standard. The development of flood storage and detention zones has lagged, resulting in problems in their application. Since the 1990s, in particular, extraordinary floods have continuously occurred along the major rivers, causing a total economic loss of RMB 1,000 billion. The floods that occurred along the Yangtze and Songhua Rivers in 1998 alone caused direct economic losses of more than RMB 250 billion. Thus, flood control remains an arduous task for China.

Water-use efficiency in all water-use sectors remains low. In the past 20 years or more, China has made great efforts to promote water-use efficiency and has achieved significant progress; however, a big gap remains compared with the advanced levels in other parts of the world. For example, in 2000, the national integrated irrigation water efficiency was 0.43, but the advanced irrigation water efficiency of foreign countries was above 0.7. In the same year, the rate of industrial water reuse in China was 0.55, while in the advanced countries it was between 0.75 and 0.85. As agriculture accounts for 70 per cent of the total water use in China and tertiary industries comprise only a small proportion of all industries, the GDP per unit volume of water use in China is even farther behind the advanced world level.

Water pollution is heavy and has basically not been controlled. The natural quality of river flows in China is generally good, but the rivers have been polluted to a varying extent due to human activities and increasing discharges of domestic, industrial and agricultural wastes. According to recent statistics, the total discharge of sewage and wastewater was 62 billion tons in 2000, of which only 24 per cent was treated collectively up to the national standard. The remainder was either not treated or treated but not up to the national standard before being discharged or used for farmland irrigation. In the 100,000 km of river reaches that were evaluated throughout the country, water in the category of grade IV or worse accounted for 47 per cent; while more than 75 per cent of the lakes were polluted. An investigation of drinking water in 118 cities indicated that groundwater had been polluted to a varying degree in 97 per cent of the cities, of which 64 per cent was serious pollution. Water pollution has caused ecological deterioration, declines in water quality in rivers, lakes and reservoirs, and has reduced the value of useable water. This has made water shortages even more serious.

Soil erosion and ecological deterioration are serious in some parts of the country. China is among those countries with the most serious soil erosion. In addition to natural factors, human activities have also increased soil erosion. Since the founding of the People's Republic of China, the Chinese Government has invested a great deal of resources in soil erosion control, but the trend of worsening soil erosion and ecology has not been checked. According to the second national survey on soil erosion, based on remote sensing, the current area of soil erosion in the whole country is 3.56 million km^2, accounting for 37 per cent of the national land area. In some areas, particularly the western regions, ecological deterioration has been virtually unaltered. At the same time, the phenomenon of damaging activities coexisting with remedial efforts still remains.

China has a large number of wetlands. However, the pressure of population growth and economic development has continued to damage the wetlands to varying extents. In the past few decades, the total areas of lakes in the country have decreased by 1.3 million hm^2 and, on average, 20 lakes have disappeared each year. The degree of river flow exploitation is more than 50 per cent for most of the major rivers, thus resulting in silting up of river channels or mouths, drying up of middle or lower reaches and of lakes in lower reaches, the reduction or disappearance of natural vegetation, desertification and serious damage to aquatic life. Groundwater overdraft has created 72 depression cones around the country, covering 61,000 km^2, hence resulting in ground subsidence, cracking and other geological hazards or environmental problems.

3. Vision statement of the Ministry of Water Resources

In order to carry out the new development perspective of the Central Committee of the Communist Party of China, the Ministry of Water Resources has changed its thinking on implementing sustainable approaches to water resources management. The essence of the new viewpoint is harmony between humans and nature, requiring changes in traditional ideas and behaviour.

The first change is to shift from the concept that water cannot be exhausted to the concept that freshwater is a limited and vulnerable resource; from the view that water is a free natural resource to that of water being an important strategic economic resource.

The second change is a shift from unbounded development and use of water resources, without consideration being given to ecological needs, to paying careful attention to ecological use and rationally arranged domestic, productive and ecological water use.

The third change is from simply emphasizing flood control and prevention to a coordinated relationship between humans and nature in order to preserve the necessary space for flood flows and storage, and to make use of floodwater as much as possible with the prerequisite of ensuring safety against flooding.

The fourth change is a shift from biased emphasis on development, utilization and harnessing of water to coordinated development, utilization, harnessing, allocation, conservation and protection, with the focus gradually being moved to rational allocation, high-efficiency utilization and effective protection.

The fifth change is a shift from the separation between water resources and the economy and society, to basing population growth, economic structure and layout of productivity, development scale and speed on the carrying capacity of water resources, while seeking the coordinated development of population, resources, economy, society and environment.

The sixth change is a shift from only depending on engineering measures to integrating engineering and legal, administrative, economic and technical measures, and from engineering planning to strategic integrated water resources planning.

The seventh change is a shift from only using surface water or groundwater resources to jointly using surface water, groundwater, rainwater, floodwater, low-quality water, reclaimed wastewater, seawater, desalinized seawater etc.

The eighth change is a shift from water supply management that only pays attention to satisfying demand to management that applies multiple measures to rationally check demand.

Establishing a water-saving society is a new task of the Ministry of Water Resources. The ministry will widely publicise water saving in society, encourage the agricultural and industrial sectors to adopt new methods of saving water, and promote the use of new equipment for domestic water saving.

Combined with environmental considerations, the Ministry of Water Resources will strengthen water resource protection in its efforts to control water pollution.

The ministry will also promote efficient water resources use further through water allocation. It is currently compiling comprehensive water resources planning, which will fully consider water usage in the various watersheds and by water use departments and the domestic sector as well as in production and the ecology.

In order to promote water-use efficiency; the Ministry of Water Resources will take into full consider the use of market mechanisms in the future. At present, water rights and water markets are not in good form; therefore, the ministry will develop them and introduce them into water resources allocation.

4. Mission statement of the Ministry of Water Resources

The Ministry of Water Resources is the department of the State Council that is responsible for water administration. In accordance with the stipulations of the State Council, the Ministry of Water Resources has been given the following mandates.

(a) Formulation of water-related policies, development strategies and medium-term and long-term development plans, including water conservation and demand management policies;

(b) Drafting and implementation of enabling legislation and the design of water-related regulatory frameworks. This includes the implementation of the water-drawing permit system and the water resource fee system, and the mediation and arbitration of intersectoral and interprovincial water disputes;

(c) Implementation of integrated water resources management, including atmospheric water, surface water and groundwater. This includes:

  (i) The formulation of national and interprovincial development plans for water supply and demand, and schemes for water allocation

  (ii) Supervision of the execution of the above plans and schemes

  (iii) The assessment of water resources, flood risk and flood mitigation measures in relation to the overall planning of the national economy, urban planning and major construction projects

  (iv) The publication to national research and development in hydrology

  (v) Guidance of national research and development in hydrology

(d) The formulation of water resource protection plans in accordance with related national laws, regulations and standards concerning resource and environment protection; the demarcation of functional water areas and the control of wastewater discharges into potable water areas and other water areas; monitoring the quantity and quality of water in rivers, lakes and reservoirs; and review and approve the pollution loading capacities of water bodies with proposed limits on total wastewater discharge;

(e) The formulation of economic regulatory measures for the water sector; the enforcement of macroeconomic regulations on the utilization of funds within the water industry; the provision of guidance on economic activities related to water supply, hydropower and diversified development within the water sector; and the provision of recommendations on economic regulation of water pricing, taxation, credit and financial affairs;

(f) Drafting and reviewing of proposals and feasibility study reports on large and medium-sized capital construction projects in the water sector;

(g) Drafting and supervision of the execution of technical standards for the water sector as well as specifications and codes for water works; the implementation of key hydro-science research projects, and the popularization and dissemination of water-related technologies;

(h) The organization and direction of management protection for hydraulic facilities, water areas, dykes and coast lines, and the regulation, reclamation and development of major rivers and lakes as well as beaches; handling foreign affairs in relation to international rivers between China and its neighbouring countries; the organization of

construction and management of key controlling and interprovincial hydro-projects; and the organization and direction of monitoring and management of the safety of reservoirs and dams of hydropower stations;

(i) Provision of guidance on activities related to rural water resources; the organization and coordination of capital construction of farmland drainage and irrigation, rural electrification, and water supply for townships and villages;

(j) The organization of water and soil conservation nationwide, including the formulation and development of engineering measures for water and soil conservation; and organization of monitoring and overall prevention and control of soil and water losses;

(k) Responsibility for activities concerning science, technology and foreign affairs that are related to water resources, including the provision of guidance in the development of a competent workforce for the water sector;

(l) Responsibility for the day-to-day work of the State Flood Control and Drought Relief Headquarters. This includes the organization, coordination, supervision and direction of nationwide flood control as well as the execution of flood control and drought prevention operations in major river basins and key water projects; and

(m) Other duties and responsibilities assigned by the State Council.

IV. Consultation mechanisms and initial findings

1. Consultation mechanisms in place and future developments

a. Framework for participation

Based on the Constitution, the public participation issues have been provided for in a number of laws, decrees, notices, guidelines etc., with regard to sector-based specific requirements. Some of the specific public participation issues related to each sector are detailed below:

(a) The Environmental Law states that all persons and organizations residing in China have an obligation to protect the environment and face penalties for behaviour that is harmful to the environment. The improvement of scientific education concerning environmental protection, the development of science and technology for environmental protection, and the popularization of environmental protection knowledge are encouraged. In the institutional arrangement framework, the environment management and monitoring processes include all organizations, from the grassroots to top central levels, including village administrations, environmental management and monitoring units at the district, municipal, provincial and ministerial levels, and State environmental protection administration as a whole.

(b) The Environment Impact Evaluation Law requires that the State involves the relevant institutions, experts and the public in environmental impact assessment. Whenever planning has the potential to create a negative impact on the environment, the department in charge of special planning must organize a workshop or other meeting to enable the relevant institutions, experts and the public to voice an opinion on the draft report, which should specify why such opinions should be adopted or rejected before it is submitted for approval. The municipal and provincial level authorities of the involved district must recommend to the appointed environmental administrative department or other department that relevant representatives and experts be allowed to establish a panel to examine the environmental impact assessment report. The panel must put forward a conclusion in written form.

In cases where planning may have a major impact on the environment, the responsible department should follow up the environmental impact assessment and submit the results to the approving department. If a serious negative impact appears likely, the corresponding remedial measures should be put forward immediately. The operator responsible for carrying out such projects must then organize a workshop or other meeting to enable the relevant institutions, experts and the public to express their opinions prior to the submission of the environmental impact evaluation report for approval, except in the case of classified projects. The report should specify why such opinions should be adopted or rejected as well as the obligations of different partners, such as the project developers, and other stakeholders before it is submitted for approval.

(c) The Water Law states that water resources are national property. The developers of water resources must contribute funding for such projects and, where human resettlement is necessary, they must provide adequate arrangements and funding for such resettlement. In addition, within the framework of the Ministry of Water Resources and River Basin Commissions, some relevant key documents have been drafted, including: (i) a draft decree to implement the Water Law; (ii) a draft policy on the water resources development objectives, which are to ensure that the management, exploitation, use and development of water and water resources are sustainable, equitable and in support of the goals of socio-economic development and environmental protection in China; and (iii) to organize a public awareness programme to increase the understanding of the importance of water resources, the vulnerability of these resources and clear ideas concerning the development, management, use and preservation of water resources. At the same time, the public is to be allowed to participate in the implementation in an effective manner. In the drafting process of those documents, a number of broad discussion meetings with different line agencies are to be organized at all levels throughout country, which gives the relevant agencies the opportunity to contribute their views and raise their concerns regarding the draft documents. The other objective is to gather comments, suggestions, data and information from those meetings, in order to ensure that the documents are consistent with the realistic situation prevailing in China.

b. Level of public participation

In China, public participation is handled at four levels:

(a) Information gathering. This involves the systematic analysis of existing social, cultural and economic conditions among the directly affected groups of stakeholders (such as farmers or indigenous minorities);

(b) Information dissemination. This involves the provision of information about a project to all interested parties (stakeholders). Stakeholders cannot genuinely be consulted or participate if they are not fully informed about the objectives of a project;

(c) Consultation. Decision-makers listen to the views of other stakeholders in order to improve project design prior to implementation or make necessary changes during implementation. The consultation process should involve the government authorities concerned, affected parties, donor agencies, mass awareness organizations and local and/or international organizations; and

(d) Participation. This aspect is an extension of consultation where directly affected groups become joint partners in the design and implementation of projects. They participate in “making” the decisions.

The lessons and experiences acquired by the water sector related to the creation of awareness and the implementation of the public participation policy are different. However, these activities are, generally speaking, new and without a given priority since each sector is obliged to concentrate on project implementation with the aim of meeting the urgent demands of society.

2. Initial findings of recent efforts

Strategic planning places emphasis on the construction and improvement of scientific, efficient and systematic concepts and mechanisms. The initial findings resulting from recent efforts are detailed below.

a. Necessity to rank the human-centred and nature-harmonized concept as a foundation

Due to guidelines provided by the Government, the whole of society has been made aware of the importance of human-centred involvement when making decisions. This is in line with the principle of benefiting the public instead of only considering economic or political interests as the leading target. The convenience and improvements have been obvious. What is more, the harmony between mankind and nature is also a critical indicator in the evaluation of water development project implementation. No stakeholders, even famous state-owned enterprises, can ignore their obligation to protect the environment. Local governments at different levels not only take the prevention of environmental pollution into consideration, but also regard it as a key motivation in promoting socio-economic development activities. At present, strategic planning highlights the reform of traditional measures in order to make environmental protection a profitable business, i.e., the more that the stakeholders invest, the more they can gain not only in terms of social benefits but also economic returns.

b. Importance of reinforcing the systematic mechanism

The systematic mechanism, strengthened by the strategic planning, mainly comprises the democratic consultation system, an efficient supervision system and an open evaluation system to allow different functions to be performed in making, implementing and assessing relevant decisions. Before making a decision, consultation workshops are organized at the community, district, provincial and central levels. Well-known researchers, institutions and universities, both at home and abroad, are encouraged to contribute a variety of methods and ideas. When implementing the projects, the supervision department is responsible for measuring the work output and results, discerning the drawbacks and advantages, and coordinating cooperation among the involved sectors. When implementing projects, evaluations are carried out in an open atmosphere to ensure acceptance of assessments, both from professional experts and relevant stakeholders.

c. The integration of water resources management

HRWRC experience of overall strategic planning and management suggests that the integration of water resources management into socio-economic development plans should be carried out at two levels: (a) the overall level, which refers to the links with national economic and social development; and (b) the sector level, which refers to integrated water resources management. At the overall level, five elements are involved: (a) water planning coordination; (b) policy and registration development: (c) data and information management; (d) training; and (e) public awareness of integrated water resources management.

d. Additional strategic planning and management training

Strategic planning and management is crucial to integrated water resource management, and a great deal of successful experience has been accumulated in this filed. The representatives from the Haihe and Huaihe River basins regard strategic planning and management as a powerful tool in water resource management. However, since they have no experience and incomplete understanding of strategic planning and management, ESCAP has been requested to provide strategic planning and management training.

E. STRATEGIC PLAN – INTEGRATED WATER RESOURCES DEVELOPMENT FOR THE NADI RIVER BASIN, FIJI

By
Department of Land and Water Resources Management[1]
Fiji

Introduction

Fiji is an island nation comprising more than 300 islands, of which 109 remain uninhabited. The two main islands (Vanua Levu and Viti Levu) support the majority of the total population of 775,000 with a sizeable percentage being in the urban centres of Suva (168,000), Lautoka (43,300), Labasa (24,100) and Nadi (30,884). The islands are predominantly volcanic and rise to an elevation of around 1,000 m with rivers and streams supporting the tropical rainforest on the windward side and extensively cultivated sugarcane farms on the leeward side.

All major economic activities including tourism are based on these islands. In contrast, the outer islands vary considerably in both geology and topography, ranging from smaller coralline islands to larger volcanic edifices that support smaller but significant populations. The country's total land area of 18,272 km^2 is dispersed in territorial waters of about 141,800 km^2. The proportion of land to water is only 13 per cent, and even less when compared with the even larger Exclusive Economic Zone. Fiji enjoys two seasons (hot/wet and cool/dry) with rainfall averaging between 1,500 mm to 4,000 mm annually. The topographical effects mean that much of the rainfall falls within the windward side of the nation. Up to 80 per cent of the rainfall is recorded in the wet season and the remainder in the dry season.

Drought conditions are exacerbated during El-Nino episodes, leading to adverse impacts on all sectors of the economy. The development of water resources by the government are thwarted by a lack of clear and comprehensive legislation.

Fiji is blessed with an abundance of freshwater resources but the general population continues to experience inadequate water supplies for their daily chores or other needs such as agricultural and industrial uses.

Water resources development has not been given much attention despite experiences of extreme conditions, with half the year having above average rainfall and the second half suffering spells of drought. The Government's complacency towards providing a policy framework as a driving force in establishing a strategic approach to fresh water resources development and management has led to indiscriminate exploitation of these resources. The development and management of water resources is currently vested in a number government ministries and statuary authorities, each focusing on its own area of interest. Although some consultation between developers and the government agency responsible for legal approval, there is no authority or an apex body responsible for overall national development and management policies on water resources.

Of late, the Government's economic goals have been shifting increasingly towards encouragement of industrial activities, tourism and private sector promotion as a way of improving the standard of living. All these developments are dependent on the availability of quality water supplies.

[1] The views expressed herein do not necessarily reflect those of Government of Fiji or the United Nations.

The government's vision for sustainable development of this resource is:

> "To provide safe, adequate and affordable water and wastewater services for the total population of Fiji while equitably meeting the needs of other users (food production, energy generation and environmental maintenance) in a sustainable manner."

Water is a valuable natural resource that depends on the development of a strong political will that is related to highly sensitive land issues. However, there are many weaknesses in the development and management of the water sector that need to be addressed to ensure that socio-economic growth is not stalled. These include:

(a) The development of a Water Sector Policy

(b) Legislation enactment

(c) Institutional development

(d) Strong public sector coordination

(e) Development of human resources capabilities

The major challenge for Fiji is to maintain its freshwater resources from diminishing and to protect them from degradation.

I. Government policy

The Government has embodied in its overall Strategic Development Plan in its commitment to the United Nations Millennium Declaration that was adopted by the United Nations General Assembly in 2000. The Declaration established a number of goals:

(a) Eradication of extreme poverty and hunger. The poverty level in the country is on the increase. In 1996, it was around 25 per cent, but recent figures indicate that it has increased to around 50 per cent. As a response to this situation, the Government recently increased its assistance to poverty alleviation including upgrading squatter settlements and other income-generating activities;

(b) Promotion of gender equality and empowerment of women. Women form more than half the population of the country. The Government recognizes the need to empower women in all phases of development and participation, both in the public and private sectors;

(c) Improvement of maternal health. Although life expectancy has increased from 67 years to 69 years, non-communicable diseases have been on the increase. The Government is committed to dedicating funds to health promotions and disease prevention. Waterborne diseases such as diarrhoea, dysentery, hepatitis and typhoid are due to the lack of a quality water supply;

(d) Ensuring environmental sustainability. Although Fiji is blessed with an abundance of natural resources (agriculture, forestry, fisheries and mining), it is interposed by climate extremes in the form of hurricanes, cyclones, flooding and drought. These extremes have serious economic, social and environmental consequences that require prudent macroeconomic management, proper land-use planning and water and watershed management. The Government's challenges are to address the degradation of land resources, the increasing risk of flood and the inundation of coastal areas, and unsustainable exploitation of land and water resources that undermines the quality of life; and

(e) Developing a global partnership for development. The Government is a member of the global village and recognizes the need for partnership in the development of its resources. It will therefore follow the indicators for achieving the Millennium Development Goal developed by various United Nation agencies, the International Monetary Fund and the Organization for Economic Cooperation and Development.

The government is committed to achieving these goals and gives assurance that the policies in its strategic plan are consistent with the Millennium Development Goal. The proposed strategic plan for the Nadi River basin is aimed at contributing positively towards the Government's Strategic Development Plan and the Millennium Development Goals.

As part of the case study to look into the above aspects, the Nadi River basin has been selected as a model because:

(a) The Nadi River is vital to Fiji's economy as it continues to provide water for domestic uses as well as agricultural, hydropower and industrial production. Nadi town, which is located in the Nadi River basin, is the main commercial centre for the tourism industry. The importance of Nadi is both as the principal "gateway" to Fiji and as the base resort from where tourists travel to other parts of the country. The potential of Nadi Bay as a major resort centre and the development of Denarau Island as an integrated resort can form a model for the Tourism Development Area;

(b) Increasing population, rapid urbanization and industrial development continue to put high pressure on the water resources. Flood damage increase exponentially due to the rapid development taking place in the subject area;

(c) A strong strategic plan for the development and management of the Nadi River basin water resources and watershed management is required to ensure the sustainable and smooth operation of the present and planned structures;

(d) The hydrological functions within this watershed's forest and rangelands have been seriously disturbed by improper land-use practices. This has resulted in a number of onsite problems in the watershed areas such as the direct loss of productive agricultural land to gullies, landslides, surface erosion as well as the drying up of springs and wells. Downstream problems of flooding, drought and excessive siltation need to be addressed even more urgently; and

(e) As part of Nadi River basin plan, it has been proposed that the Nadi Watershed Management Project be established as a showcase project to strengthen the watershed management capability of the Land and Water Resource Management Department by implementing and constructing check dams in the tributaries of the Nadi River. It will also demonstrate the impacts of soil erosion and siltation within the catchment area, and this could be part of the department's education, training and research programmes for its personnel involved in the project.

II. Features of the Nadi River basin

1. Hydro-geographical characteristics

The subject area is covered with young volcanic rock as well as many types of older rocks scattered throughout the watershed area.

The monthly mean temperature fluctuates seasonally, the highest temperature occurring in February (27-30°C) and lowest in July (average 22°C). The relative humidity in this area ranges between 60 and 80 per cent. The seasonal variation of relative humidity is distinct as it is lower around September to November and higher in March and April.

2. Water resources

As discussed above, the Nadi River basin has good water resource potential to support its socio-economic growth in the domestic, energy, agriculture and tourism sectors. There is one major river and a number of perennial creeks that service the Nadi watershed.

3. Political, social and economic characteristics

The Government has the political will to ensure the sustainable development and management of the country's natural resources. It has the social obligation to ensure that the quality of life among its people is on a par with international standards.

The annual economic growth rate ranges from 5 per cent up to 8 per cent with political stability, and it is envisaged that this trend will continue for some time. However, the Reserve Bank of Fiji at a recent financial summit in Nadi warned that Fiji's economic survival rested on agricultural development and revenue earned from agricultural export commodities and other natural resources. The expiry of leases for tenant farmers and the future of the sugar industry has been a recent cause of concern for the Government. The development of the Nadi watershed could therefore provide the required platform for the Government to achieve its objectives of economic growth, food security and poverty alleviation.

4. Water and land development

In the Nadi watershed, the difference between the current surface water potential and the water demand are close (surface water potential is 0.7 m^3/sec and water demand is 0.23 m^3/sec). However, with the rapid growth that is envisaged in this area, water demand by 2015 will be much higher than the potential.

The coastal plains of the Nadi watershed are currently under sugar cane cultivation. However, these areas are already being considered for tourism development. A number of five star hotels are either being built or are on the drawing board awaiting approval from the authorization agencies. Water demand will continue to show an increasing trend. The total area of this watershed is 516 hectares and, with a population of more than 70,000 people, demand for land has already started to escalate. With development and job opportunities in this area, the migration of skilled people is expected to increase. The population explosion is expected to put pressure on land demand; thus, exploitation of land and water resources will be inevitable.

5. Environmental issues related to water resources

The Nadi watershed is highly vulnerable to natural and man-made disasters. Cyclones, flooding and severe drought have adversely affected the key sectors of the economy, particularly sugar cane production. During the past decade, cyclones and flooding have caused loss of life and damage amounting to millions of US dollars. The drought of 1997/1998 had a severe impact on the economy.

The main environmental problems within the subject area are land degradation, water pollution, climate change and sea level rise. The expansion of agricultural land is the principle cause of land degradation. To address these problems, the Government is finalizing an Environmental Management Bill that should provide the overall framework for identifying and addressing environmentally related issues. The Bill will provide policing of activities that bring about depletion of the natural environment.

6. Water-related conflicts

The river system in the Nadi River basin runs across many different clans (*matagali* or landowners). Currently, there is sufficient water for all, and supplies from this watershed are transported outside the area for domestic and industrial purposes. Hydropower is also expected to be generated from within this watershed. However, with continuing population growth as well as developments that are being proposed, water demand will increase and water conflicts will arise.

7. Goals linked to social and economic development in the context of national development

A small, open economy and dependency on a few major exports makes Fiji's economy highly vulnerable to natural disasters as well as large swings in export prices. This has caused growth to be highly volatile. Fiji's economic growth has fluctuated erratically, with gross domestic product GDP varying from -5 per cent in 1985 to 3.8 per cent in 2001. Its real GDP per capita over the review period ranged from F$ 1,870.55 to F$ 2,590.64, the lowest rate being in 1987 and the highest in 1999. Table E.1 shows the major economic indicators in Fiji from 2001 to 2005.

Table E.1. Major economic indicators, Fiji Islands, 2001-2005

Category	2001	2002	2003	2004	2005
GDP growth (%)	3.0	4.1	5.0	3.9	3.0
Gross domestic investment/GDP (%)	14.8	13.8	14.2	13.5	–

Sources: Ministry of Finance and National Planning, *Economic and Fiscal Update: Supplement to the 2004 Budget Address,* 7 November 2003; Reserve Bank of Fiji, *Quarterly Review,* various issues; staff estimates; and Asian Development Bank.

Agriculture remained the economic base for Fiji with heavy reliance on a single crop (sugar cane). A significant change in the structure of the economy during the 1990s coincided with a shift in economic policy from import substitution to export promotion.

The main challenge for the agriculture sector will come when the preferential price agreement for sugar ends in 2007. Sugar cane farming will no longer be viable unless the industry is reformed. The agricultural sector will need to diversify and look for other high-value crops for niche markets. However, such commodities will need a consistent water supply to ensure the production of good quality crops on a regular basis. The Nadi watershed, with its allowable water potential, can make an impact on export-oriented crops with outside markets at its doorstep.

The tourism sector is booming with a number of five-star hotels either under construction or at the planning stage. This sector is supposed to be a potential major income earner for the country. With most of the hotels (including those still planned) located within the subject area, water demand will continue to increase.

As table E.2 indicates, the agriculture sector has shrunk considerably during the past decade, except in 1999. Since then, the sector has grown at a very modest rate of less than 2 per cent annually. According to table E.3, agriculture accounted for some 16 per cent of Fiji's GDP while industry and services accounted for 27 and 57 per cent, respectively. This implies that the Nadi River basin has good potential to contribute more to the socio-economic growth of the country.

Table E.2. Composition of GDP components and growth rates

Category	1985	1990	1995	1998	1999	2000	2001	2002
GDP by industrial origin	703.7	1 611.5	1 838.9	1 907.3	2 089.5	2 023.4	2 109.5	2 201.1
Agriculture	156.2	328.9	362.8	298.9	346.7	343.7	349.7	353.5
Mining	0.8	55.3	46.7	50.2	59.5	51.1	52.0	55.6
Manufacturing	79.3	218.3	267.7	287.9	315.5	295.9	330.2	343.1
Growth of output annual change (%)								
GDP	-5.1	3.6	2.5	1.5	9.6	-3.2	4.3	4.3
Agriculture	-13.7	-4.6	-3.2	-7.0	16.0	-0.9	1.7	1.1
Industry	-9.2	3.0	1.7	3.1	9.8	-7.4	7.4	5.1
Services	-0.0	7.2	5.0	3.3	7.7	-1.8	3.6	4.9

Source: *Key Indicators of Developing Asian and Pacific Countries,* Asian Development Bank.

Table E.3. Fiji macroeconomic data profile

Category	1998	2001	2002
Population, total	791 000	817 000	823 000
Population growth (annual %)	1.0	0.6	0.7
GNI, Atlas method (current US$)	1.8 billion	1.7 billion	1.7 billion
GNI per capita, Atlas method (current US$)	2 300.0	2 100.0	2 130.0
GDP (current US$)	1.7 billion	1.7 billion	1.9 billion
GDP growth (annual per cent)	1.5	4.7	4.1
GDP implicit price deflator (annual % growth)	5.7	4.6	2.8
Value added in agriculture (% of GDP)	15.7	16.6	16.2
Value added in industry (% of GDP)	27.0	26.7	27.0
Value added in services (% of GDP)	57.4	56.7	56.8
Exports of goods and services (% of GDP)	56.0	71.3	..
Imports of goods and services (% of GDP)	58.5	64.8	..
Gross capital formation (% of GDP)	13.4	13.5	..

Source: *World Development Indicators database,* April 2004, World Bank.

8. Legal and institutional issues of water resource management

The responsibility for water resource development and management is vested in different government agencies. However, very little coordination exists between those agencies at any stage of either the development or the management of water resources.

Each agency has its legislation in terms of management and empowerment to utilize water for its own purpose. Efforts made earlier to put in place legislation to develop and manage water resources under a unified law proved futile due to strong objections from some sectors with regard to the ownership of water. A draft legislation entitled “Water and related land resources management” was proposed in 1976 as an umbrella Act to allow better coordination of policy and implementation. This was shelved because of a legal dispute between the Native Land Trust Board (custodian of native lands) and the State regarding recognition of riverbeds and banks in relation to their ownership.

Another attempt was made in 1987 by Professor Stanford D. Clark to review the draft Watershed Management Bill together with the draft Water and Land Related Resources Management legislation. This experienced a setback in terms of government priorities after the coups of 1987.

The Government also attempted to draw up a National Water Policy in 2002. Some work has already been done on this and it is currently with the office of the Chief Executive Officer of the Ministry of Lands and Mines.

The Environmental Management Bill (formally the Sustainable Development Bill) has been somewhat watered down to enable developers and managers to continue their exploitation of resources. This is currently being examined by the Parliamentary Working Group.

9. Strength and weaknesses of the current legal and institutional framework

The current organizational setup within the Government is targeted towards national policies.

III. Strategic plan goals

1. Vision for the overall integrated water resources management goal of the Nadi River basin

The Fiji Vision Statement: "Nadi, a flourishing oasis and tourism capital of the Pacific by 2025" as the result of an integrated approach to management and development of the Nadi River basin.

By 2025, the key infrastructure for effective management of the Nadi River basin water and related resources will be in place to support the initiatives to make it an environmentally sound river basin and the most important socio-economic centre of Fiji and the Pacific.

2. Integrated water resources management goal 1

This goal is to manage, develop and protect water and related resources to meet the needs of current and future generations.

a. Strategies to achieve the goal

The following areas need to be addressed:

(a) Policy and strategies for improving water management in the Nadi River basin;

(b) Programme of action for priority issues; and

(c) Policy and strategies to mobilize resources for an effective implementation of an IWRM programme in the Nadi River basin.

(1) Stage 1: Preparations for medium-term development

Stage 1 involves:

(a) Measures in 2004 to address the urgent need for flood control in priority areas of the basin, in order to enable tourism and other service sectors to attract private and foreign investment to the area. Carrying out a comprehensive flood mitigation programme to identify additional measures for the medium term (2005-2010);

(b) Measures in 2004 to ensure adequate water supplies to meet the urgent needs of expansion of tourism and other service sectors. Carrying out a comprehensive programme for the provision of water supplies for development and urbanization in the medium term (2005-2010);

(c) Establishing a detailed programme on natural disaster reduction and undertaking priority measures to improve preparedness and reduction, especially with respect to flooding and storm surges;

(d) Preparation of a detailed programme to promote eco-tourism and a report on corresponding impacts on water resources management in the basin;

(e) A priority programme to improve environmental conditions in the basin;

(f) A study on financial resources mobilization for the development of the basin with special attention to involving the private sector and international funding agencies;

(g) A study programme aimed at strengthening institutional capacity for water resources management at the Nadi River basin level and its linkage to national water resources policies; and

(h) A study on modernization of the irrigation system in the basin.

(2) Stage 2: Preparations for long-term development

Stage 2 involves:

(a) Establishing a Nadi River basin organization to facilitate coordination among stakeholders in order to enhance opportunities and efforts; and

(b) Undertaking measures in 2004 to address the urgent need for flood control in priority areas of the basin to enable tourism and other service sectors to attract private and foreign investment to the area. Carrying out a comprehensive flood mitigation programme to identify additional measures to be carried out in the medium term (2005-2010).

b. External factors affecting goal achievement

The most important factors affecting the progress of work in this area include:

(a) Willingness of all key stakeholders to participate and commitment by policy-makers to effect changes in economic structure and institutional set-up to meet emerging socio-economic demands;

(b) The lack of sufficient expertise in advanced technology and facilities for handling complex technical processes towards optimization of key stakeholders; and

(c) Continuity and consistency of leadership commitment, and availability of resources.

c. Cross-cutting relationships

In order to ensure smooth cross-cutting relationships with all key stakeholders, regular consultations and the establishment of common targets will be necessary for evaluation purposes.

d. Performance evaluation and monitoring

It will be necessary to prioritize activities so that their results can be directly linked to service improvement according to customers' requirement and market conditions.

e. Performance measures

The performance measures include:

(a) Policy and strategies to improve water supply and flood management in order to create an enabling environment for socio-economic development of the basin (June 2005);

(b) A report on a strategy to provide, manage and protection sources of water to meet the socio-economic goal of the Nadi River basin up to 2010 (December 2005);

(c) A programme of action for integrated water resources management in the Nadi River basin (December 2005).

3. Integrated water resources management goal 2

This goal is the operation, maintenance and rehabilitation of facilities safely, reliably and efficiently in order to protect the public investment.

Strategies to achieve the goal

The strategies include:

(a) Identifying and empowering the authorities with the necessary legislation, personnel, funds and other required resources for them to effectively undertake the operation, maintenance and rehabilitation of public investment in the basin;

(b) Developing and implementing a manual and procedures for reliable and efficient management of investment; and

(c) Encouraging the operating agencies within the basin to use the appropriate tools to manage their facilities effectively.

4. Integrated water resources management goal 3

This goal is the enhancement of organizational effectiveness. In order to achieve this goal, it will be necessary for all key agencies to improve the service provided to clients, particularly top decision-makers in the water sectors and the Government, and to strengthen the coordination among these agencies. For this purpose, it will be necessary to establish a coordination and information sharing mechanism among the agencies involved in the water sector; an institution should be assigned the responsible to provide such coordination.

In that connection, such an institution should assume its leadership role in coordination of water resources management, development and protection, and support an innovative growing workforce to respond to diverse needs. To improve business, it will be essential to involve decision-makers and key stakeholders in the formulation and implementation of this strategic plan as well as subsequent monitoring and evaluation.

a. Strategies for achieving the goal

The strategies include:

(a) Establishing an interim coordination mechanism and gradually developing it into an operational institution for coordination of Nadi River basin development;

(b) The formulation of a river basin plan for the development, use and management of the water resources;

(c) Development of capacity within the lead organization by engaging consultants and training locals in specialized areas;

(d) Encouraging stakeholder participation, from project formulation to the implementation and operational stages;

(e) Generating regular awareness among the stakeholders of the benefits of the project;

(f) Building pride of ownership and partnership in the project;

(g) Ensuring that adequate resources (physical/financial) are available at all times; and

(h) The provision of government support and political will.

b. Priority activities

The priority activities include:

(a) Preparation of an Action Plan for two- and five-year periods. The Action Plan will be based on the urgent need for coordination of development activities in the Nadi River basin as well as priority water resource management issues at the national level. In the Action Plan, it will be necessary to emphasize the need to integrate a more balanced view of sectoral perspectives in the programmes of investment and operation of all water-related agencies. It will also be necessary to present the Action Plan to the Government for approval.

(b) Preparation and implementation of a capacity-building plan for key agencies, based on the requirements for achieving the Action Plan. The capacity-building plan will include building up a core expert group to support basin development. It is expected that external assistance will be provided for implementing all aspects of the capacity-building plan.

(c) Conduct a needs assessment for strengthening the legal and institutional framework for IWRM in the river basin. Prepare a coordinated training plan to address the priority training needs and assess the required training budget.

c. Performance measures

The performance measures include:

(a) A capacity-building plan (December 2004); and

(b) Total number of trained staff – 50 with advanced technology expertise (December 2006).

IV. Implementation, monitoring and evaluation

A monitoring and evaluation mechanism needs to be put in place to assist policy-makers, donor agencies and other stakeholders in periodically assessing the performance of the project.

1. Identification of indicators and benchmarks for performance measurements

a. Expected time frame and necessary resources

The expected time frame and necessary resources are:

(a) Finalize the pilot project within the Nadi River basin on the watershed management concept by the Department of Land and Water Resources Management in 2004 as a showcase project;

(b) Submission of a project proposal for 2005 Budget consideration by the central Government;

(c) Conduct a workshop to seek comments from the stakeholders and endorse the strategic plan in 2004;

(d) Establishment of a Working Committee in 2004 to ensure implementation of the strategic plan; and

(e) Seek government support for endorsement of this plan and funding for implementation.

b. Mechanisms for reporting, monitoring and evaluation

Various mechanisms are in place for reporting, monitoring and evaluation purposes. The individual ministries and agencies involved in the development and management of water and associated resources are:

(a) Ministry of Agriculture, Sugar and Land Resettlement – responsible for development and management of water resources for agricultural use. Legislation for this purpose includes the Irrigation Act, Drainage Act, and Land Improvement and Conservation Act. There are no long-term water requirement plans in place;

(b) Ministry of Works – responsible primarily for the development and management of water for domestic and industrial purposes. Related legislation is the Water Supplies Act and Water Master Plan;

(c) Ministry of Health – responsible for ensuring good quality water for public health purposes. Legislation used is the Public Health Act;

(d) Ministry of Local Government, Housing, Squatter Settlement and Environment – responsible for the development and management of local government (Nadi Town Council) and the surrounding environment. Legislation used includes the Local Government Act, Environment Management Bill, and the Town and Country Planning Act;

(e) Ministry of Lands and Mines – responsible for regulating river and streams, and underground water. Legislation used is the Rivers and Streams Act. Currently, there is no legislation to regulate the development and management of underground water;

(f) Native Land Trust Board – responsible for the management of more than 90 per cent of the land in Fiji. Legislation used is the Native Lands Trust Act; and

(g) Fiji Electricity Authority – responsible for the provision of electricity supply, both rural and urban, through hydro-turbines or fuelled generators. Generation of power through windmills is currently at the initial stage. Development of hydropower within the Nadi River basin is also proposed for generating 2.8 MW of electricity.

2. Consultation mechanisms and initial findings

All the stakeholders will be consulted at a workshop to outline the proposal contained in this strategic plan as well as the expected results and outcome.

a. Consultation mechanisms in place and future developments

As a way forward in ensuring that this becomes a living document, periodical meetings and workshops need to be scheduled to ensure that all stakeholders are kept up to date on the developments of each agency's work in the Nadi River basin. This will instill pride and a sense of ownership.

Moreover, the Government, other stakeholders and donor agencies will need to be attracted to ensure their support for this plan.

b. Initial findings from recent efforts

Initial interviews with the major players involved in formulating this strategic plan have shown positive reactions. They have also indicated that the Department of Land and Water Resources Management can be the lead agency; however, more detailed consultations are needed with all the stakeholders in order to sell the idea and built good support. The development of ownership for the vision of this plan will have a strong bearing on its success.

The development of Fiji's National Water Policy has made some progress possible for the present Government's efforts to regulate the development and management of water resources. There is a need for support and assistance to ensure that this policy is adopted and allow the responsible agency to proceed with the formulation of legislation to regulate the development, utilization and management of water resources.

The stakeholders understand that water resources in the Nadi River basin can become a scarce commodity in view of current developments within the Nadi watershed, its rapid growth and the fact that Nadi could become the tourism capital of the Pacific.

3. Priority action programme

The workshop established a Nadi River Basin Working Team including the following core members: the Department of Land and Water Resources Management, the Nadi Town Council, the Tourism Bureau, NLTB and Land Department. It was agreed that the Working Team would aim at achieving the following priority outputs:

(a) Improved coordination of the different roles and functional activities such as awareness and disaster planning;

(b) Accelerated infrastructure development to attract investment;

(c) The establishment of supporting networks;

(d) The implementation of micro-catchment watershed management projects;

(e) Improved understanding among stakeholders through periodic consultations;

(f) Strengthened institutional framework of cooperation through the delegation of authority to related organizations;

(g) Improved information sharing and excellent coordination among all relevant stakeholders, including the development of an integrated database for the Nadi River basin (including GIS); and

(h) The establishment and implementation of effective risk management plans.

The Working Team agreed to carry out the following activities as part of the priority programme of action:

- Hold the first workshop to consider and approve the Terms of Reference of the Working Team before end of 2004;
- Formulate a detailed strategic plan for the Working Team on the basis of the current draft strategic plan for integrated water resources management in the Nadi River basin;
- Seek endorsement by stakeholders and communities;
- Implement, monitor and evaluate; and
- Report the findings to all relevant agencies, including the Government, for further support and resource mobilization.

V. Conclusion

The strategic planning and management process for the integration of water resources management in the Nadi River basin can contribute immensely to the socio-economic growth of the province and the nation. Although various modalities and methodologies are involved in developing a strategic plan, it appears that the people-centred approach can be very effective.

F. STRATEGIC PLANNING FOR INTEGRATED WATER RESOURCES MANAGEMENT IN THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

Secretariat of the Water Resources Coordination Committee
Lao People's Democratic Republic

Introduction

The objectives set by the Government of the Lao People's Democratic Republic in its current Five-Year Plan (2000-2005) were to develop, modernize and industrialize as well as achieve a high quality of life for all. In the process of developing its strategic plan management (SPM), the Government specified three goals:

(a) Achieve an average annual economic growth of 8-8.5 per cent, which would translate into a per capita income exceeding US$ 500 by 2005;

(b) Devote at least 20 per cent of public expenditure to the social sectors, making education, health and social welfare the new "beacon sectors"; and

(c) Make poverty alleviation the major reference for socio-economic development by giving major attention to basic rural infrastructure and social services.

These goals clearly require support from the water sector, which comprises a number of agencies with resource development and management functions related to water and water resources.[1] The sector is largely structured around the various uses of water such as hydropower, irrigation, water supply, fisheries and wastewater. These water subsectors developed their programmes to provide the support required for the Government's objectives. The programmes, however, did not consider the potential for interaction between the policies and plans of subsectors. This was because no agency was given overall responsibility for managing water resources or the coordination of water resources development.

The Water Sector Strategic Plan has been developed to show how water sector activities support the Government's objectives of long-term socio-economic growth and to indicate the importance of these activities. The Water Sector Strategic Plan consists of a vision and mission for the water sector, a set of objectives and descriptions of key result areas necessary to achieve the objectives, with short-term goals and activities within those key result areas.

The Water Sector Strategic Plan is complemented by an Action Plan to address areas where current subsector strategies need supplementing in order to achieve sustainable and efficient use of the water resources. The strategy showed the area mostly overlooked was that concerned with cross-sector issues, which is the responsibility of the Water Resources Coordination Committee (WRCC). The Action Plan describes the required activities and shows their timing.

At meetings held to discuss the development of SPM, an issue of concern has been the difference between a master plan and a strategic plan. Therefore it is valuable at this point to state the difference between these two types of plans, as seen by the authors:

(a) Strategic plan. This is a plan with an underlying strategy or scheme for achieving an outcome, and which usually starts from the consideration of the goals, and institutional and policy issues. A strategic plan provides an outline structure within which a number of other more detailed development plans may be prepared;

[1] Agencies in the water sector manage and/or use water or water resources. Water and water resources are defined in the Lao People's Democratic Republic Water and Water Resources Law, 1995 as the liquid form of water and the natural resources in the water.

(b) Master plan. This is a plan for controlling other plans at a lower level and usually does not involve institutional issues as a major item. A water resources master plan should follow the accepted strategy, and usually concentrates on issues related to the development of those resources.

1. National water sector context

Some 80 per cent of the country lies within the Mekong River basin. The remaining 20 per cent drains through Viet Nam directly into the South China Sea. The major tributaries of the Mekong all have significant watersheds. In addition to the major tributaries of the Mekong, there are hundreds of small streams, most of which have a torrential regime during the monsoon season and very low or no flow during the dry season.

The total annual flow of water flow in the Lao People's Democratic Republic is estimated at 270,000 million m^3, equivalent to 35 per cent of the average annual flow of the whole Mekong River basin. The monthly distribution of the flow of the rivers in the Lao People's Democratic Republic closely follows the pattern of rainfall: about 80 per cent during the monsoon season (May-October) and 20 per cent in the dry season (November to April). For some rivers in the central and southern parts of the country (particularly the Se Bang Fai, Se Bang Hieng and Se Done), the flow in the dry season is less, amounting to some 10 to 15 per cent of the annual flow.

The rivers outside the Mekong River basin – the Nam Ma, Nam Sam and Nam Neune – flow through Viet Nam into the South China Sea. The limited information on these rivers restricts assessment of their potential. The estimated inland water resources area totals approximately 723,500 ha, of which 200,000 ha are from Mekong River; 54,000 ha from other main rivers; 57,000 ha from reservoirs, 1,500 ha from swamps; 406,000 ha from rice fields; and 5,000 ha from fish ponds.

At the beginning of 2001, 140 gauging stations were in operation in the Lao People's Democratic Republic, nearly all of which are in the Mekong River basin. This amounts to an average density of about 1,350 km^2 per station, the highest among the countries of the lower Mekong River basin. Records of flow for the Mekong River were started in 1904. However, the records for the Mekong tributaries have a much shorter history and vary considerably in length; most tributary stations are located on the lower reaches of the rivers where access is not too difficult.

2. Scope of the study

The strategic plan management aims to maximize the benefits to the Lao People's Democratic Republic from the water resource management function. SPM comprises a number of component plans as specified in the draft policy:

(a) Principles of water and water resources management;
(b) Water source development and management;
(c) Public involvement;
(d) Financial resources for water source development and management;
(e) Water allocation, quality management and use;
(f) Data and information management; and
(g) Capacity-building and human resources development.

SPM will be based on a careful review of the effects of past development and will particularly take into account issues related to cultural minorities, including the stakeholders' preferred mode of development and implementation arrangements. The formulation of the development and

management strategic plan will follow a consultative process to obtain the views of the stakeholders as well as the Government and its agencies.

3. Water resources potential and challenges for the Water Resources Coordination Committee

The abundant water sources in the Lao People's Democratic Republic have the potential to support socio-economic development, especially the hydropower and irrigation subsectors. The hydropower potential of the country is large compared to other countries in the lower Mekong River basin, providing an opportunity to earn foreign revenue. The hydropower sector also has the ability to develop rapidly; it increased its production about five times from 247 million kWh in 1976 to 1,187 million kWh in 1999 when it exported 473 million kWh.

The Government has given high priority to investment in the irrigation subsector as agriculture forms the foundation of national economic development, and is necessary for food stabilization. In addition, some 85 per cent of the population lives in rural areas. From 1976 to 2000, the area of irrigated dry season rice increased about 40 times from 2,700 ha to 110,000 ha. The irrigation subsector also significantly increased the average yield of rainfed paddy rice from 1.43 mt/ha in 1976 to 3.27 mt/ha in 2000. However, water resources development is still at a low level: the irrigated area is only 20 per cent of the national paddy area while hydropower production is still at only 2 per cent of its potential of 30,000 megawatts.

Development in other sectors is still at a low level compared with hydropower and irrigation. In addition, several problems are faced by the water sector. These include:

(a) Unusual rainfall patterns in some years, plus high evaporation, flooding and drought in some of the main agricultural areas of the country;

(b) The impact of shifting cultivation on water resources, although this activity has been significantly reduced; and

(c) Conflicts of interest for management within the sector since most water subsectors are still responsible for multiple roles of regulator, manager and service provider.

As the Lao People's Democratic Republic is a least-developed country with rich water resources, the most important challenges for WRCC in carrying out its coordinating role include:

(a) Strengthening the legal framework for effective and harmonious integration of water resources management, development and protection activities into the socio-economic development process of the country, in particular to meet national priorities;

(b) Enhancing and consolidating the existing systems and foundation to operate, maintain and rehabilitate facilities safely, reliably and efficiently in order to protect the investment for public benefit; and

(c) Prioritizing the capacity-building needs in order to enhance the organizational capacity and effectiveness of the water resources coordination system.

I. Summary of the goals linked to socio-economic development targets

1. Overall socio-economic development context of the country

Within the water sector, the irrigation and hydropower subsectors remain the most important in terms of investment. Dry-season irrigation, especially small pumping irrigation schemes, has been given the highest priority in the short term because rice production was seriously affected by

droughts and flooding during several consecutive years. Pumping schemes have successfully increased income in rural areas while delegating management to local authorities. The ongoing programme of transferring irrigation management to the beneficiaries has become critical to the sustainability of these schemes. This transfer of responsibility will need to be intensified in view of the number of pumping schemes being implemented.

The development of medium and large-scale hydropower schemes for energy export was affected by the economic crisis in Thailand, which has been the major market to date. In the short term, hydropower development will focus on medium, small and micro schemes for remote urban centres and rural areas.[2] In the water supply and sanitation subsector, the target is to provide basic facilities to all provincial capitals and access to clean water for 70 per cent of the rural areas by the end of the century.

In 1997, real GDP growth was estimated to be 7 per cent, slightly higher than in 1996. This result was mainly due to the contribution by agriculture, which experienced favourable weather conditions after severe and extensive flooding in 1995-1996.

As the economic structure of the Lao People's Democratic Republic is dominated by subsistence agriculture, the effect of the current regional economic situation is not expected to be as severe as in some other countries. The subsistence economy of most rural areas will be less affected than the urban centres. Sectors most affected by the regional economic crisis will be foreign direct investment and timber exports due to the slowdown of construction activities in the region, particularly Thailand. Depreciation of the national currency, the kip, will seriously affect the national budget in the short term. The gap between the resources available and the socio-economic development requirements will widen. The Government's ability to close this gap is also influenced by the high fertility rate of 5-6 per cent (compared with the population growth rate of 2-3 per cent), and the high incidence of poverty.

Three essential elements are embodied in the national policy framework:

(1) Growth with equity while safeguarding the social, cultural and political identity of the country;

(2) National integration; and

(3) Shifting from a landlocked to a land-linked country in order to enhance economic and trade cooperation of the Greater Mekong Subregion.

The long-term development directive for 2000-2020, adopted by the sixth Party Congress, is to permanently rise above least developed country[3] status. To achieve this result, the Government has set three overall goals for the five-year period of 2000-2005. The eight priority programmes of the Government stemming from these goals are at various stages of formulation by line ministries. These programmes are:

(a) Food production
(b) Stabilization of shifting cultivation
(c) Commodity production
(d) Infrastructure development

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[2] Houmphou Boulinyaphonh, Director of Department of Energy, Ministry of Industry and Handicrafts, 15 December 1998.

[3] Currently, least developed country status means an annual per capita GDP of less than US$ 856, a low "augumented physical quality of life index" (comprising life expectancy, per capita calorie supply, primary and secondary school enrolment ratio and adult literacy rate) and a weak economic diversification index.

(e) Rural development

(f) Human resources development

(g) Services development

(h) External economic relations

In the water sector, irrigation contributes to self-sufficiency in food, agricultural production and a reduction in shifting cultivation. Hydropower contributes through export power projects and by reducing migration to urban centres through increased availability of electricity, rural development and income redistribution. Navigation improves transportation links, particularly with China, Myanmar and Thailand. Fisheries are a major source of food and contribute to foreign earnings. Urban water supply meets industry and urban population needs. Rural water supply and sanitation improvements increase the health and living standards of rural communities and assist tourism. Drainage, solid waste and sewerage provide for industry and development in urban areas. Water also maintains the natural environment and hence the welfare of the Lao people by providing fish and animal protein as well as aquatic plants. Wetlands are a refuge for fish, animals and birds.

Article 19 of the Constitution of the Lao People's Democratic Republic is specifically devoted to the protection of the environment. Action to protect the environment is considered a duty of all organizations and citizens. Recognizing the strategic value of natural resources in the socio-economic development of the country, especially forests, land and water resources, the national environment policy places primary focus on the preservation of these resources while maximizing revenue generation and maintaining the livelihood of rural population.

2. Opportunities and threats for water resources development from the perspective of the Water Resources Coordination Committee

The Lao People's Democratic Republic has plenty of surface water available but its quality is not always good. Land-use changes appear to be altering the pattern of stream flows (stream flow regime) and some supply shortages are occurring. Nevertheless, in general there is currently little conflict over water use. Increased water storage will be needed to support development. This additional storage will need careful management to prevent unwanted effects.

Throughout the Lao People's Democratic Republic, sediment is the primary river pollutant, although close to the major developed areas nutrients are also an issue. Some nutrients and some sediment are needed to support the aquatic environment; however, too great a quantity of nutrient may lead to algal blooms and encourage unwanted weed growth. Land that has little or no vegetation is the main source of sediment. The issue of sediment sources is being addressed in upland areas through watershed management activities.

Current water quality is mostly good, although the trend is towards increasing pollutant loads. Because of this, plans for increasing agricultural production through the application of high phosphate fertilizers should be implemented with caution.

Increasing population and higher population densities will increase health risks unless accompanied by good water management. Disease risks include dysentery, dengue fever, malaria, cholera and typhoid.

There is little information on the extent and capacity of groundwater systems. However, some use is already being made of the systems for water supply. This resource could be significant in some areas, particularly those underlain by limestone where large extraction rates could be expected from a single correctly placed bore. Such areas with high groundwater flow rates will also need careful management to avoid pollution from inappropriate land use.

Flooding is a major issue, with damage occurring in both urban and rural areas. Floods cause communal disruption, economic losses and increase health risks. On the other hand, floods bring some benefits such as building rich floodplains and replenishing soil moisture. Flood plain management could be considered as a way to reduce flood damage by guiding sensitive development away from flood-prone areas.

The population needs fish for protein. Fisheries also employ significant numbers of people and contribute economically. Fish populations are declining, and this is becoming a serious concern. The reasons for this decline are not yet known. Changes in land use, declining water quality, construction of dams and other barriers to migration, and high levels of capture are all likely to be involved. Reservoir fisheries are being developed to increase production.

3. Vision statement of the water sector

A Vision Statement is a phrase that expresses the long-term objective and goal of the water sector. The Vision Statement suggested by working group members for the sector is “coordinated development of water and water resources for health, wealth and happiness”. Some of the reasons and thinking behind this statement are worth elaborating. Coordinated development refers to the need to consider the interests and aspirations of all stakeholders in water and water resources. Water and water resources has a specific meaning in the Water and Water Resources Law, and therefore refers directly to that law. Health, wealth and happiness refer to the desired outcomes from development for the population of the Lao People’s Democratic Republic. These three words imply sustainable development, or a balance in economic, social and environmental outcomes. The phrase also has some commonality with the national motto: “Peace, independence, democracy, unity and prosperity”

II. Legal and institutional framework

1. Legal and institutional context

Since 1991, the Constitution has become the foundation document for the socio-economic management of the country. It forms the basis for the functioning of a multi-sector economy, and provides the conditions for the education, culture and health of the Lao people.

In June 1998, a National Commission for Constitution Review was established to assess the impact of the new Constitution and to propose possible amendments in order to adapt to the changing domestic, regional and global environments, and bring the Constitution in line with the new economic mechanism. The draft of the amended Constitution underwent a nationwide public consultation process to ensure that the amendments met the real needs of the Lao people in the current economic period.

The Water and Water Resources Law of 1996 sets out a legal framework for development in the water sector. Many issues in the law, particularly the roles and responsibilities of various agencies for specific activities such as water allocation and the process for licensing water users, need to be developed. There is an urgent need for the development of further legislation or decrees for subsectoral activities, as well as the necessary legal documents to accompany the law and make it effective. Support given to the Government in this area should be undertaken in a counterpart relationship with the Department of Legislation within the Ministry of Justice, as this agency has the final responsibility for issuing decrees.

External assistance is also required by water subsector agencies in drafting regulations. This assistance should cover both drafting and the operational and enforcement aspects of regulations. A pre-requisite for success in this field is capacity-building throughout the water sector

because this is a new activity and because the water sector traditionally focuses on development rather than management and regulation.

2. Current situation and perspectives of the legal and institutional framework

The WRCC Secretariat is the executing body for WRCC and comprises a director and a number of technical specialists. It is responsible for any task assigned by the WRCC Chairman. It is also responsible for administrative and financial matters and for the management of WRCC assets. WRCC is composed of the Vice-President of the Science, Technology and Environment Agency as chairman together with representatives of the following organizations nominated by the Prime Minister's Office:

(a) Ministry of Agriculture and Forestry (Vice-Chairman)
(b) Ministry of Industry and Handicrafts (member)
(c) Ministry of Communications, Transport, Post and Construction (member)
(d) Ministry of Public Health (member)
(e) Lao National Mekong Committee (member)
(f) Science, Technology and Environment Agency (member)

Due to the necessity for wider coordination as well as contributions from water users in all aspects, additional representation from the Ministry of Justice, Lao Women Union and Lao Front for National Construction to the WRCC was needed. Under the Prime Minister's Office Notice No. 1908/PMO, dated 29 October 1999, a representative from the Lao Women's Union was assigned to join the Committee. The two other assignments are still in the consideration process. At the same time, an increase in secretariat staff is needed to expand both quality and quantity of work.

The development of sound legislation, regulations and guidelines is one of the primary means by which WRCC can play its coordinating role within the water resources sector and within this project. The process must be open and consultative, involving stakeholders at the central, provincial and local levels. WRCC already has some experience in this respect but further capacity-building for policy analysis and development is needed. WRCC should establish an inter-ministry working group for legal and institution development. It should seek the comments of stakeholders through the awareness and consultation process described below. Legal and institutional changes need to be accompanied by detailed implementation plans that indicate agency responsibilities and, where necessary, provide for further capacity-building to allow implementation to be successfully carried out (annex 2).

3. Strengths and weaknesses of the current legal and institutional framework

Present organizational arrangements at the national and provincial levels generally support the achievement of national policies. However, some agencies have conflicting roles such as those of regulator and service provider. This could result in ineffective implementation of government policies as well as enforcement of rules and regulations.

The Government has a policy of decentralizing planning and development to the provinces, with broad control and guidelines set at the central level. This is to ensure that local conditions and needs are appropriately considered. In the case of irrigation, for example, the head of the Provincial Irrigation Service is responsible to the head of the Provincial Agriculture and Forestry Service Office who, in turn, is responsible to the provincial governor. The intervention of the Department of Irrigation in the provinces is related mainly to reviewing the annual irrigation development plans and budgets proposed by the provinces, providing technical assistance to the Provincial Irrigation Service,

and monitoring the implementation of the annual work programmes. There is no involvement of a regulator to consider whether these plans conflict with natural resource values or to set operating conditions.

Although devolving the responsibility from the central Government to the provincial authorities is helpful in gaining greater community input, the task of achieving broad environmental outcomes and maintaining technical performance is made harder. The control of natural resources and cross-sector coordination needs to be considered in planning this decentralization.

The current institutional problems in the water sector are mainly related to the lack of coordination between agencies within the sector and with those of other sectors, and to the loose lines of communication and coordination between the national agencies and their provincial counterparts. WRCC, as a national apex body, is mainly aimed at improving the coordination of multi-sectoral activities that involve various water uses, and also at defining and managing water allocations. This is an important initiative for coordination at the national level as it enables the Government to overcome the current fragmented management of water resources.

The tasks of WRCC are greater than just coordinating the activities of the subsectors. WRCC should be vested with the responsibility of allocating water resources among the various water users and the environment. To undertake this significant task in addition to coordination, WRCC will require a strong, dedicated and experienced secretariat. This will only occur with sustained support from donors such as the Asian Development Bank and a commitment from the top levels in the Government. Measures required for coordination at the provincial level should not be viewed as being of lower importance, as the greater part of the national budget (covering project planning and execution) is managed by the provincial administrative authorities.

The first step would be to assess the present institutional set-up at the ministerial and provincial levels, and to conduct a diagnostic study of each targeted river basin. The findings of these studies could be used as a basis for designing a river basin management body tailored the development mix in each basin.

The policy of decentralization is now being implemented. Decision-making authority is being moved from central government to the provincial level. This includes formulating annual work programmes, project planning, implementation, and operation and maintenance. Service provision is also being transferred to local agencies and communities, such as provincial water supply agencies, irrigation water user associations and village water supply management committees. State-owned service providers are vested with greater operational and financial autonomy but are still limited in matters related to personnel management, salaries and incentives policy. State-owned service providers are usually operating within the administrative boundary of the province.

As a result, development objectives and investment performance depend on local commitment and capacity. The need for institutional strengthening and capacity-building is increasing as a result of the changes now underway. Efforts in this area should, therefore, focus on the provincial and local levels, while incentives for government employees should be biased in favour of the provinces.

In all aspects of capacity-building at the central, provincial and local levels, efforts should consider and promote the capabilities of women. The aim should be to correct the imbalance in women's involvement in planning, management and decision-making concerning water resources development and management. The specific skills of women in the essential human aspects of this work (e.g., coordination and conflict resolution) should be encouraged.

4. Mission and vision statements of the Water Resources Coordination Committee

The Mission Statement suggested for the water sector is "Protect, manage and develop water and water resources to achieve improved quality of life in the Lao People's Democratic Republic". As with the Vision Statement, the words used have specific meanings. Protect refers to the need to ensure the continuing supply of high-quality resources. Manage refers to the activities of managing the resources, including managing access to the resources, managing developments that use the resources and managing the institutions with responsibilities related to the resources. Develop refers to converting the resources to new uses and to a mature state for the purpose of improved quality of life.

The 1999 WRCC Mandate defines the rights and duties of WRCC.[4] That list of rights and duties, although broad, is mainly directed towards actions such as "study, monitor, coordinate and advise." It also clearly indicates an important role for WRCC in all the integrated water and resources management functions mentioned below.

The 2001 Decree to Implement the Law on Water and Water Resources, issued by the Prime Minister, defines the structure of water resources planning and management at the national and river basin levels. The Decree states that WRCC is:

> "Responsible for coordinating line agencies in drafting of strategies and action plans, programmes and regulations necessary for the planning, management, use and protection of water and water resources. It is also responsible for monitoring, control, promotion and reporting on the implementation of activities related to water and water resources."[5]

In this connection, the WRCC Vision Statement is "to attain the modern status of a State coordination agency to provide advisory services to the Government in decision-making, based on a more balanced treatment of sectoral water perspectives, and to mobilize the public in their participation in the development, management and protection of the water and water resources to achieve improved quality of life in the Lao People's Democratic Republic".

III. Strategic plan goals

1. Overall WRCC goal

The overall WRCC goal is "towards consensus building and sustainable development of water and water resources in the country, particularly for the priority areas identified by the Government". Within the context of this overall goal, WRCC will attempt to achieve the following three main mission goals:

WRCC mission goal 1: Improve and modernize the legal and technical framework for managing, developing and protecting water and related resources to meet the needs of current and future generations.

WRCC mission goal 2: Enhance and consolidate the existing systems and foundation for operating, maintaining and rehabilitating facilities safely, reliably and efficiently, in order to protect the public investment.

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[4] "Mandate of the Water Resources Coordination Committee," No. 09/PM, 8 February 1999, Article IV, Lao People's Democratic Republic.

[5] "Decree to Implement the Law on Water and Water Resources," No. 204/PM, 2001, Article 3.8, Lao People's Democratic Republic.

WRCC mission goal 3: Enhance the organizational capacity and effectiveness of the water resources coordination system.

The three mission goals are linked to the three above-mentioned priorities of the country, in terms of ensure high economic growth, poverty alleviation and strong framework for sustainable development.

2. WRCC mission goal 1

WRCC mission goal 1 is to "improve and modernize the legal and technical framework for managing, developing and protecting water and related resources to meet the needs of current and future generations". To achieve this goal, WRCC will work in cooperation with all key agencies and stakeholders towards effectively managing, developing and protecting water and related resources for agricultural, municipal, industrial, rural, hydropower, recreational, and fish and wildlife purposes. WRCC seeks to gain the greatest benefit from existing resources in a manner that recognizes competing interests, uses sound conservation practices and is efficient.

Within the context of the Water Resources Law and existing legal framework, WRCC will pursue its coordinating roles aimed at improving water and related resource management, development and protection activities. The framework for the coordinating roles includes:

(a) Administering the implementation of the Water Resources Law as well as the development of laws and regulations to ensure balanced treatment of sectoral perspectives, optimum water resources development benefits and an effective decision-making process;

(b) Formulating a policy and strategies to improve the water resources planning system of the country, with emphasis on the river basin water resources planning system;

(c) Formulating a policy and strategies to improving the efficiency of water use; and

(d) The promotion of integrating applied sciences and technology into water resources management.

a. Improving the implementation of the Law on Water and Water Resources

A review of current water resources policy and legislation was initiated in 2004 in order to recommend priority topics for further policy and legislation development and, with WRCC approval, assist WRCC to prepare a draft policy, legislation, regulations, guidelines and other documents for submission to the Government for approval in 2005.

(1) Strategies for achieving the goal

To assist in this review process, arrangements for effective inter-ministry and key stakeholder involvement will be made to establish an appropriate mechanism, such as a Policy and Legislation Working Group. In this process, all key ministries, agencies and stakeholders will be requested to prepare a brief plan (2-4 pages) listing and prioritizing policy and legal issues to be addressed, opportunities for more effective management, development and protection of water and water resources, and, if possible, to present strategies for dealing with the critical issues. For each significant issue or opportunity, the plans should briefly address the following aspects:

(a) The history of the issues, including the customers and key stakeholders involved;

(b) Current status of the issues;

(c) Recommended strategies, actions and options for each agency or stakeholder, including goals to measure progress;

(d) Implications of the proposed actions and intended results; and

(e) External factors (social, policy, legal etc.) affecting achievement of the strategy and progress in addressing the issue.

On the basis of inputs from key ministries, agencies and stakeholders, WRCC in cooperation with the Policy and Legislation Working Group will analyse and synthesize the issues into a framework for the development of policy, legislation, regulations, guidelines and other documents for submission to WRCC and the Government for approval.

(2) External factors affecting goal achievement

The most important factors affecting the progress of work in this area include (a) willingness of all key stakeholders to participate, (b) the lack of expertise in the policy and legislation areas of key stakeholders, including the limited staff of WRCCS, (c) the understanding among expatriate experts of local sensitivity in the implementation of policies and enforcement of legislations, and (d) public awareness. On the other hand, given the limited resources available to the country, and particularly to all key agencies, it will be difficult to ensure active participation by all key stakeholders.

(3) Cross-cutting relationships

To ensure smooth cross-cutting relationships with all key stakeholders, regular consultations and the establishment of common targets will be necessary for evaluation purposes.

(4) Performance evaluation and monitoring

It is necessary to prioritize activities so that their results can be linked to the priority areas of socio-economic development of the country, and in particular stable and sustainable economic growth and poverty eradication goals. For example, specific target dates with appropriate indicators should be identified for priority areas of economic development and poverty eradication, particularly in those areas facing water constraints.

(5) Performance measures

The performance measures include:

(a) A comprehensive review of priority issues in water resources policy and regulations in the Lao People's Democratic Republic;

(b) Formulation of a strategy to develop policy, legislation, regulations, guidelines and other legal documents for submission to the Government for approval; and

(c) The start of operations (expected in 2005) by the Inter-Ministerial Working Group on Policy and Legislation Improvement.

b. Improving the water resources planning system

This aspect requires careful coordination of the river basin water resource planning system, including detailed procedures and roles for WRCC, river basin committees and other key participants in the preparation, approval and implementation of river basin plans. This plan is expected to serve as the guideline for provinces, local authorities and other central agencies in conducting detailed project planning in a coordinated manner. The plan will also specify agency responsibilities, including that of monitoring plan implementation.

(1) Strategies for achieving the goal

In view of the limited resources available for modernizing the water resources planning system in the Lao People's Democratic Republic, it is necessary to devise a number of strategies to respond to the priority needs of socio-economic development, particularly stable and sustainable economic growth and poverty eradication goals. This can be achieved through the following three-pronged approach:

(a) A pilot river basin study. The Nam Ngum River basin has been selected as the river basin for the pilot study;

(b) Pilot community-based water resources development areas for poverty eradication. These areas could be within the Nam Ngum River basin or in other areas, depending on the critical dimension of water resources constraints; and

(c) A programme to expand basin planning systems to other river basins and poverty eradication areas. Depending on availability of resources, this programme could have a number of target dates, but the overall framework will be governed by the long-term development goals of the country, such as Vision 2020.

(2) External factors affecting goal achievement

The most important factors affecting the progress of work in this area include (a) the willingness of all key stakeholders to participate, (b) commitment by the Government and key funding agencies, (c) the effectiveness of technology and know-how transfer to local staff, particularly WRCC technical staff, and local consultancy firms, and (d) the "brain drain".

(3) Cross-cutting relationships

In order to ensure smooth cross-cutting relationships with all key stakeholders and the effective transfer of technology and know-how, regular consultations and establishment of common targets will be necessary for evaluation.

(4) Performance evaluation and monitoring

While detailed implementation of the Nam Ngum River basin plan has been established with clear target dates of delivery, no plan has been established for the second and third prongs of the above strategies. In addition, indicators should be established to ensure sustainability of the new water resources planning system.

(5) Performance measures

The performance measures should include:

- A pilot river basin study of the Nam Ngum River basin;
- A report on the development of a river basin water resource planning system, including detailed procedures and roles for WRCC, the Hydro-Power Organization, river basin committees and other key participants in the preparation of river basin plans, including plan approval and implementation procedures;
- An integrated management plan for the Nam Ngum River basin. This plan is expected to serve as the guideline for provinces, local authorities and other central agencies in conducting detailed project planning in a coordinated manner. The plan will also indicate agency responsibilities, including the responsibility for monitoring plan implementation;

- Pilot community-based water resources development areas for poverty eradication.
- A draft report on detailed procedures and roles for related agencies and stakeholders in the planning of community-based water resources development, including plan approval and implementation procedures;
- A report of community-based water resources development for pilot areas for funding and implementation;
- A programme for expanding basin planning systems to other river basins and poverty eradication areas; and
- A strategy for applying the planning systems to other river basins and other priority areas.

c. Formulation of policy, strategies and plans to improve water-use efficiency

WRCC will assist related agencies in the planning and development of water and power projects that improve the efficient use of limited water supplies in order to meet the socio-economic development needs.

(1) Strategies to achieve the goal

WRCC will aim at addressing the following three areas:

- A policy and strategies to improve water supply and sanitation in order to achieve the national goal in water supply and sanitation
- A policy and strategies to improve water management in the Nam Ngum River basin
- A policy and strategies to replicate the experiences for other areas of the country

With regard to the Nam Ngum River basin, activities will include:

- Recalibrate the river basin model for short-term (weekly and daily) operational planning of the Nam Ngum 1 Reservoir for hydropower generation and flood mitigation during the monsoon season as part of an integrated flood model, consisting of: (a) the Nam Lik River down to the confluence with the Nam Ngum River; (b) the Nam Ngum 1 Reservoir and the upstream catchments area; (c) a hydro-dynamic model of the area downstream of the Nam Lik/Nam Ngum confluence; and (d) an economic model based on flood damage cost functions and hydropower benefits; and
- Application of the integrated flood model to: (a) define the optimum flood control operation rules for different flood scenarios in the Nam Ngum River basin and the Mekong (backwater) as general guidelines; (b) demonstrate the hydrologic/hydraulic inter-relationship causing flooding in the Vientiane Plain; and (c) propose other flood mitigation measures to alleviate frequent flood damage.

(2) External factors affecting goal achievement

The most important factors affecting the progress of work in this area include: (a) willingness of all key stakeholders to participate, particularly the public, in demand management; (b) the lack of sufficient expertise in advance technology and facilities on handling the complex technical process towards optimization of key stakeholders, including the limited staff of WRCC; (c) the willingness of key expatriate experts to transfer technical know-how; and (d) continuity and consistency of leadership commitment and availability of resources.

(3) Cross-cutting relationships

In order to ensure smooth cross-cutting relationships with all key stakeholders, regular consultations and the establishment of common targets will be necessary for evaluation.

(4) Performance evaluation and monitoring

It is necessary to prioritize activities so that their results can be directly linked to service improvement according to customers' requirement and market conditions.

(5) Performance measures

(i) Policy and strategies to improve water supply and sanitation so as to achieve the national goal in water supply and sanitation

Submission of a strategy to provide, manage and protect sources of water to meet the national water supply goal in 2020.

(ii) Policy and strategies to improve water management in the Nam Ngum River basin

Submission of a report on sharing water resources in the Nam Ngum River basin, and the preparation of a detailed plan for flood management and preparedness in the Nam Ngum River basin.

(iii) Policy and strategies to replicate the experiences for other areas of the country

Proposed policy and strategies to improve efficiency of water use in other areas of the country.

d. Promoting integration of applied sciences and technology into water resources management

Application of sciences and technology to water resources management will facilitate decision-making, improve transparency to ensure better coordination, and enhance accountability.

(1) Strategies to achieve the goal

Apart from improvement of the planning system, the flow of information is important. The strategies in this area will include:

(a) Improving the flow of information for decision-making, and enhancing the effective and efficient use of resources for basic data collection;

(b) Coordinating the development of a detailed data and information management strategy. This includes an assessment of current practices and issues in the use of technology in decision-making and recommendations for introducing greater coordination and accessibility of water resources data. Review, update and disseminate the metadata directory established under previous technical assistance. Prepare and maintain a water resources information system for WRCC; and

(c) Reviewing the need for additional meteorological and hydrological data, within the available budget, in order to enhance the quantity and quality of data for calibration and future applications of the model, and recommending site locations, purchases and supervision of the installation of new equipment.

(2) External factors affecting goal achievement

The most important factors affecting the progress of work in this area include:

(a) Willingness of all key agencies to participate in the establishment of coordinated data systems, which should not take away the incentives and ownership of all data collection agencies;

(b) The lack of effective mechanisms for the transfer of data and information;

(c) The lack of sufficient expertise and guidelines to link advanced technology to decision-making, especially in the case of the limited WRCC staff;

(d) Willingness of key expatriate experts to transfer technical know-how; and

(e) The lack of regular communication between decision-makers and technical staff, and consequently the lack of continuity and consistency in leadership commitment and availability of resources.

(3) Cross-cutting relationships

To ensure smooth cross-cutting relationships with all key agencies, regular consultations and the establishment of common targets will be necessary for pilot projects on information management improvement and their subsequent expansion.

(4) Performance evaluation and monitoring

It is necessary to prioritize activities with target dates and indicators so that their results can be directly linked to the expectations of decision-makers in terms of policy and strategy implementation in water resources management.

(5) Performance measures

(i) Strategy on data and information management for decision-making in the water resources sector

Preparation of a report on a comprehensive review of priority issues in water resources policy and regulations in the Lao People's Democratic Republic.

(ii) Strategy for effective collection of basic information and data on river basins

Preparation of a strategy for data collection and management in the Nam Ngum River basin and possible application to other river basins.

3. WRCC mission goal 2

WRCC mission goal 2 is to "enhance and consolidate the existing systems and foundation for operating, maintaining and rehabilitating facilities safely, reliably and efficiently, in order to protect the public investment". To achieve this goal, WRCC will focus on operating, maintaining, and rehabilitating existing water resources facilities so that they continue to provide project benefits. These facilities provide power and water supply delivery systems that serve agricultural and municipal requirements, in addition to having benefits for recreation, fish and wildlife as well as flood control. By ensuring that facilities are safe, cost-effective and reliable, WRCC can assist the agencies concerned to provide the best possible project benefits while protecting public health, sustaining environmental values, and providing timely and economical services to customers and thus protect the public investment.

WRCC will assist the related agencies to conduct oversight reviews and planning to ensure timely operation and management procedures, including control and communications systems for continued safe and reliable operation of existing facilities. In this connection, it is expected that the related agencies will be able to verify reliability, improve maintenance practices, and identify and implement risk reduction actions.

a. Ensure effective operation of facilities

It is important that related agencies comprehensively review, update and implement standard operating procedures and related operating guidance to ensure that existing facilities provide project benefits in a safe and reliable manner.

(1) Strategies for achieving the goal

WRCC will, through the implementation of the related laws and development of regulations, encourage all operating agencies to use appropriate tools, technologies, innovations and research to operate facilities effectively, including internal auditing systems.

(2) External factors affecting goal achievement

Natural events such as flooding, drought, earthquakes and fires have a serious impact on the ability of the related agencies to operate facilities and provide project benefits in a safe and reliable manner. Funding limitations may restrict accomplishments.

(3) Cross-cutting relationships

In accomplishing this long-term goal, WRCC will have to ensure that appropriate procedures and investments are allocated the necessary resources to undertake these activities and encourage the participation of stakeholders.

(4) Programme evaluation and performance improvements

The establishment of indicators and monitoring of incidents will be necessary for ensuring effective evaluation of performance improvements.

(5) Performance measures

Reporting on emerging issues in the operations of existing facilities in the water sector. Proposed strategy for improving the efficiency and effectiveness of existing facilities.

b. Effective participation by the public

Participation by the public is essential to enhancing the benefits of existing facilities and minimizing risks and impacts of disasters. In addition, effective public participation will result in better investment strategies in terms of resources mobilization and investment scheduling.

(1) Strategies for achieving the goal

The following approach is necessary:

(a) Develop an awareness and consultation strategy. This strategy will (i) identify target groups and their information needs as well as an appropriate and cost-effective means of providing information and creating awareness, (ii) identify modalities and an action plan for consultation with stakeholders regarding draft policy and legislation, and other

important consultation topics, and (iii) identify awareness and consultation roles of central government agencies and the River Basin Committee in relation to all major target groups.

(b) Carry out awareness and consultation responsibilities in accordance with the agreed strategy.

(c) Play an awareness and consultation role at the river basin level.

(d) Develop and implement national guidelines for dam safety.

(2) Cross-cutting relationships

As the overall coordinating body in water resources management, WRCC will assist other agencies in the development of the above strategies and guidelines, including the establishment of an appropriate mechanism for implementing the strategies and guidelines.

(3) Programme evaluation and performance improvements

Detailed indicators will be developed to monitor the implementation of the related strategies and guidelines.

(4) Performance measures

The performance measures should include (a) the establishment of working groups on public awareness and participation, and (b) a plan and strategy to enhance public awareness and participation.

4. WRCC mission goal 3

WRCC mission goal 3 is to "enhance the organizational capacity and effectiveness of the water resources coordination system". WRCC needs to be strengthened to become an effective organization in order to achieve the mission goals. Under this mission, WRCC will improve the service provided to clients, particularly top decision-makers in the water sector and the Government, strengthen its leadership role in the coordination of water resources management, development and protection, and support an innovative and growing workforce to respond to diverse needs. To improve its operation, involvement of decision-makers and employees of WRCCS in the formulation and implementation of the strategic plan and subsequent monitoring and evaluation is essential.

(1) Strategies for achieving the goal

The strategies should include:

(a) Preparation of an Action Plan for two-year and five-year periods. The Action Plan will be based on the WRCC mandate, priority water resources management issues at the national level and in the river basin. It will be necessary for the Action Plan to emphasize the need to integrate a more balanced view of sectoral perspectives in the programme of investment and operation of all water-related agencies. WRCC will present the Action Plan to the Government for approval.

(b) Preparation and implementation of a Capacity-Building Plan for the WRCC, based on the requirements for accomplishing the Action Plan. The Capacity-Building Plan will include:

(i) The expansion of WRCC staff from its present size of 12 to 25 persons;

(ii) Staff selection and management;

(iii) An internal structure (tied to the mandate and long-term work plan of the Secretariat), including position descriptions and assignments;

(iv) A WRCC administrative system, including financial, accounting, asset management and record keeping, planning and budgeting, and priority and goal setting; and

(v) Awareness raising for WRCC members and training for WRCC staff, to be implemented under the project's training component. It is expected that external assistance will be provided in implementing all aspects of the Capacity-Building Plan.

(c) Conducting a training needs assessment for integrated water and resources management training in WRCC and the provinces in the river basin. Preparation of a coordinated training plan to address the priority training needs, drawing on the training modalities identified in the project and the available training budget. The training needs assessment and plan will be submitted to WRCC for approval. Support will be solicited for WRCC to facilitate and coordinate the delivery of training activities under the approved plan as well as evaluate training results, and recommend ongoing training needs and activities.

(2) Performance measures

The performance measures should include a WRCC Action Plan, a Capacity-Building Plan and the total number of staff trained with advanced technology.

IV. Implementation, monitoring and evaluation

1. Identification of indicators and benchmarks for performance measurements, expected timeframe and necessary resources

a. Human resources development

Having established a strategic plan management process, it must be implemented. To do this, alignment of the organization as well as development of the right skills and competencies to match the strategy must be undertaken. This includes:

(a) Building the organization around the critical strategic elements;

(b) Mobilizing and allocating resources to match the strategic plan;

(c) Establishing administrative systems, policies and procedures in accordance with the strategic plan;

(d) Developing a personnel reward system linked to achievement and the strategy; and

(e) Recognizing that the most important task of leadership is to establish and believe in strategic plan management as well as ensure that everyone in WRCC complies.

b. Funding for the future

Because of the almost complete reliance of WRCC on external funding for continued existence, it is crucial that a clear fundraising and resources mobilization strategy be developed and implemented urgently. Only if fundraising is treated as a fundamental part of operations, and approached in a professional and structured fashion, will there be any chance of WRCC becoming financially secure in the future. If it is to become the leading organization in promoting and coordinating water and water resources development for the benefit of the river basin population, WRCC has a duty to treat fundraising as an essential component of its overall operation.

Attaining financial security means that funding must be sought and obtained creatively from diverse sources, including WRCC members, development partners, the private sector, members of the public and others. Because of their respective financial situations, it is not expected that total funding by WRCC members will be achievable in the foreseeable future, although that is the ultimate aim. For the present, a sensible, rational mix of funding needs to be the target. Nevertheless, WRCC will explore what might be considered as a reasonable goal for funding and in-kind services over the term of the strategic plan management, what the funding and services should be used for, and how long it could take to reach this level of contribution.

WRCC accepts the notion that its members should at least own and support the core of its organization. This means the basic structure as defined in the Water and Water Resources Law. The amount of funding needed to cover these commitments must now be determined and decisions made as to whether each WRCC member is able to meet this level of contribution in the foreseeable future. WRCC may need assistance in moving toward the desired funding proportion over the period of this plan.

2. Mechanisms for reporting, monitoring and evaluation

a. Coordination framework

Ministries and agencies responsible for the management, exploitation, development and use of water and water resources are:

(a) The Ministry of Agriculture and Forestry. Responsible for the (i) management, exploitation, development and use of water and water resources in agriculture, (ii) prevention and control of flooding in agricultural areas, (iii) surveying and collecting meteorological and hydrological data on the Mekong River, its tributaries and other rivers outside the Mekong River basin, and (iv) preparation, updating and dissemination of the inventory of water sources and river basins;

(b) The Ministry of Communications, Transportation, Post and Construction. Responsible for the management, exploitation, development and use of water and water resources in the fields of communications, transportation, town water supply, urban drainage, river bank protection, and flood prevention and control. In addition, the Ministry is responsible for the collection of hydrological data and hydrographical surveys for navigation purposes;

(c) The Ministry of Industry and Handicrafts. Responsible for the management, exploitation, development and use of water and water resources in the fields of electricity, industry, mining, drainage from industries, and handicraft activities;

(d) The Ministry of Public Health. Responsible for the management, exploitation, development and use of water for rural domestic consumption and health care;

(e) The Ministry of Trade and Tourism. Responsible for the management, exploitation, development and use of water and water resources in tourism;

(f) The Science, Technology and Environment Agency. Responsible for ensuring coordination between different line agencies in establishing rules and regulations pertaining to the management of the environment, and research, scientific and technological services related to water and water resources;

(g) The Lao National Mekong Committee. Responsible for coordinating with line agencies in carrying out studies, and for implementing policies, strategic plans and programmes for Mekong development projects in the Lao People's Democratic Republic that are included in the Mekong River Commission Development Plan, which is being prepared in coordination with countries in the Mekong River basin region, other countries and

donors. The Lao National Mekong Committee is responsible for drafting laws and regulations that may be necessary as a result of the Chiang Rai Agreement of 5 April 1995; and

(h) WRCC. Responsible for coordinating with line agencies in drafting strategies and action plans, programmes and regulations necessary for the planning, management, use and protection of water and water resources. It is also responsible for monitoring, control, promotion and reporting on the implementation of activities related to water and water resources.

The above ministries and agencies shall coordinate with the local authorities in the detailed determination of responsibilities and scope of activities within their sectors.

b. Licensing of water use and water resources development activities

The relevant ministries will issue regulations on the licensing of medium-scale water use and water resource development activities within their sectors. Local authorities will be involved in licensing medium-scale water use. The Government must approve medium-scale water use that is important.

Individuals and organizations wishing to undertake large-scale water use and water resource development activities must apply to the relevant ministries for approval by the Government. Applications for large-scale water use must be accompanied by feasibility and environmental impact studies.

The relevant ministries will prepare guidelines on the preparation of feasibility studies and environmental impact studies in accordance with Article 8 of the Environmental Law.

The ministries, WRCC, the Lao National Mekong Committee and local authorities will monitor and control the development of water resources under Notification and Public Consultation on Water Resources Development.

All water resources development projects, particularly the construction of dams, irrigation schemes, and the diversion of rivers and streams, must go through a public consultation process with the local population.

When a water resource development project is expected to have an adverse impact on the natural or social environment, the ministries and local authorities will issue a notification and inform the public about the project through newspapers, public notices and other means. The ministries and local authorities, depending on the type of project involved, will determine the duration of such a notification, and they will organize public hearings at the relevant location. The developer or its representative will attend such public hearings and provide a detailed explanation and information on the proposed mitigation measures. All costs associated with the public hearing will be the responsibility of the developer.

c. Monitoring and evaluation

The relevant ministries, WRCC and local authorities are responsible for monitoring and evaluating the implementation of mitigation measures and will report to the Government on a regular basis.

There are three types of monitoring and evaluation: (a) regular evaluation; (b) monitoring with prior notice; and (c) evaluating without prior notice.

V. Consultation mechanisms and initial findings

1. People-centred approach

National policy promotes a "people-centred" approach to achieving the objective of "Growth with Equity". In line with this approach, the local communities, non-governmental organizations (NGOs) and stakeholders in socio-economic development activities have been encouraged to participate. This approach is relatively new and thus unfamiliar to most national agencies. However, there is no established practice for dealing with this matter.

Currently, regulations on environmental impact assessments for medium- and large-scale development projects are enacted; consultation workshops are organized at the community, district, provincial and central levels before decisions are made. In the irrigation and rural water supply subsectors the selection of projects takes into account the readiness and willingness of a community to participate in project implementation, operation and maintenance.

NGOs have contributed to the development of community irrigation schemes and rural water supplies in remote areas. The Department of Irrigation has estimated that there are about 150 to 200 irrigation schemes, ranging from 5 ha to 100 ha, which are supported by NGOs. NGO-sponsored water supply schemes have utilized rainwater, surface water and groundwater supplies.

2. Consultation mechanisms in place and future developments

a. Framework for participation

Based on the Constitution, public participation issues have been provided for within a number of laws, decrees, notices, guidelines etc., regarding sector-based specific requirements. In the Lao People's Democratic Republic, all key legislation related to land (1996), water (1996), mining (1997), electricity (1997) and forestry (1997) takes account of the need to minimize adverse social and environmental impacts. The Mining Law (1997) also addresses the social need to avoid economic hardship for project-affected persons. In addition, in 1999, the Government approved an Environmental Protection Law that made provisions for the need to consult with project-affected persons during the environmental assessment process. The Government also developed a draft resettlement policy in 1997, which states "that the population participates in the consultation, planning and design process of their new settlement and production areas" (Article 1.2).

Some of the specific public participation issues related to each sector are detailed below:

(a) In the environmental sector, the Environmental Protection Law specifies that all persons and organizations residing in the Lao People's Democratic Republic have an obligation to protect the environment. The provision of relevant data and information, raising public awareness and providing education to the citizens on the importance of the environment are encouraged. In the framework of institutional arrangements, the environmental management and monitoring processes are included in all of the organizations, from the local grass-roots level to the top ranking central level – village administrations, environmental management and monitoring units at the district, provincial, municipal/special zone and ministerial levels as well as the Science Technology and Environment Agency as a whole. In addition, Article 6 of Final Draft of Environmental Impact Assessment Guideline of the Lao People's Democratic Republic specifically states the environmental commitments and obligation of different partners, such as project developers, project-affected people and other stakeholders. Principles, approaches and methodologies to implement the Guideline related to the public participation are also provided;

(b) The Water and Water Resources Law states that Water and Water Resources are the property of the people of the Lao People's Democratic Republic as a whole. Water and water resources developers must contribute funds for water sources and water resources. If water sources development required human resettlement, the developers or projects must make adequate arrangements and provide funding for such resettlement. In addition, within the framework of the WRCC, which is playing the role of advisor to the Government on water and water resources related issues, some key documents have been drafted, including:

(i) A Draft Decree on implementing the Water and Water Resources Law as well as the establishment of responsibilities of different ministries, agencies and local authorities with regard to the management, exploitation, development and use of water and water resources;

(ii) A Draft Policy on Water and Water Resources with the objectives of ensuring that the management, exploitation, use and development of water and water resources is sustainable, equitable and supports the goals of socio-economic development and environmental protection of the Lao People's Democratic Republic; and

(iii) A Public Awareness Programme that has, as its main objectives, the creation of public awareness of the importance of water and water resources, the vulnerability of such resources and the sense of right and wrong concerning the development, management, use and preservation of water. At the same time, this will allow public involvement to be effectively implemented for the well being of the people and the sustainable use of the water resources. In the drafting process of those documents, a number of broad discussion meetings with different line agencies were organized at all levels throughout the country. That provided the opportunity for those agencies to contribute their views and raise any concerns regarding the drafted documents. The meetings also made possible the collection of comments, suggestions, data and information, in order to ensure that the documents were consistent with the prevailing situation of the country.

(c) The Articles of the Forestry Law state that "… the Government promotes the individual and organizations involved in forestry conservation, rehabilitation, reforestation and extension processes by providing policies, regulations and measures, in order to ensure the abundance, values and sustainability of the forestry resources"; the Articles also state that "… After the forestry allocation and classification processes, and identification of forest areas and forest lands, the Government will transfer the rights to the local governments, and then the provincial and municipal authorities will transfer the rights to districts and then to the village administrations to be responsible for such resources. The provincial and municipality authorities, and district or village administrations that share their borders, will be involved in those processes".

(d) The Electricity Law states that the environmental impact assessment process in the construction of electric power plants must take into account the impact on the communities living within the project areas.

A policy identifying the different management responsibilities of the central and district authorities has been adopted. The provincial level is to undertake strategic planning. The district level is to be responsible for planning and budget. The village level will implement plans.

b. Level of public participation

In the Lao People's Democratic Republic, there are four levels of public participation:

(a) Information gathering. This involves the systematic analysis of existing social, cultural and economic conditions among directly affected groups of stakeholders (such as farmers or indigenous minorities);

(b) Information dissemination. This refers to the provision of information about a project to all interested parties (stakeholders). Stakeholders cannot genuinely be consulted or participate if they are not fully informed about the objectives of a project;

(c) Consultations. This stage is where decision-makers listen to the views of other stakeholders in order to improve project design prior to implementation, or to make necessary changes during implementation. Consultation should involve the Government, affected parties, donor agencies, mass awareness organizations and NGOs (local and/or international); and

(d) Participation. This stage is an extension of the consultations where directly affected groups become joint partners in the design and implementation of projects. They participate in "making the decisions".

The lessons and experiences acquired by each sector related to the creation of awareness and implementation of public participation policy are different. However, in general, these activities are new and have not been given priority, since each sector has been obliged to concentrate on project implementation with the aim of meeting the urgent demands of society.

VI. Conclusions and recommendations

In general, progress in the integration of water resources management into economic and social development plans in the Lao People's Democratic Republic was found to be good through the assessment of various integration elements, such as progress in water resources assessment, monitoring and planning, in water supply and sanitation and in mobilization of community participation. The experiences of the Lao People's Democratic Republic show a wide variation in the modalities and methodologies used for integration. Among them, the most commonly accepted methodologies were long-term development plans and medium-term development plans (10 years). The use of water resources for economic growth, food security and poverty alleviation was found to be the most common top priority in water resources development.

Information received was extensive with regard to the legal and institutional framework, which can be considered an indicator of the important progress made in those areas. SPM results indicated that planning information was the most important aspect in coordination at the line ministries, while water resources information was considered to be most essential at the provincial/ basin levels.

SPM also provided some guidelines with respect to the needs of cooperation and technical assistance among the eight priority areas identified in the National Economic Development Plan.

The overall SPM in the WRCC experience suggested that the process of integrating water resources management into economic and social development plans be viewed on two levels: the overall level in connection with national economic and social development, and the sectoral level for integrated water resources management. At the overall level, five elements were identified: water planning coordination, policy and registration development, data and information management, training, and public awareness for integrated water resources management. At the sectoral level, the process was seen as comprising the two main elements of development and management, supported by their major programmes, with final integration into a national water resources action programme.

G. STRATEGIC PLANNING AND MANAGEMENT OF WATER RESOURCES IN MALAYSIA: LANGAT RIVER BASIN CASE STUDY

Md. Nasir Md. Noh*

Introduction

Malaysian Government through the Economic Planning Unit (EPU), Department of Irrigation and Drainage (DID), and Malaysian Water Partnership (MyWP) initiatives has conducted a two days workshop on Strategic Planning and Management for the Langat River Basin from 21st to 22nd July 2003. Altogether, over 70 senior experts from various national agencies, local authorities and NGOs related to the Langat River basin attended the workshop including the Executive Committee of MyWP and Mr. Ti Le-Huu, Economic Affairs Officer of the Water Resources Section of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP).

The Langat River basin was chosen as the prime/case study for this project since this basin exhibits interesting conflicts among the stakeholders. Among these are (i) one of the most studied river basin in Malaysia, (ii) shared between Federal Territory, State of Selangor and State of Negeri Sembilan, (iii) serve as the core natural river within premier development activities like Putrajaya, Cyberjaya, Kuala Lumpur International Airport (KLIA), Nilai, Ulu Langat and Puchong industrial estates, commercial and housing estates, and at least 4 higher learning institutions, and (iv) there are sensitive environmental issues/landmarks such as incinerator at Broga, water supply dam and intake points as well as North and South Langat peat swamps.

I. Background of the Langat River basin

The Langat River basin is a unique basin since it passes through 3 distinct administrative regions of (i) Federal Territory of Putrajaya and Cyberjaya, (ii) State of Selangor, and (iii) State of Negeri Sembilan. The entire basin is slightly less than 2,400 sq. km. with its uppermost stretch originates from the Titiwangsa main range of the State of Selangor and Negeri Sembilan. The total length of this river has been recorded at 200 km and ends its journey into the Strait of Malacca. In this process it flows through the nation heart of Putrajaya and Cyberjaya. Putrajaya holds the new Central Government Administrative Complex while the Cyberjaya locates the major international IT industries. Map G.1 shows the Langat River basin base map. For the benefit of the entire study, this basin has also been divided into 10 strategic zones that reflect on the degree of economic and social interests.

II. Objective of the workshop

The workshop was meant to identify the various issues underpinning the water resources sectors within the Langat River basin. Five main issues that have been elaborated and discussed, which include:

- Land use;
- Biodiversity and water quality;
- Domestic, industrial and agricultural water supply;
- Floods; and
- Support and capacity-building.

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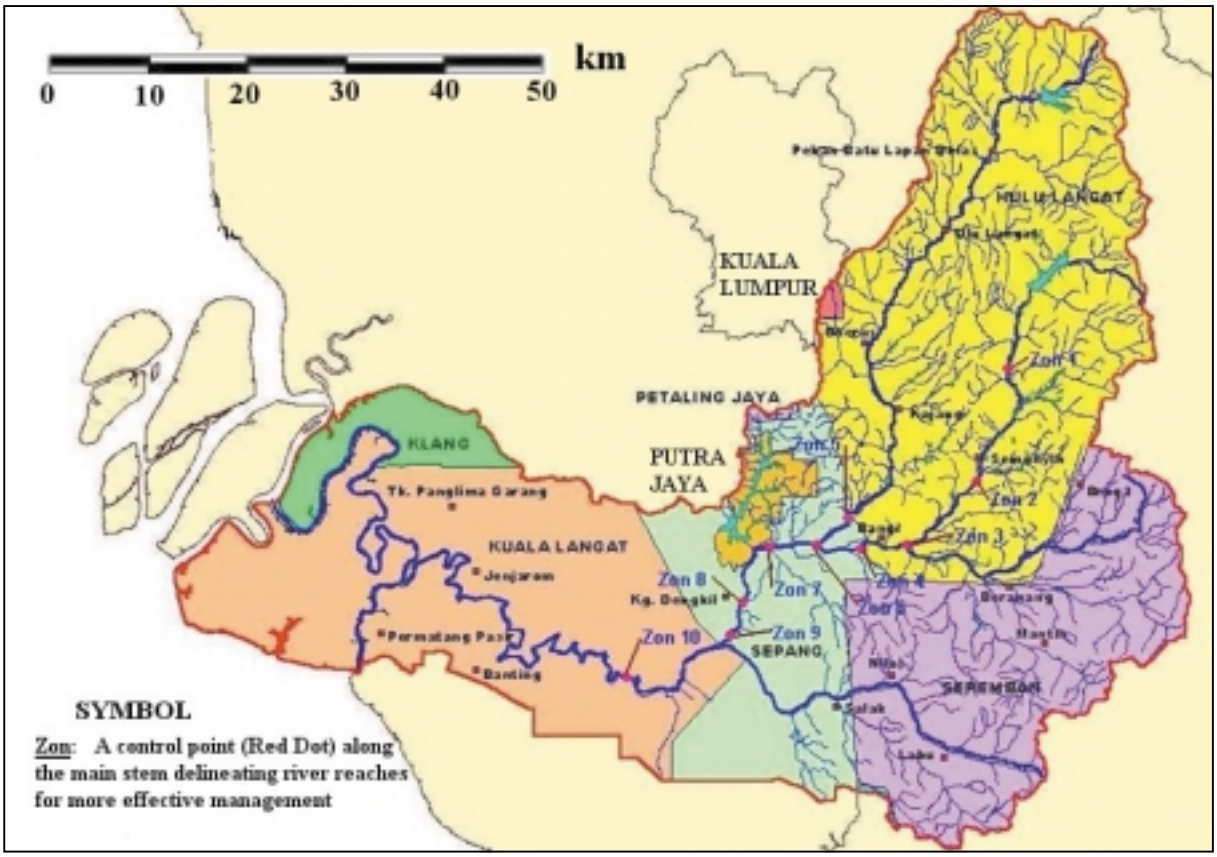

Map G.1. Langat River basin base map, Malaysia

The second objective is to lay out the plan of actions in such a way that the problems are comprehended by the various stakeholders while at the same time enable control measures to be strategically imposed according to short and long terms approaches. The third objective is to identify the key factors and forces that will ensure the specified action plans are implemental and sustainable within the context of the Langat River basin especially and in Malaysia generally. The final objective is to synthesize the action plans based on the Integrated River Basin Management (IRBM) plan for the five main issues. This technique speculates on:

- Determination of lead agency;
- Expected outputs; and
- Priority short-term plans.

Finally, all the objectives were gathered and recommendations arisen were strengthened and polished further into acceptable plan of actions within the context of IRBM plan that could be utilized by the three respective administrative regions within the Langat River basin.

III. Outcome of the workshop

1. Issues identification

Figure G.1 indicates the main issues that have been discussed by the groups and the issues arisen from the discussion process. Each main issue has been contemplated further with several sub issues. Only three (3) sub issues have been prioritized for each main issue. Further analysis shows that some of the sub issues are inter related with several main issues like 'Lack of Political Will', which connects to the 'Inadequate Support and Capacity Building' as well as 'Pressure

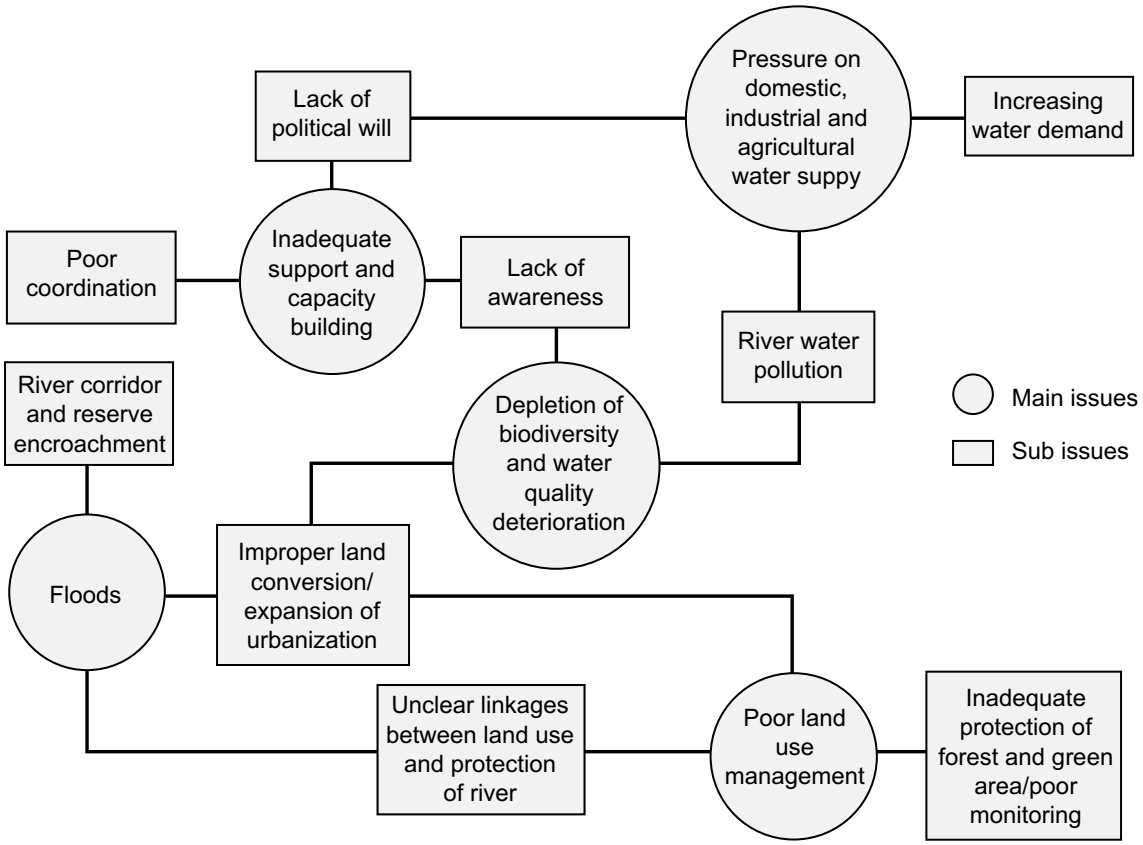

Figure G.1. Issues and correlations

on Domestic, Industrial and Agricultural Water Supply'. Other sub issues that fall under these categories are 'Lack of awareness', 'River Water Pollution', and 'Improper Land Conversion/ Expansion on Urbanization'.

The analysis also indicates that sub issue of 'Improper Land Conversion/Expansion on Urbanization' is related to three main issues that are 'Poor Land Use Management', 'Floods' and 'Depletion of Biodiversity and Water Quality Deterioration'. This is a clear indication why integrated approach is the favourable step towards holistic planning and management of the entire river basin i.e. IRBM.

2. The Plan of actions

Figure G.2 lists down all the action plans for the five main issues. Only two action plans are related to several main issues that are 'Strengthen Enforcement' and 'Educate and Establish Public Awareness Programme'. The former is related to three main issues, which are 'Poor Land Use Management', 'Floods', and 'Depletion of Biodiversity and Water Quality Deterioration' while the latter are ''Poor Land Use Management' and 'Floods'.

The rest of the action plans stand by their own, which speculate that fragmented planning and management are required to be implemented in order to tackle each respective main issue. These indications are the unlikely approach towards holistic measures. To apprehend the outcome towards holistic strategic planning and management approach, the groups are given the benefit to reevaluate and conclude the plan of actions by focusing on Integrated River Basin Management (IRBM) for the Langat River basin.

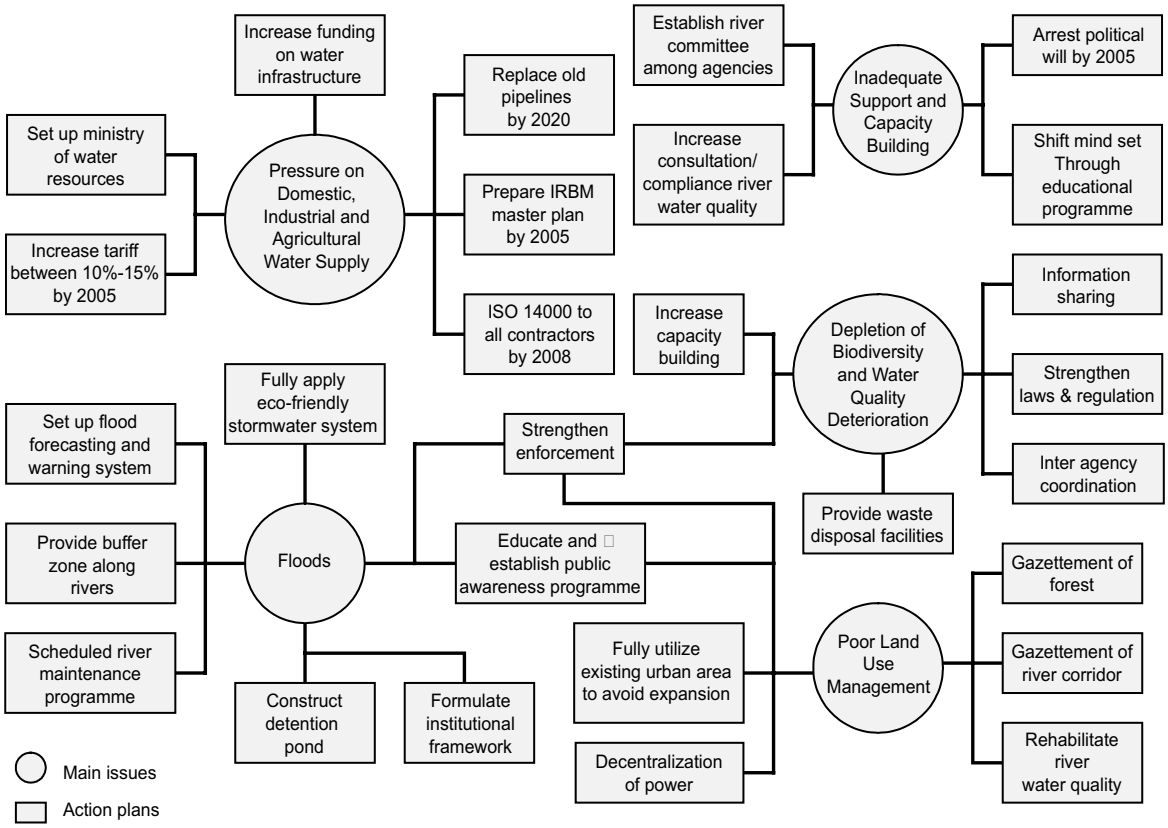

Figure G.2. Plan of actions

IV. Integrated river basin management (IRBM)

The groups are required to conduct brain storming sessions and further discuss on three major points that include (i) determine the Lead Agency, (ii) expected outcomes, and (iii) priority short term plans. Finally, all groups were required to summarize their findings in the conclusions and recommendations.

1. Lead agencies

The 'Land Use' group specified that a river authority should be established namely the 'Langat River Authority'. The chairman shall be rotated among the Federal (Putrajaya) and respective States (Selangor and Negeri Sembilan) representatives. Similar enactments like in Selangor should be set up in Putrajaya and Negeri Sembilan. The group of 'Biodiversity and Water Quality' suggested that a 'National River Basin Authority' should be set up. These should cater not only the Langat River basin area but also the whole country. The Department of Irrigation and Drainage (DID) should be the interim caretaker as well as the IRBM secretariat.

The third group of 'Domestic, Industrial and Agricultural Water Supply' proposed the 'Ministry of Water Resources' as the leader supported by Federal and State Water Agencies.

The group of 'Floods' specified the lead agency comprises DID and Local Authority. Other agencies involved as members are Department of Environment (DOE), Department of Town and Country Planning (JPBD), Land Office, Department of Mineral and Geosciences (JMG), Department of Agriculture (DOA), State Water Agencies (LUAS, PUAS etc.), Ministry of Health, Forestry Department, Public Work Department (PWD), Malaysian Highway Authority (MHA), NGOs, General Public Representatives.

The final group of 'Support and Capacity Building' listed DID, DOE, State Water Agencies, Sewerage Services Department (SSD), JPBD, Negeri Sembilan Executive Council (Exco), Department of Local Government, Perbadanan Putrajaya and NGOs. The committer should be chaired by Selangor State Government while DID as the secretariat. The Selangor State Government was chosen to chair since most of the Langat River basin is located within Selangor. Table G.1 summarises the proposals from each group.

Table G.1. Lead agencies

Group Name	Lead Agency	Agency in Committee	Comments
Land Use	Langat River Authority	–	Insist power rotation between Federal and State Government
Biodiversity and Water Quality	National River Basin Authority	State Water Authority (LUAS, PUAS etc.)	DID as interim caretaker as well as IRBM secretariat
Domestic, Industrial and Agricultural Water Supply	Ministry of Water Resources	State Water Authorities and Federal Agencies (DID, DOE etc.)	–
Floods	DID and Local Authorities	DOE, JPBD, Land Office, JMG, DOA, LUAS, PUAS, Ministry of Health, Forestry Dept., PWD, MHA, NGO and public	–
Support and Capacity Building	Selangor State Government	DOE, LUAS, SSD, JPBD, Negeri Sembilan Exco, Dept. Local Government, Perbadanan Putrajaya and NGO	DID as secretariat

2. Expected outcomes

Figure G.3 depicts the expected outcomes for each group. Interesting results have been collated in these processes whereby the numbers of action plans that are inter-connected with the main issues increase quite substantially. In this respect the numbers increase from two to six (3 folds). This is a positive indication that integration between the action plans is implemental.

The analysis also indicates that action plans for 'Support and Capacity Building Group' need more integrated approach due to the fact that these action plans are also belong to 'Land Use Group', 'Floods Group', and 'Biodiversity and Water Quality Group'. These action plans are 'Expediting gazettement of river reserve', 'Create awareness through public participation', and 'Coordinated collaboration and performance'.

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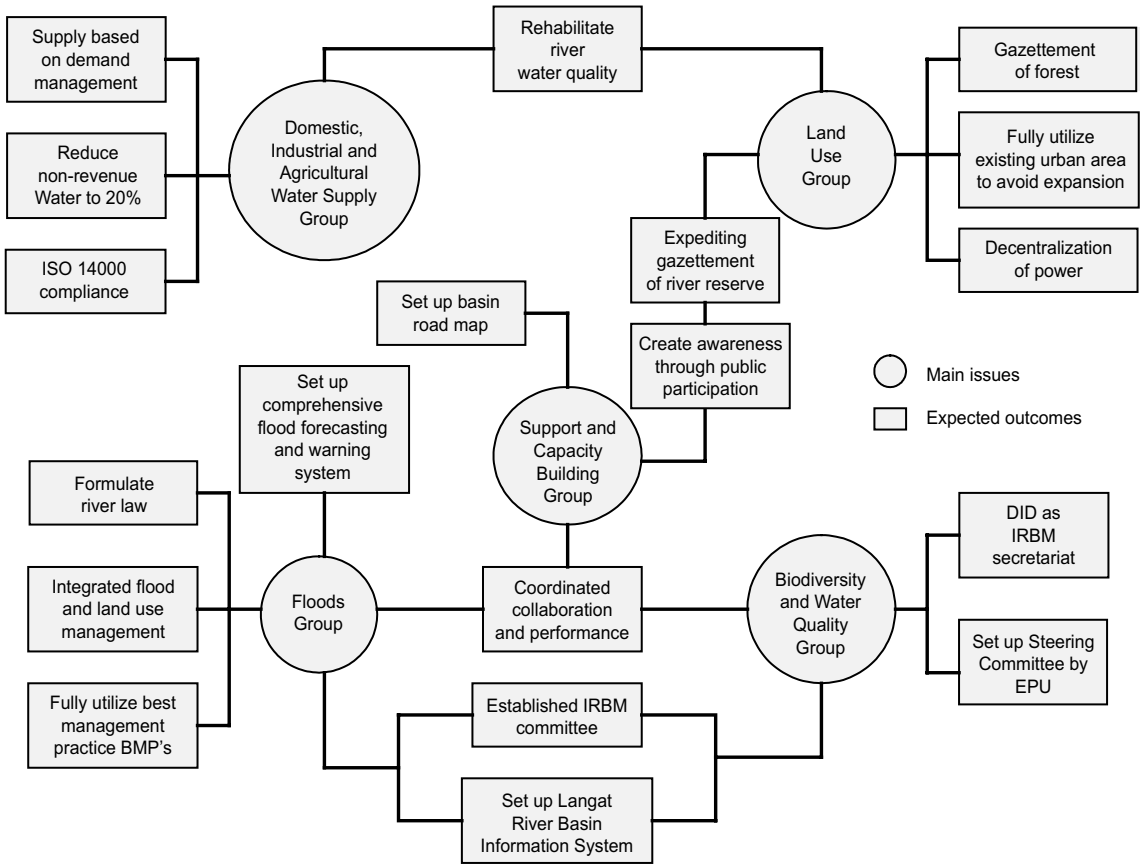

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Figure G.5 shows the final outcome of the strategic planning and management of water resources development of the Langat River basin. None of the recommendations merge with each other denoting these issues have been converged into several essentials action plans. These plans are meant for both the short and long terms measures.

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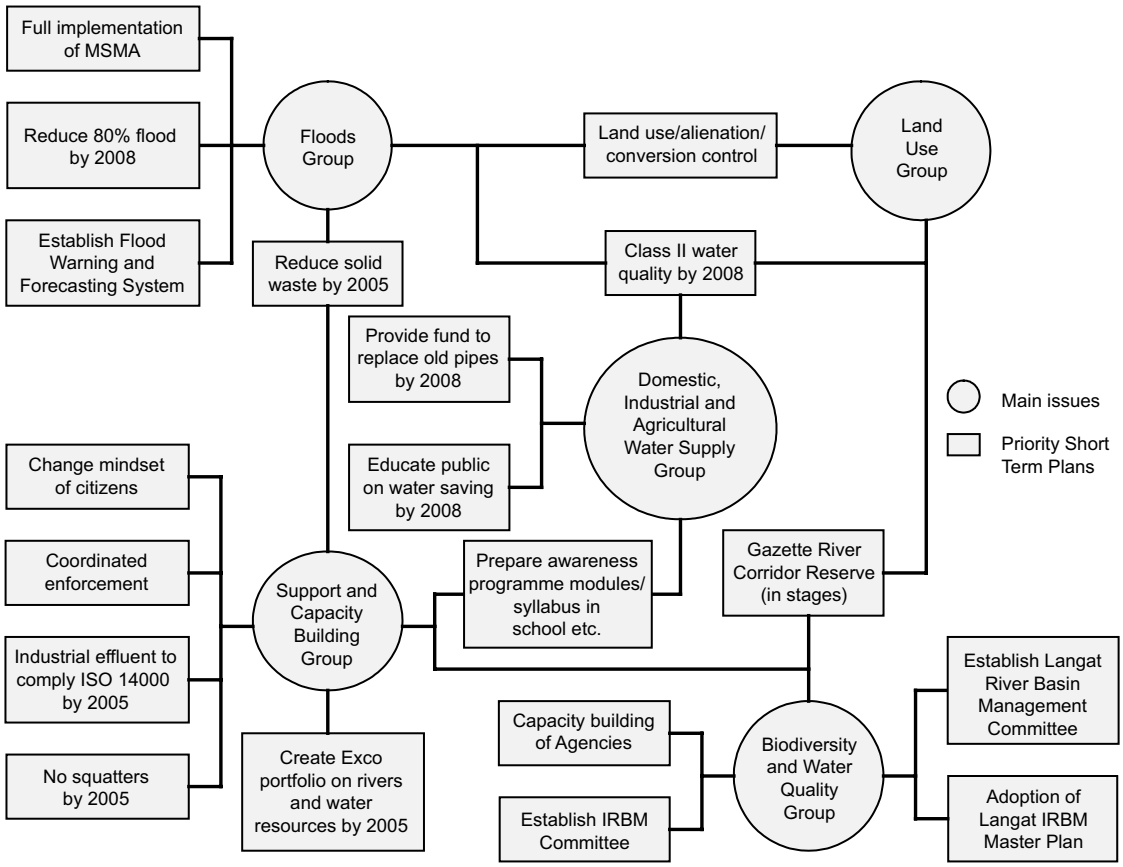

Figure G.4. Priority short term plans

- Lay generic and specific action plans for each issue;
- Pave way the cross sectoral solutions;
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In short, the Malaysian Government has implemented some of the recommendations listed by the Workshop using the SPM approach such as:

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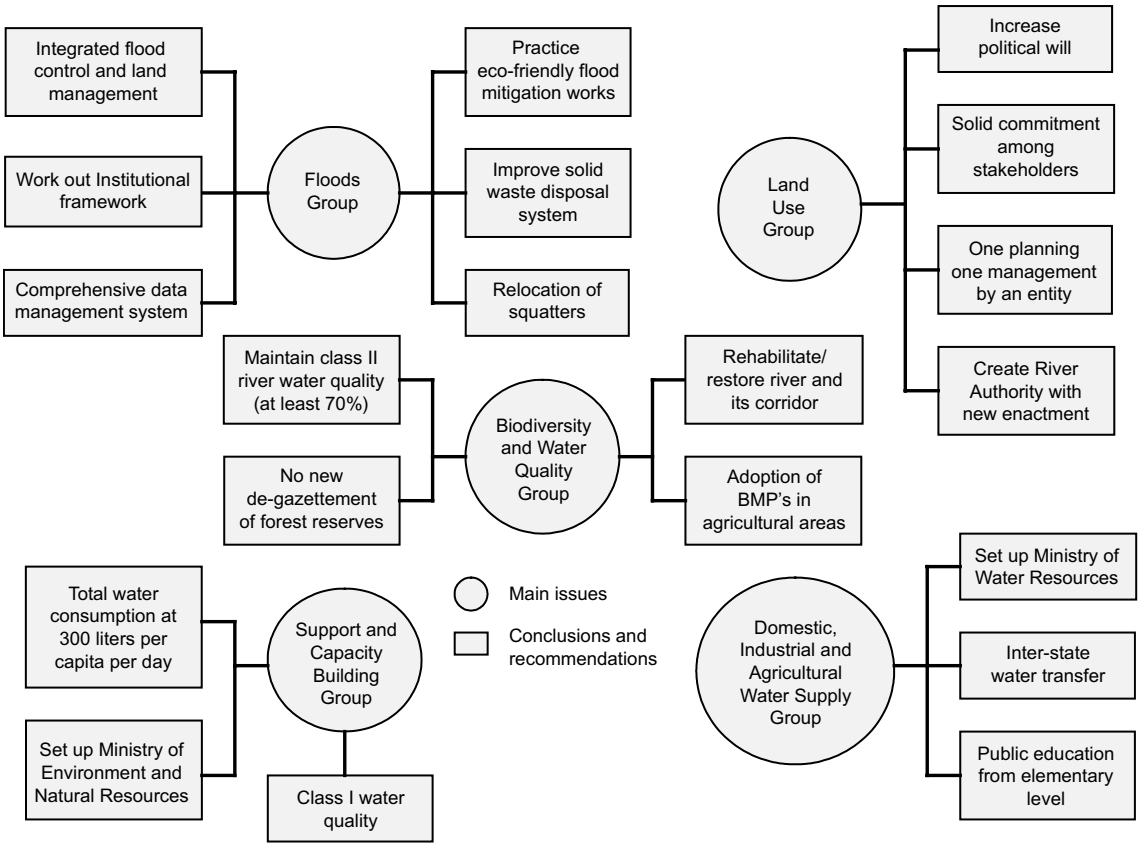
- Squatters free by 2005;
- Love Our Rivers Campaign (ongoing);
- Study on Integrated River Basin Management (IRBM);
- River rehabilitation and restoration programmes;
- Establish National Rivers Blueprint and etc.



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Among the challenges discovered by employing the SPM approach are:

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- The willingness to be transparent during discussion
- Needs strong and dependable vehicle to bring up the recommendations

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Practical plans that could adduce the sustainability of SPM approach are:

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- Follow up by experts on periodical/monthly basis
- Establish networking among the partners

VIII. Concluding remarks

The workshop was able to bring up important issues and propose solutions generated from five identified main issues through implemental action plans. The workshop was conducted by dividing the participants into ten groups denoting two groups per issue. The initial process was to diverge the issues through brainstorming sessions by using various facilitations techniques. Most of the groups utilized card techniques to extract ideas. For choosing the appropriate solutions, action plans and recommendations, most groups used matrix technique.

The concept of Strategic Planning and Management (SPM) introduced in this workshop has enabled the water resources stakeholders within Langat River basin to convene and discuss on the basic issues, solutions and action plans that are vital for the formulation of Integrated River Basin Management Plan (IRBM) in Malaysia. Some of the inputs and outcomes that have been put through in this workshop last year have been applied and harnessed by the Government recently and further improvement on the overall concept of IRBM is moving progressively. With these positive steps, the utilization of SPM technique in Malaysia is heading towards the right track and could be utilized also for the same purpose on other strategic management issues in the country.

G. STRATEGIC PLANNING AND MANAGEMENT OF WATER RESOURCES IN MALAYSIA: LANGAT RIVER BASIN CASE STUDY

Md. Nasir Md. Noh*

Introduction

Malaysian Government through the Economic Planning Unit (EPU), Department of Irrigation and Drainage (DID), and Malaysian Water Partnership (MyWP) initiatives has conducted a two days workshop on Strategic Planning and Management for the Langat River Basin from 21st to 22nd July 2003. Altogether, over 70 senior experts from various national agencies, local authorities and NGOs related to the Langat River basin attended the workshop including the Executive Committee of MyWP and Mr. Ti Le-Huu, Economic Affairs Officer of the Water Resources Section of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP).

The Langat River basin was chosen as the prime/case study for this project since this basin exhibits interesting conflicts among the stakeholders. Among these are (i) one of the most studied river basin in Malaysia, (ii) shared between Federal Territory, State of Selangor and State of Negeri Sembilan, (iii) serve as the core natural river within premier development activities like Putrajaya, Cyberjaya, Kuala Lumpur International Airport (KLIA), Nilai, Ulu Langat and Puchong industrial estates, commercial and housing estates, and at least 4 higher learning institutions, and (iv) there are sensitive environmental issues/landmarks such as incinerator at Broga, water supply dam and intake points as well as North and South Langat peat swamps.

I. Background of the Langat River basin

The Langat River basin is a unique basin since it passes through 3 distinct administrative regions of (i) Federal Territory of Putrajaya and Cyberjaya, (ii) State of Selangor, and (iii) State of Negeri Sembilan. The entire basin is slightly less than 2,400 sq. km. with its uppermost stretch originates from the Titiwangsa main range of the State of Selangor and Negeri Sembilan. The total length of this river has been recorded at 200 km and ends its journey into the Strait of Malacca. In this process it flows through the nation heart of Putrajaya and Cyberjaya. Putrajaya holds the new Central Government Administrative Complex while the Cyberjaya locates the major international IT industries. Map G.1 shows the Langat River basin base map. For the benefit of the entire study, this basin has also been divided into 10 strategic zones that reflect on the degree of economic and social interests.

II. Objective of the workshop

The workshop was meant to identify the various issues underpinning the water resources sectors within the Langat River basin. Five main issues that have been elaborated and discussed, which include:

- Land use;
- Biodiversity and water quality;
- Domestic, industrial and agricultural water supply;
- Floods; and
- Support and capacity-building.

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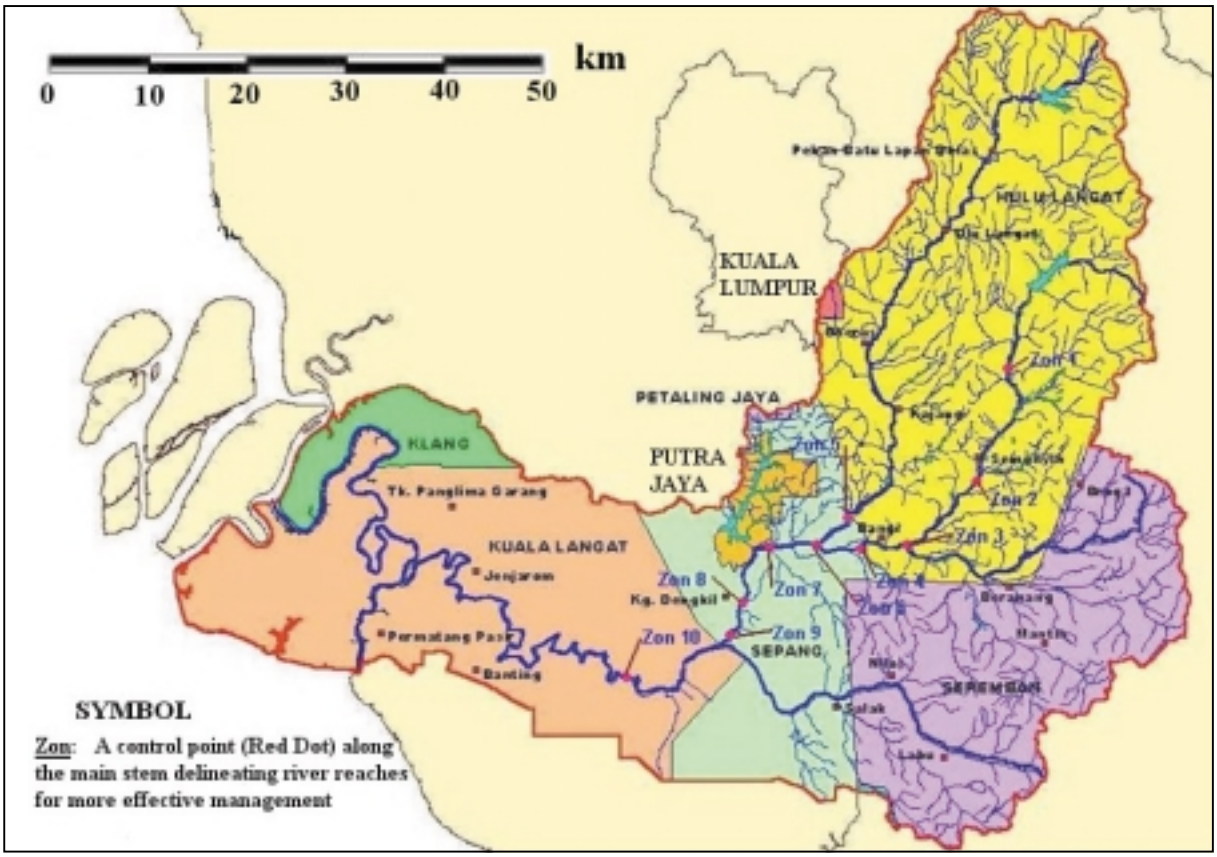

Map G.1. Langat River basin base map, Malaysia

The second objective is to lay out the plan of actions in such a way that the problems are comprehended by the various stakeholders while at the same time enable control measures to be strategically imposed according to short and long terms approaches. The third objective is to identify the key factors and forces that will ensure the specified action plans are implemental and sustainable within the context of the Langat River basin especially and in Malaysia generally. The final objective is to synthesize the action plans based on the Integrated River Basin Management (IRBM) plan for the five main issues. This technique speculates on:

- Determination of lead agency;
- Expected outputs; and
- Priority short-term plans.

Finally, all the objectives were gathered and recommendations arisen were strengthened and polished further into acceptable plan of actions within the context of IRBM plan that could be utilized by the three respective administrative regions within the Langat River basin.

III. Outcome of the workshop

1. Issues identification

Figure G.1 indicates the main issues that have been discussed by the groups and the issues arisen from the discussion process. Each main issue has been contemplated further with several sub issues. Only three (3) sub issues have been prioritized for each main issue. Further analysis shows that some of the sub issues are inter related with several main issues like 'Lack of Political Will', which connects to the 'Inadequate Support and Capacity Building' as well as 'Pressure

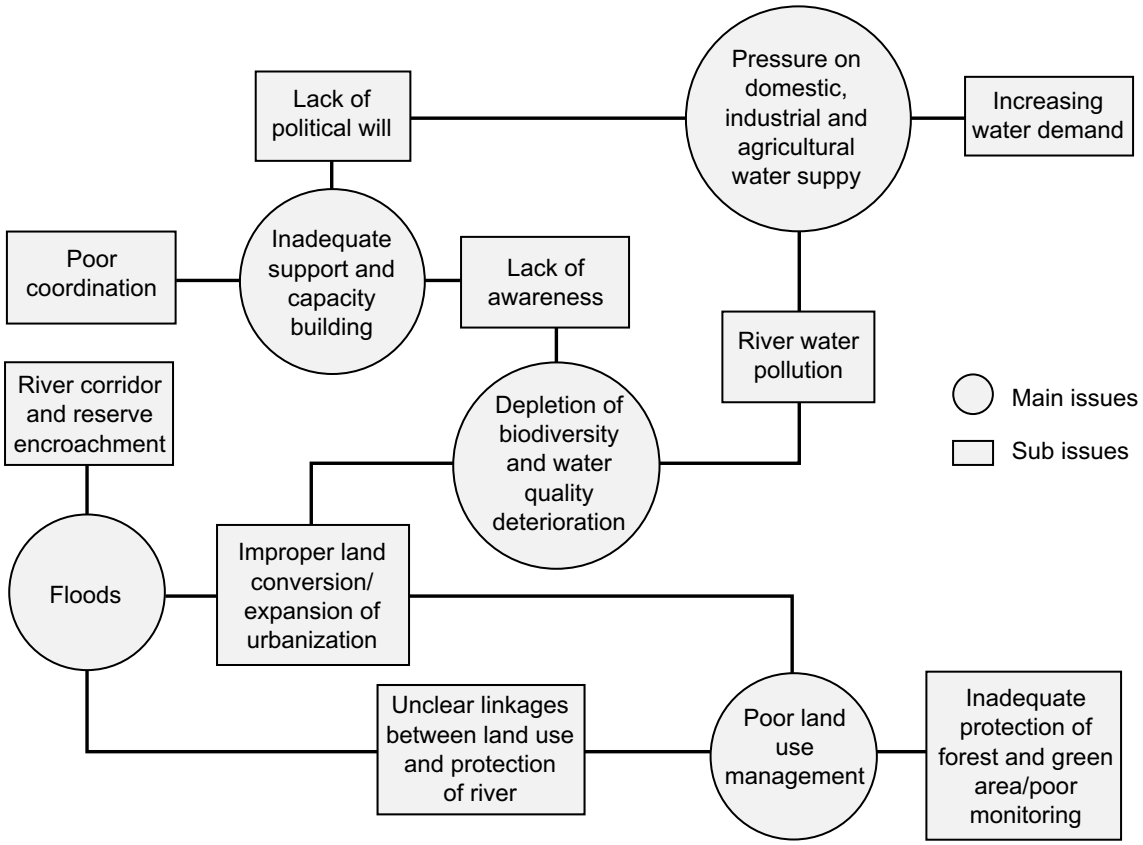

Figure G.1. Issues and correlations

on Domestic, Industrial and Agricultural Water Supply'. Other sub issues that fall under these categories are 'Lack of awareness', 'River Water Pollution', and 'Improper Land Conversion/ Expansion on Urbanization'.

The analysis also indicates that sub issue of 'Improper Land Conversion/Expansion on Urbanization' is related to three main issues that are 'Poor Land Use Management', 'Floods' and 'Depletion of Biodiversity and Water Quality Deterioration'. This is a clear indication why integrated approach is the favourable step towards holistic planning and management of the entire river basin i.e. IRBM.

2. The Plan of actions

Figure G.2 lists down all the action plans for the five main issues. Only two action plans are related to several main issues that are 'Strengthen Enforcement' and 'Educate and Establish Public Awareness Programme'. The former is related to three main issues, which are 'Poor Land Use Management', 'Floods', and 'Depletion of Biodiversity and Water Quality Deterioration' while the latter are ''Poor Land Use Management' and 'Floods'.

The rest of the action plans stand by their own, which speculate that fragmented planning and management are required to be implemented in order to tackle each respective main issue. These indications are the unlikely approach towards holistic measures. To apprehend the outcome towards holistic strategic planning and management approach, the groups are given the benefit to reevaluate and conclude the plan of actions by focusing on Integrated River Basin Management (IRBM) for the Langat River basin.

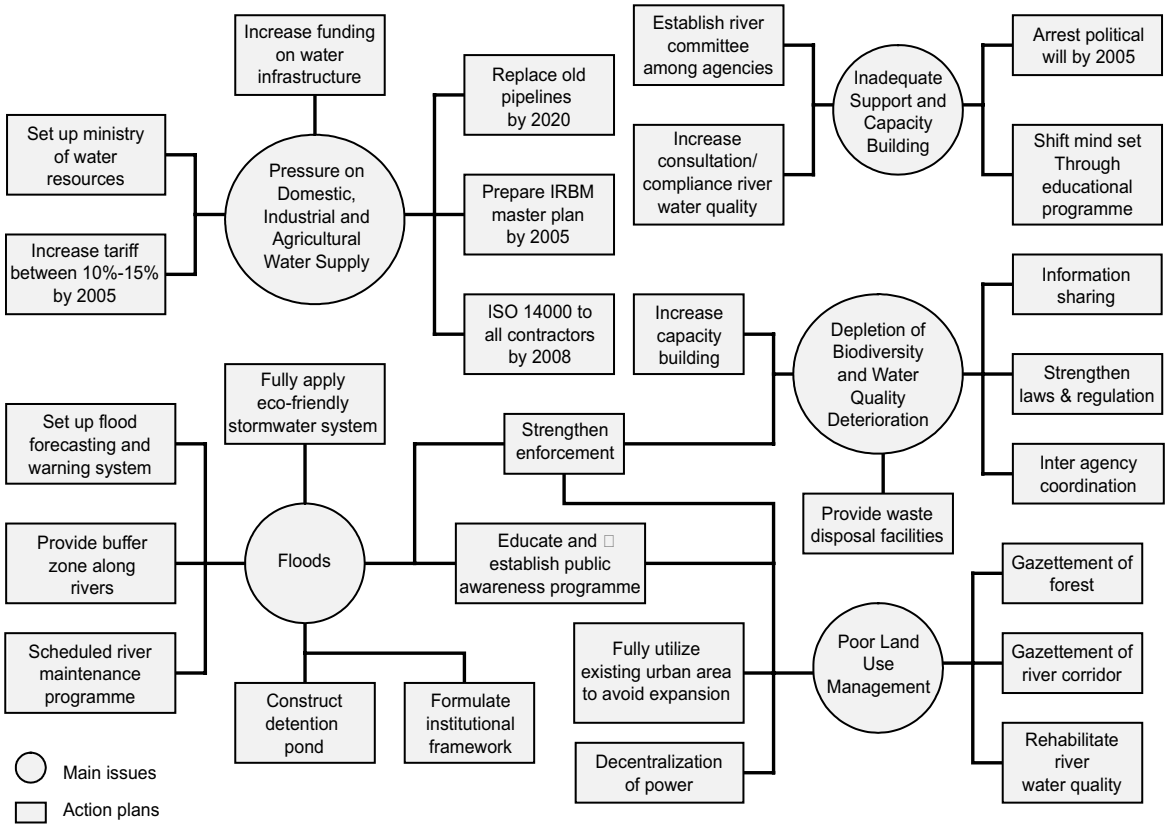

Figure G.2. Plan of actions

IV. Integrated river basin management (IRBM)

The groups are required to conduct brain storming sessions and further discuss on three major points that include (i) determine the Lead Agency, (ii) expected outcomes, and (iii) priority short term plans. Finally, all groups were required to summarize their findings in the conclusions and recommendations.

1. Lead agencies

The 'Land Use' group specified that a river authority should be established namely the 'Langat River Authority'. The chairman shall be rotated among the Federal (Putrajaya) and respective States (Selangor and Negeri Sembilan) representatives. Similar enactments like in Selangor should be set up in Putrajaya and Negeri Sembilan. The group of 'Biodiversity and Water Quality' suggested that a 'National River Basin Authority' should be set up. These should cater not only the Langat River basin area but also the whole country. The Department of Irrigation and Drainage (DID) should be the interim caretaker as well as the IRBM secretariat.

The third group of 'Domestic, Industrial and Agricultural Water Supply' proposed the 'Ministry of Water Resources' as the leader supported by Federal and State Water Agencies.

The group of 'Floods' specified the lead agency comprises DID and Local Authority. Other agencies involved as members are Department of Environment (DOE), Department of Town and Country Planning (JPBD), Land Office, Department of Mineral and Geosciences (JMG), Department of Agriculture (DOA), State Water Agencies (LUAS, PUAS etc.), Ministry of Health, Forestry Department, Public Work Department (PWD), Malaysian Highway Authority (MHA), NGOs, General Public Representatives.

The final group of 'Support and Capacity Building' listed DID, DOE, State Water Agencies, Sewerage Services Department (SSD), JPBD, Negeri Sembilan Executive Council (Exco), Department of Local Government, Perbadanan Putrajaya and NGOs. The committer should be chaired by Selangor State Government while DID as the secretariat. The Selangor State Government was chosen to chair since most of the Langat River basin is located within Selangor. Table G.1 summarises the proposals from each group.

Table G.1. Lead agencies

Group Name	Lead Agency	Agency in Committee	Comments
Land Use	Langat River Authority	–	Insist power rotation between Federal and State Government
Biodiversity and Water Quality	National River Basin Authority	State Water Authority (LUAS, PUAS etc.)	DID as interim caretaker as well as IRBM secretariat
Domestic, Industrial and Agricultural Water Supply	Ministry of Water Resources	State Water Authorities and Federal Agencies (DID, DOE etc.)	–
Floods	DID and Local Authorities	DOE, JPBD, Land Office, JMG, DOA, LUAS, PUAS, Ministry of Health, Forestry Dept., PWD, MHA, NGO and public	–
Support and Capacity Building	Selangor State Government	DOE, LUAS, SSD, JPBD, Negeri Sembilan Exco, Dept. Local Government, Perbadanan Putrajaya and NGO	DID as secretariat

2. Expected outcomes

Figure G.3 depicts the expected outcomes for each group. Interesting results have been collated in these processes whereby the numbers of action plans that are inter-connected with the main issues increase quite substantially. In this respect the numbers increase from two to six (3 folds). This is a positive indication that integration between the action plans is implemental.

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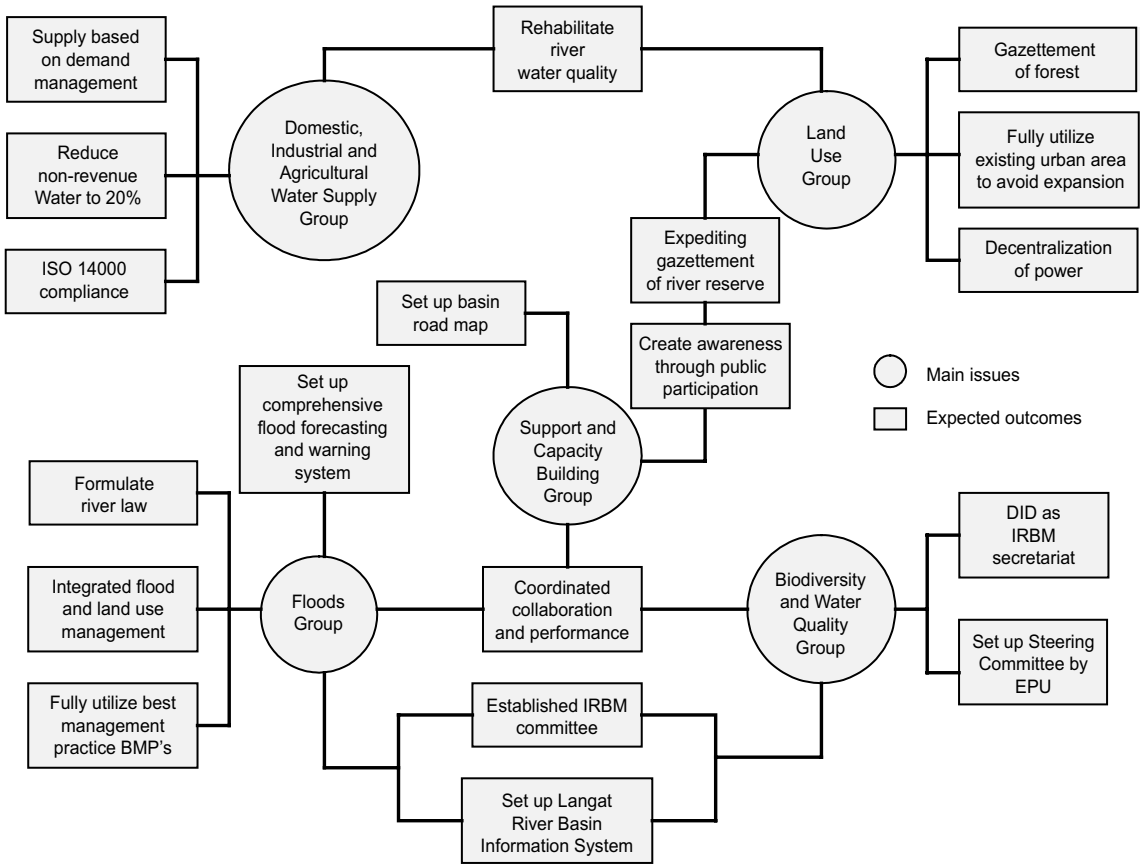

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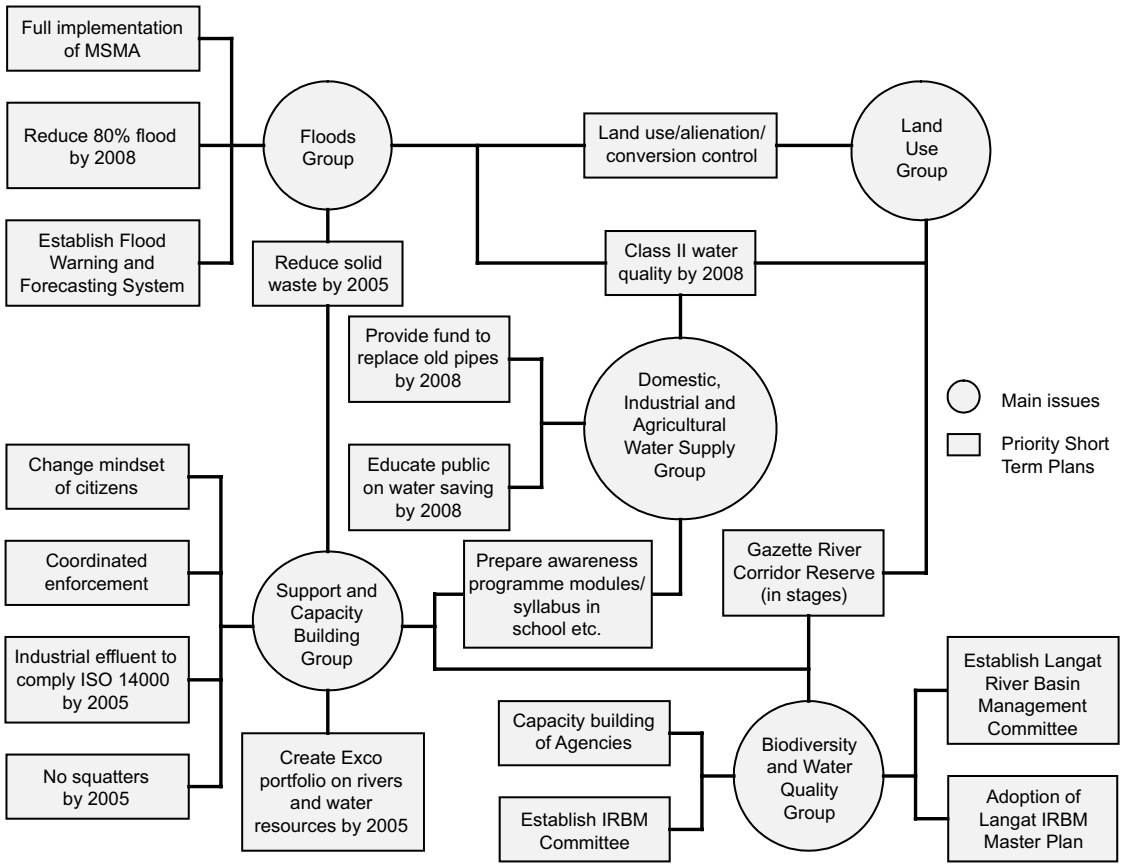

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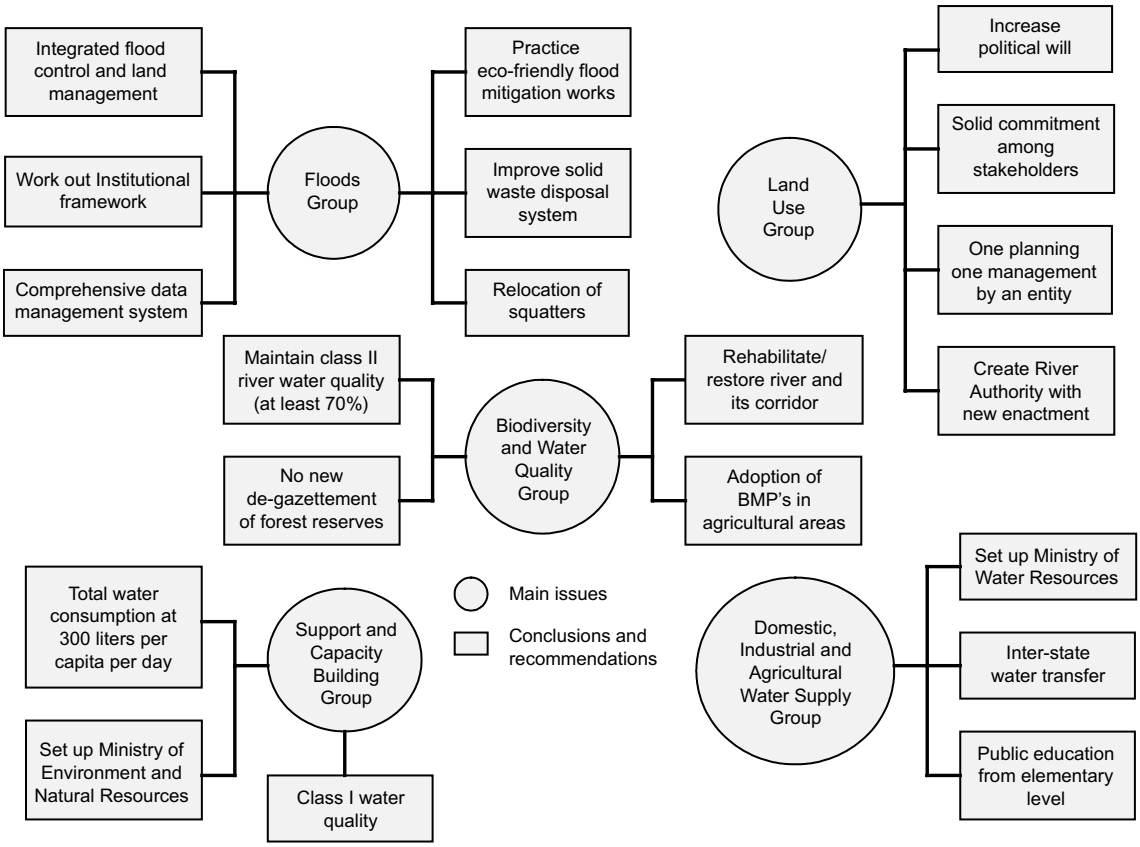

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H. STRATEGIC PLAN ON INTEGRATED WATER RESOURCES MANAGEMENT IN MYANMAR

By
The Inter-Ministry Task Force on Water Resources
Ministry of Agriculture and Irrigation

Introduction

Since water has a direct or indirect relationship with poverty, governance, environment, climate, power, agriculture, floods, food, education and culture etc., society cannot sustain life without managing water wisely and solving water problems. Therefore the Government of Myanmar has formulated plans for developing, modernizing, industrializing and promoting the quality of life for all; to do this, it has laid down four economic objectives for developing the country. One of four economic objectives is "development of agriculture as the base and all-round development of other sectors of the economy as well". The Government has also set the following guidelines on the development of rural areas where the majority of the nation's population lives:

(a) Ensuring good transport in rural areas;
(b) Ensuring adequate supplies of safe drinking water;
(c) Raising the educational standard of the rural areas;
(d) Improving health standards in the rural areas; and
(e) The development of agriculture and livestock farming.

These objectives clearly require support from the water sector, which comprises various agencies related to the use of water for hydropower, irrigation, water supply, fisheries and wastewater treatment. To achieve the development objectives, coordination among such agencies as well as the allocation of specific responsibilities for managing the water resources are essential factors.

1. National water sector context

The water basin characteristics in Myanmar are quite variable due to the differences in physiographic features. The principal watercourses flowing separately in Myanmar comprise four major rivers, the Ayeyarwady, Sittoung, Thanlwin, Bago, plus their major tributaries such as the Chindwin, Myittha, Mu, Zawgyi, Panlaung, Samon, Myitnge, Mone, Man, Salin, Yaw and Mindon. All rivers, with the exception of the Thanlwin within Myanmar territory and can be considered nationally owned water assets. Their drainage area is spread widely over the country, amounting to some 876.73 million acre/feet (1,082 km^3) of water volume per annum from a drainage area of about 284,800 mi^2. The monthly distribution of river flow closely follows the pattern of rainfall, i.e., about 80 per cent during the monsoon season (May – October) and 20 per cent in the dry season (November – April). The estimated groundwater potential in Myanmar is around 495 km^3 in eight principal river basins in Myanmar.

There are about 200 gauging stations under irrigation department for water level recording and discharge measurement. Some 70 hydrological stations have been installed along the Ayeyarwady, Chindwin, Myitnge, Sittoung, Thanlwin, Bago and Kalandan rivers since 1965 by Department of Meteorology and Hydrology. The department has about 30 discharge stations and 20 sediment discharge stations on main rivers and big tributaries as well as about 15 water quality stations on rivers of Ayeyarwady delta area for measuring discharge and sediment flows and monitoring salt intrusion. These measurement data are valuable for national planning related to water management and, in August 2003, the Myanmar National Committee for the International

Hydrology Programme for cooperation with the United Nations Education, Scientific and Cultural Organization (UNESCO) was established for strengthening these activities.

The Ministry of Forestry is responsible for the rehabilitation and conservation of forests and watersheds and for maintaining the stability of the environment, in order to develop the social and economic conditions of the nation, especially in rural areas.

The National Commission for Environmental Affairs (NCEA) was formed in February 1990 to deal with all environmental matters. In March 2004, the Environmental Conservation Committee was set up with the aim of carrying out environmental conservation activities in the country effectively and systematically.

2. Scope of the study

The main objective of strategic plan management is to enhance the application of integrated water resources management in the country. In this connection, the components of integrated water and resources management to be studied when formulating a strategic plan are:

(a) Principles of water resources development and management
(b) Operation and management
(c) Water allocation among competing uses and users
(d) Water productivity at the farm, system and basin levels
(e) Financial resources for water source development and management
(f) Conjunctive use of surface water and groundwater
(g) Interactions between irrigation, human health and environment
(h) Public involvement
(i) Capacity-building and human resources development

Experience and effects should be considered when formulating the development and management strategic plan. It is also important to take into account the issues related to the cultural and adverse effects on the environment.

3. Water resources utilization and challenges

Myanmar is an agricultural country with an abundance of water resources. The agricultural sector is the most basic economic of the State as well as the main source of livelihood in rural areas, since the rural population represents some 70 per cent of the nation's population. The development programmes for the agricultural, livestock breeding and fisheries sectors are included.

At present, the State has been systematically disseminating advanced techniques and support for the development of the nation's economy. Irrigation facilities have been increased since 1988 to reach 163 in August 2004. Dams are now irrigating more than 1 million ha of farmland. In addition to the dams, river water pumping stations, underground water tapping stations and small dams have been built throughout the nation. A total of 265 river pumping projects are irrigating about 150,000 ha of cultivated land. In addition, 7,478 tube wells have been provided to irrigate 36,000 ha of farmland.

Tributaries originating in the western hill region and southern part of the country constitute some 10 per cent of the catchment areas and surface runoff. The hydropower potential of these tributaries is considerable. According to studies by the United Nations and other sources, the hydropower potential of Myanmar is estimated to be as much as 40,000 MW. By 2002, 35 hydropower stations (including 15 medium-scale projects) had been completed with a total

estimated generated power of 390 MW, which is almost 1 per cent of potential generated power in Myanmar. The development of the electrical power sector thus can provide a significant contribution to the socio-economic growth of the country. Therefore, electric power projects are being implemented wherever possible to fulfill the electricity needs of Myanmar.

The Development Affairs Committee under the supervision of the Department of Development Affairs has implemented 15,715 projects to supply drinking water to 10,602 villages, using funds form the Government, the Department of Development Affairs and donors at home and abroad. The projects have been implemented with participation by international and non-governmental organizations.

The water sector faces several problems including unusual rainfall patterns in some years, flooding and drought in some of the main agricultural areas of country, the impact of shifting cultivation, illegal logging in water resources areas as well as management conflicts of interest and a lack of coordination within the agencies. The most important challenges include:

(a) Strengthening the legal framework to ensure effective and harmonious integration of water resources management, development and protection activities into the socio-economic development process of the country;

(b) Enhancement and consolidation of the existing systems;

(c) The operation, maintenance and rehabilitation of facilities safely, reliably and efficiently; and

(d) Prioritizing capacity-building needs in order to enhance organizational capacity and effectiveness of the water resources coordination system.

I. Summary of the goals linked to socio-economic development targets

1. Overall socio-economic development context of the country

Agriculture (including crop production, livestock, fisheries and forestry) is the most important sector in the country's economy because:

(a) It is the main source of livelihood for about 70 per cent of the population, who live in the rural areas;

(b) It accounts for about 64 per cent of the labour force;

(c) It contributes about 41 per cent of export earnings; and

(d) It contributes about 42 per cent of the gross domestic product (GDP).

Due to the importance of the agricultural sector, the Government has accorded high priority to its development, and numerous irrigation facilities have been implemented during the present decade for irrigation and water supply to monsoon and summer paddy crops. Total irrigated area increased from 1.1 million ha in 1980-1981 to some 2 million ha in 2000-2001.

Apart from the agricultural sector, the hydropower subsector is also the most important in terms of economic development and investment. Dry-season irrigation, especially from river pumping projects, has been successfully increased; as a result, power demand is also increasing annually. The Government is making every effort to be able to catch up with development in other countries around the world. The power generation sector plays a very important role in those efforts and it will contribute considerably to socio-economic growth. Therefore, electric power generation projects are being implemented wherever possible in order to meet the demand for electricity supplies.

The Government is implementing plans for the national grid and additional power supply projects. There are 11 major projects being implemented for the power grid and a further 19 projects

are planned. Three regional projects are being implemented, with an additional 10 planned for implementation. Myanmar is one of the richest water resources countries in the Association of South East Asian Nations. In view of its current level of water utilization, Myanmar can therefore sell electricity and drinking water if there is a consensus for Global Water Partnership on a regional basis (GWP-SEA).

2. Opportunities and threats in water resources development

Myanmar is rich in water resources. The total utilization of the nation's water resources is only about 5 per cent or 45 million acre-feet (56 km^3). It is clear that the physical potential for further development of water resources in Myanmar is substantial. Myanmar has now reached a major turning point in the use of water resources for all-round development of the country. Providing innovative and integrated solutions for sustainable management of water resources to meet national development needs has become a necessity. At the same time, the increasing water use will need careful management to prevent unwanted effects.

Sedimentation is one of the major adverse effects of storage dams and in the lower courses of rivers. Mining and deforestation along the upper reaches of river basins cause serious watershed erosion problems. Transported sediment is reducing the storage capacity of reservoirs and the bed level in the lower reaches of rivers is rising. Consequently, flooding occurs and navigation faces serious problems. Although some nutrients and some sediment are needed to support the aquatic environment, the Government is emphasizing the implementation of the terrace farming system to reduce shifting cultivation.

The development of industry and increasing population density will cause increasing river pollution and health risks for people living close to the rivers. Careful management of groundwater extraction is also required in order to avoid pollution.

Flooding is a major issue, with damage occurring both in urban and rural areas. On the other hand, flooding brings some benefits as it creates rich floodplains and replenishes soil moisture. Flood plain management could be considered as a way to reduce flood damage, with sensitive development being encouraged away from flood-prone areas.

The State has given higher priority to providing adequate support and assistance for further development of the fisheries industry in order to enhance food security while protecting the environment. Changes in land use, declining water quality, the construction of dams and other barriers to migration and high levels of capture are likely to be responsible for declining of fish populations. Therefore, increases in water bodies for aquaculture systems such as reservoirs, river courses, fishponds etc. should be temporarily stopped.

Vision statement

The vision statement of Myanmar is "sustainability of water resources to ensure sufficient water quantity of acceptable quality to meet the needs of the population in terms of health, food security, economy and environment."

II. Legal and institutional framework

1. Legal and institutional context of water resources management

The participants in the roundtable Workshop on the National Water Vision in Myanmar, held in Yangon under the framework of cooperation with UNESCAP and FAO in June 2003, proposed that the national water Vision Statement be adopted. They also recommended the establishment of a national level coordination body responsible for water-related activities and issues and improved

coordination between agencies. It was noted that most of the laws, regulations and legislation set out in the early 1900s needed to be reviewed and amended. All existing laws, legislation, rules and regulations should be reviewed with the objective of enacting a unified water resources law that would allow the adoption of a more effective legal framework for coordination and management of water resources.

Even though there is no single umbrella law covering all aspects of water resources, the laws of Myanmar deal with the subject in one way or another. Many issues in the law, particularly the roles and responsibilities of various agencies for specific activities such as water allocation need to be developed. There is an urgent need for the formulation of further legislation or decrees for proper management. The Central Law Organization (CLO) and the Attorney-General have the final responsibility for issuing decrees.

2. Current situation and perspectives of the legal and institutional framework

At present, there are a number of government water supply agencies with varying water pricing policies and little coordination (see annex 1). There is no apex body responsible for the overall management of national water resources in cooperation with the public and private sectors. Therefore, water conservation with appropriate management and planning practices is urgently required in view of the rapid socio-economic development of the country as well as for protection against water-related environmental degradation.

The participants in the roundtable workshop recommended the establishment of a high-level coordination body in accordance with the three priority objectives of (a) sustainable development, (b) a clearer water resources policy, and (c) the mobilization and effective utilization of resources.

A proposal for establishing a Myanmar Water Commission (MWC) had been submitted to the Ministry of Agriculture and Irrigation for official approval. The proposed MWC organization chart is shown in annex 2. According to the proposal, the commission will comprise a senior minister as chairman and the ministers from water-related ministries as members. It should also establish a working (coordination) committee comprising heads of the departments in the ministries concerned as members.

The suggested duties and responsibilities of MWC are:

(a) To lay down and prescribe the Policies and Guidelines concerning with water and water resources and required assessment;

(b) The preparation of water laws;

(c) The introduction of new laws, and the enforcement and amendment of existing laws;

(d) To act as coordinator for water users of both a consumptive and non-consumptive nature and to give necessary instructions to the different water sectors; and

(e) To take the necessary action where relevant.

The suggested duties and responsible of the working committee are:

(a) To deal with international organizations such as the United Nationals Development Programme, the Food and Agriculture Organization of the United Nations, the United Nations High Commissioner for Refugees, the International Commission on Irrigation and Drainage and GWP-SEA as well as regional and national organizations;

(b) Conduct coordination work between water sectors;

(c) The preparation of standardization works for water quality of each sector of water usage;

(d) To prepare and implement a National Water Vision;

(e) To monitor and make the necessary assessments, e.g., environmental impact assessment (EIA), for water usage;

(f) Recommendations for water and benefit sharing and resolving conflicts over transboundary water usage between neighbouring countries; and

(g) Decision-making and establishing the cause and effect of water use and development of water resources.

3. Brief analysis of strengths and weaknesses of the current legal and institutional framework

The freshwater resources in Myanmar are mainly used by the agriculture sector, with small quantities being used for domestic, industrial and other purposes. Although Myanmar has abundant water resources and no scarcity of water at present, proper management and a strong policy on sustainable and continuous development of the economy and the conservation of the environment are required for the security of future generations.

Present organizational arrangements at the national and provincial levels generally support the achievement of national policies, but the current institutional problems in the water sector are mainly related to (a) the lack of coordination and collaboration between agencies within the sector and with those of other sectors and (b) inadequate communication and coordination between the national agencies and authorities.

Despite the many Acts, laws and regulations related to the water sector, most require modification. Therefore, they should be reviewed with a view to enacting a unified water resources law in order to promote a more effective legal framework for coordination and management of water resources. Some Acts (such as the Burma Groundwater Act of 1930.) are weak as jurisdiction was greatly limited and no attempts have been made to amend them. In fact, some Acts are no longer applicable and suitable to the present and changing situation.

Others weaknesses in the water sector are limited manpower, scarce financial resources, and a lack of appropriate monitoring facilities, proper and systematic record keeping, and regular monitoring and surveillance of water quality. As for water quality control, basic standards of quality for drinking water were recommended in 1990, but have not yet been approved.

As for watershed management, the Forest Department is the main agency for undertaking management activities. Prior to 1935, watershed management was a part of forest management; currently, the Ministry of Forestry emphasizes conservation of watersheds and it has implemented projects in some watershed areas. It is also planned to extend the projects to other watershed areas. The new Forest Law was also drafted to be in line with the principles of the United Nations Framework Convention on Climate Change, since the previous Forest Law that was promulgated in 1902 did not deal with the principles. The current law is very important for water resources management as it protects water catchment ecosystems. NCEA established an Environment Conservation Committee in March 2004 in line with the Myanmar Agenda 21 requirement concerning more efficient freshwater resources management.

If MWC is established it could act as a national apex body and manage water allocation. The tasks of MWC would not only be coordination but also reviews of existing laws and the institutional framework, the various water users and the environment. However, MWC will need sufficient funds and a commitment from the top level of the Government.

Joint efforts of the Government and local communities will be the key to the success of water resources management programmes. Institutional strengthening, capacity-building and public awareness are essential elements of development work.

4. Mission and vision statements

The mission statement for the water sector is "to establish a beneficial framework and effective mechanism for managing, developing and protecting water and related resources in an environmentally and economically sound manner in order to meet the needs of the people of Myanmar." This statement, if adopted by the Government, will provide a guiding light towards establishing national strategies for both short- and long-term efforts by all agencies, people and stakeholders towards the common goals of national socio-economic development and environmental conservation.

III. Strategic plan goals

1. Overall goal

The overall goal is the alleviation of poverty and upgrading of living standards by means of sustainable development of the water and water resources and conservation of the environment. The overall goal incorporates the three following main mission goals:

1. Mission Goal 1 – Manage, develop and protect water and related resources to meet the needs of current and future generations.
2. Mission Goal 2 – Operate, maintain and rehabilitate facilities safely, reliably and efficiently to protect the public investment.
3. Mission Goal 3 – Enhance the organizational effectiveness of the water resources coordination system, and promote capacity-building.

2. Mission Goal 1 – Manage, develop and protect water and related resources to meet the needs of current and future generations

To achieve this mission goal, cooperative efforts are necessary in undertaking the work of managing, developing and protecting water and related resources in every sector related to water. The framework for such coordination should include:

(a) Facilitation and formulation of related laws and regulations

(b) The improvement of the water resources planning system for all-round development including the extension of irrigated land

(c) The improvement of efficiency in water use

(d) The improvement of technology used in water resources management

a. Facilitation and formulation of related laws and regulations

Current water resources policies and legislation of all water-related agencies concerned need to be reviewed and modified. Further policies and legislation should be developed for efficient water resources management and environmental protection. CLO is the main responsible agency for compiling and drafting new laws and presenting them to the Government for approval.

(1) Strategies for achieving the goal

To assist in this process, involvement of all related ministerial agencies and the key stakeholders will be required in order to establish an appropriate mechanism, such as a Working

Group for Policy and Legislation. The working group will be requested to prepare a brief plan for effective management, development and protection of water and water resources and, if possible, to present strategies to deal with the critical issues. For each significant issue, the plan should briefly address the following:

(a) The history of the issues;

(b) Current status of the issues;

(c) Recommended strategies, actions and options;

(d) Implication of the proposed actions and intended result; and

(e) External factors such as the social, policy, legal and other aspects affecting achievement of the strategy and progress in addressing each issue.

Based on inputs by key ministries, agencies and stakeholders, CLO in cooperation with the Policy and Legislation Working Group will analyse the issues and establish a framework for the development of new policies, legislation, regulations, guidelines etc., for consideration and approval by the Government. MWC should also become responsible for analysing the issues and their submission, if Government approves the establishment of MWC.

(2) External factors affecting goal achievement

The most important factors affecting the progress of work are (a) the willingness by all key agencies and stakeholders to participate, (b) the lack of expertise in the field, (c) public awareness and (d) availability of funding.

(3) Cross-cutting relationship

Regular consultations and the establishment of common targets with all related agencies will be necessary for evaluation.

(4) Performance evaluation and monitoring

It will be necessary to prioritize socio-economic development activities in priority areas of the country aimed at meeting poverty eradication goals. Specific target dates with appropriate indicators should be identified for the priority areas, particularly those areas facing water issues.

(5) Performance measures

The performance measures include:

(a) A comprehensive review report on priority issues in water resources policy and regulation, to be completed within three years;

(b) The formulation of a strategy to develop policies, legislation, regulations, guidelines and other legal instruments to be submitted to the Government for consideration and approval by 2010; and

(c) The establishment of a Working Group on Policy and Legislation Improvement that, after being approved, will become active by 2010.

b. Improvement of the water resources planning system

To coordinate the development of water resources planning, a detailed procedure plan approval and implementation procedure will be required. The plan should be based on the interests of the public and local requirements. Local authorities, the agencies concerned and local

communities should conduct detailed project planning in a coordinated manner. The plan will also include the responsibility for monitoring implementation of the plan.

(1) Strategies for achieving the goal

Available resources (including manpower, water resources and technology), allotment of funds, and local needs and interests for conducting plans must be considered. It will also be necessary to devise a number of strategies to respond to the priority needs of socio-economic development, particularly stable and sustainable economic growth as well as poverty eradication goals. The following four strategies are mainly adopted for planning purposes:

(a) A pilot river basin study. The Sittoung River basin has been selected for this purpose;

(b) An implementation plan for increasing irrigated farmland for food security;

(c) A plan for promoting the energy sector by implementing hydropower projects; and

(d) A plan for safe drinking water in dry zones and other areas.

(2) External factors affecting goal achievement

The most important factors affecting achievement of this goal are: (a) willingness of all key stakeholders to participate, (b) public awareness and participation, (c) commitment by the Government and key funding agencies, (d) know-how of local staff, (e) coordination between local authorities and the agencies concerned, and (f) sufficient staff for implementation.

(3) Cross-cutting relationships

Regular consultation and establishment of common targets with all related agencies will be necessary for evaluation.

(4) Performance evaluation and monitoring

Specific target dates with appropriate indicators should be identified for priority projects.

(5) Performance measures

The performance measures include:

(a) A report on the development of the Sittoung River basin water resources planning system including detailed procedures and roles of river basin committee and other key participants in the preparation of plans, including plan approval and implementation procedures, within five years;

(b) Increase in the area under irrigation. The ratio of irrigated area to net sown area shows a rising trend, having increased from 18.2 per cent in 2000-2001 to 18.8 per cent in 2001-2002. The long-term target plan for the increment of the irrigated area is up to 25 per cent by 2015;

(c) Promotion of the energy sector including (a) electricity demand and supply management, including types and sources of energy and expansion of transmission system, and (b) the development of hydropower potential. At present, 29 projects are under consideration, of which 19 projects are for the national grid and 10 are regional; and

(d) The implementation of 15,715 safe drinking water projects in 10,602 villages under a 10-year plan.

c. Improvement of water-use efficiency

Coordination among authorities, agencies and local people to support the planning and development of water resources projects efficiently in order to meet socio-economic development requirements.

(1) Strategies to achieve the goal

The strategies for achieving the goal include:

(a) Improving river basin watershed management

(b) Implementation of rehabilitation projects in existing irrigable areas for saving irrigation water

(c) Improving public participation and awareness

Watershed management projects on sustainable use of water resources have been carried out by the Forest Department in some major watershed areas. The projects included reforestation, establishment of community forests, and training for staff and local residents.

To save irrigation water, it is essential to carry out rehabilitation work on the existing irrigation system instead of implementing new projects. This includes the adjustment of cropping patterns, water supply scheduling, water pricing, and the initiation of sprinkler and drip irrigation systems. Programmes that promote irrigation efficiency directly affect the farmers through the reduction of energy use, labour and costs as well increases in production.

Public participation and the establishment of Water User's Associations (WUAs) will directly increase water-use efficiency. Conducting training and extension works could improve awareness and expertise among local communities with regard to saving water.

(2) External factors affecting goal achievement

The most important external factors include (a) willingness of the public to participate in demand management, (b) the lack of sufficient expertise in advanced technology and facilities, (c) limited numbers of staff in the agencies concerned, and (d) insufficient allotment of budgets and other necessary funds.

(3) Cross-cutting relationships

Regular consultation and establishment of common targets will be necessary for evaluation.

(4) Performance evaluation and monitoring

Specific projects should be selected according to priority so that their results can be directly linked to service improvement according to requirements.

(5) Performance measures

The Forest Department has already developed a 30-year Master Plan (2001/02 to 2030/31), aimed at undertaking forest conservation and restoration. By the end of the 30-year plan, the following work will have been completed:

(a) The formulation of land-use plans for all states and divisions of the country with three revisions;

(b) The establishment of 199,355 ha of watershed plantations;

(c) The completion of 450 gully control units, 182.88 km of terrace farming, 274.32 km of percolation and diversion ditches, and 914.4 km of contour bunds; and

(d) The establishment of 295,431 ha of community forest.

The Irrigation Department has to implement rehabilitation work for the North Nawin Dam Project, the Zawgyi Irrigation Scheme and the South Nawin Dam Project within five years. The department also has to conduct training courses on irrigation water management for staff and local farmer as well as prepare reports on training programmes for each year and proposals for the formation of WUAs in appropriate areas.

d. Improvement of technology used in water resources management

The application of science and technology to water resources management will facilitate decision-making, improve coordination and enhance water-use efficiency.

(1) Strategies to achieve the goals

The strategies include:

(a) Coordinating the development of detailed water resources data and management, including an assessment of current practices and issues as well as recommendations for more applicable technology;

(b) A review update, dissemination of existing data, and the preparation and maintenance of a database system and information system for project planning purposes;

(c) A review of the need for additional meteorological and hydrological data within the available budget to enhance the quantity and quality of data for calibration and future application; and

(d) Making recommendations for site locations, selection of equipment and supervision of the installation of new equipment.

(2) External factors affecting goal achievement

The most important external factors affecting the projects include (a) willingness of all key agencies to participate in the establishment of coordinated data systems, (b) the lack of a data communication system, (c) the lack of sufficient expertise in the use of advanced technology, and (d) insufficient budget for investment in advanced equipment.

(3) Cross-cutting relationships

Regular consultations and the establishment of common targets will be necessary for information management improvement.

(4) Performance evaluation and monitoring

It will be necessary to prioritize activities with target areas and dates so that their results can be applied by decision-makers in the implementation of policies and strategies in water resources management.

(5) Performance measures

The performance measures include:

(a) A comprehensive review of priority issues in water resources policy and regulations as well as existing practices in data information systems to be completed by the relevant agencies; and

(b) The introduction of a strategy for implementing database and management systems for water and water resources projects.

3. Mission Goal 2 – Operate, maintain and rehabilitate facilities safely, reliably and efficiently to protect the public investment

Mission Goal 2 focuses on operation, maintenance and rehabilitation, to ensure that existing facilities continue to provide project benefits. These facilities provide power and water supply delivery systems that serve agricultural, municipal in addition to power generation, recreation, fish and wildlife benefits, and flood control. Ensuring that facilities are safe, cost effective and reliable means that they can be operated efficiently and effectively in providing project benefits while protecting public health and sustaining the environment.

Operation, maintenance and rehabilitation

(1) Strategies for achieving the goal

While operating facilities to provide water, power, recreational use, flood control, and fish and wildlife benefits, it is necessary to maintain system reliability and promote water-use efficiency to ensure continuous and effective operating systems. To accomplish this goal, the following strategies are important:

(a) Establish a working group for each relevant water and water resources agency to review practices, and ensure that current operations and maintenance practices are efficient and effective; and

(b) Address the problem of ageing infrastructure, carry out research on infrastructure materials (e.g., geotextiles and soil hardening agents such as Mg-white for seepage control) in order to detect potential maintenance and safety constraints. Future research will focus on developing cost-effective repairs and maintenance procedures.

(2) External factors affecting goal achievement

Natural events such as flooding, drought, earthquakes and fire can have an adverse impact on facilities. Funding limitations may also restrict accomplishments. Changes in regulations and policy can have an impact on the ability to provide project benefits such as changing cropping patterns and decision-making on priorities for power components and irrigation components in multipurpose projects.

(3) Cross-cutting relationships

In accomplishing this goal, it will be necessary to coordinate effective operations as needed within related agencies.

(4) Programme evaluation and performance improvements

The establishment of indicators and the monitoring of incidents will be necessary for effective evaluations of performance improvements.

(5) Performance measures

The performance measures include:

(a) Reporting by the working group of each water-related agency on emerging issues in the operation and maintenance of existing facilities in the water sector by 2006; and

(b) Compiling reports from each water-related agency and proposing a strategy by 2007 to improve efficiency and effectiveness of existing facilities by a special committee, comprising members from water-related agencies.

4. Mission Goal 3 – Enhance organizational effectiveness of the water resources coordination system and promote capacity-building

Mission Goal 3 focuses on enhancing the organizational effectiveness of the water resources coordination system and on promoting capacity-building. To achieve this goal, a productive and effective organization is necessary. If MWC is established, it will become the apex body for controlling, managing and improving coordination and support of work for water and water resources in Myanmar. Before establishing MWC, all the water related agencies need to improve their services for the people and particularly top decision-makers in the water sector and the government. In March 2004, Ministry of Foreign Affairs formed an "Environmental Conservation Committee"; 10 task forces were established under this committee to consider river basin management works as well as other water-related issues and environmental conservation works.

(1) Strategies for achieving the goal

There are two main strategies for achieving this mission goal:

- Improvement of coordination among relevant agencies. This includes (a) reviewing the existing organization capacity, duties and responsibilities of water-related agencies, (b) establishing an efficient communications system for improving coordination and collaboration, and (c) taking follow-up action on approval for establishing the Myanmar Water Resource Commission.
- Preparation and implementation of a capacity-building plan, which will include (a) selection of staff for specific fields, (b) training, (c) an administrative system including financial, record keeping planning and budgeting, and (d) raising awareness of staff. External assistance can be expected in implementing training for transferring knowledge and advanced technology. In addition, university curricula for water resources management and engineering programmes should be strengthened.

(2) External factors affecting goal achievement

The most important factors affecting the progress of achievement are (a) a lack of funds, (2) limited external assistance in terms of expertise and technology transfer, (c) a shortage of staff for sharing training and administration work, and (d) a lack of facilities for a communications network.

(3) Cross-cutting relationships

A coordinated effort is required within the water-related agencies and with universities to strengthen the curricula for training and programmes.

(4) Programme evaluation and performance improvements

A programme evaluation of current and future capacity performance in existing organizations is required. This evaluation will make it possible to build upon current and future needs for skills and disciplines.

(5) Performance measures

The performance measures include a report on the review of existing organizational capacity, the preparation of a proposal in 2005 for new organizational capacity and the preparation of a capacity-building plan, including training programmes, after approval is given for MWC to be established.

IV. Implementation, monitoring and evaluation

1. Identification of indicators and benchmarks for performance measurements and expected time frame

Myanmar, in cooperation with FAO and ESCAP, launched a programme in 2003 to develop the "Myanmar Water Vision". The Myanmar Water Vision has since recommended that a high-level "Myanmar Water Resources Commission" be established. This recommendation is now in the process of being approved by the Ministry of Agriculture and Irrigation.

In March 2004, important progress in the improvement of water resources management was achieved, especially following the establishment of the "Environmental Conservation Committee". Under the guidance of this committee, 10 special task forces were set up, based on the country's main river systems, coastal areas and forest conservation regions. The most important achievements were related to better coordination of the water sector agencies and departments in water resources management, with increased interest and attention of the Government. To make the National Water Vision a reality, it will be necessary for implementation to be carried out in accordance with established strategic plan management.

Myanmar has to face and overcome the challenges of adequate investment, human resources development and financial support from international organizations. In this case, investment should be made after priority is given to a study of resources development for accomplishing integrated water and resources management. For this purpose, it is recommended that the Water Resources Commission play the key and principal role in the realization of a strategic plan on integrated water and resources management. Its fundamental activities would be (a) proper resource mobilization, (b) enhancing participation by all stakeholders and (c) the organization of funding for water resources development.

In order to monitor the implementation and coordination of activities, the following priority indicators need to be taken into consideration:

(a) Most of the storage dams are located on first and second order tributaries of main rivers, causing no hindrance to the flow in the main channels and dually minimizing environmental impact. The Ministry of Agriculture and Irrigation, in cooperation and in conjunction with the Ministry of Forestry, has been actively engaged in reforestation of watersheds with a view to preventing sedimentation in the reaches. It is recognized that the problems of forest area reduction and river sedimentation should be one of the priority indicators for monitoring to be able to maintain the current situation;

(b) So far, no problems have surfaced with respect to shared rivers with neighbouring countries. However, with the anticipated integrated water resources management in the future, it might be judicious to handle the accompanying legal environmental and economic aspects with verity and wisdom on a basis of bilateral or multilateral understanding. It was recommended that conflicts between nations be monitored to reduce the chance of conflict or violations of international laws;

(c) As part of sustainable water resources development, monitoring water quality and saline intrusion in delta and coastal areas is required. These are also the priority indicators for monitoring to ensure the condition and quality of the watershed; and

(d) Concerning resource mobilization, the capital outlay in the water resources sector is quite satisfactory for the time being and it is recommended that annual financial resources be increased to ensure effective support for the sustainable development. It is also recommended that resource mobilization should be doubled in five years.

2. Mechanisms for reporting, monitoring and evaluation

To ensure appropriate and efficient monitoring and reporting, it is advisable to use existing mechanisms in the following ways:

(a) The Department of Meteorology and Hydrology will be responsible for (i) monitoring and reporting water quality, (ii) developing indicators for watershed quality, (iii) surveying and collecting meteorological and hydrological data of the main river systems, and (iv) disseminating and sharing of water resources data with other water sector agencies;

(b) The Irrigation Department will be responsible for managing the exploitation, development and use of water and water resources in agriculture, reclamation and drainage. It will also be responsible for preventing and controlling flooding in protected areas, the collection of hydro-meteorological and water quality data on a project-oriented basis, and disseminating and sharing data with other water sector agencies;

(c) The Department of Hydroelectric Power will be responsible for the management, exploitation, development and use of water and water resources. It will also be responsible for collecting and disseminating hydrological data and hydrographical survey data together with generated firm power for past, present and future projects;

(d) The Department of Tourism will be responsible for the management, exploitation, development and use of water and water resources in the tourism sector;

(e) The Ministry of Industry 1 and 2 will be responsible for the management, exploitation, development and use of water and water resources in industry and mining as well as water quality from industrial waste;

(f) The Ministry of Health will be responsible for the management, exploitation, development and use of water for health care purposes;

(g) The Ministry of Progress of Border Areas, National Races and Development Affairs will be responsible for the rural water supply and domestic consumption. It will also be responsible for water supply in rural and urban areas, water quality and urban drainage;

(h) The Water Resources Utilization Department will be responsible for implementation, development and use of water pumping from rivers and groundwater to be used to irrigate farmland;

(i) The Directorate of Water Resources and Improvement of River Systems will be responsible for the implementation, management, development and use of water and water resources in transportation, the protection of river banks and river systems as well as the collection of hydrological data and hydrographical surveys for navigation;

(j) The Department of Forestry will be responsible for conservation management, development and use of forests in a sustainable manner. It will also be responsible for the reforestation programme and for monitoring deforestation and forest cover reduction in critical areas;

(k) NCEA will be responsible for cooperation between various line agencies in establishing rules and regulations pertaining to environmental management and for providing advice related to water and water resources. It will also be responsible for giving advice according to Myanmar Agenda 21 and for initiating EIA activities that may be necessary during the course of a project's life;

(l) The Environmental Conservation Committee will be responsible for coordinating with the ministries and for supporting and presenting proposals, with recommendations, put forward by the task forces to the Government;

(m) The Water Resources Commission will be responsible for coordinating the various line agencies in carrying out studies and formulating policies, drafting laws, strategies and action plans for the planning, management, use and protection of water and water resources. It will also be responsible for reporting the results of implementing activities related to water and water resources, including watershed quality indicators, to the Government;

(n) The National Planning Department will be a mechanism for monitoring financial resources allocation and utilization for the water sector. It will also be responsible for compiling resources allocation to the water sector and for providing advice or strategies to increase resource mobilization and utilization; and

(o) The Ministry of Foreign Affairs will be responsible for setting up and monitoring a programme for reducing the number of conflicts with neighbouring countries that are against international laws concerning utilization of water and water resources from transboundary rivers. It will also be responsible for keeping track of, and compiling information on, conflicts and violations and for preparing a report together with recommendations for improving/resolving such conflicts.

V. Consultation mechanisms and initial findings

The enhancement of public awareness and participation is crucial to the successful implementation of integrated water and resources management in Myanmar. Stakeholders, national entrepreneurs and non-governmental organizations need to make concerted efforts to participate in the development of the agricultural, livestock, power and forestry sectors. To promote organizational effectiveness, especially for local communities, development measures are being taken to ensure successful implementation of the five rural development tasks.

Myanmar has an abundant hydropower potential of about 40,000 MW, which is considerably more than the domestic requirement. Until now, only about 1 per cent of this potential has been exploited and developed. Therefore, the Government has decided to invest extensively in the renewable energy sector, particularly large hydropower schemes, to cover urgent domestic needs. The Ministry of Electric Power is enhancing the organization and functions of the Department of Hydroelectric Power in order to extend construction of the countrywide power grid as a long-term plan.

In the meantime, Government is encouraging the development of small or medium-sized hydropower schemes to be installed in completed storage dams under the Irrigation Department, to supply areas far from the current electricity grid as part of the rural development programme.

As a small-scale community development, localized hydropower schemes are being formulated at the border areas for domestic consumption of electricity. This is being done with assistance from non-governmental organizations and participation by the private sector, in order to promote the hydropower sector.

The Irrigation Department is carrying out a community development programme to promote private participation in the water resources sector. The programme includes community irrigation schemes such as the construction of small-scale village irrigation systems and village embankment works. These works are formulated under a capital budget allotment together with contributions from the local villages.

NCEA has already launched a programme on EIAs for medium and large-scale development projects with foreign technical assistance. Consultation workshops and seminars have been held with participation by various agencies and departments. Initiation of EIAs is essential to strengthening institutional and human resources for the protection of watersheds. Although

regulations or a decree on EIAs have yet to be enacted, NCEA has disseminated the fundamental regulations for public participation in all stages of a project including construction, operation and maintenance.

1. Consultation mechanisms in place and future developments

In Myanmar, several agencies, under their respective ministries, remain responsible for the supply and management of water for agriculture, industrial, domestic and sanitation purposes. In reviewing current conditions, many inconsistencies can be identified in the existing mechanisms for coordination of development among the various agencies involved. Different agencies have different Acts, proclamations and laws, but most of them need to be strengthened in order to overcome problems caused by the lack of regulations on water and water resources management and utilization.

The supporting role for a high-level Water Resources Commission is needed in the following priority functions: (a) the establishment of regulations for water resources management, (b) a study of a pilot river basin management project as laid down by the Myanmar Water Vision and (c) the harmonization of the relationship between water-related agencies.

The legal enactments concerning water resources development in Myanmar are found either in special laws related to one or more uses of water or in other Acts that contain a section that is related to specific aspects of water use.

2. Water and water-related laws under the Irrigation Department

According to existing legislation, the ultimate ownership of water resources is vested in the Union of Myanmar. The first Act reserving such a right of overall control was the Burma Canal Act, 1905, which regulated irrigation, navigation and drainage in Myanmar. This Act permitted water in all rivers and streams flowing in natural channels as well as lakes and other national still water bodies to be used and controlled for public purposes.

It was evident that the ratio of irrigated area to that of the net sown area is experiencing a rising trend. It increased from 18.2 per cent in 2000-2001 to 18.8 per cent in 2001-2002. The long-term target for the increment of irrigated area is up to 25 per cent by 2015. There are strong linkages between irrigation and poverty alleviation. The following considerations are aimed at reducing the magnitude of the impact of any irrigation intervention on poverty:

(a) Irrigation infrastructure improvement
(b) The development of irrigation water management and allocation
(c) The improvement of the quality of irrigation water
(d) The enhancement of irrigation technology
(e) The selection of appropriate cropping patterns

The water laws or other provisions thereof are contained in the following laws and their amendments:

(a) The Rangoon Water Works Act, 1885
(b) The Burma Municipal Act, 1898
(c) The Burma Canal Act, 1905 as amended by the Burma Act, 1914, 1924, 1928 and 1934
(d) The Burma Embankment Act, 1905 as amended by the Burma Act, 1923, and 1931
(e) The City of Rangoon Municipal Act, 1922

(f) The Underground Water Act, 1930

(g) The Burma Water Power Rules, 1932

At present, a separate and relevant national policy on water allocation does not exist in Myanmar. The main objective of water resources allocation is to make the best use of available resources for the well-being of the people. Water use in Myanmar, in decreasing order of priority, include the domestic, irrigation, hydropower, industry, fisheries and aquaculture sectors. Generally, there is no standing order of an Act or Rules prohibiting the exploitation of either surface or subsurface water. Some of the existing Acts or Rules are almost two-thirds of a century old and are no longer applicable or suitable to the present situation.

VI. Conclusions and recommendations

The most important achievement during 2005 has been the establishment of the Environmental Conservation Committee with the Ministry of Foreign Affairs acting as chairperson and 10 task forces operating under it. The duties and responsibilities of each task force include reporting to the chairperson with recommendations on river systems, coastal zones and forest conservation regions.

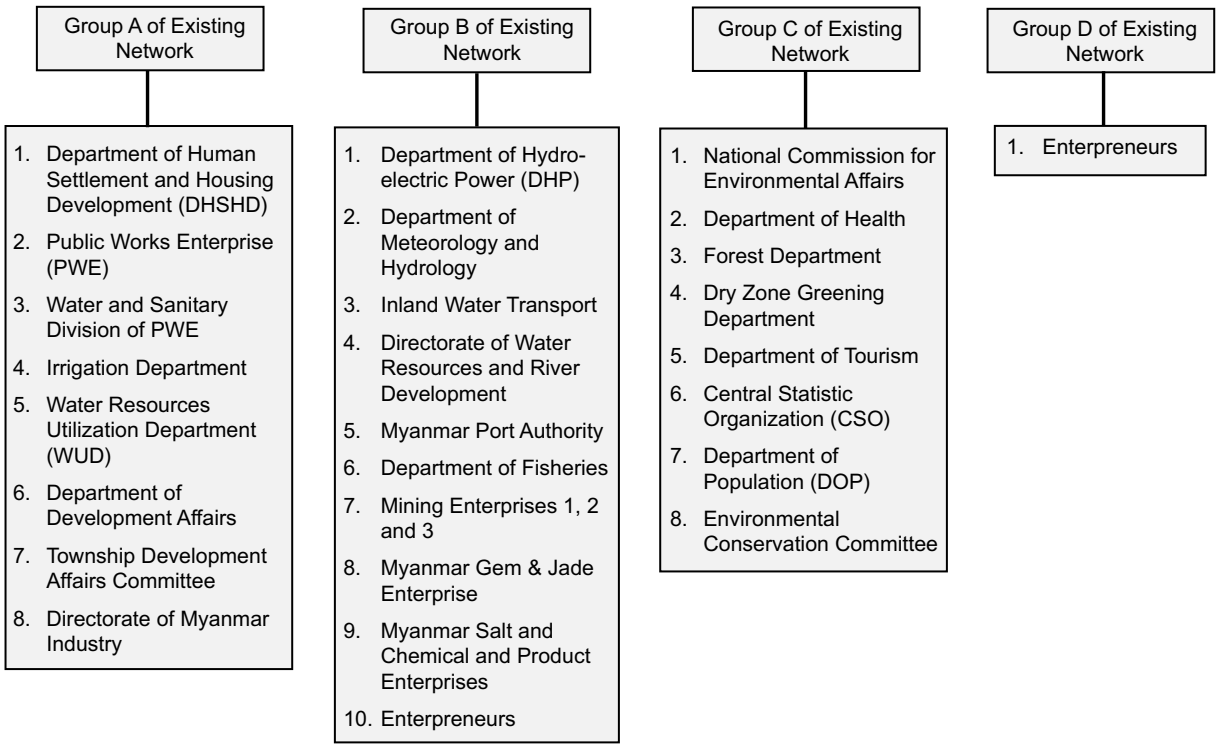
Another achievement during the past three years has been the effort by the Department of Development Affairs to sink tube wells for community development in rural areas, financed by public donations. The cost of sinking tube wells for drinking and domestic water supply amounts so far to K 691.94 million in 1,839 villages in dry zone areas and other parts of the country.

Each water-related department in the ministries has formulated a 30-year Master Plan for the development and management of water resources.

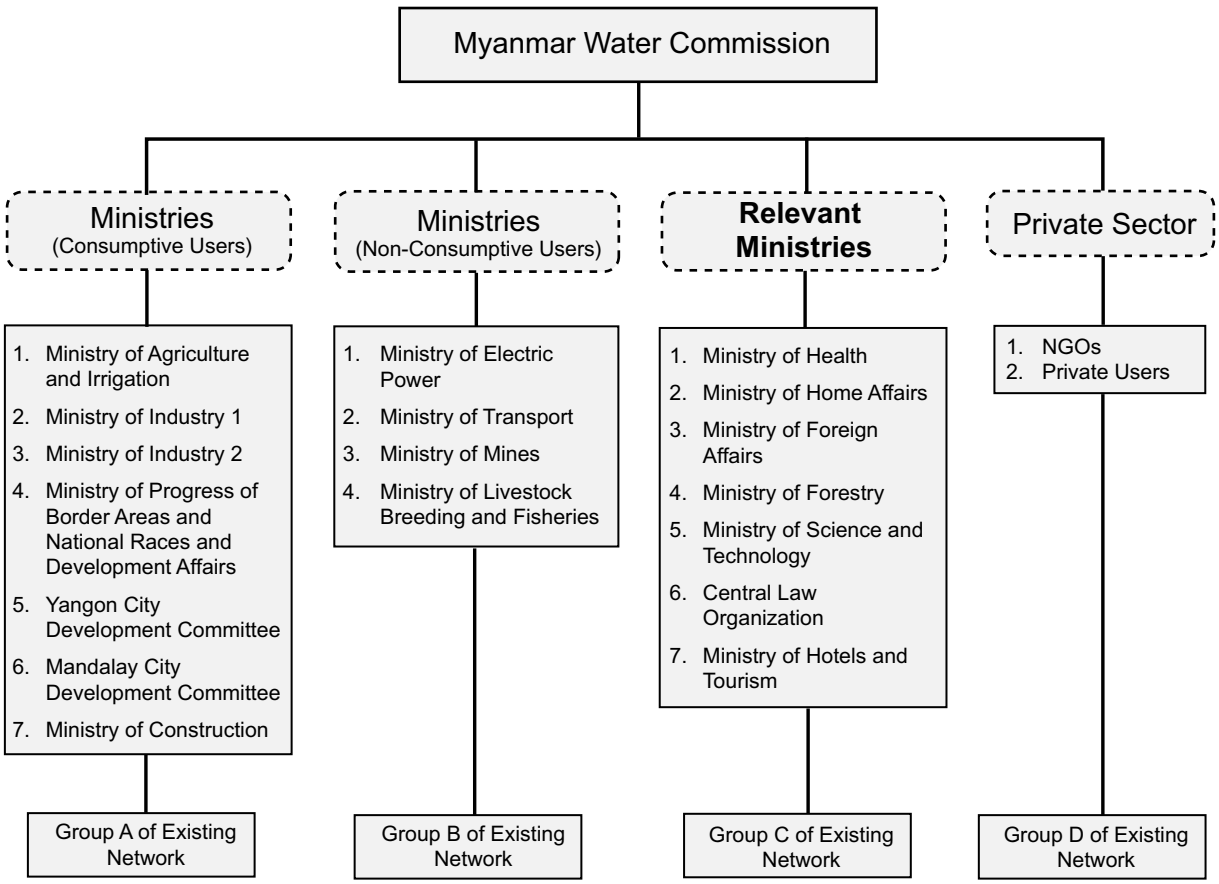
The Ministry of Agriculture and Irrigation has implemented several activities during this decade with regard to the improvement of irrigation facilities, efficient management and use of water, water pricing, the initiation of sprinkler and drip irrigation wherever feasible, and the introduction of appropriate cropping patterns.

The pressure of rapid population growth and attendant demands for more food will inevitably strain the country's water resources further. Therefore, it will be necessary to establish a high-level Water Commission as well as an effective national Water Policy covering water laws, disaster preparedness, efficient water use, ecosystem conservation, institutional strengthening and sectoral coordination of all relevant aspects.

Annex 1. Organizations of existing network



Annex 2. Organization chart of Myanmar Water Commission



I. STRATEGIC PLAN OF THE PAKISTAN COUNCIL OF RESEARCH IN WATER RESOURCES*

Introduction

The Islamic Republic of Pakistan, the second largest South Asian nation, has a total population of 146 million and a land mass of 79.61 million hectares (ha), of which 70 million ha is arid and semi-arid (including 11 million ha of deserts). The country has a great variety of landscapes ranging from the high mountain ranges of the Himalayas, Karakoram and Hindu Kush (HKH region) with interspersed valleys, and the vast rich irrigated Indus plain to the impressively rugged rocky plateaus of Pothwar, Punjab and South West Balochistan (map I.1).

The country has four distinct climate seasons. April, May and June are extremely hot and dry months. July, August and September are hot and humid with intensive heat and scattered rainfall. The cool and dry period starts at the beginning of October and continues through November. December, January and February are the coldest months of the year. Due to the diversity of the climate, a large variety of crops is grown to support the agricultural economy.

1. Water resources

Pakistan's water resources include rainfall, surface water and groundwater. Rainfall is low and irregular. Annual rainfall ranges from less than 100 mm in the south to about 1,500 mm in the north on the southern slopes of the Himalayas. It generally decreases from the Himalayas towards the south, with the lowest rainfall occurring in southern Punjab and upper Sindh. About 70 per cent of the annual rainfall occurs from July to September (the monsoon period). This causes the loss of most of the run-off to the sea without any economic benefit to the country.

The contribution of rain to crops in the irrigated areas (16 million ha) of the Indus basin has been estimated to be 9.24 billion m^3 or 7.55 million acre/feet. In non-irrigated areas (*barani* areas – 4 million ha) rainfall is utilized for rain-fed agriculture and meeting the drinking water needs of the population and livestock. The contribution of rain to crops in the *barani* areas has been estimated at 7.34 billion m^3 (6 million acre/feet).

The surface water resources depend on the Indus River and the five major tributaries, the Jhelum, Chenab, Ravi, Beas and Sutlej, on its eastern side. Since the Indus Basin Treaty between India and Pakistan in 1960, the availability of water to Pakistan has become limited to the three western rivers of Indus, Jhelum and Chenab, which provide about 173 billion m^3 of water annually.

Table I.1 shows annual flows measured at rim stations (upper most points on the rivers where they enter the plains) of the rivers for the Pre- and Post-Tarbela periods. The Indus River alone provides 65 per cent of the total river flow, while the share of the Jhelum and Chenab is 16 and 19 per cent, respectively. Rivers in Pakistan have individual flow characteristics but all of them generally start to rise in the spring and early summer, with the monsoon rains and snowmelt on the mountains causing a combined peak discharge in July and August. The river flows are at their minimum during winters, e.g., November to February, when the mean monthly flows are only about one tenth of those in summer. In addition to the three major rivers, there are numerous small rivers and streams that are only seasonal, with flow depending on rainfall and they carry practically no water during the winter months.

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Table I.1. Annual discharge of western rivers at rim stations

(**Unit: Billion m^3**)

River	Location	Pre-Tarbela (1922-1976)			Post-Tarbela (1976-2002)		
		Mean	Min.	Max.	Mean	Min.	Max.
Indus	Kalabagh	109.41 (89.39)	94.74 (63.19)	146.99 (120.09)	111.70 (91.26)	81.26 (66.39)	137.31 (112.18)
Jhelum	Mangla	27.75 (22.67)	16.59 (13.55)	40.07 (32.74)	28.49 (23.28)	14.55 (11.89)	39.17 (32.00)
Chenab	Marala	30.78 (25.15)	22.31 (18.23)	43.00 (35.13)	33.19 (27.12)	23.13 (18.90)	40.01 (32.69)
Total		167.9 (137.2)	–	–	173.4 (141.7)	–	–

Source: Indus River System Authority (IRSA) and Water and Power Development Authority Annual Reports.

Note: Numbers in parenthesis are values in million acre/feet.

Most of the groundwater resources exist in the almost 1,600 km-long Indus Plain, which extends from the Himalayan foothills to the Arabian Sea and covering an area of 21 million ha. The water is stored in extensive and deep alluvial deposits under unconfined conditions. This aquifer is fast becoming the supplemental source of water for irrigation. The aquifer has been built due to direct recharge from natural precipitation, river flow and continued seepage from the conveyance system of canals, distributaries, watercourses and application losses in the irrigated lands during the past 90 years. Outside the Indus Plain, the groundwater resources are also available in inter-mountain valleys of Balochistan and North West Frontier Province (NWFP). The national groundwater potential is 81.6 billion m^3 (table I.2).

Table I.2. Estimated groundwater resources

Province	Million acre/feet	Billion m^3
Punjab	43.2	52.8
Sindh	18.4	22.5
Balochistan	2.1	2.5
North West Frontier Province	3.1	3.8
Total	**66.8**	**81.6**

Source: National Water Policy, Vol. II, January 2002.

2. Main issues and challenges in the water sector

The water sector in Pakistan faces numerous issues, with the most prominent being:

(a) Shortages of water due to inadequate storage facility;

(b) Mismanagement of water distribution, operation and maintenance of the irrigation network;

(c) Low productivity per unit of water;

(d) Non-adoption of efficient conservation technologies;

(e) Low irrigation efficiency;

(f) Water quality deterioration (inefficient disposal and handling);

(g) Over-pumping and groundwater mining;

(h) Mixing of fresh and saline aquifers with saltwater up-coning;

(i) Lack of legislation on groundwater utilization;

(j) Waterlogging and salinity including disposal of saline drainage effluents;

(k) Pollution and degradation of wetlands;

(l) Sedimentation of storage reservoirs;

(m) Lack of research on ice and snow hydrology;

(n) Non-participation of beneficiaries in project identification, development and management;

(o) A lack of coordination among research and development agencies; and

(p) A lack of public awareness and education about water conservation.

3. Mandate of the Pakistan Council of Research in Water Resources

The mandate of the Pakistan Council of Research in Water Resources (PCRWR) is to undertake research and development activities with the following objectives:

(a) Organize, coordinate and promote research in various fields of water resources and set up national research establishments in these fields;

(b) Provide financial and technical support to universities and other research institutions for carrying out collaborative research schemes;

(c) Promote research activities on various aspects of water resources among young graduates through the establishment of fellowships in various subjects of water resources in collaboration with various engineering and agricultural universities;

(d) Collect, disseminate and arrange the utilization of information and research processes or results, and publish scientific papers, reports and periodicals related to the activities of the Council;

(e) Accept fees, donations, endowments and gifts for furthering the objects of the Council;

(f) Establish a library in Islamabad covering the subjects related to the activities of the Council;

(g) Establish scientific liaison with other related national and international organizations; and

(h) Undertake any further activities to promote generally the aims and objects of the Council.

I. Summary of the goals linked to socio-economic development targets

Since the establishment of PCRWR, the council has undertaken 35 research and development projects at a cost of PRs. 638,611,000, including six ongoing projects valued at PRs. 319,188,000 (a list of the completed projects is give in annex I.1). A total of PRs. 259,037,000 has been expended on non-development activities. Research conducted on various aspects of water resources under completed research and development projects has contributed towards the solution of various problems on emerging issues. Some of the contributions include:

(a) Development of technologies to harvest water in desert and mountain areas in order to meet the demand for water during the dry season;

(b) Identification of salt-tolerant plants to stabilize sand dunes in the deserts with saline groundwater;

(c) The introduction of low-cost technologies to divert water from streams in mountain areas to provide increasing regular supplies of irrigation water to small-scale farmers;

(d) Exact quantification of the recharge mechanism through delayed action dams on the Karez in Balochistan;

(e) Determination of the optimum value of the drainage surplus for economical design of drainage systems to control waterlogging and salinity;

(f) Motivation of progressive farmers to share irrigation and drainage costs with the public sector;

(g) Determination of crop water requirements to reduce field application losses in irrigated areas;

(h) Development of irrigation schedules commensurate with the rotational irrigation supply system for wheat, cotton, sugar cane, maize and rice in the Lower Indus Plains;

(i) The fabrication of low-cost soil moisture measuring instruments for farming communities;

(j) Solutions that address urgent drinking water quality problems; and

(k) The introduction of leaky dams to recharge depleting aquifers in Balochistan.

These contributions have ultimately provided very useful socio-economic benefits to the local people and helped to enhance the economy of the country.

1. PCRWR research and development projects/programmes

Since 1964, PCRWR has been engaged in conducting research on various aspects of water resources through its research and development projects/programmes being carried out all over the country. Keeping in view the rapidly decreasing per capita water availability, extended periods of drought during the recent past, deteriorating drinking water quality, depleting groundwater aquifers and other issues needing immediate attention, PCRWR has submitted a number of projects/programmes to the Ministry of Science and Technology. The current approved and pipeline projects are described below.

a. Ongoing projects

The Council initiated six projects throughout the country in 2001:

(1) Mitigation of Drought Disaster in the Cholistan Desert by Management of Water Resources

The Mitigation of Drought Disaster in the Cholistan Desert (MDDC) Project has been initiated in March 2001 at a total cost of PRs. 152,620,000 for a four-year period. The project is aimed at providing safe drinking water throughout the year in the Charleston Desert for humans (110,000 million) and livestock (2 million). This goal has been achieving by collecting rainwater in 70 newly constructed ponds, each with a storage capacity of 4 million gallons, pumping useable groundwater by installing 20 turbines each with a discharge capacity of 1.0 cusec, and desalinating saline water by a reverse osmosis plant with the capacity of 3,000 gallons per day. A total of 1,686 million gallons water annually will be made available for consumption by humans and livestock after the completion of project.

(2) National Water Quality Monitoring Programme

This programme has been launched in April 2001 with a worth of PRs. 39.66 million for 5 years. Under this programme, surface and groundwater quality of 21 cities of four provinces are being monitored on seasonal basis (before and after monsoon). Apart from these cities, 6 rivers and 13 reservoirs are also being monitored.

(3) Rejuvenation of depleting aquifers and propagation of high-efficiency systems in Balochistan

This project was launched in April 2001 with a budget of PRs. 38,288,000 for three years in Balochistan Province where rainfall is low (50-400 mm), rivers/streams are non-perennial, evaporation rates are very high (2,000 to more than 5,000 mm per annum), and groundwater is the only dependable source of water for domestic, agriculture and industrial uses. The project was aimed at developing/evaluating new artificial groundwater recharge technologies for depleted aquifers, and propagating high-efficiency irrigation techniques such as trickle, sprinkler and bubbler systems. The recharging technologies would make contributions of more than 20 per cent to groundwater aquifers, thus saving surface water from going to waste through evaporation. The change over from low- to high-efficiency irrigation techniques will also provide water savings of more than water.

(4) Upgrading of PCRWR laboratories and libraries

This is a short duration project (two years) with a total cost of PRs. 39.9 million. The key objective of this project is to upgrade capabilities/facilities of existing soil and water laboratories and libraries at PCRWR headquarters and its regional offices while keeping in view the requirements of each laboratory and library. Procurements of state-of-the-art equipment have been to enable the research studies to be carried out accurately and efficiently.

(5) Demarcation of groundwater quality zones in the Indus Plain and its marginal areas for sustainable development and management of groundwater (Phase I)

Initially, this project was commissioned in Punjab Province at a cost of PRs. 38,720,000. The objectives of the project are to demarcate fresh groundwater quality zones in the Indus Plain and its marginal areas, develop groundwater quality maps for the Indus Plain for future sustainable development of groundwater, and develop a groundwater usability map based on soil-crop-climate and water quality status in different areas for optimum cropping.

(6) On-farm collaborative pipe drainage project

This project, financed by the Water and Power Development Authority (WAPDA) under the National Drainage Programme, is being implemented in Sindh Province. The objectives of the project are to evaluate the feasibility of on-farm pipe drainage on a watercourse command basis with participation by farmers (sharing of capital costs and bearing full O&M costs), and to develop sustainable low-cost, village-level technology for field investigation, design pipe and filter materials, pipe installations, manholes, sump construction and system maintenance.

b. Approved projects

PCRWR was to launch the following eight research and development projects in various fields of water resources throughout the country in July 2004:

(1) Sustainable Technologies for Efficient Water Management in Irrigated Areas of the Southern Indus Plain (five years – PRs. 39,670,000)

(2) Result Oriented Short Term Research Studies to Improve Water Resources of Mountainous Areas (five years – PRs. 8,010,000)

(3) Water Quality Monitoring in Rural Areas of Pakistan and Installation of Low-Cost Water Conditioning and Filtration Units (five years – RPs. 8,710,000)

(4) Strengthening of PCRWR by Establishing a Geographical Information System, Hydrological Modelling Centre and Water Resource Data Bank (three years – RPs. 32.2 million)

(5) Strengthening of the PCRWR Regional Office, Lahore for Undertaking Research on Irrigated Agriculture (four years – RPs. 30,739,000)

(6) Impact Assessment of Sewerage and Industrial Effluents on Human Health, Water Resources and Agriculture Productivity in Faisalabad (one year – RPs. 7.80 million)

(7) Enhancement and Management of Groundwater Resources in Balochistan (four years – RPs. 38,690,000)

(8) Recharging Depleting Groundwater Aquifers through Rainwater Harvesting (four years – RPs. 17,560,000)

c. Pipeline projects

The following five research and development projects have already been submitted to the Ministry of Science and Technology for approval:

(a) Mitigation of Desertification for Poverty Alleviation by Integrated Management of Land and Water Resources in Cholistan (four years – RPs. 34,440,000)

(b) Managing Water Resources in Thar Desert for Desertification Control and Economic Uplift of the Local People (four years – RPs. 39,939,000)

(c) Use of Non-Conventional Water Resources for Drought Mitigation (four years – RPs. 195,630,000)

(d) Participatory National Integrated Water Management Programme (five years – RPs. 174,470,000)

(e) Mass awareness programme for water conservation and development

2. Opportunities and threats facing PCRWR

The research efforts of PCRWR are aimed at maximizing economic productivity of resources through coordinated and collaborated research by:

(a) The improvement of existing resource development and management systems;

(b) The protection of the environment against the detrimental efforts of resource development and management; and

(c) Exploitation of untapped resources.

In order to contribute to maximizing the economic productivity of the resources, PCRWR requires specialization in some selected areas in which a breakthrough can be accomplished.

a. Opportunities

The Council has the following opportunities to conduct and promote countrywide research and development activities:

(a) Collaborative research efforts in the fields of irrigation and drainage, which will make substantial contributions to improving the national economy through:

  (i) Developing and popularizing high-efficiency irrigation methods for high delta crops;

  (ii) Lowering tile drainage costs to maintain an optimum water table in saline groundwater zones;

(iii) Adopting integrated irrigation and drainage management practices to reduce secondary salinization and up-coning of salt water in central *doabs*; and

(iv) Improving irrigation scheduling for increasing crop yields per unit of water.

(b) The introduction, evaluation and propagation of artificial groundwater recharge techniques in urban areas where aquifers have been rapidly depleting due to over-exploitation of groundwater. This will not only help in mitigating the adverse effects of groundwater mining but also offset the adverse impact of saltwater intrusion and high energy costs.

(c) Research on the following emerging water related issues to improve water availability of the country:

(i) Water conservation through rainwater harvesting technologies in urban areas, reservoir evaporation reduction technologies in hyper arid areas, etc.;

(ii) Utilization of flood water for groundwater recharging in depleted aquifers; and

(iii) Effectively application of sewerage water and saline drainage effluent for agriculture in conjunction with canal water.

(d) Research studies on the following potential aspects in the northern part of the country, which is not only a haven for tourists but also an area of high precipitation and the location of many watersheds and glaciers:

(i) Sedimentation control

(ii) Watershed management

(iii) Water and soil conservation

(iv) Low flow analysis for hydropower generation

(v) Artificial glacier melts

(vi) Water harvesting technologies

(e) Research on dry and wetland areas with regard to making them productive through suitable land and water management practices. This will be helpful in mobilizing the potential of stressed lands to offset population pressure from irrigated agriculture.

b. Threats

In order to gain the fullest benefit from the above-mentioned opportunities, PCRWR has to deal with the following threats:

(a) Overlapping research activities due to a lack of collaboration between research institutions;

(b) The lack of coordination between implementing, operating and research agencies;

(c) The absence of important research visualized by bureaucracy, industry as well as the public at large;

(d) The lack of appreciation of research work due to long gestation periods; and

(e) The absence of attractive career opportunities for research oriented scholars.

II. Legal and institutional framework

1. Historical development of PCRWR

In view of the added importance of water, resulting from its uneven distribution in various regions of Pakistan, and to meet the challenges that lie ahead, in 1964 the Government established the Irrigation, Drainage and Flood Control Research Council within the Ministry of Natural Resources. As an autonomous federal research organization, its function was to undertake and promote research activities in the fields related to water resources. One of its objectives was to provide support, on the research side, to WAPDA and other federal and provincial development agencies in the three major thrust areas, i.e., irrigation, drainage and flood control. The Council started functioning in August 1965.

The Irrigation, Drainage and Flood Control Research Council was brought under the control of the Ministry of Science and Technology in 1970. In 1984, the Ministry of Science and Technology announced a national policy on science and technology, giving high priority to water resources. Particular emphasis was laid on conducting research and development in various fields of water resources at the federal level. Consequently, the Council was reorganized in August 1985, with a wider mandate and more autonomous character to facilitate efficient functioning, under the present name of the Pakistan Council of Research in Water Resources. The Council has now grown into a premier organization, ensuring the enrichment of the water sector, which functions like an artery in the socio-economic structure of Pakistan.

The Council has remained aware of the problems of limited land and water resources as well as the unabating adverse impacts of water logging and salinity, soil erosion and desertification. Hence, it took timely action in establishing the Drainage and Reclamation Institute of Pakistan (DRIP) at Hyderabad in 1974 and the Pakistan Desertification and Monitoring Unit (PADMU) at Bahawalpur in 1982. DRIP started functioning with Dutch technical assistance to help in controlling water logging and salinity through new drainage technology, especially that of tile drainage and skimming wells. Subsequently, DRIP was moved to the Irrigation, Drainage and Flood Control Research Council to conduct applied research. The main objectives of PADMU were to monitor research activities for the desert areas of Pakistan, particularly Cholistan, and to study the interaction of wind, rain and overgrazing on the ecosystem of the Cholistan desert.

As PCRWR is a national organization, it has to shoulder the responsibility of solving water-related problems of different provinces. In 1986, it created four Water Resources Research Centres for each of the northern areas of Rawalpindi/Islamabad, Punjab and Balochistan. Moreover, PCRWR developed various projects to solve specific problems of water resources management, safe use of groundwater, and the development of economically and viable irrigation and drainage technologies. It also has discussed ways and means of motivating farmers to shoulder the financial and management responsibilities.

The overall control, direction and supervision of the affairs of the Council is vested in the Board of Governors presided of by the Minister/Adviser in charge of the Ministry of Science and Technology. The Council is headed by a chairperson appointed by the Federal Government. The chairperson is assisted by a Technical Advisory Committee under whose guidance technical policies are designed and implemented. General administrative and financial policies are implemented under the instructions of the Ministry.

2. Current situation of PCRWR

PCRWR, with its head office at Islamabad, is conducting research through its eight Regional Offices and Water Resources Research Centres located in all four provinces. The organization chart of the Council is given in annex I.2. These research centres are equipped with experienced

research staff, computer facilities, and soil and water testing laboratories. For field research and liaison outside Islamabad, the Council has established eight centres.

a. Drainage Research Centre, Tandojam

In 1997, DRIP was renamed the Drainage Research Centre (DRC). DRC covers 40 acres and includes offices, residential buildings and land for field experiments. It has been conducting research in drainage of agricultural land, salinity control, land reclamation, irrigation practices and water management, and irrigation and drainage modelling.

b. Regional Office, Lahore

The Regional Office, Lahore was established in 1986 for effective linkages and better collaboration with WAPDA, Provincial Irrigation Departments, the International Water Management Institute of Pakistan, International Waterlogging and Salinity Research Institute, and the Directorate of Land Reclamation. In addition to conducting research in various aspects of water management, the office has been providing consultancy/technical services to the public and private sectors in selecting suitable sites for the installation of tubewells with the electrical resistivity survey technique.

c. Regional Office, Bahawalpur

The Regional Office, Bahawalpur was established on the foundation of PADMU. The ultimate objective of this Regional Office, in Addition to liaison with line agencies, is to evolve technology for sand dune stabilization and to save fertile border areas from drifting and moving sand dunes. Lessons learnt from visits to the deserts in mainland China were duly incorporated into the research experimentation at Bahawalpur. This office is conducting research in water harvesting techniques, saline agriculture and saline agro-forestry at its field station in the Cholistan desert. The field station was established in 1986 at Dingarh, about 75 kilometres south of Bahawalpur city by acquiring 500 acres from the Cholistan Development Authority.

d. Lysimeter Station, Lahore

Eighteen lysimeters of 3 m x 3 m x 6 m were constructed in 1970 at the Directorate of Land Reclamation, Lahore to conduct studies on soil-water-plant relationship for salinity and waterlogging control. These lysimeters are equipped with locally fabricated well-tested tensiometers for in-situ measurement of soil moisture tension at required depths. Locally fabricated gypsum blocks are also used for measuring of soil salinity. Water requirement experiments on wheat, maize, sugar cane and sunflowers have been completed, as have experiments on the proportionate contribution of surface irrigation and sub-surface irrigation to total crop water requirement.

e. Lysimeter Station, Tandojam

Twelve drainage lysimeters measuring 3 m x 3 m x 5 m have been installed at the Directorate of Land Reclamation campus to study the soil-water-plant relationship for salinity and waterlogging control in the Lower Indus Plain. Irrigation water requirements for wheat, cotton, and sugar cane have been established and crop coefficient curves of these crops for the Penman equation have been developed.

f. Water Resources Research Centre, Quetta

This centre was established in 1985 to carry out research programmes and to provide the necessary infrastructure to undertake, collaborate and coordinate effective research in the water sector in Balochistan. The centre undertakes research studies to help solve the problems of water scarcity, improvement and recharge of the centuries-old indigenous *karez* system as well as its interaction with delay action dams and artificial groundwater recharging techniques.

g. Water Resources Research Centre, Islamabad

This centre was established in 1985 with thrust areas of environmental engineering (pollution of water supply and wastewater management), sedimentation and soil erosion in hilly watershed areas. It has considered water quality problems and sources of water pollution to ensure safe and clean drinking water for humans.

h. Water Resources Research Centre, Peshawar

This centre was initially established at Gilgit in 1986 to conduct research studies on developing snowmelt streamflow relationships, character analyses of snow and ice hydrology, and related studies in the northern areas of Pakistan where the Indus River system originates. Little progress was achieved by this centre due to its remote location and frequent ethnic disturbances. Thus, it was moved to Peshawar in June 1993. It is envisaged that the objectives outlined above can be attained at the new location with better efficiency and control.

3. Strengths and weaknesses of PCRWR

a. Strengths

The Council has 90 professionals in various fields of land and water resources. It has five Ph.D. holders, 42 MEng/MSc holders and 43 BSc (Engineering) holders. For field research, the Council has established four Research Centres at Tandojam, Quetta, Islamabad and Peshawar, two Regional Offices at Lahore and Bahawalpur, and two Lysimeter Stations in Punjab at Lahore and Sindh at Tandojam. Almost all the centres have their own buildings and modest soil and water analysis laboratories. PCRWR has three Research Farms (Tandojam, Dingarh and Lahore), five groundwater investigation equipment sets (terameters), two well loggers, three laser levellers and scrappers, drainage machinery (tile-laying machines, gravel hoppers, tractors etc.) and agricultural machinery (zero-drills, bed and furrow shapers, cultivators and dithers).

b. Weaknesses

The weaknesses of PCRWR include:

(a) A lack of financial resources for research, publication and dissemination;

(b) Inadequate qualified manpower in the following water-related fields:

  (i) Hydraulic/river engineering
  (ii) Sediment transport
  (iii) Dam/geo-technical engineering
  (iv) Reservoir operation
  (v) Remote sensing
  (vi) System engineering
  (vii) Snow and ice hydrology

(c) A paucity of equipment and laboratories for performing advanced research in the above mentioned fields; and

(d) Inadequate emoluments, fringe benefits and social status of the research scholars.

4. Vision and Mission Statements of PCRWR

To “make Pakistan self-sufficient in food and fibre, and help achieve the goals of providing better health for citizens through efficient and effective laboratory and field-oriented research in areas of development, use, management and quality of water resources”.

III. Strategic plan goals

1. Identification of priority areas

In view of the challenges faced by the water sector, the following approaches to research and development in water resources have been identified:

(a) Tapping existing unutilized resources, and the development of new and unexplored water resources;

(b) Managing water resources to achieve the goal of maximum production per unit of water used;

(c) Improving the existing institutional set-up to remove constraints to better management of water resources; and

(d) Improving the research infrastructure by undertaking user-oriented research, avoiding unnecessary duplication of research efforts, and better coordination between research bodies, industry, and universities.

The following 10 areas need to be included in the strategic plan:

(a) Desertification – assessment and mitigation
(b) Groundwater development and management
(c) Agricultural water management
(d) Waterlogging and salinity
(e) Erosion and sedimentation
(f) Hydrology and climate change impacts
(g) Dams, storage reservoirs and water
(h) Water quality – assessment and amelioration
(i) Saline agriculture, disposal and re-use of saline water
(j) Drought and flooding

2. Research on managing, developing and protecting water resources

The goals have been set for undertaking research in the following fields of management, development and protection of water resources:

(a) Development of appropriate rainwater harvesting systems for various potential areas;

(b) Promoting the use of non-conventional water resources;

(c) Development of appropriate and economical artificial recharge techniques in various hydrogeological and climatological conditions;

(d) Developing appropriate technologies/practices that allow the use of drainage effluents for crop production;

(e) Developing and popularizing integrated water management systems for water conservation and utilization on a main and secondary canal command basis with user participation;

(f) Optimization of skimming well technology and its extension to farmers for adoption in areas where shallow freshwater overlies saline water;

(g) Studies to determine the level of pollution, and measures to manage the problems of environmental degradation;

(h) Watershed management in urban, rural and natural catchment areas;

(i) Studies of optimizing cropping patterns under various water availability scenarios in different agriculture zones;

(j) Development of low delta and drought resistant, high-yield crop varieties;

(k) The extension of bio-saline agriculture to the field through coordinated efforts in using salt tolerant varieties, conjunctive use of fresh and saline water, halophytes for fodder production etc.; and

(l) Studies of harnessing snow and ice reservoirs in the northern areas.

3. Research on operating, maintaining and rehabilitating facilities

It is planned to undertake research in the following areas of operation, maintenance, and rehabilitation of water resources:

(a) Reactivation and updating of the Indus basin model for operational studies and management of IBIS;

(b) Development of computer models for irrigation/water scheduling at watercourse command level;

(c) Studies of the mechanism of groundwater abstraction, and development of a framework of regulatory authority;

(d) Establishment of a Groundwater Regulation Authority at the provincial level;

(e) Preparation of a National Drought Management Plan;

(f) Studies of drought forecasting mechanisms;

(g) Human resources development in the water sector to deal with the challenges imposed by the current water situation;

(h) Development of a mechanism to strengthen the extension programmes in the provincial setups; and

(i) The introduction of a National Mass Awareness Programme.

4. Enhancing organizational effectiveness

Failure to achieve success in addressing any of the water development/management constraints is common to most government institutions. This stems mainly from (a) widespread pre-occupation with routine duties to meet the procedural requirements of outmoded rules and regulations as opposed to fulfillment of substantive professional responsibilities; and (b) widespread pursuit of self-interest as opposed to the public interest. Furthermore, undue political intervention in the day-to-day affairs of the departments requires arbitrary and often unfair decisions to be made by the functionaries, serving as a major disincentive to staff and leading to the adoption of malpractice on an even wider scale.

According to the 10-Year Perspective Development Plan (2001-1011), water shortages will approach 21 per cent in 2011, despite planned additional water sector facilities. The situation demands enhanced management facilities including water management activities, reduced losses in the conveyance system (lining of canals), investment in the reuse of industrial and sewage effluents and the harnessing of non-conventional sources.

The already available research and development infrastructure, climatic conditions and land resources in the country are well suited for maximizing agricultural production and handling the multitude of problems faced by the water sector. What is required is the increased commitment of

various administrative, developmental and extension agencies to implementing legislation in protecting water bodies and extending research results to users in the form of better and improved crop varieties, fertilizers, pesticides, cropping patterns, efficient water use, management practices etc.

The Government should also ensure the formulation and implementation of better pricing and credit policies for the farming communities, which are aimed at providing incentives not only in irrigated areas but also in rain-fed areas of the country. Achievement of increased water availability at the farmgate as well as high water-use efficiency to enable high crop production per unit of water used are some other targets for ensuring self-sufficiency in food, or at least for maintaining the current status in the future.

Most of the problems are already receiving attention from the Government through the implementation of various programmes with assistance from donor agencies that have been very active in following various developments in the sector. The major programmes being implemented include the National Drainage Programme that provides improved irrigation and drainage facilities in irrigated areas, and the Social Action Programme aimed at improving social services including drinking water supplies and sanitation.

The water sector has experienced meagre investment in the past in relation to other commodities, and most of that investment has been in the development of the water sector. Yet, the management of this huge interlaced sector has been limited. In the public sector, there are certain limitations on making very large investments, especially on the management side for operation and maintenance, regulation etc. At present, there is no significant private sector investment in the water sector. Active community participation is needed in achieving an enhanced private sector role.

In addition, some incentives must be introduced for scientists and engineers involved in research and development activities, such as the revival of the research allowance. The recently introduced productivity allowance does not benefit the middle level professionals/establishment related to research. Alternatively, an enhanced pay package, similar to that already being offered to academic people, could be considered.

IV. Implementation, monitoring and evaluation

1. Identification of indicators and benchmarks for performance measures

The growing water demand with respect to population and resultant food and fibre needs require concerted efforts to meet present as well as future water shortages. In this regard, all aspects of water resources development and management have to be taken into consideration. Table I.3 lists the indicators and benchmarks that may help achieve the targets. Although the targets are set in each five-year/perspective development plan, continuation of activities should be maintained above all regional and political constraints.

2. Expected framework and necessary resources

A three-pronged approach towards the formulation of strategies to meet the growing water needs is proposed:

(a) Tapping of existing un-utilised resources and development of new and unexplored water resources;

(b) Management of water resources to achieve the goal of maximum production per unit of water used; and

Table I.3. Indicators and benchmarks for helping to achieve targets in five-year/perspective development plans

Activity	Indicator	Benchmark
New storage to overcome water shortages	Enhanced water availability	Reduced gap between demand and supply
Management of delivery system to reduce system losses	Enhanced system efficiency	Reduced water shortage
Activities to improve water-use efficiencies	Improved water-use efficiency	Improved agricultural and water-use productivity
Strengthening of Institutions	Effective planning and implementation of activities	Enhanced organizational role

(c) Improvement of the institutional set-up and better governance of water resources institutions and infrastructure.

Based on the above approach, the strategies are grouped as short-term (1-3 years), medium term (4-10 years) and long term (11-25 years) extending over a period of 25 years. The necessary resources required for this would involve financial allocations for social sector development activities as well as promotion for research and development of science and technology in the country. In this regard, international donor agencies could also be approached, e.g., the United Nations Development Programme, the United Nations Children's Fund, JICA, IUCN-World Conservation Union, and the Food and Agriculture Organization of the United Nations. The inclusion of local investors could provide support for such activities and offer the additional advantage of indigenous technology development.

3. Action Plan

Though concerted efforts are needed for improving the national research and development infrastructure in the field of water resources, the recommendations also include development-oriented projects and actions. In this regard, the approach defined in the previous section has been adopted for the formulation of an Action Plan to meet the challenges faced by the nation in the water sector, as summarized below.

a. Short-Term Plans (1-3 years)

The following projects are research and development oriented:

(a) Development of computer models for irrigation/water scheduling at watercourse command level (three years – PRs. 60 million)

(b) Reactivation and updating of the Indus basin model for operational studies and management of IBIS (two years – PRs. 40 million)

(c) Studies of the mechanism of groundwater abstraction and development of a framework of regulatory authority (three years – PRs. 20 million)

(d) Studies of optimizing cropping patterns under various water availability scenarios in different agriculture zones (three years – PRs. 50 million)

(e) Preparation of a National Drought Management Plan (three years – PRs. 50 million)

(f) Studies of drought forecasting mechanisms (three years – PRs. 120 million)

(g) Establishment of a drought forecasting mechanism (two years – PRs. 80 million)

b. Medium-Term Plans (4-10 years)

The following projects are research and development oriented:

(a) Developing appropriate rainwater harvesting systems for various potential areas (five years – PRs. 300 million);

(b) Promoting the use of non-conventional water resources (five years – PRs. 450 million);

(c) Developing appropriate technologies/practices allowing the use of drainage effluents for crop production (five years – PRs. 300 million);

(d) Optimization of skimming well technology and its extension to farmers for adoption in areas where shallow freshwater overlies saline water (five years – PRs. 150 million);

(e) Lining of canals in saline aquifer areas with appropriate and effective lining material such as geo-membranes (10 years – PRs. 500 million);

(f) Developing and popularizing an integrated water management system for water conservation and utilization on a main and secondary canal command basis with user participation (five years – PRs. 900 million);

(g) Watershed management in urban, rural and natural catchment areas (10 years – PRs. 20,000 million);

(h) Studies to determine the level of pollution and measures to manage the problems of environmental degradation (five years – PRs. 40 million);

(i) Developing low delta and drought-resistant, high-yield crop varieties (10 years – PRs. 50 million);

(j) Promoting saline fish culture in saline aquifer areas. This would include feasibility studies, research and extension to the field (five years – PRs. 50 million);

(k) Extension of bio-saline agriculture to the field through coordinated efforts in pursuing salt-tolerant varieties, conjunctive use of fresh and saline water, halophytes for fodder production etc. (five years – PRs. 100 million);

(l) Implementation of recharge programmes in stressed groundwater areas/basins through pilot projects (10 years – PRs. 500 million);

(m) Development of appropriate and economical artificial recharge techniques in various hydrogeological and climatological conditions (five years – PRs. 100 million);

(n) Studies and feasibility studies of harnessing snow and ice reservoirs in the northern areas (five years – PRs. 200 million);

(o) Studies on optimization of irrigation systems to minimize sedimentation in canals and watercourses (100 million PRs. – 5 years);

(p) Studies of appropriate watershed management techniques suited to local conditions in various physiographic regions (five years – PRs. 100 million);

(q) Strengthening of the existing institutional infrastructure to improve coordination and deal with present and future challenges in the water sector (seven years – PRs. 500 million);

(r) Human resources development in the water sector in order to face the challenges imposed by the current water situation (seven years – PRs. 500 million);

(s) Strengthening of extension programmes in the provincial setups (seven years – PRs. 300 million); and

(t) National Mass Awareness Programme (five years – PRs. 500 million).

c. Long-Term Plans (11-25 years)

The following projects are development oriented:

(a) Continuation of the On-Farm Water Management Project, with more emphasis on lining distributaries, watercourses and minors with appropriate lining material (22 years – PRs. 3,000 million); and

(b) Construction of major and minor multi-purpose dams for storage and power generation (22 years).

4. Mechanisms for reporting, monitoring and evaluation

PCRWR maintains its monitoring and evaluation unit comprising experts in various water-related areas at the PCRWR headquarters in Islamabad. The Council's research and development activities, which are being implemented all over the country through its six regional centres, are monitored and evaluated regularly for planning/reporting and perusal of the Government's comments. The coordinated research efforts with national and international organizations are also monitored and evaluated by PCRWR headquarters. The reporting period varies depending upon the activity; such reports are published in the form of monthly, quarterly and annual progress reports, among others.

V. Consultation mechanisms and initial findings

1. Consultation mechanisms in place and future developments

At present, PCRWR is providing consultation facilities in following areas of water resources:

a. Water quality testing, management and technology development

PCRWR water quality laboratories in six centres are providing water-testing facilities to the public, the Government and private organizations at nominal charges. In addition, quality management facilities are being extending to various agencies/local development authorities such as the Water and Sanitation Authority. Technology for various organizations such as water testing kits, water treatment units etc. is also being designed.

b. Groundwater Investigation

PCRWR provides services to government/private entities for groundwater investigation all over the country. For this purpose, the Council has acquired sophisticated equipment and investigation tools/software in addition to qualified experts and trained staff.

c. On-Farm drainage facilities

The PCRWR Drainage Research Centre, Tandojam is providing consultancy services to farmers on the installation of drainage systems in Sindh Province. In addition, farmers are being provided with consultancy services in irrigation and land management activities.

d. Consultation on high-efficiency irrigation system

PCRWR has developed a locally pressurized irrigation system that is being promoted among farmers for wide-scale adaptation. PCRWR also provides consultancy services for designing and installing pressurized irrigation such as sprinkler and trickle irrigation systems.

e. Local manufacturing of soil and water instrumentation

PCRWR is manufacturing and supplying various soil and water monitoring instruments/ devices such as gypsum blocks, tensiometers, rain gauges, evaporation pans, potable rain guns etc.

f. Hydrologic investigation

PCRWR also has the capability for provide consultancy in surface hydrology, soil and water conservation, desertification control, flood management etc.

g. Future developments

In future, the Council intends to extend its services to other areas of water resources including hydrologic modelling, water resources management, a geographical information system and water resources database management. To accommodate this plan, a Hydrological Modelling Centre and a Geographical Information Centre are being established at the Water Resources Research Centre, Islamabad. In addition, more field research and demonstration stations are being established for wide-scale dissemination of research findings and the creation of awareness as well as imparting training among water users/farmers.

2. Initial findings of recent efforts

The Council has made significant achievements through its consultation and technology transfer/dissemination activities. Further research and dissemination programmes have been planned to extend activities in other areas including the northern areas, NWFP, the Pothwar region, the lower Indus basin etc. for water quality management, rainwater harvesting, land and water management, groundwater recharge, drainage, glacier and snow monitoring etc.

VI. Conclusions and recommendations

The conclusions and recommendations are:

(a) Declare PCRWR as a focal point organization at the federal level. A joint forum of water resources research institutes, technical universities and line agencies working in the water sector should be established to watch the national interests;

(b) Keeping in view the importance of research and development activities in the water sector, there is a need to develop capacity-building of PCRWR to handle present and future challenges in order to contribute to the development and management of water resources;

(c) Currently, there is lack of coordination among research institutes, industry and line agencies. Therefore, PCRWR should involve various research organizations, industry, universities and end-users in implementing the Action Plans;

(d) Keeping in view the current and future water shortage in Pakistan, the country has to learn to live with such shortages. Therefore, PCRWR should promote a culture of water conservation through mass media campaigns; and

(e) Currently, PCRWR rarely avails itself of the opportunities to share its experiences/ knowledge with regional and international water-related institutes/agencies. This gap should be closed by developing close linkages with those institutes/agencies in order to meet future challenges in the water sector.

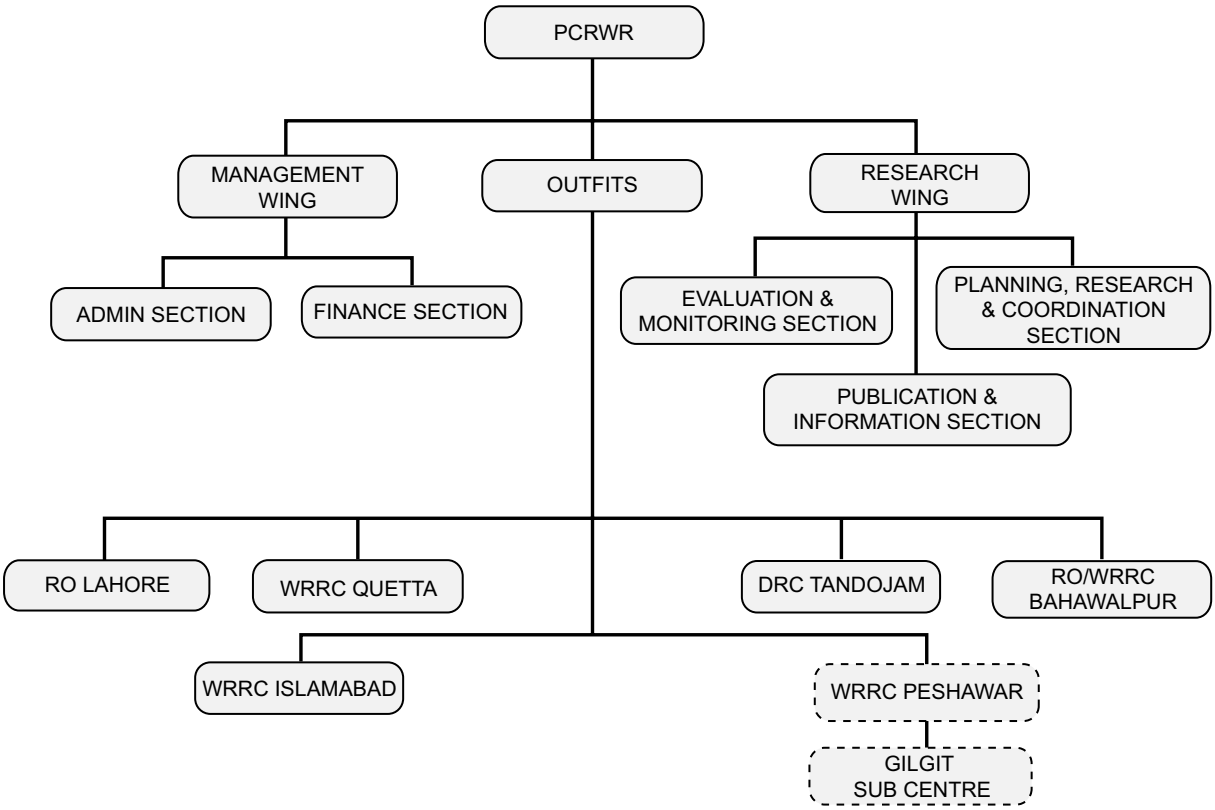
Map I.1. Location map of Pakistan

Annexes

Annex I.1. List of completed projects

Project	Cost (10^6 PRs)	Duration (years)
Special Short-Term Research Programme (STRESS)	11.233	17 (1982-1999)
Surface Water Development for Agriculture	10.09	6 (1994-2000)
Salt-Affected Soil and its Reclamation	9.708	12 (1988-2000)
Alternatives Project Development for Drainage in Irrigated Lands	9.882	12 (1988-2000)
Drainage and Reclamation Institute of Pakistan (DRIP)	43.194	14 (1974-1988)
Pakistan Desertification and Monitoring Unit (PADMU)	4.516	4 (1982-1986)
Promotion of Research Activities	1.733	8 (1986-1994)
Designing and Fabrication of Soil Moisture Instruments	0.27	12 (1980-1992)
DRIP Security Systems	1.486	3 (1991-1994)
Lysimeter Studies Sindh	3.745	10 (1977-1987)
Skimming Well Modelling	8.962	9 (1987-1996)
Irrigation System Management Research – National Documentation Library and Information Network (ISMR-NADLIN)	24.583	8 (1986-1994)
Irrigation System Management Research – Surface Development Water Training Course (ISMR-SDWTC)	10.748	8 (1986-1994)
Irrigation System Management Research – Competitive Grants Programme	20.335	8 (1986-1994)
Irrigation System Management Research – Encouraging Water Users	9.545	8 (1986-1994)
Establishment of Water Resources Research Centre, Quetta	8.724	11 (1985-1996)
Establishment of Water Resources Research Centre, Islamabad	9.3	11 (1985-1996)
Establishment of Water Resources Research Centre, Bahawalpur	8.724	11 (1985-1996)
Lysimeter Studies in Punjab	3.647	15 (1970-1985)
Groundwater Management Cell	4.546	7 (1987-1994)
International Hydrology Technicians Training Course	5.800	9 (1985-1994)
Establishment of Water Resources Research Centre, Peshawar/Gilgit.	8.724	9 (1983-1992)
Development of Tile Drainage Programme for East Khairpur, Phase-II	13.163	5 (1911-1996)
Monitoring Studies, Phase-I	2.200	11 (1985-1996)
Qadirabad Baloki Drainage Research Pilot Project	19.750	7 (1991-1998)
Conjunctive Use of Flood Water	2.009	3 (1991-1994)
Development and Fabrication of Trickle Irrigation System on Orchards in Pakistan	19.83	5 (1993-1998)
Strengthening of NADLIN	3.15	3 (1984-1987)
Development of Water Resources Management Model for Chapper Valley, Balochistan	16.897	3 (1996-1999)
Total	**296.494**	**–**

Annex I.2. Organization Chart



J. NATIONAL WATER RESOURCES BOARD STRATEGIC PLANNING AND MANAGEMENT OF INTEGRATED WATER RESOURCES MANAGEMENT IN THE PHILIPPINES

By
The National Water Resources Board of the Philippines

Introduction

Water has always been, and will remain an essential natural resource in the development of the country. Ensuring the long-term availability of adequate supplies of clean water at a reasonable price is one of the greatest challenges currently facing the Philippines. Clean drinking water is essential for human health, and large volumes of water are needed for sanitation, agriculture, industry, power production, recreation, navigation and countless other human activities. In addition, there is increasing recognition of the importance of maintaining surface waters to meet ecosystem needs.

The Philippines, once known to be relatively abundant in water resources, is now confronted with formidable water and sustainable development problems. Population growth, economic development, urbanization and industrialization are creating serious pressure on the water resources of the country. One consequence is increased competition in the use of water resources for water supply, irrigation, hydropower etc. Another is increasing pollution of water resources and watershed degradation that continue to damage the environment and threaten thousands of lives.

Despite a series of active efforts in the water sector, there seems to be a continuing momentum in the degradation of the country's dwindling water resources. Although this has been given priority attention by the Government, and despite the substantial progress achieved in the sector, a significant portion of the country's urban and rural population still needs to be served by the public water supply. The situation is expected to deteriorate partly due to the disequilibria in investment in the sector and the rapid growth in population. Practically all sectors have contributed to the situation, which could lead to an acute water shortage in the near future especially in the nine water-critical urbanized areas where water is consumed intensively as identified in the 1998 Master Plan Study on Water Resources Management. Thus, water must now be viewed as a finite and scarce resource that has to be managed more efficiently and effectively.

With increasing water demand – water being such a critical factor to the country's socio-economic development and global competitiveness – there is a need to adopt a more integrated and holistic management of our water resources such as an Integrated Water Resources Management (IWRM) approach. This approach involves the coordinated development and management of water, land and related resources within the hydrological boundaries, in order to optimize economic and social welfare without compromising the sustainability of vital ecosystem.

1. National water sector context including main issues and challenges, and possible water scenario

The Philippines is an archipelago comprising some 7,100 islands with a land area of about 300,000 km^2. The country's annual rainfall is about 2,400 mm of which 1,000-2,000 mm are collected as runoff by a natural topography of more than 421 principal river basins, some 59 natural lakes and numerous small streams. It has an extensive groundwater reservoir with an aggregate area of about 50,000 km^2. For planning purposes, the country was divided into 12 water resources regions. The major consideration in the regionalization is the hydrological boundaries as defined by physiographical features and homogeneity of climate.

The country's dependable surface water supply is estimated at 206,230 m^3/day and 125,790 m^3/day for probabilities of 50 per cent and 80 per cent, respectively. The total available groundwater supply is estimated at 20,200 m^3/day. In this regard, the Philippines has a total dependable water supply of 145,900 m^3/day if considering the 80 per cent probability for surface water, or 226,430 m^3 total mean supply.

While these averages indicate water abundance and should not therefore be a cause for alarm, some regions in the country are already experiencing water stress. Water is becoming the most critical resource in the Philippines. Some areas in the country are subject to devastating floods during the wet season. Many areas experience water shortages during the dry season so that storage facilities are needed to store some of the floodwater. It is therefore necessary to examine the availability of water in both time and area to make assessments that are more meaningful.

The Philippines was among the first in South-East Asia to undertake this activity in the mid-1970s. The assessment, carried out by the National Water Resources Board (NWRB) (annex I), divided the country into 12 water resources regions based on the hydrological boundaries defined by physiographic features and homogeneity in climate. It was then followed by a Framework Plan for each of the 41 river basins in the 12 water resources regions as well as the 1998 Master Plan Study on Water Resources Management also conducted by NWRB. These studies indicated that, on a regional basis, two regions would have emerging water problems.

Furthermore, the 1998 Master Plan Study identified nine water-critical urbanized areas in the Philippines where water is consumed intensively and needs a short-term and long-term plan to cope with the anticipated water deficit (table J.1). Two of those areas are Metro Manila and Metro Cebu, due mainly to the enormous water demand by the high population increase, brisk industrial activities and a serious saline intrusion problem.

Table J.1. Water demand in major cities of the Philippines (m^3/year)

Cities	1995	2025	Groundwater availability	Surplus/(Deficit) (per cent)	
				1995	2025
Metro Manila	1 068	2 883	191	(82)	(93)
Metro Cebu	59	342	60	2	(82)
Davao	50	153	84	69	(45)
Baguio City	12	87	15	21	(83)
Angeles City	11	31	137	1 148	343
Bacolod City	37	111	103	179	(7)
Iloilo City	9	47	80	788	70
Cagayan de Oro City	29	98	34	18	(65)
Zamboanga City	28	203	54	92	(73)

The major water resources users in the Philippines are the municipal, industrial, agricultural and hydropower sectors. However, the use of hydropower is considered non-consumptive. The estimated water withdrawals as of 2003, based on the water right grantees registered with NWRB is 77,456 m^3/year excluding water use for power generation (non-consumptive). Among the NWRB-registered water users, irrigation is the biggest water user accounting for 64,015 m^3/year or the equivalent of 82 per cent of total water withdrawal (table J.2).

Initially, the major issues would appear to be water supply shortages, inconsistent water resources allocation among water users, water pollution and watershed degradation. However, the

Table J.2. Volume of water extraction based on water right grantees (As of 2003)

Purpose	Volume withdrawn (m^3/year)
Domestic and municipal	5 458
Irrigation	64 015
Power generation (non-consumptive)	102 579
Fisheries	747
Livestock raising	12
Industrial	6 935
Recreational	232
Other purposes	57

core of the problem is the need for an integrated, coherent and sustainable water resources management programme.

Several studies undertaken on water resources during past years have revealed an array of problems confronting the water sector. Some of these studies reviewed and examined the entire breadth of the water resources sector. The result showed fragmentation, economic and resource regulation, and planning and policy formulation.

The responsibility for water resources management is essentially exercised by several national agencies of the Government. Each agency has been made responsible for only a limited aspect of water resources development and management. In addition, agencies in each subsector have largely independent strategies and programmes for resource development and operations. This has often created confusion, resulting in uncoordinated efforts in administering regulatory policies and site-specific issues in water resources management. Conflicts of interest in the utilization of water and overlapping of development activities are becoming more and more apparent. While there is a reasonably well-established institutional hierarchy administering the sector, its dichotomy presents a medley of uncoordinated, sometimes intermingling tasks, thrusts, directions and plans.

Among the issues and concerns that exist in the present water resources sector are:

(a) A non-systematic approach to water resources management;

(b) The necessity to improve coordination and systematize basic water data collection system for an efficient and effective flow of information;

(c) Inadequate institutional capacity-building;

(d) Watershed degradation;

(e) Inadequate financial support to the programmes/projects of the sector;

(f) Unabated extraction of groundwater by illegal users; and

(g) A lack of appreciation of water as an economic good; hence, the inability to allow market-based mechanisms to function.

Another prevalent concern currently facing the sector is the absence of an independent regulatory body responsible for both resource and economic regulation. Thus, Bills have been filed in Congress to create such a body but not much progress has been made towards enactment. Given this situation, an interim option was to strengthen NWRB as the coordinating and regulating agency for all water resources development and management activities in the country. This led to the signing of Executive Order 123, reconstituting NWRB to enable it effectively and efficiently perform its mandate. The Board composition was reconstituted to exclude those with direct claims on water resources.

Likewise, NWRB is currently revising its organization structure and amending the Implementing Rules and Regulations (IRR) of the Philippine Water Code in order to effectively carry out its mandate as well as implement and enforce the provisions of the Code. The improvement of NWRB in terms of power, structure, status and capability will provide an interim step towards the rationalization of the water resources sector.

2. Scope of the study

This case study forms part of a series of case studies to be undertaken in the programme of ESCAP to compile relevant experiences and achievements on the application of strategic planning and management for integrated water resources management. The study carries out actual application of strategic planning and management that is focused on assisting NWRB in the formulation of a strategic plan. The objective is to enhance the capability of NWRB to contribute to the development of policies and implementation of integrated water resources management to support socio-economic development and sustainable utilization of the country's water and related resources.

The study includes workshops organized for key stakeholders to discuss and comment on the formulated draft strategic plan as well as enhance capacity for application of strategic planning and management of water resources development.

3. Water resources potential and challenges for NWRB

The proper development, control and utilization of water resources are among the key factors in the country's social and economic progress. As the Philippines progresses and the population increases, keener competition and conflict of interest will develop among water users.

Water, once considered an unlimited natural resource, is now becoming a scarce commodity in some areas. Thus, there is an urgent need to manage water more effectively and efficiently. In recognition of this urgency, the Government has implemented projects aimed at addressing the sectoral concerns of water resources agencies. It has also recognized the need to pursue a more focused approach to water resources management through an integrated water resources planning and management such as river basin approach. Such a move will consolidate and harmonize all government efforts in the formulation and implementation of integrated water policies and the rationalization of the sector investment programme. NWRB has a key role top play in this regard.

NWRB remains at the forefront of coordinating and regulating the activities of water resources agencies and the water-related activities in the 12 water resources regions of the country. As the overall policy and coordinative body in the water sector, NWRB formulates policies and plans for the water sector within the framework of IWRM, through the coordination and integration of development programmes, projects and activities.

NWRB is currently undergoing a process of change. It is reaffirming its position as the policy-maker and coordinator of the water sector as well as the country's primary water resource regulator. With the signing of Executive Order 123, NWRB is now in a better position to implement reforms that will institutionally strengthen it. It provides an opportunity for NWRB to carry out an action plan needed to attain integrated and sustainable development of water resources through its policy formulation, regulation and coordination function. As an arbiter of all water resources development, the major challenges NWRB currently faces include:

(a) Institutional strengthening of NWRB. The need to strengthen NWRB and institute reforms was highlighted in several previous studies. Addressing the need to coordinate the concerted efforts of all water-related agencies (annex II) towards sustainable development was also a government priority;

(b) Revision/amendment of the Implementing Rules and Regulations (IRR) of the Philippine Water Code to enforce the provisions of the Code effectively;

(c) Pursuing raw water pricing to effect efficient allocation and conservation;

(d) The formulation of a long-term management plan with a funding mechanism to support ongoing data collection and management efforts for a more comprehensive water resources assessment;

(e) A capacity-building programme on IWRM to nurture, enhance and utilize the skills and capabilities of people and institutions at all levels for better development and management of water resources;

(f) The identification of additional water sources for Metro Manila and other critical areas by conducting strategic studies; and

(g) Development of other strategies/technologies such as rainwater harvesting, water recharging and reclamation.

Efforts should be made to expedite the adoption of other approaches such as desalination, rainwater utilization and other recycling methods to augment the current water supply.

NWRB has taken up the challenge. With the support of the Government and agencies concerned in the sector, NWRB will be able to fulfill its mandate to the fullest as the arbiter of all water resources development.

I. Summary of the goals linked to socio-economic development targets

1. Overall socio-economic development context

The Philippines is a home to 81.1 million people as of July 2003 according to the National Statistical Coordination Board projection and is one of the most populous countries in Asia and the world. While most of the population still resides in the rural areas, urban migration has increased steadily. In 2000, the total urban population constituted 48.05 per cent of the total national population of 76.5 million, according to the 2000 Census of the National Statistics Office. Metro Manila, with its continued influx of rural migrants, has become a very densely populated place. About 13 per cent of the country's population resides within Manila's limited land area, which represents a mere 0.2 per cent of the country's total land area.

Development potential in the Philippines rests largely on the abundant natural resources and well-educated workforce, with major economic challenges coming from rapid population growth, high levels of poverty and inequality, low productivity and intensified global competition.

In terms of economic performance, economic indicators reflected national growth with an upward trend of the gross national product (GNP) and gross domestic product (GDP). The 2003 performance brought average GDP growth in 2001-2003 to 4 per cent, up from 2.9 per cent in 1998-2001. Various structural reforms over the years have improved the economy's resiliency.

Per capita income figures also show disparity in wealth and development distribution in the Philippines, with Metro Manila residents earning much more than residents of other areas.

From 1995 to 2000, the population of the Philippines increased at an annual average growth rate of 2.36 per cent. This is slightly higher than the growth rate during the first half of the 1990s (2.32 per cent). The average annual growth rate during the entire 1990s was 2.34 per cent, while in the 1980s it was 2.35 per cent. If the annual growth rate continues at 2.36 per cent, then the Philippine population is expected to increase to 82.7 million in 2004 and double in approximately 29 years.

Water resources development and management have been recognized as playing a key role in the reduction of poverty. Among the critical factors with direct impact on the poor are water scarcity, water pollution and degradation of watersheds that diminishes productivity.

In the Philippines, statistics show that in 2002 only 80 per cent of the total population had access to a potable water supply. The remaining 20 per cent still depended largely on water from sources of doubtful quality and quantity. This was due to a pervasive lack of cost recovery, disparities in water supply coverage across the region, depletion of groundwater and inadequate capacity-building.

In the Master Plan, annual domestic water demand is projected to increase 3.8 times from the 1995 level of 1,958 m^3 to 7,430 m^3 by 2025. The increase may be higher considering that the actual population growth rate is higher than the projected rate.

Urbanization is adding pressure in providing water supplies. Supplying water to an urban centre whose population is rapidly expanding requires installation of more expensive and sophisticated water facilities. Water must be derived from areas that are more distant. To convey and distribute this water will require huge budgetary allocations on the part of water providers. The additional costs will also have to be passed on to consumers.

The urban poor who are not able to access the utility-run water supply system end up paying much more for inferior water and sanitation services than the well-to-do. They are also more exposed to water-related diseases because of unsafe water sources, and inadequate sanitation and hygiene. Improper waste management further pollutes freshwater bodies and threatens the environment. Water resources degradation results in reduced urban productivity, increased cost of manufacturing, and a lower quality of life, eventually undermining the sustained economic growth and social development of the affected area.

An expanding population will also require the production of more food. To produce more food, the agriculture sector will require more water – more water to produce cereals such as rice and corn, other major crops, more livestock and more fishery products. Thus, the Master Plan Study on Water Resources Development in the Philippines has projected annual agricultural water demand to increase from an estimated 25,533 m^3 in 1995 to 72,973 m^3 in 2025, or 2.8 times. Some 72.6 per cent is allocated for the irrigation subsector, 27 per cent for the fishery subsector and 0.4 per cent for livestock.

Water is necessary for all industrial activities. In the 1998 Master Plan Study, a high correlation was derived between industrial water demand and GDP of the industrial sector. Using the high growth scenario of 8.7 per cent for the industrial sector, annual industrial water demand is estimated to grow 2.24 times the 1995 level of 2,233.6, to 4,997.6 m^3 in 2025. Under the lower growth scenario of 5.9 per cent in the industrial sector, industrial water demand will grow 4.48 times to 3,310.1 m^3.

With regard to the sources of industrial water, the Master Plan Study assumes that the surface water supply will be unchanged, since many of the mining companies that are the main users of surface water in the industrial sector are ceasing or suspending their operations. For groundwater, it was assumed that 30 per cent could be reused for industrial purposes until 2025. More intensive recycling of three times was contemplated for Metro Cebu and the Pasig-Laguna de Bay Basin, inclusive of Metro Manila given the severe water shortage foreseen in the future.

As identified by the 1998 Master Plan Study, there are nine water-critical urbanized areas in the Philippines where water is consumed intensively, and which need short-term and long-term plans to cope with the anticipated water deficit. Two of these areas are Metro Manila and Metro Cebu.

One of the long-outstanding problems in Metro Manila is a chronic shortage of water resources for a stable water supply, which constitutes one factor hampering the economic and social development of the area. Since water demand in Metro Manila is increasing year by year,

the expansion of water supply capacity urgently needs to be resolved. Apart from increasing industrial and domestic demand, another contributing factor to the water shortage in Metro Manila is the high level of water loss due to leaking pipes and illegal connections. Further, the present water supply depends almost on a single water source, the Angat Dam, which supplies 97 per cent of Metro Manila's water supply. In order to establish a stable and reliable water supply system, another bulk water source is needed. For this reason, the Master Plan Study on Water Resources Development for Metro Manila (which is one of the recommendations in the Master Study on Water Resources Development in the Philippines) was formulated. The study formulated a water resources development plan for the Agos River basin to cope with the growing water demand in Metro Manila and nearby cities/municipalities.

Another factor that that has a direct socio-economic impact is the quality of water. Poor water quality has a significant adverse impact on economic and quality of life costs, both now and in the future, in terms of health and foregone revenues. Clean water is an integral part of the strategy for reducing poverty.

Population growth, urbanization and industrialization reduce the quality of Philippine waters, especially in densely populated areas, and regions of industrial and agricultural activities. The discharge of domestic and industrial wastewater and agricultural runoff has caused extensive pollution of the receiving water-bodies. The adverse impact of water pollution costs the economy an estimated P 67 billion annually. The Government is continuing its fight against worsening water pollution by espousing, and including among its priorities, environment policies, legislation and decrees that address the growing need to control water pollution.

The recently passed Clean Water Act proposed an integrated, holistic, decentralized and participatory approach to abating, preventing and controlling water pollution in the country. This monumental step, taken collectively by various stakeholders, is the first attempt to consolidate different fragmented laws, provide a unified direction and focus on fighting water pollution.

The Philippines is also vulnerable to many natural hazards. It is affected by tropical cyclones, volcanic eruptions, El Niño and La Niña episodes, earthquakes, tsunamis, drought and flooding. The worst disasters have caused the loss of human lives, homes and livelihood, and resulted in economic disruption amounting to billions of Philippine pesos. In the past decade alone, the world witnessed the impact on lives and property in a large number of Filipino communities because of the Mt. Pinatubo eruption in 1991, the earthquake in 1990, the Leyte-Ormoc flash flood in 1991 and the recent flash flood in Quezon in December 2004.

The Government responds to these climate-related impacts through at least eight major mechanisms. One such mechanism is the National Disaster and Coordinating Council (NDCC) of the Department of National Defence. This acts as the lead coordinating agency mandated to prepare for, and respond to disaster situations. It collaborates with the Department of Science and Technology through the Philippine Institute of Volcanology and Seismology (PHIVOLCS) and the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) in delivering timely information to other government agencies, particularly local governments, for quick response.

Due to increasing water demand, and water being such a critical factor in the country's socio-economic development and global competitiveness, the Philippines needs to further strengthen water resources management and development in a more integrated and holistic fashion. It is apparent, therefore, that an effective, efficient and equitable water resources management system is needed to balance the demands on this valuable and vulnerable natural resource arising from accelerated economic growth, industrial development and a growing population with the available supply and carrying capacity of the ecosystem.

In line with the goal of an economically and environmentally sound support system for sustainable development, the Philippine Government is committed to providing adequate, safe, accessible and affordable water supplies that will respond to the increasing needs and growing demands of the Filipino people. To realize this goal, it will be necessary to adopt IWRM, based on river basin or hydrological boundaries, as the direction for future water resources planning and investments. Thus, IWRM has been recognized by the Government as important in achieving harmonized water use and allocation. Government efforts include investment in, and financing of high priority infrastructure projects as a necessary component of ensuring sustainability of water resources for various economic uses.

2. Opportunities and threats for water resources development from the NWRB perspective

a. Opportunities

(1) Strengthening NWRB

For the past several years, NWRB has been actively involved in several water resources management and development activities and capacity-building programmes. The agency carried out the National Water Resources Master Plan in 1998 and since then has been actively involved in several water resources management projects:

(a) The National Water Data Collection Network (NWDCN) for Streamflow, Groundwater and Water Quality;

(b) The National Water Information Network (NWIN) under the Water Resources Planning and Management Improvement Component of the Water Resources Development Project (WRDP); and

(c) The recently completed Water Resources Development for Metro Manila.

All these undertakings provide opportunities to address the objective of sustainable water resources development in the country.

The Government's efforts and support in institutionally strengthening NWRB will provide an environment that facilitates better coordination, integration, regulation and supervision of the country's water resources development activities within the framework of the national economic development plan. With the signing of Executive Order 123, NWRB was placed in a better position to implement integrated water resources management for sustainable water resources development and to implement the National Water Vision. Through Executive Order 123, the members of the Board were reconstituted to make NWRB independent of direct claims to water.

The Board is currently reviewing and revising its organizational structure to perform its mandate effectively, taking into consideration one of the major provisions of Executive Order 123, which is the regulation of water tariffs of Water Districts. Likewise, the Board is currently revising the IRR of the Water Code to amend the same to enforce the provisions of the Code effectively.

(2) Implementation of the Millennium Development Goals

Ongoing efforts are being made by the water sector and the government to attain the national water vision in realizing the government commitment in the Millennium Development Goals.

(3) Enhancement of collaboration with the private sector

Existing government policies have been established to enhance private sector participation in water resources development.

(4) Enhancement of public awareness on water resources management

There was a clear increase in the important role of water and the need to increase awareness of the vital role of water in sustainable development.

b. Threats

Currently, the threats include:

(a) High information costs due to many users of river basin water, which has impeded the process of negotiation and exchange that could lead to a social and economical optimal allocation;

(b) Social acceptability of the water resources development project;

(c) Political intervention. Priority project changes due to changes in management;

(d) Non-consumptive uses that interfere with or lower the value of water, precluding or impairing its use by others. For example, non-consumptive uses such as leaching of salts from agricultural fields, diverting river water to cool water plants and using the river to dispose of partially treated or untreated waste all degrade water quality at the expense of other uses;

(e) A lack of sufficient and updated data and information for developing modelling studies that will support policy formulation and decision-making in water resources development; and

(f) Insurgency or security problems in the proposed priority areas.

c. Vision statement

A National Consultation on Water Sector Mapping and Visioning was conducted in May 1999 by NWRB. The national consultation meeting was undertaken as part of the formulation of a National Vision that served as an input to the regional report of a Water Sector Mapping and Vision for South-East Asia and later in the global reports presented to the Second World Water Forum in The Hague, Netherlands in March 2000. The National Water Vision shared by the participants of the workshop was "By the year 2025, water resources in the Philippines are being used efficiently, allocated equitably and managed sustainably."

The National Water Vision and the framework for action was reviewed and validated at a Workshop on Water Resources in the Philippines: Vision to Action convened by NWRB. The workshop adopted the National Water Vision with a modification to include the provision for water-related disasters, as follows: "By the year 2025, water resources in the Philippines are being used efficiently, allocated equitably and managed sustainably with provision for water-related disasters."

In support of the National Water Vision, NWRB in consultation with other water-related agencies during the workshop on strategic planning and management on IWRM, formulated the following Vision, which is an integration of the two earlier versions developed by NWRB:

> "Widely recognized lead authority in the effective regulation of water resources and its economic services through a modernized, well-coordinated, sustainable and efficient system."

The Vision was developed based on the participants' expectations of the NWRB role and priority activities as the leading agency responsible for research and regulation of water resources towards a more effective formulation of a national IWRM plan.

II. Legal and institutional framework

1. Brief historical overview of the legal and institutional context of water resources management

The fundamental principles and policies on water resources development and management are embodied in a number of enabling laws. Among these are the Philippine Constitution, 1987, Presidential Decree 424, 1974, the Water Code, 1976, the Environmental Code, 1977 and the Philippine Clean Water Act, 2004.

The Philippine Constitution, 1987 provided the basic principles of water resources development and management, which stipulate that all waters of the Philippines belong to the State.

Presidential Decree 424, 1974 created the National Water Resources Council (now NWRB) to coordinate the planning of some 30 water resources agencies of the Government.

The Water Code, 1976 provides the framework for implementing the provisions of the Constitution on water resources development and management with regard to water quality. This includes the rules governing the rights and obligations of water users as well as the administrative structure to enforce the provisions of the Water Code. The code adopts prior appropriation doctrine of “first in time, first in right” for water allocation in the country.

The Environmental Code, 1997 prescribes, among other things, the management guidelines aimed to protect and improve the quality of the water resources through (a) classification of surface waters, (b) establishment of water quality standards, (c) protection and improvement of the quality of water resources, and (d) responsibilities for surveillance and mitigation of pollution incidents.

Republic Act No. 9275 (also known as the Philippine Clean Water Act, 2004) provides for comprehensive water quality management. It also provides the framework for sustainable development to achieve a policy of economic growth in a manner consistent with the protection, preservation and revival of the quality of fresh, brackish and marine waters.

The main components of water resources management in the Philippines are vested in the mandates of the various government agencies that undertake most of the water resources programmes and projects in the country. There are about 30 such agencies and offices, each dealing with a particular aspect of water resources development. Thus, there are separate agencies dealing with each of the sectors of water supply, irrigation, hydropower, flood control, pollution, watershed management etc. Each agency undertakes programmes and projects exclusively within its own field of responsibility. Project identification and planning are performed to meet the targets of the agency.

Under this setting, the then National Water Resources Council (NWRC) was created in 1974 as the authoritative national organization to coordinate and integrate all activities in water resources development and management. Its main objective was to achieve scientific and orderly development and management of all the water resources of the Philippines, consistent with the principles of optimum usage, conservation and protection to meet present and future needs. The mantle of authority of NWRB is derived from Presidential Decrees 424 (NWRC Charter), 1067 (Water Code of the Philippines) and 1206 (Water Utilities).

2. Current situation and perspectives of the legal and institutional framework, including organization charts

In the water resources sector, the current institutional and regulatory framework is the product of incremental developments over many years, each in response to the particular challenges

of the time. This has led to the absence of an integrated water resources management system that adopts a holistic approach to the sector demands.

The Water Code, 1976 is the basic water law of the Philippines. Together with a set of IRR, the law provides a framework for water management, defines the rights and obligations of water users as well as the protection and regulation of such rights, and identifies administrative agencies for enforcing the Code. Through this instrument, NWRB is able to administer and enforce sustainable policies and directions in appropriate water resources management scenarios. However, the present IRR are already outdated since they were issued more than 28 years ago. Some provisions are no longer responsive to the current usages and to the changing needs of the country. NWRB is currently revising/amending the IRR, which are scheduled to be implemented in 2005.

Another significant step towards sustainable development, taken by the Government in consultation with stakeholders, is the Philippine Clean Water Act, 2004. The Department of Environment and Natural Resources together with other agencies concerned, including NWRB, is currently developing its IRR.

There are some 30 government agencies and offices concerned with water resources development and management responsible with their own sectoral concerns. These agencies deal with the water supply, irrigation, hydropower, flood control, water management, etc. For administrative supervision, these agencies are distributed among executive departments of the national Government. In the government-controlled corporations, councils, boards and development authorities, supervision is only exercised at the policy level. The Department of Environment and Natural Resources exercises direct-line supervision, authority and control over its respective bureaus and other offices. At the national level, the National Economic and Development Authority (NEDA) coordinates the activities of all sectors while NWRB coordinates the water resources sector, and the regional councils and authorities deal with regional activities (annex II).

The major water service providers and users are the National Irrigation Administration and the Bureau of Soil and Water Management for irrigation and drainage; Local Water Utilities Administration/Water Districts, Metropolitan Waterworks and Sewerage System through its concessionaires, Department of the Interior and Local Government/Local Governments Units for municipal and industrial water supply; and National Power Corporation for hydropower. The Department of Health (DOH) is responsible for drinking water quality regulation and supervision of general sanitation activities while the Department of Public Works and Highways-Project Management Office for Major Flood Control Project (DPWH-PMO-MFCP) is responsible for flood control mitigation.

The National Water Resources Board remains at the forefront of coordinating and regulating the activities of water resources agencies and the water-related activities in the twelve water resources regions of the country. It is responsible for cross-sectoral coordination and regulation of water resources development and management. The Board membership comprises heads of the departments and agencies with no direct claims on water resources:

(a) Department of Environment and Natural Resources
(b) NEDA
(c) Department of Justice
(d) Department of Finance
(e) Department of Health
(f) National Hydraulic Research Centre
(g) University of the Philippines
(h) The Executive Director of NWRB, as the head of the Secretariat.

The Board, presided over by the Secretary of the Department of Environment and Natural Resources as chairman and the Director-General of NEDA as vice-chairman, meets every month to define policies and to resolve all issues and conflicts in water resources development and management.

Executive Order 123 stipulates that in order for NWRB to implement its mandate effectively it will prepare a revised Organization Structure that will be approved by the Department of Budget and Management and the President. Another provision is the review and amendment of the IRR. The proposed Organizational Structure includes the decentralization of NWRB functions through the Establishment of Water Area Operations (WAOs) in the country. The WAOs will provide secretariat services to the Water Resources Regional Councils to be created.

NWRB is supported by a fulltime working staff comprising specialists in the different aspects of water resources as well as administrative support personnel. The staff headed by an Executive Director, comprises some 65 engineers, economists and legal specialists as well as some 49 administrative, financial and technical level support personnel. Annex I shows the existing NWRB organizational structure.

Another important institution in the water sector is the Department of Environment and Natural Resources, which is responsible for watershed management and monitoring water quality. The issues of pollution prevention and control are the primary concerns of the department and the Environmental Management Bureau, with cooperation from various regulating agencies, particularly the Department of Health, in sanitation and countrywide surveillance of drinking water sources to protect public health.

The Philippines has also some experience with basin management authorities, most notably the Laguna Lake Development Authority (LLDA), which was granted an institutional mandate in 1966 by virtue of Republic Act 4850 as amended by Presidential Decree 913 and Executive Order 927. LLDA has a very strong statutory mandate, yet its charter provides it with both regulatory and development powers, which may present long-term conflicts of interest. Another river basin organization is the Agno River Basin Commission (ARBC), whose function has been limited to coordinative roles. However, ARBC was abolished with effective from December 2004 through an Executive Order issued by the President. Meanwhile, NWRB is proposing the absorption of its functions in line with its decentralization programme.

Several efforts have been made towards the creation of a similar organization. One of the proposed projects geared towards promoting integrated watershed and water resources development and management within the river basin context is the proposed River Basin and Watershed Management Project, which involves pilot testing of the IWRM Strategy in the Bicol River basin.

3. Brief analysis of strengths and weaknesses of the current legal and institutional framework

a. Legal framework

As more than 27 years have passed since most of the basic laws on water were promulgated, some of them will need to be revised in order to address the problems that have been encountered. Most of the problems or issues may be traced to inadequate implementation and/or enforcement of the existing laws and the need to revise the IRR of the Water Code as a result of increasing water demand, and current pressures on the water and related land resources. The IRR were formulated 27 years ago. While implementation policies and procedures have been continuously updated through the years by NWRB board resolutions to ensure relevance to current times, these have not have been consolidated and integrated into the IRR. However, the basic laws including some existing water policies are still relevant and adequate, but some need to be amended.

Poor quality water also results in extensive economic and quality of life costs, both now and in the future, in terms of health, foregone tourism revenues, lost fisheries production, potable water constraints etc. The Government is continuing its fight against worsening water pollution by including among its priorities such aspects as environment policies, legislation, and decrees that address the growing need to control water pollution.

The recently passed Clean Water Act proposed an integrated, holistic, decentralized and participatory approach to abating, preventing and controlling water pollution in the country. This significant step, taken collectively by various stakeholders, is the first attempt to consolidate different and fragmented laws, provide a unified direction and focus on fighting water pollution.

b. Institutional framework

The major institutional problem that has beset the sector is the multiplicity of agencies and consequent fragmentation of water resources planning and management. There are no cross-sectoral water resources plans to integrate various water and land-use activities, or water quantity and quality management of the conjunctive use of surface and groundwater. Due to the range of functions of multiple agencies, planning is undertaken independently of the others. Consequently, the water sector is inherently fragmented and some overlaps of responsibility and conflicts exist among agencies.

One measure that was considered earlier was the creation of an apex body in water resources to address the need for a strong regulatory body. Thus, Bills were filed in Congress to create such a body, but little progress has been made towards its enactment. Given this situation, an interim option was to strengthen NWRB, the coordinating and regulating agency for all water resources development and management activities in the country through Executive Order 123, which reconstituted the agency to perform its mandate effectively and efficiently. The improvement of NWRB in terms of power, structure, status and capability provides an interim step towards the rationalization of the water resources sector. NWRB is thus in a better position to implement integrated water resources management together with other government agencies with mandates on water concerns.

4. NWRB mission

With the strengthening of NWRB as one of the identified priority activities of the Government, a Strategic Plan for NWRB was developed to provide direction as well as place focus on the organization and ensure the most effective use of its limited resources.

NWRB in consultation with the stakeholders' proposed two Mission Statements, which were later integrated into the following Statement:

> "To effectively formulate policies, regulate water use and allocation as well as improve and expand the delivery of water services through well coordinated, sustainable and efficient systems responsive to the needs of national development."

III. Strategic plan goals

IWRM has been recognized as one of the best approaches towards sustainable management of water resources. IWRM in the Philippines is not actually a recent creation. The first attempts had been made more than 27 years ago to bring a more holistic perspective to water development and management. The birth of IWRM as a policy direction can be traced through policies on water resources management, as embodied in several enabling laws starting with the creation of the former NWRC (now NWRB) in 1974. The Philippines then was considered to be in the forefront by many countries at a similar stage of development, as it had an institutional structure for integrated

water resources management. However, while significant headway has been made on IWRM during the past decades, reform initiatives are still needed to provide an adequate enabling environment for the effective and efficient implementation of IWRM.

Earlier efforts were made at the regional and river basin planning, for which corresponding institutions were established. Some of them have ceased operation for various reasons. The Government, through the Medium-Term Philippine Development Plan (MTPDP), has decided to pursue IWRM based on the river basin approach as the most suitable direction for water resources planning and investment. This is from a sector approach to a more focused river basin approach that is integrative and coordinative of all water-related efforts. The country's strong commitment to the Philippine Millennium Development Goals (MDG) and the World Summit on Sustainable Development is further enforced in the goals, strategies and targets embodied in the MTPDP.

Mapping and visioning have been identified as among the strategic approaches in developing effective means of water resources management. Visioning and several national consultations were conducted wherein NWRB took the lead role as the Government's coordinating and regulating agency on water resources management. The latest consultation was the National Water Forum 2004. The forum presented and discussed priority actions and policy in the water resources sector; as the lead convener of the forum, it will take charge of all post-forum activities based on the recommendation.

The water sector is being guided by the policies and strategies stated in the MTPDP, which is consistent with the 10-point agenda of the President. The MTPDP embodies the anti-poverty and overall development framework of the administration. In preparing all Filipinos for the new economy, the MTPDP aims to expand and equalize access to economic and social opportunities, inculcate receptivity to change, and promote personal responsibility. It has identified several related policies that will provide an integrated and systematic approach to water resources planning and management, an overall planning framework to guide investment activities and ensure efficient sourcing and utilization.

The Government, as articulated in the MTPDP, is keen to move away from sectoral planning and implementation towards a more decentralized and integrated approach to water resources management – taking a holistic view of supply (quantity and quality) and demand (economic, social and environmental).

The Strategic Plan goal for IWRM to support socio-economic development and sustainable utilization of the country's water and related resources is detailed below.

(1) Overall IWRM goal

The overall IWRM goal integrates and coordinates all water-related efforts in a more focused approach to water resources management for sustainable development of water and related land resources in order to support socio-economic growth. Within the context of this overall goal, NWRB will attempt to achieve the following three main mission goals:

(i) Goal 1

An effective regulatory framework for water resources management (Water Resource Regulation).

Water resources management is the integrating concept for a number of water subsectors such as hydropower, water supply and sanitation, irrigation and drainage, and environment. An integrated water resources perspective ensures that social, economic, environmental and technical dimensions are taken into account in the management and development of water resources. An

effective regulatory framework for water resources management plays a fundamental role in maintaining water resources development towards sustainable growth and poverty reduction.

Under this goal, NWRB, in cooperation with other water-related agencies and stakeholders, will focus on the following priority strategies:

(a) Pursue the creation/strengthening of an independent regulatory authority;

(b) Provide an enabling legislative and institutional framework for sustainable water resources development;

(c) Implement a capacity-building programme for the water resources sector;

(d) Formulate a long-term management plan with a funding mechanism to support ongoing data collection and management efforts for more comprehensive water resources assessment;

(e) Adopt an holistic approach to water resources development through the creation of River Basin Organization/Water Resources Regional Councils (WRRCs);

(f) Identify additional/alternative water sources for Metro Manila and other critical areas through strategic studies;

(g) Pursue a programme on flood mitigation and minimizing losses/reduction of damage;

(h) Identify and develop other strategies/technologies such as rainwater harvesting, water recharging and reclaiming to augment current water supplies;

(i) Undertake a Water Resources Assessment Programme for improved water resources regulation;

(j) Pursue the preservation of the environment, particularly the maintenance and development of watershed areas; and

(k) Develop a water allocation strategy and guidelines to increase water-use efficiency for different water users.

(ii) Goal 2

An effective framework for sustainable water utilization (economic regulation and cost recovery).

Economic regulation refers to water pricing, tariff setting and, to a certain extent, safeguarding service standards in the sector. An ideal economic regulation environment provides incentives for suppliers to improve efficiency while ensuring that benefits are passed on to consumers. A balance to assure cost recovery of investments and adherence to service standards should be struck to ensure that the customers' interests are safeguarded while allowing the investors to receive a fair rate of return.

The current approach to water pricing is inadequate for reflecting the true value of water. The fees charged by NWRB for either ground or surface water are grossly insufficient with regard to providing for cost recovery and sustainability of water resources or for providing incentives to use water efficiently. A more rational system for raw water pricing that considers environmental, economic and social costs and benefits should be instituted in order to achieve more efficient and equitable water resource allocation.

To achieve this goal, NWRB will work on the following strategies in cooperation with the stakeholders and other concerned agencies:

(a) Pursue raw water pricing in order to effect efficient allocation and conservation of water resources;

(b) Conduct a study of tradable water rights. Water rights transfers have the potential to increase the productivity of water use, improve operations and maintenance of water service systems, secure private investment and economic growth, and reduce water conflicts;

(c) Develop a mechanism that takes into consideration full cost recovery and other externalities while balancing it with people's capacity and willingness to pay to effect efficiency and effectiveness of water resources development; and

(d) Establish a market-based instrument for sustainable development.

(iii) Goal 3

An organizational mechanism and policy for the coordination and integration of water resources development and management. This will include:

(a) A capacity-building programme for IWRM in order to nurture, enhance and utilize the skills and capabilities of people and institutions at all levels for better development and management of water resources;

(b) Formulate policies and strategies to improve water resources planning and efficiency of water use; and

(c) Provide climate outlook and advisories for short- and long-term planning.

IV. Implementation, monitoring and evaluation

1. Indicators of the implementation of water resources management activities

Quantifiable and measurable indicators that monitor the implementation of water resources management activities of all water subsectors must be validated. These indicators can be (a) the population served in a given period, (b) the increase in irrigation areas, (c) how much rice is being produced, (d) how much rice is being imported annually, (e) the number of flood control structures and (f) the reduction of area being flooded. Other quantifiable indicators could include those that show the effectiveness of the Government's programmes in implementing water resources management (e.g., the number of water resources development projects per region or basin).

2. Action Plan

Table J.3 details the priority activities proposed by NWRB and other water-related agencies who participated in the strategic planning and management (SPM) workshop for the realization of the National Water Vision.

Table J.3. Priority activities proposed by NWRB and other water-related agencies

Programmes/projects	Key agencies	Indicators	Time frame
Goal 1: Effective regulatory framework for water resources management (water resource regulation)			
Revise/amend the IRR of the Philippine Water Code to enforce the provisions of the Code effectively	NWRB	Amended IRR of the Water Code	By January 2005
Coordinate post-forum activities to implement IWRM and formulate policies relative to the four thematic papers	NWRB	Number of policies implemented	2005-2010

Table J.3. *(continued)*

Programmes/projects	Key agencies	Indicators	Time frame
Reorganization of NWRB structure to efficiently and effectively perform its mandate as arbiter on water resource management and development	NWRB	Revised NWRB structure with corresponding budget allocation	By CY 2005
Master Plan Study for the Agusan River basin	NWRB/DENR	Master Plan for Agusan River basin	2005-2006
Strengthening NWRB regulatory mechanism for issuance of water permits and preparation of water resources assessment and development plan for sustainable utilization of water resources	NWRB/LGUs/ WDs	Improved regulatory practice for groundwater in selected LGUs	CY 2005 onwards
Decentralization of NWRB functions in eight priority areas to provide a more responsive, stronger and capable institution	NWRB with concerned agencies	Decentralized NWRB function in eight priority areas	2005- 2010
Creation of River Basin Organizations/ establishment of Water Resources Regional Councils to implement IWRM	NWRB	WRRCs established	2005-2010
Water resources assessment for five critical areas	NWRB	Water resources assessment conducted	2005-2007
Groundwater mapping and assessment in highly urbanized cities	NWRB	Assessment Conducted	2005-2007
Regulate eco-activities to address pollution in Laguna Lake	LLDA	Identified water conservation measures	2004 onwards
Programme on risk mapping, forecasting and warnings	PAGASA	Master Plan and feasibility study for alternative source of water supply in the identified areas	By 2005
Study on water conservation and management	NWRB/LGUs and other water-related agencies	Recommended policies and identified appropriate technology	By 2010
Water resources development study for other water critical areas	NWRB/LGUs/ WDs and other water-related agencies		2007-2010
Study of rainwater harvesting	NWRB/LGUs/ DOST		2006-2007
Goal 2: Effective framework for sustainable water utilization (economic regulation and cost recovery)			
Pilot implementation of raw water pricing (Bohol and Negros Oriental)	NWRB/NEDA/ DENR	Raw water pricing implemented in the identified pilot area.	By 2006
Economic regulation of water utilities	NWRB	Enhanced capacity of NWRB clients; Development of regulatory guidelines	By 2006
Capacity-building of NWRB on economic regulation	NWRB	Integrated billing and collection system; Development of guidelines for operations audit and commercial systems for water utilities	BY 2006

Table J.3. *(continued)*

Programmes/projects	Key agencies	Indicators	Time frame
Goal 3: Organizational mechanism and policy for coordination and integration of water resources development and management			
IEC programme for public school children on water conservation, disaster reduction and water pollution	OCD/PAGASA	Increased awareness of school children	2004-2005
Review and amend Water Code of the Philippines	NWRB/NEDA	Amended Water Code	By 2010
Formulation of water policies for water critical areas	NWRB	Policies formulated	2004 onwards
Undertake/catalyze intervention through LGUs to improve the water quality of Laguna Lake	LLDA/LGUs		CY 2004-2008
Study of water-use efficiency for different water users	NWRB	Developed water allocation strategies and guidelines to increase water use efficiency	2005-2010
Study of the socio-economic impact of floods	NWRB/NEDA/ DPWH/OCD and other water-related agencies	Recommended policies on flood management to sustain economic growth	BY 2006

Note: DENR – Department of Environment and Natural Resources; DOST – Department of Science and Technology; DPWH – Department of Public Works and Highways; LGU – local government unit; OCD – Office of Civil Defence; WD – Water District.

3. Mechanisms for reporting, monitoring and evaluation

Within NWRB, monitoring will be under the Executive Director through the Executive Committee, which comprises division heads. Meanwhile, national government agencies are accountable primarily to the public and then to the Government headed by the President.

The performance of each government organization is determined through the Department of Budget and Management's Agency Performance Measures, which contain a five-year presentation of the performance of the organization. Based on the Organizational Performance Indicator Framework, the organizations specify their outcomes and major outputs, appropriate performance indicators, accomplishments and targets, and corresponding budgetary allocation for related programmes/activities/projects.

For the whole sector, the Department of Budget and Management and NEDA take the lead in establishing the Medium-Term Expenditure Framework (MTEF) as well as in developing performance indicators to measure the extent to which the programmes and projects are achieving the desired sector outcomes identified in the MTPDP. One of the features of MTEF is the Medium Term Philippine Investment Programme, which is an outcome-oriented framework that includes the preliminary task of clear understanding of, and agreeing on the needs of the sector before even identifying programmes and projects. The methodology in formulating the Medium-Term Public Investment Plan veered away from the practice of consolidating project lists. In this methodology, NEDA will just validate the internally prioritized projects of the agencies to see if they are consistent with the sectoral priorities. The methodology is operationalized in the sector effectiveness and efficiency review.

As a coordinating body, NWRB also continuously conducts inventories on all water resources development programmes and projects, which can also be used in monitoring water sector status.

V. Consultation mechanisms and initial findings

1. Consultation mechanisms in place and future developments

National consultation through the organization of forums, workshops and visioning are among the existing strategic approaches in the Philippines for developing effective means of water resources management. Visioning in the Philippines consists of a series of workshops widely participated in by water-sector stakeholders in order to come up with a national vision and framework for action. It is where stakeholders from various subsectors and institutions that include water professionals and social scientists in the water sector come together and share their vision of water, life and environment in 2025. A National Consultation on Water Sector Mapping and Visioning was conducted in 1999 and documented in a report entitled “Integrated Water Resources Management in the Philippines: Needs, Expertise, Visioning and Action”.

The visioning exercise was followed by the Workshop on Water Resources Management in the Philippines: Vision to Action, held in May 2000. The workshop reviewed and validated the formulated national vision and framework for action. To be consistent with the provisions of the MTPDP, which provides the detailed work plan for 2001-2004, and to link the vision to the Medium-Term Public Investment Plan, which provides for investments to implement the development plan, a Workshop on the Philippine Programme for Action in the Water Resources Sector (2001-2004) was organized in June 2001.

Another major activity in the water sector that was recently undertaken was the National Water Forum, which was also marked by a series of meetings and workshop. The Forum aimed to present and discuss the priority actions and policy in the water resources sector. Aside from the above mentioned national consultation meetings, Administrative Order 258, which declared March 22 as the annual World Water Day, also serves as another consultation mechanism. It provides a venue for hundreds of stakeholders and decision-makers from various water-related agencies to interact, express diverse views, exchange ideas, recommend new approaches to meet the challenges that lie ahead and suggest measures for resolving issues confronting the water sector.

The creation of inter-agency task forces and committees to thresh out specific problems and issues related to water resources development and management is another existing approach or mechanism for successful coordination among water-related agencies.

2. Initial findings on recent efforts

The findings on recent efforts are:

(a) A need exists for streamlining the water sector to ensure effective coordinated planning and implementation of a river basin or watershed approach;

(b) There is a need to strengthen and regionalize NWRB as an interim option while waiting for the creation of an autonomous, independent water resources authority;

(c) A need exists for a clear definition of the role of river basin organizations;

(d) There is a need to incorporate the economic value of water into pricing of raw water to ensure sustainability of water resources development and management; and

(e) Further study of the transfer and trading of water rights is required.

VI. Conclusions and recommendations

The Philippine Government has recognized the urgency for effectively and efficiently managed water resources. Thus, it is now pursuing a more focused approach to water resources management through integrated water resources planning and management, such as the river basin approach. The objective is to consolidate and harmonize all government efforts in the formulation and implementation of integrated water policies, and to rationalize the sector investment programme. Several water-related activities have been conducted to identify issues and recommend appropriate legal and institutional action to address the identified issues.

NWRB, as the Government's arm to implement the basic policies and guidelines that govern the control, conservation, development and utilization of the country's water resources, is implementing projects and programmes to attain integrated and sustainable development of water resources. The ongoing effort to strengthen NWRB institutionally, together with increasing public awareness of addressing the issues in the water sector, will provide a fundamental step in overcoming the constraints and barriers to implementing policies in integrated and sustainable development of water resources.

Therefore, the biggest challenge for NWRB is the successful management of water resources that will create an impact, both at the political and national levels. It has to develop a consolidated programme wherein the different water-related agencies will come up with various strategies or specific programmes within their respective agencies that can be of help to NWRB. It is fortunate that NWRB, under its new leadership, wants to do something different – something that will create bigger impacts. With the new term of the President, there is much enthusiasm to move forward.

It has noted that although the concept of SPM is not new, different people have different perceptions. Hence, human resources development is an important aspect of SPM with regard to ensure people have the same perception and direction. SPM is a continuous learning process. How to create a win-win situation is another aspect, which is of paramount importance in SPM.

To integrate all previous efforts in the water resources sector and to achieve the national vision, there is a need to start developing an IWRM Plan for the Philippines. This will not only help NWRB meet the high economic agenda of the Government as stated in the MTPDP (2005-2010) but will also help other government organizations to contribute to the development of water resources in an IWRM way. The successful management of water resources in the country is not only the duty of NWRB but also of everybody in the sector.

1. Benefits of the SPM approach

The benefits of the SPM approach include:

(a) Strengthening NWRB and the water sector through formulation of an Action Plan;

(b) The development of guidelines that strengthen the national capacities of different water related agencies;

(c) Providing participants with a better understanding of the SPM approach; and

(d) Serving as a tool in fulfilling the commitment to the World Summit on Sustainable Development for development of IWRM in 2005.

2. Lessons learnt

The lessons learnt are that:

(a) The implementation of IWRM requires the adoption of SPM;

(b) Capacity-building is essential and a part of the process for achieving successful SPM; and

(c) Consultation and stakeholders' participation play a major role in this activity.

3. Plans for sustaining the SPM approach in IWRM

The plans for sustaining the SPM approach in IWRM include:

(a) Adoption of the Strategic Plan of MTPDP towards IWRM;

(b) Decentralization of NWRB and the creation of WRRCs;

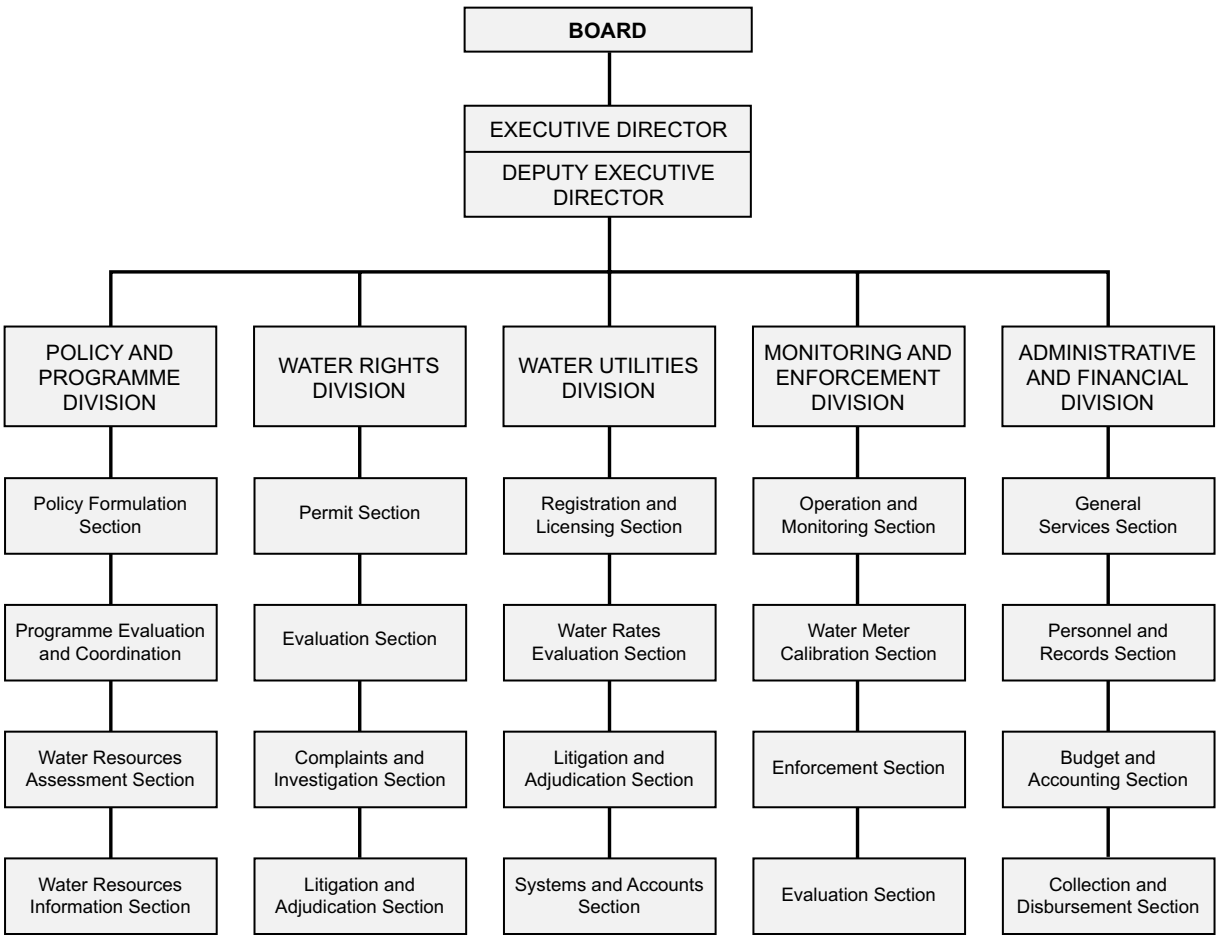
(c) Continuous capacity-building activities;

(d) Increasing revenue and proposing other sources of revenue such as market-based instruments and raw water pricing; and

(e) Consultations and information dissemination as a continuous process.

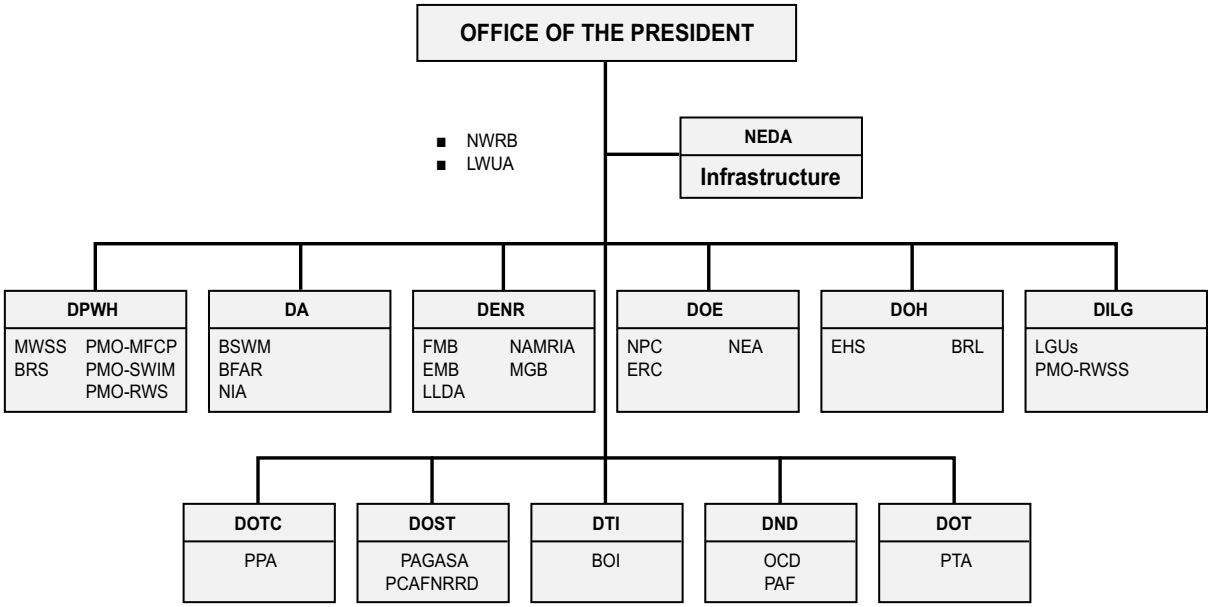
ANNEXES

Annex I. National Water Resources Board organizational chart



Chairman:	Secretary, Department of Environment and Natural Resources
Vice-Chairman:	Director-General, National Economic and Development Authority
Members:	Secretary, Department of Finance
	Secretary, Department of Health
	Secretary, Department of Justice
	Director, National Hydraulic Research Centre
	Executive Director, National Water Resources Board

Annex II. Organizational relationship of government water-related agencies



BFAR	Bureau of Fisheries and Aquatic Resources
BOI	Bureau of Investment
BRL	Bureau of Research and Laboratories
BSWM	Bureau of Soil and Water Management
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Government
DILG-PMO-RWSS	DILG-Project Management Office-Rural Water Supply and Sanitation
DND	Department of National Defense
DOE	Department of Energy
DOH	Department of Health
DOST	Department of Science and Technology
DOT	Department of Transportation
DOTC	Department of Transportation and Communication
DPWH	Department of Public Works and Highways
DPWH-PMO-MFCP	DPWH-Project Management Office-Major Flood Control Project
DPWH-PMO-SWIM	DPWH-Project Management Office-Major Flood Control Project
DPWH-PMO-RWS	DPWH-Project Management Office-Rural Water Supply
DTI	Department of Trade and Industries
EHS	Environmental Health Sciences
EMB	Environmental Management Bureau
ERC	Energy Regulatory Commission
FMB	Forest Management Bureau
LGUs	Local Government Units
LLDA	Laguna Lake Development Authority
LWUA	Local Water Utilities Administration
MGB	Mines and Geosciences Bureau
MWSS	Metropolitan Waterworks and Sewerage System
NAMRIA	National Mapping and Resource Information Authority
NEA	National Electrification Administration
NEDA	National Economic and Development Authority
NIA	National Irrigation Administration
NPC	National Power Corporation
NWRB	National Water Resources Board
OCD	Office of Civil Defence
PAF	Philippine Air Force
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PCAFNRRD	Philippine Council for Agriculture Forestry, Natural Resources and Resource Research and Development
PPA	Philippine Ports Authority
PTA	Philippine Tourism Authority

K. OUTLINE OF THE STRATEGIC PLAN TO ESTABLISH A NATIONAL WATER RESOURCES AUTHORITY OF SRI LANKA

By the Interim National Water Resources Authority of Sri Lanka*

Introduction

This report is presented by the Interim National Water Resources Authority (I-NWRA) of Sri Lanka as a part of the assignment set out in the partnership agreement with ESCAP. The assignment includes the preparation of a strategic plan as a case study on designing and implementing critical water sector reforms in Sri Lanka. The assignment comprises two major activities:

(a) Draft a strategic plan of the National Water Resources Authority, to be implemented under the provisions of the Water Act for Integrated Water Resources Management to support socio-economic development and sustainable utilization of the country's water and natural resources; and

(b) Invite comments on the draft strategic plan from key stakeholders for discussion at a roundtable workshop to be held in Colombo.

The Government of Sri Lanka has set out millennium goals for future socio-economic development. Currently the Government is actively pursuing water sector reforms through the policy, legal and institutional framework to meet the future challenges in the management of water resources. The Government's aim is to reform the sector to reduce its expenditures, avoid duplication of functions, optimize resource mobilization for performance and results, and create an environment for private sector participation in the delivery of services.

I. National water sector context

Sri Lanka's water sector reforms are influenced by a number of warning signs related to water. One problem is the non-availability of cost-effective water resources for expanding safe drinking water supply to the targeted population in spite of massive investments made in the water sector in the past three decades. Degradation of water quality and critical watersheds are among the other major issues for priority intervention. Because of the warning signs and emerging competition for water, the Government has taken action to implement reforms in the area of water resources management. Sri Lanka lacks a comprehensive approach to water allocation or an adequate system of water rights. Water is managed as an input to a number of major national sectors.

Economic development, urbanization and industrialization are placing increasing pressure on Sri Lanka's water resources and highlight the need for reforms to improve overall management of those resources. In response to this challenge, the Government embarked on an Action Plan for Comprehensive Water Resources Management to initiate policy and legal reform, and institutional strengthening. It has produced the country's first-ever comprehensive policy and law for the sustainable management of surface and groundwater resources. This will provide a framework for integrated basin planning, management and conservation of water resources, providing efficient delivery of water services in subsectors such as irrigation, hydropower, domestic and industrial water supply, and sanitation. Water rights, allocation, and demand management will be part of the policy.

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At present, Sri Lanka has one of the highest population densities in the world and the pressure on natural resources has almost reached the threshold value, even though Sri Lanka is considered as having one of the world's richest ranges of biodiversity. Some alarming environmental evidence has prompted the Government to take action in the past decade to reform the natural resources management structure of the country.

Since independence, the focus of successive governments has been to use water as an input to meet various economic benefits and to fulfil politically ambitious projects and programmes. New agencies were created with powerful mandates to maximize water utilization through multipurpose water development. In the recent past, essential water resources management functions for the sustainability of the resource base have not been given adequate attention.

The chapter on the national water sector context discusses the Sri Lankan approach to water resources management, while the chronology of events since the early 1950s is presented in annex I in order to provide a clear picture of what has evolved. The current sector reforms are the most significant changes to be effected in deviating from the traditional approach. The main focus in the reforms is the setting up of a legal and institutional framework for establishing integrated water resources management (IWRM). The final report will discuss the challenges that will face the I-NWRA and its establishment as an institution performing an important function. The compelling reasons for the reforms are presented in a few brief case studies and the policy action initiated in the water sector since 1990, which has led to the current reforms.

Analysis of water sector performance in the past decade, including projects and programme and their focus, will be presented in detail to highlight the issues and trends that have led to current reforms. The SWOT analysis for the emerging institutional framework will be the basis for the strategy to be formulated. Gaps, overlaps and lack of coordination were the main issues related to existing institutional framework. Acceptance and endorsement of proposed institutional arrangements at the highest level of government is a positive sign for success.

Existing institutional arrangements

There are 20 principal state agencies involved in the water sector operating at the national level. The water-related functions of the agencies are:

(a) The Meteorology Department – collection and dissemination of weather and climatic data and information;

(b) The Irrigation Department – provision of irrigation infrastructure, flood control systems and salt water exclusion schemes;

(c) The National Water Supply and Drainage Board (NWSDB) – provision of piped water and safe drinking water schemes using surface and groundwater resources, and development and management of sewerage systems;

(d) The Ceylon Electricity Board (CEB) – provision of hydropower and thermal power for electricity;

(e) The Water Resources Board (WRB) – conducting scientific investigations on groundwater resources and commercial drilling of tube wells;

(f) The Mahaweli Authority of Sri Lanka (MASL) – water resources development in the Mahaweli River basin and transfer to adjacent basins construction and management of irrigation and hydropower infrastructure and settlements, promoting irrigated agriculture, upper watershed management water allocation between competing users;

(g) The Irrigation Management Division (IMD) of the Ministry of Irrigation – promoting participatory management of irrigation schemes of a selected number (37) of major irrigation settlement schemes; institutional support to set up farmer companies and pilot testing;

(h) The Water Resources Development Division – policy reviews, coordination and monitoring of activities related to standing committees, such as selected foreign-funded projects on irrigated agriculture and watershed management;

(i) The Natural Resources Management Centre of the Department of Agriculture – promoting agricultural production through conservation measures for soil erosion and watershed management;

(j) The Agrarian Services Department – provision of agricultural inputs and enforcement of agrarian laws on farmer organizations, and administration of irrigation management procedures;

(k) The National Planning Department – planning of water resources projects and programmes at the national level and advising on resource allocations among the projects;

(l) The Central Environmental Authority (CEA) – implementation of environmental laws related to environmental impact assessment regulations while conducting environmental awareness programmes and enforcement of the provisions in the National Environmental Act;

(m) The National Aquatic Resources Agency – conducting research and development work in aquatic resources, such as inland and marine fish resources, limnological studies in water bodies, and water quality measurements;

(n) The Natural Resources Energy and Science Authority – administration of research grants for science and energy, publication and dissemination of research results carried out by independent researchers;

(o) The National Building Research Organization – measuring water quality for state agencies and developing water quality standards;

(p) The Ceylon Institute of Science and Industrial Research – conducting research on industrial population control, water quality measurements, liquid waste management;

(q) The Health Department – administration of quality of water supply and sanitation programmes, including prevention of water-borne diseases;

(r) The Coast Conservation Department – administers the Coast Conservation Act covering environmental impact assessment regulations in coastal development projects and the implementation of the master plan on coastal zone management;

(s) The Sri Lanka Land Reclamation and Development Corporation – the development of low lying marshlands, drainage improvement projects, and canal maintenance; and

(t) The Land Commissioner's Department – the administration of land ordinances, into which most of the water-related legislation has been incorporated.

In addition, there are provincial, divisional (*Pradeshiya Sabhas*) and local authorities, such as municipal and urban councils, that have been entrusted with water-related responsibilities. Functions of some of the agencies are devolved, while other remain as centrally managed. In certain instances, there is an overlapping mandate of the agencies and target clientele, and limited coordinating mechanisms between agencies and those that can be implemented as decentralized units.

Considering the new policies that are being adopted, there needs to be a revision of the roles, responsibilities and functions of the above agencies with respect to water-related functions. Hence, a management review of the existing structures is needed, calling for a reorganization programme to strengthen the institutions that will have to respond to the current development and management changes taking place in the water sector. The water agencies of Sri Lanka could be

categorized according to their service delivery functions in major service delivery areas such as irrigation water supply and hydropower. The agencies are mandated to develop and utilize resources independently for the intended purposes.

II. Main issues and challenges

1. Major issues

Sri Lanka has a high rainfall on average but with wide variation in regional water availability, which causes water stress in dry zone areas. Competition among water users, a lack of compliance on the part of pollution control and poor land-use policy is threatening critical watersheds. Lack of data and information for real-time water planning is a setback for equitable water allocation. The absence of a legal basis to safeguard water rights discourages the promotion of user commitment for protection and conservation. The degradation of the river environment due to sand and clay mining, and waste dumping are major issues that are causing damage to river health and water resources systems.

2. Environmental issues

The growing needs of Sri Lanka's rising population are often being met by exploiting the country's natural resources with increasing severity, an approach that needs proper attention and correction for sustainable natural resource management. Population density is the single most stressful factor on the water and environment. Sri Lanka has one of the highest population densities, especially in the western region; in densely populated areas, more resources are needed to sustain the population. Resource conversion and waste generation occur at a rate far too high for the natural system to absorb.

Achieving a good quality of life for all, which goes beyond material wealth, depends on the quality of the environment, food, air and water. For too many people in the world today, survival is the number one objective – obtaining enough water and food just to live consumes all their time and efforts. Therefore, poverty is the main contributory factor to poor environment; poverty has a spiralling effect on the environment. Protection of the environment needs economic capacity and knowledge, and cooperation and commitment of the people. Ironically, Sri Lanka's urban fringe does not show commitment to environmental issues.

The negative signs include:

(a) Degradation of the river environment due to sand and clay mining. Controlling this problem requires strong political will and, so far, success in most of the country's western region rivers has not been achieved;

(b) Indiscriminate solid waste dumping;

(c) River preservation is not enforced, and encroachment is severe; and

(d) Water pollution due to urbanization and a lack of regulations for ensuring ambient water quality.

Although Sri Lanka's rivers are not as polluted as many of the rivers in other countries in the region, it is necessary to be proactive in order to avoid the inevitably high cost of restoration in the future. Water and environmental protection will constitute an integral part of the development process, and the associated environmental cost need to be incorporated on a day-to-day basis for environmental sustainability.

3. Planning issues

Sri Lanka's quest for self-sufficiency in rice paddy and its dependability on hydropower have utilized the bulk of its water resources. The country has achieved one of the highest storage capacities in the region, in terms of per capita storage, second only to Thailand. However, water resources development has reached its limit, as there are no more easily exploitable resources left. Further large-scale water resources development will not be a viable proposition in the future. At the same time, world opinion is against large-scale development projects due to the complex social and environmental issues connected with such projects. Traditionally, water resources planning has focused on maximizing the utilization of water for agriculture and hydropower. Currently, the country is facing a water shortage in other vital economic sectors and further resource development has become unaffordable as all the cost-effective water resources are already being exploited.

In the past, water resources development only considered a few aspects such as utilization of water to meet certain demands. Therefore, planning was limited to project planning. There are a number of such examples in Sri Lanka and other parts of the world. The illusion that engineers can produce water almost everywhere by constructing large dams, river diversions and trans-basin projects has been pursued rigorously by decision-makers. The lack of focus on integrated planning is an issue to be addressed. When Sri Lanka prepared its water resources master plan in the mid-1960s IWRM was not a pressing issue; the priorities were irrigation and hydropower.

4. Institutional issues

The oldest water sector institution is the Irrigation Department, which has inherited all inland water bodies managed by the Irrigation Commission established under British rule. Up to the creation of the Miahaweli Authority to implement the accelerated Miahaweli Development Scheme, the Irrigation Department carried out a de facto water allocation function. The department is committed to issuing water for paddy farmers as a priority. Culturally, paddy farming is also considered a noble profession. In addition, food security is considered as a priority issue by the Government. Therefore, water is supplied free to farmers and any policy to introduce charges for irrigation water will have political repercussions. As a result, investment in the irrigation sector has come to a halt and continuous government support has to be provided for rehabilitation and improvements.

In the early 1960s, the water supply was separated from the Public Works Department to achieve water supply coverage through safe drinking water. Donor assistance was available from the United Nations Children's Fund and the World Health Organization for rural water supply and World Bank assistance for expansion of the Greater Colombo water supply. The need was recognized for a dedicated institution to focus on the water and sanitation of the country in order to achieve the targets in the sector. In 1975, the Public Works Department was transformed into a Statuary Board by an Act of Parliament. The National Water Supply and Drainage Board (NWSDB) was created with a mandate to extract water from any source for the provision of safe water to the people. The advent of the Water Supply and Sanitation Department saw donor assistance become available for rapid growth of the water supply sector and NWSDB was converted to a viable institution with gradual implementation of a tariff policy. Nevertheless, the process was slow due a lack of political will at the start.

Rapid expansion of a piped water supply system is facing serious water resources issues due to pollution and depletion of the resource. In the dry zone, the only sources of water available are irrigation reservoirs. Priority for drinking water supply remains an unwritten policy and, at present, potential conflicts between subsectors are evident since past water resources planning did not consider all aspects of water. The need for an integrated approach to planning and management of water resources has been accepted as important. Donors have continued to support the water supply sector since the 1970s owing to the quick response to reforms and satisfactory performance

in terms of accountability and financial viability. Major constraints to the expansion of water supply coverage exist due to lack of water resources in close proximity to the supply area, as all cost-effective water resources have already been developed for irrigated agriculture. The percentage coverage of piped water supply achieved in the island at present is only 27 per cent while five per cent are served by tube wells, after nearly 30 years of operations by the Water Board. Major changes are required in the investment policy for the water supply sector. The main issue is the lack of inter-agency coordinating in water resources planning and the desire to focus on maximizing resource utilization for a single purpose.

5. Collection and use of data and information

The collection, storage, processing, analysis and dissemination of hydrological and other water-related data is an indispensable instrument for water resources planning for future decision-making and use on a sustainable basis. Although many agencies are involved in the collection and storage of data, a lack of knowledge of their existence often puts them out of reach of the public or users, either public or private. Each of these institutions follows its own procedures and standards as required by the particular objectives for which the institution is responsible. In the future, institutional framework data and information management will be given high priority and agencies have agreed to enter into a data sharing agreement.

6. Issues related to water rights and allocation

Issues related to the absence of a legal water rights system are evident due to emerging conflicts. For a more transparent system of water rights, and to promote equitability, the following processes will be adopted:

(a) Administrative water allocation is the most commonly practised system in Sri Lanka as almost all the developed water resources is utilized by state agencies. Major water service delivery agencies are mandated appropriate water from any source. Major water agencies such as the Irrigation Department and the Mahaweli Authority of Sri Lanka are carrying out de-facto water allocation functions according to a predetermined plan based on the project beneficiaries. There are no arrangements within this system to allocate to new users. The State acts as the owner of water rights and water allocation priorities are fixed. Variations may take place within user groups according to politically and socially determined priorities;

(b) User-based allocation takes place when stakeholders are organized as water user organizations, irrigation districts and the like. They determine the distribution of water resources among themselves on the basis of timed rotations, proportional distribution according to area of land owned, or proportional shares of stream flow etc. Water rights are usually held collectively and negotiated among users, according to variant and shifting conditions, needs and priorities; and

(c) Market allocations. Water rights can be traded and the opportunity costs of water would form the basis for decisions about the allocation of water to specific users. Water rights are individualized and can be transferred independent of collective or national considerations and priorities. In this system, water has actual value and maximized benefits for society at large.

The current issues include:

(a) Lack of water rights (cause for conflicting demands)

(b) Water used wastefully

(c) Unsound public hydraulic projects

(d) A lack of a demand-oriented approach
(e) Limited access by the poor, while the rich are subsidized
(f) Inability to prevent environmental degradation
(g) Sector biased operational policies
(h) Economic returns and cost benefits are ignored
(i) A lack of a regulatory mechanism

7. Legal issues

Although extensive legislation and enactments have been accumulated over the past century and a half, non-compliance and weak enforcement have taken precedence especially during the last few decades. There are at least 51 enactments that are related to natural resources management in Sri Lanka. Fragmented responsibilities cause confusion in the institutional mandates and too many administrative layers in the Government have contributed to the current state of the affairs related to natural resources management. The lack of political will, social inequality and unregulated exploitation of natural resources are the key issues. The Government has taken positive steps to enact the National Water Resources Act for the first time in Sri Lanka despite strong opposition by activists who claim that these policies are connected to globalization.

Existing water-related enactments have been adopted over time to address specific sectoral needs, i.e., needs arising within the water supply, agricultural, hydropower and other water user sectors, but they have failed to address the problems now emerging as a result of growing water demand and the degradation of water quality. In addition, each enactment creates or assigns water development and/or management functions to a separate government department or statutory body, with no attention being paid to similar functions performed by other institutions under other enactments. The result is fragmentation and duplication of functions. Importantly, certain water management functions are not contemplated under any of the present laws.

The State Lands Ordinance of 1947 is, by and large, the enactment that most addresses water allocation issues, in that its Part IX regulates the abstraction and use of water through a system of permits. The Ordinance, however, has a number of shortcomings because it is limited to surface water and does not extend the permit requirement to water uses for irrigation purposes. Therefore, it is obsolete. In addition, it has been implemented in only a few instances.

Earlier, efforts were made to regulate the management of water resources in a more comprehensive manner through a draft Water Act that was developed in 1980. The draft Act, however, was never submitted to Parliament.

As pointed out in various policy and legal studies conducted under the auspices of the Water Resources Council (WRC) and even earlier, a solution to the issues highlighted requires water resources planning and the introduction of a system of water allocation and groundwater management measures, all administered by a neutral institutional mechanism operating in coordination with the existing departments and statutory bodies.

Aware of this need, the Government requested the assistance of the Asian Development Bank (ADB) and the Food and Agriculture Organization of the United Nations (FAO) in formulating a national water resources management policy (see above) and implementing legislation, respectively. In parallel with this, it set up the Water Resources Council and mandated the Council's Water Resources Secretariat (WRS) to oversee the process.

The draft Water Resources Act proposed in this report is the result of a number of studies conducted in parallel under the ADB-funded Institutional Strengthening for Comprehensive Water Resources Management project and the FAO Water Law and Policy Advisory Programme, and is

based on the policies developed under both projects. It has taken shape after intense research work and numerous rounds of consultations with different stakeholders, and with the invaluable support of WRS.

III. National water policy

1. Policy process

The government's water policy initiative, which commenced in 1996 with the establishment of WRC and WRS with ADB and FAO assistance, completed its activities with the formulation of a water policy and the draft National Water Act. This action was the result of the recommendation made after the institutional review of the current institutional framework, which was conducted under technical assistance funded by ADB. The National Water Resources Policy and institutional recommendations were completed with WRC guidance, and through consultation and dialogue with the Inter Agency Coordinating Committee represented by the major water agencies. In addition, an extensive stakeholder consultation was carried out at the district and divisional administrative levels involving the Government, non-governmental organizations (NGOs) and water users. The consultation followed an agenda to create awareness of the current and future issues related to water, and promoted the need for a national policy for water resources management and institutional development to fill the gaps, eliminate overlapping and strengthen the capacity of agencies.

2. Policy implications

In March 2000, the Cabinet of Ministers approved the water resources policy in principal. Since the approval of the water policy, a negative campaign launched by the media and some NGOs misrepresented the objectives of the policies and turned public opinion against continuing with policy actions. The radical elements implied that the proposed reforms and recommendations were related to globalization policies. A major setback was that the policy was only prepared in the English language at the crucial stage of approving the policy, which also contributed negatively in the eyes of the public. Since the presidential elections were scheduled for October 2000, the Government did not pursue the implementation of the recommendations of the policy. Some special interest groups emerged to protect water, claiming that the policies had been formulated to satisfy the World Bank and multinationals in acquiring Sri Lanka's water resources. However, it was revealed that the formation of these groups was encouraged by the agency critical of creating an apex body.

3. Issues raised

I-NWRA/WRS were unable counter the criticisms in the midst of the political climate prevailing at the time due to the lack of commitment and the uncertainties prevailing in the country. Table K.2 provides a brief outline of the issues raised to block the policy initiative.

4. Recommendations for implementation

The present Government's vision for socio-economic enlistment has been comprehensively presented. The specific reference to the water sector states that efforts to sustain and improve the productivity of water resources will become increasingly important in the future as competition for water between agriculture, industry and urban uses increase, and as farmers shift more to high-value crops. The Government's strategy for ensuring that water is used efficiently and is available to the poor revolves around the introduction of transferable water entitlements and the establishment of effective river basin management organizations.

Table K.1. Policy components and issues to be resolved

Policy components	Issues to be resolved
Water resources	Policy objective Scope Policy principles
Policy foundation	Role of the State
Policy strategy	Financial and physical sustainability Development and management conservation Water allocation/national priorities Water use rights Integration of gender Management areas and plans Water quality and quantity Water-use permits Environment and social water requirements River basin or groundwater plans Transfers
Demand management	Transferable water entitlements Regulatory control Water saving technology Education and awareness Capital investment, operation and maintenance Information and demand management performance
Groundwater management	Sustainable management Coordination of surface and groundwater management Management of small-scale groundwater use Groundwater information management Groundwater quality Awareness and participation Strategic approach
Information management	Data ownership Data coordination and sharing Data and information access dissemination
Institutional structure for water resources management	Functions of NWRA Reporting relationship and structure Delegation and contracting Regional water agencies Water mediation board Relationship of NWRA with other agencies Provincial and basin water resources Groundwater administration Water quality administration Watershed management

Table K.2. Issues raised to defeat the policy initiative

Public opinion interpretation and criticism	Policy statement	I-NWRA comment
All water resources will be vested in the State with a view to transferring water to multinationals. News media, NGOs and political parties.	Policy Principle No. 3 All surface and groundwater resources are owned by the State and managed by the Government in partnership with water users on behalf of all Sri Lankans.	Public opinion is created by interpreting the State as the Government. Ownership of water is a misconception. What is implied is that water resources management is a government function.
Cost recovery of water supplied to farmers. In future, charges will be imposed on farmers Irrigation engineers union NGOs	Water management cost sharing. A transferable system of water rights for cost sharing will be implemented; however, for the irrigation sector, the Government will pay the share of water management costs.	The Irrigation Ordinance has the provision for levying various charges for water from farmers. It is a matter for the irrigation sector to decide. Present policy is to continue free water for irrigated agriculture.
Promotion of other field crops in order to discourage paddy farmers and get them to give up paddy cultivation. NGOs and the media	Demand Management Policies and Practices. Demand Management. To promote water conservation and save water for allocation to new users.	Implementation of demand management measures have already been promoted by various government and private sector initiatives
Transferable entitlement system will allow businessmen to acquire water from farmers, and food security will be threatened.	Water rights and allocation. Voluntary transfers encouraged, subject to approval and compensation.	The Water Act provides the legal framework for protecting the rights of current water users. Only bulk water users are required to get permits. Under the present law, ownership of private water is unclear and there is no provision for regulating such water for public use. This has led to many conflicting situations.
Charges will be imposed on domestic wells in future. Misrepresented by the media, and public opinion directed against the policy.	Policy statement is that “the local authorities are encouraged to register domestic wells”. These are livelihood users and there is no reason to impose any charges.	Information on the number of people using unprotected sources, such as dug wells for drinking, is important in the intervention for management of water quality as there is a threat of pollution in unprotected wells
Policy adopted to satisfy the World Bank and other international donors. NGOs, media and political parties.	Water Policy and law programme supported by ADB, FAO and the Government of the Netherlands.	WB, ADB, FAO, UNDP and other donors have been supporting the Sri Lanka Government in the efforts to provide safe and adequate water since the 1960s. Without such assistance, large piped water schemes or hydropower projects would not have been implemented.
Policy document is available only in English language this is to hide contentious issues from public. Media, NGO and political parties.		WRS did not get an opportunity to translate the policy into local languages and campaign for public awareness to convince the objectives due to a lack of political will that prevailed during that time.

Note: The negative campaign launched in 2000 gathered momentum as it became a political issue during elections. Even at present, the opposing parties are actively carrying out the campaign. However, the Government has assured the donors of the target date for passing the Act by Parliament. The law is intended to protect customary water rights by regulating large-scale users through a permit system. Moreover, water security is guaranteed for consumers by prioritizing drinking water in the water allocation policy. Public perception with regards to “water consumer” and “water user” is unclear. Opinion makers have used this to their advantage to mislead water consumers. The National Water Policy is for dealing with water users who have a stake in the resource base.

The National Water Policy calls for a major change in the way in which water is to be used. Under the new water management policy, transferable water entitlements are to be created under the supervision of a National Water Resources Authority. This will involve the issuance of licences for large-scale water users (bulk water entitlements) on each of the main watersheds and river basins. River Basin Committees (RBCs), representing all stakeholders and with ample representation of the poor, will be established to issue the licences. Bulk water entitlements will be issued taking into account the water supply/demand conditions and environmental requirements. The RBCs will also protect traditional water entitlements, and evolve development and management plans for water resources investment in their respective regions. Arrangements between the Government and water users will be developed to ensure that the water resources infrastructure is operated and maintained to a reasonable standard. A Water Resources Tribunal will be established to adjudicate water-sharing disputes. While small-scale water users are exempted from the licensing system, they will play a much more active role in allocating water entitlements, and in planning the development and management of the water resources in their own river basins.

The most immediate challenge is to commence implementing the objectives of the National Water Policy and to restructure existing institutions and government organizations, in order to be consistent with the new policy perform functions essential to meeting IWRM objectives.

IV. Sectoral water strategies

1. Water supply and sanitation

The provision of safe drinking water as well as adequate sewerage and sanitation is frequently cited as the single, highest social-service priority by poor households. In some districts, more than half the rural population has no access to safe drinking water.

The Government's objective is to ensure safe water to 85 per cent of the population by 2010. The draft National Policy on Rural Water Supply and Sanitation Sector recognizes that water is a basic human need, but that it also has an economic value. Users should contribute to investments and bear the recurrent costs of drinking water and utilizing sewage and sanitation services. At present, the water supply coverage is only 57 per cent of the rural population and 70 per cent of the urban population. The approach to providing water to rural communities will combine community development, capacity-building of local authorities and health education. The main strategy for supplying drinking water in the rural areas is the provision of tube wells and dug wells, protection of springs and the supply of piped water. The Government will adopt a more demand-driven orientation in service provision. Water consumer societies, representing both those served and those to be served with piped water, will be promoted. New institutional arrangements will be made to provide greater focus on rural water supply and sanitation development within the Government.

Eventually, the mandate for rural water supplies will be completely shifted to local authorities rather than the Water Board. The Water Board will then be responsible for the delivery of water and sanitation services to small towns with more than 1,000 households. Future provisions of new rural water supplies and sanitation services will be on a more demand-led basis, with NGOs and CBOs playing an important role in the provision and operation of such systems. The Government's strategy is to encourage rural communities to contribute to the construction of piped water systems and to then manage those systems on a community basis. Local communities will be required to finance the operations and the upkeep of their water supplies and sanitation systems. WSSD will set quality standards and assist in the capital development programmes, but local communities will be fully responsible for the operations and maintenance of local water supplies and sanitation systems.

The strategy for improving access to clean drinking water and sewerage services in the major cities and towns differs from that pursued in the countryside because of the size and scale of the water-delivery systems involved. Inadequate sewage and sanitation infrastructure in the urban and peri-urban areas is a leading cause of public health problems in poor urban communities. Piped water services are available to only 29 per cent of the population. Large-scale sewerage services are available only in the Colombo municipality; and are limited to partial treatment before sea outfall. None of the other urban areas are provided with sewerage or treatment facilities. Implementation of sewerage and wastewater treatment is constrained by the unaffordable cost of such facilities and scarcity of suitable land in close proximity to the urban centres. Currently, NWSDB is battling with other government agencies to acquire suitable land for the Kandy sewerage scheme, funded by JBIC.

There is an urgent need to rehabilitate and expand the water supply, sewerage and drainage services around the country, yet the investment requirements are very large indeed. The private sector will have to play a major role in this effort since it is estimated that some US$ 50 million per year for the next decade will be required to rehabilitate and expand water supply and sewage services in the main urban settlements. Demarcation of potentially profitable service areas has been made and the private sector will be invited to enter into partnerships with the Government to operate, maintain and extend water systems through long-term concession contracts, leases, management contracts and BOO/BOOT service provision. To facilitate private sector involvement in the water sector, the Government will establish an independent regulatory authority that will set tariffs and regulate water delivery quality.

The provision of clean drinking water, sewerage and sanitation services has exceeded the Government's institutional and financial capacity. There is a clear shortfall of resources in meeting actual demand in these areas. New modes of delivery of safe water and primary sanitation facilities are being developed that will increasingly rely on public-private partnerships. For several years, the Water Board and the Community Water Supply Programme have both formulated policies and acted as project implementers. Growing competition for water among sectors and the lack of a clear policy has resulted in substantial water shortages in some parts of the country. This is mainly felt by the poorer communities and it affects their livelihood.

The Government estimates that the investment requirements in the water sector will be as much as SLRs. 50 billion from 2001 to 2010. Public investment, mainly coming from donors, may be sufficient to meet, at most, half of this requirement. At present, the average annual allocation of the capital budget in the sector is nearly SLRs. 5 billion. This underscores the importance of attracting private sector investment in the provision of clean water. A prerequisite to this is the introduction of a water pricing policy that is based on the cost of delivering water as well as other economic criteria.

Under existing arrangements, domestic water consumers are heavily subsidized by non-domestic consumers. Since the latter account for only a small share of total sales, heavy cross-subsidization is financially unsustainable for the National Water Supply and Drainage Board. The Government should rationalize water tariffs to ensure that these reflect the economic costs of providing clean water, and phase out the heavy cross-subsidies among different classes of water users. Within the acknowledged limits of affordability, the Government will seek full cost recovery in its tariff policy. The heavy cross-subsidization of domestic consumers by industrial consumers should be substantially reduced. This will make more money available for extending direct connections to the under-served urban poor. The most critical issue is a strategy of charging the cost of water through a tariff policy in order to attract the private sector to enhance investment in order to meet the targeted population coverage. The latest service coverage estimates are shown in table K.3.

Table K.3. Latest service coverage estimates (2001 census and NWSDB corporate plan)

Pipe borne water supply	5 213 144 (27.7%)
Protected Dug Wells	6 434 406 (34%)
Tube wells (ground water)	1 457 531 (7.8%)
Systems Operated by Others	249 256 (1.3%)
Non-reliable sources	5 500 000 (29%)

On the supply side, NWSDB stands as the apex institution responsible for the development, distribution, and operation and maintenance of 90 per cent of the water supply schemes in the country. NWSDB operates 275 water schemes with 727,554 connections. The key indicators shown in table K.4 are derived from the detailed performance indicators in the NWSDB Annual Report for 2002.

Table K.4. Incremental performance of NWSDB operations

Annual Increment of major Indicators	Benchmark 2000	Percentage increase, 2001	Percentage increase, 2002
Piped water production	343 MCM	3.3	2
Service connections	665 166	14.5	10.2
Operation and maintenance costs	SLRs. 2 863 million	26.5	19.4
Average operation and maintenance cost per m^3	SLRs. 8.35	22.4	17
Operation and maintenance staff/connection	9	(13.7)	(11)
Total revenue	SLRs. 4 010 million	16.6	14.8
Capitol fund allocation on new development	SLRs. 4 494	29.3	81.6

A five-year Corporate Plan of the Board for 2003-2007 is expected to raise annual investment from SLRs. 9 billion to SLRs. 16.5 billion, totalling SLRs. 71 billion in five years, the equivalent to US$ 700 million. The Board has identified three main sources of funding: the Government, donors and the private sector. The targeted private sector investment is 50 per cent of the total expected amount, which appears too ambitious. See table K.5 for the corporate plan goals and investment plan.

Table K.5. Corporate plan goals and investment plan

(Unit: SLRs. million)

	2003	2004	2005	2006	2007
Requirement (SLRs. million)	9 000	16 240	14 413	15 000	16 500
Allocation from Government (expected)	1 500	2 000	2 000	2 000	2 000
Expected funds from donors	2 500	4 600	4 500	4 500	5 000
NWSDB funds	700	700	700	700	700
Expected funds from the private sector	4 300	8 940	7 213	7 800	8 800
Percentage of population receiving pipe-borne water supply (%)	29	31	34	37	39

a. NWSDB corporate goals and investment plan

The corporate goals are:

Goal 1: To provide additional coverage to facilitate achievement of the Government's objectives.

Goal 2: To improve operational efficiency through the reduction of non-revenue water (NRW) supply and resource optimization.

Goal 3: To improve the level of service in served areas in terms of accessibility, duration of supply and quality of water supplies.

Goal 4: Provide pipe-borne sewerage facilities to high-density urban areas.

Goal 5: Ensure that NWSDB operates with greater accountability and transparency.

Goal 6: Ensure that NWSDB operates with good corporate governance.

Goal 7: Secure funds for capital investment.

The goals need to be consistent with the corporate plan (table K.5). The projected investment for water supply in the next five years will be SLRs. 71 billion, made up of contributions from the Government, donors and private sector investments.

The required annual per capita investment may go up to US$ 350 in 2007. Twenty years ago, this figure was US$ 150 in 1987 prices and US$ 50 for rehabilitation.

It is important identify potential private sector partners for the expected investment. The issues to be resolved are: (a) whether private water is acceptable to people in Sri Lanka; and (b) what level of income generation is required in the utility to attract private investment.

The other major financial issue is that at present tariffs are set to reflect the capital subsidies given by the public investment programme. The utility does not generate funds for augmentation, rehabilitation or new developments.

In future, schemes will require self-sufficiency at all levels, to satisfy the following key performance categories:

(a) The facility should earn a net income;

(b) Debt services/depreciation or replacement cost are covered;

(c) A contribute made towards new capital investment;

(d) Debts collected and paid promptly;

(e) Adequate working capital; and

(f) Cost recovery as defined by (sound administrative and financial) reasonable accounting practices.

At the current rate of investment, on average, the piped water supply service is extended to approximately 200,000 people annually; this number is totally inadequate to meet the projected target for 2015. The annual rate of population increase is 230,000 and therefore the percentage population coverage will remain static at the present rate of investment in new piped schemes. Water pollution and depletion of naturally occurring water will compel more and more people to look for piped supply. A massive investment is needed to provide a safe and reliable water supply to at least 4 million more people by 2015, whether piped water or water from dug wells. If the objective is to provide safe water, new impetus is required to attract substantial investment.

Some 5.5 million people are unaccounted for in terms of water supply. Therefore, NWSDB needs to identify the opportunities and constraints clearly with regard to the extension of service to those people not included in previous plans if the corporate goals are to be achieved.

b. Solid waste management

Solid waste management has become a major concern due to its impact on public health, the environment and the low-income community. Solid waste collection and transportation are carried out by the local authorities with different levels of service and little capacity for meeting

minimum accepted health or environmental standards. Local authorities are obliged by law to collect and dispose of solid wastes put out by residents in areas in their jurisdiction. These wastes have largely been disposed of within their own boundaries, and increasingly the local authorities are running out of space. In addition, open dumping of solid waste has created a myriad of public health and environmental problems.

The Government has prepared a National Solid Waste Management Strategy, which shifts the role of local authorities from being a provider of solid waste management services to a facilitator of a range of public and private waste management efforts. Implementation of the strategy implies that (a) the Government will contract out for, and regulate, private provision of solid waste management services, (b) private investment will be facilitated, (c) local authorities and Provincial Councils will provide suitable local sites for waste management, (d) NGOs and other community organizations will be encouraged to foster waste segregation and recycling programmes, and (e) provision will be made for the use of common treatment facilities.

The current practice of open landfills will be brought to an end and a new system of properly engineered sanitary landfills will be established. The National Solid Waste Management Strategy provides a framework for improved cooperation between the environmental authorities, urban development authority, zonal ministries and provincial councils in coordinating matters related to solid waste management. Six main cities outside Colombo have benefited from semi-engineered land fill facilities provided by Japanese assistance.

c. Water and sanitation policies and strategies

The present water provision policy appears to be “some water for all, rather than more for some” as endorsed at the New Delhi Global Consultation in 1990. To make this policy effective, it has been estimated that the water supply sector requires annual capital investment in the order of SLRs. 8 billion to ensure safe water for all by 2010.

With rapid urbanization and the tendency for economic activities to be concentrated in and around the Greater Colombo Area, the demand for drinking water and wastewater disposal facilities will intensify. The real cost of water supply and sanitation services is expected to increase drastically as marginal or long-distant sources of water will have to be exploited to meet rising demand over the long term.

Having recognized this challenge, the Government intends to adopt innovative policies and strategies in the medium term, some of which are:

(a) The continuation of capital subsidy for construction and rehabilitation of new water supply and sanitation facilities. The present policy of subsidizing 50 per cent of the capital cost of the urban sector and 85 per cent of the rural sector will be reviewed in order to ensure that the flow of funds to the sector is maintained at desirable levels;

(b) Promotion of the private sector, local authorities and community-based user organizations to operate and manage water supply schemes on a selective basis. Suitable measures will be adopted to attract private sector participation in construction and maintenance of new water supply schemes;

(c) The adoption of stringent financial viability criteria in the evaluation of new urban water supply projects, while taking appropriate measures to improve the viability of existing loss-making schemes;

(d) Gradual revision of tariffs to reflect the cost of water production;

(e) Implementation of a systematic plan of action to improve operational efficiency by reducing the share of unaccounted-for water;

(f) The development of low-cost methods to be adopted for the provision of water to rural communities. Gravity schemes, tube wells with hand pumps and protected dug wells, will be favourably considered, taking into consideration their affordability by the community; and

(g) Suitable mechanisms to be devised whereby user groups will be involved in the operation and maintenance of rural water supply and sanitation schemes in a viable manner.

2. Irrigation sector

Irrigation has been a major focus of development since the country gained its independence in 1948. Reducing unemployment through the settlement of the dry zone, achieving self-sufficiency in food production, and the development of hydropower have been major policy goals of successive governments.

The recent phase of irrigation development commenced with large multipurpose projects such as Gal Oya, Uda Walawe and finally the Mahaweli Development Project. Since 1970, the total area under irrigation has expanded by at least 200,000 ha; by 1991, it covered about 642,000 ha.

Table K.6. Sri Lankan rice production, rice imports and rate of self-sufficiency in rice for selected years[a]

Year	1 000 metric tons		
	Domestic rice Production[b] (X)	Rice imports[b] (Y)	Self-sufficiency in rice (%) $\frac{x}{\bar{x} + \bar{y}}$
1951	428	633	40
1955	613	661	48
1960	864	739	54
1965	989	710	58
1970	1 409	523	73
1975	1 400	602	70
1980	2 062	271	88
1985	2 455	220	92
1990	2 538	256	

Source: *Irrigation Investment Trends,* P.B. Aluwihare and Maso Kikuchi, 1991.

[a] Five-Year averages centring on the years shown.

[b] In approximate rice equivalent. An average value for per capita rice consumption is derived using these values and rounded up as 100 kg/p/per year.

Self-sufficiency in rice paddy has been targeted by all governments as a political ambition since independence. Major investments in water and land expanded rice production at a rapid rate and by 1985, 90 per cent of self-sufficiency was achieved (table K.6 and figure K.1). Just after independence, the country produced only 40 per cent of its rice requirement, with the balance being imported.

The achievement in the irrigation sector is attributed to the large investment in irrigation infrastructure in the past three decades. Self-sufficiency in rice was given the highest priority by the Government.

To date, about 255,000 ha of irrigated land are served by about 80 major schemes (each over 600 ha), including 45,000 ha under the Mahaweli programme. An additional 55,000 ha are irrigated by medium schemes (80-600 ha). Most of the medium and major schemes are located in the dry zone and were built or restored by the Government during the past 50 years. The Government retained the responsibility for the operation and maintenance of those schemes.

About 225,000 ha are served by about 25,000 minor schemes (each less than 80 ha). About 65 per cent of the land under minor schemes is located in the dry zone and is irrigated from tanks; the remaining 35 per cent is supplied by diversion schemes. These minor schemes are operated and maintained by the farmers.

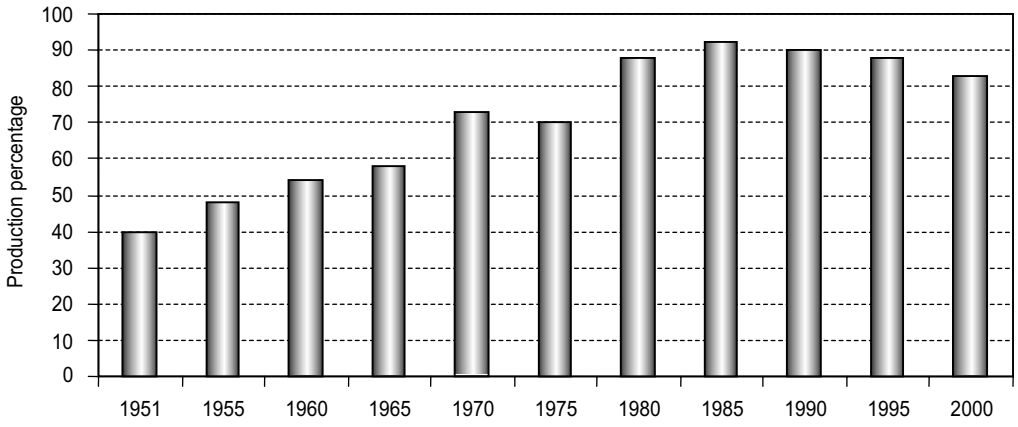


Figure K.1. Self-sufficiency in rice in Sri Lanka

Irrigation sector performance in recent years shows that a steady state has been achieved in the quantity and the extent sown. Annual average production varies from 2.6 million to 2.8 million mt of paddy, yielding 1.7 million mt of rice and a deficit of about 50,000-100,000 mt that have to be imported to maintain the consumption level at 100 kg/person/year.

Water usage for paddy production as a whole is equivalent to 16 billion m^3 per year, of which 12 billion m^3 are from developed resources. Average input of water per kg of paddy is 5.7 m^3 while for 1 kg of rice it is nearly 10 m^3. Capital outlay availability for further development of the resources needed to expand paddy areas is unlikely to happen in the future, due to the following resource constraints:

(a) Insufficient financial resources;

(b) Shortage of land; and

(c) Subsidies on the operation and maintenance of major and minor irrigation systems have become a burden to the Government.

These factors exert pressure on the irrigation sector to conserve water and transfer savings for other economic activities.

The major strategy is to ensure food security through water rights to farmers with no charge while optimizing resources and transferring water to other vital economic sectors through savings without compromising paddy sector output. Externalities and other associated benefits associated with rice farming and its contribution to GDP are socially and culturally significant.

a. Government policy

Until 1984, the entire responsibility for financing and implementing the operation and maintenance programme for the irrigation network in major irrigation schemes, from headwork to distributor canal level, was vested in the Department of Irrigation. The operation and maintenance of the field channels was the responsibility of the farmers. Over the years, it was found that the burden to the Government from operation and maintenance costs had expanded, and the required funds could not be generated in full within the Government budget. As a result, in 1984, the Government introduced an operation and maintenance fee to all major irrigation schemes. The average cost of operating and maintaining an acre of irrigated land with major irrigation schemes was estimated to be SLRs. 250 per acre. However, government policy was to recover operation and maintenance costs gradually at the rate of 50 per cent, which would eventually be increased to full recovery. Accordingly, the fee payable by farmers was set at SLRs. 100 per acre in 1984. This

decision became a political issue and was defeated within a period of two years as farmers openly refused to comply with the payment.

The Government experimented with various policy proposals to ease the burden of maintaining the irrigation infrastructure by involving end users in the management of systems. Early in 1989, the Government adopted the following proposals made jointly by the Minister of Agriculture and Lands and the Minister for Irrigation, for participatory management in irrigation schemes:

(a) Participatory management to be accepted as a policy by the Government, with the objective of improving overall management and performance;

(b) Adoption of the management principle applied to village tanks to larger systems in the turnout areas, field canals and the distributor canals respectively;

(c) Development of village-level institutions and capacity to provide for active farmer participation and involvement in the management of field-level irrigation installations;

(d) Encouragement of farmers to meet the operation and maintenance costs of the distributor systems in lieu of payment of the operation and maintenance fee;

(e) Continuation of government funding for maintaining and managing the main system, i.e., the headworks and main canals; it was estimated that this would amount to approximately 50 per cent of the total cost of maintenance;

(f) The provision of a legal framework to recognize the rights and obligations of farmer organizations, through amendments to the Irrigation Ordinance and the Agrarian Services Act, including water rights under the Water Act; and

(g) Enactment of legislation to transfer, over a period of time, ownership of irrigation networks below the distributor canal level to farmer organizations, when they are ready to take on that responsibility.

The irrigation sector in Sri Lanka has clearly moved from a construction to a management phase, in which operation and maintenance as well as research and management have become increasingly important activities in the management of irrigation systems in order to safeguard the massive investment already made in the past several decades. There is very little scope for further new construction and or extension as “there is no more land available to be brought under the plough”.

The need to modernize the irrigation systems has arisen in order to take advantage of technological advancements and make these systems more efficient with respect to the relative scarcity of water, land and managerial resources. Demand to share water resources from other sectors is also exerting pressure on the irrigation sector to become more efficient.

The major constraint in this respect is due to the conservative design of the existing infrastructure, where there are no or very limited physical facilities at the field level to regulate water for efficient use. Demand management policies and instruments are needed to save water in the reservoirs.

b. Public investment in irrigation

Since independence, irrigation has been the most important strategic factor and mainstay of the Government’s infrastructure development. Until the early 1980s, new irrigation construction investments had been by far the most important opportunity, socially and politically, accounting for more than 90 per cent of total irrigation investment and 20-40 per cent of total public investment in the country. However, at present, the construction of major irrigation projects cannot be economically

justified even under the extremely favourable market conditions for rice that existed during the food crisis in the 1970s. In the mid-1970s, the focus was on rehabilitation and modernization in order to improve water management and minimize crop failures.

Major investment in water shifted to hydropower with the accelerated Mahaweli project implementation, which commenced in the late 1970s. Although paddy production has become steady over the years to 2.8 million mt with favourable weather conditions, the cost of operation and maintenance and rehabilitation is rising. So far, the burden on the economy does not appear to be high as the current share of agriculture in GDP stands at 21 per cent. However, in terms of resources utilization, output per unit of resources is low compared with other countries in the region as Sri Lanka has the lowest agriculture sector contribution to GDP. Irrigated agriculture is the mainstay of the rural population and it has satisfactorily achieved targets in food security.

3. Subsectorial policies required to achieve socio-economic goals

The subsectorial policies required to achieve socio-economic goals include:

(a) Improved user efficiency;
(b) Provision of infrastructure/rehabilitation to improve performance;
(c) Cost recovery – pursue user pays and polluter pays principles;
(d) Strengthen formal and informal institutions;
(e) Monitor water resources, and water quality and quantity;
(f) Prioritization among user groups;
(g) Manage irrigation water to achieve national food security and rural social stability;
(h) Provide safe and adequate domestic water for all (at least 90 per cent coverage from the present 70 per cent);
(i) Institutionalize a transparent water-sharing mechanism to achieve targets;
(j) Promote national economic development in harmony with the environment;
(k) Evaluate resources and action to reverse unfavourable trends;
(l) Ensure availability of water as a fundamental resource for economic development; and
(m) Maintain poverty alleviation and achieve quality of life.

Subsectorial strategies presented for major subsectors need further refinement to include realistic targets and to facilitate gradual transformation. The water supply sector is positively pursuing its goals through reforms and strategies, whereas no significant initiative has been taken to direct the irrigation subsector institutions take up these tasks. Restructuring of the Irrigation Department is due as it has followed through on its various loan covenants with ADB-assisted water resources management projects. The objective is to implement the structural changes and capacity required to subscribe to the emerging institutional framework for performing under the proposed Water Act. The World Bank-assisted Mahaweli restructuring programme is a major step that is complementary to sector reforms. At present, MASL is subject to the transition plan to become a Regional River Basin Organization. The expectations are to manage the resources under the provisions of the Water Resources Act and comprehensive basin plans. Once this arrangement is fully established this could be replicated in other areas by NWRA.

V. Institutional reforms

Institutional reforms and policy action in the water sector commenced in 1996; in the ensuing seven years, there has been little success in the implementation of recommendations. This has been a common phenomenon in the region, as many countries have experienced setbacks in recent times due to opposition from various interested parties, with opinion makers implicating the

water policy action in globalization. Lessons learnt in this process will be important for future policy-makers. Analysis of possible short-term and long-term scenarios and strategic steps for desired output will be identified. (See annex II for the emerging institutional framework.)

Future institutional arrangements for water resources management in Sri Lanka will consider devolution functions to the lowest possible level, through empowerment of the stakeholders, as a long-term vision. The proposed institutional arrangements in the draft Water Act will have three levels:

(a) Level I – National Water Resources Authority; apex agency;

(b) Level II – Regional Water Resources Management Agency; six regions to be created, clustering major river basins; and

(c) Level III – River Basin Offices for resourceful basins; for capacity-building and carrying out delegated functions.

I-NWRA is making arrangements to employ organizational development experts to provide advice on institutional development after the passage of the Water Resources Act. Milestone agreements to establish NWRA are listed in annex III.

1. Interim arrangements (1996-2004)

In 1996, the Government established WRC on the recommendation of the study carried out in 1993 to review and analyse the water sector agency functions. The study, which was commissioned under the ADB technical assistance programme, “Institutional Assessment for Comprehensive Water Resources Management” on the request of the Government, revealed that there were agencies with poorly defined mandates, major gaps with respect to water resources management functions, and a lack of independent decision-making leading to frequent adversarial relationships among agencies and water users. Technical assistance for the water policy programme was provided by ADB, FAO and the Government of the Netherlands, and was supported by the following interim institutional arrangement:

(a) WRC formed as a neutral, interim apex body, membership derived from government, non-government and private sector representation;

(b) WRS formed to assist WRC to formulate and draft policy and Water Law for government approval. WRS manned by director and eight professional staff on contract and full-time secondment derived from major water agencies representing irrigation, water supply, hydropower, agriculture and environment to satisfy the multidisciplinary approach needed for IWRM;

(c) A campaign launched by WRS to educate stakeholders on the need for a water policy for transparent decision-making and to reverse the unfavourable trends associated with water.

(d) Three working groups formed to work with WRS in the legal, institutional and policy areas. Cross-cutting issues discussed and consensus reached on policy objectives;

(e) During the same period, the capacity of WRS staff was built through foreign and local training. Study tours were arranged to learn practices in water resources management;

(f) Policy and the draft law finalized in 2000 and in March 2000, the policy was approved by the Cabinet. Legal drafting of the Act was completed. Cabinet approval was given to the water resources policy and institutional arrangements (table K.7) for water resources management;

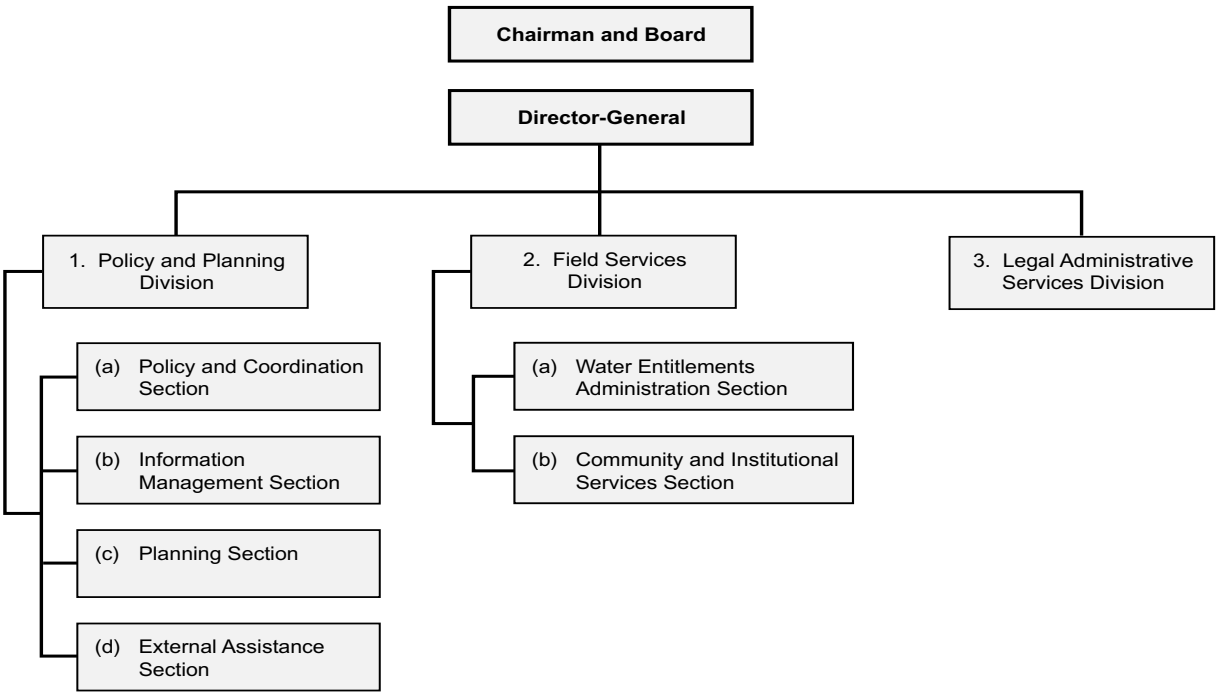
(g) In the light of the above developments, a loan project was formulated by ADB and WRS for the establishment of a permanent agency and its capacity-building;

(h) During the policy formulation, WRC/WRS and working groups held lengthy deliberations with regard to the position of the permanent body to be established. The logical argument was to place the apex agency under the highest level of the Government for independent and unbiased decision-making.

2. National Water Resources Authority mandate

Table K.7. Institutional recommendations in the policy, 2000

Functional area	Specific role of NWRA
Water resources management policy	Formulation of policy proposals. Coordination with catchment management, environmental aspects
River basin planning and other water planning	National, regional and long-term river basin planning; involvement in seasonal planning
Coordination and collection of data	Improvement of data management, including monitoring, evaluation and commissioning of research
Water allocation	Issuing water user right permits to bulk and large-scale water users; monitoring and enforcement
Drought/flood management	Advisory on response to disasters and planning measures for mitigating
Control of riverine activities	Policy guidelines, advice and monitoring of implementation
Public Information and awareness	Education, dissemination of information



Note: Important institutional tasks:

1. NWRA, under the provisions of the Water Act (Section 6.7), will be responsible for establishing river basin agencies parallel to the Mahaweli River Basin Authority in order to implement comprehensive river basin plans for other regions.

2. Capacity-building and institutional development will be based on the lead water agency that has the highest stake in the region in terms of water utilization.

3. Stakeholder mobilization and facilitation to form the RBO in order to effect full public participation in decision-making.

Figure K.2. Organization chart of the National Water Resources Authority

3. Vision statement of the National Water Resources Authority and scope

"To ensure the use of water resources in an effective, efficient and equitable manner, consistent with the social, economic and environmental needs of present and future generations."

a. Mission statement

The NWRA mission statement is: "To establish a regime for integrated water resources management." The core functional areas of NWRA are detailed in table K.8.

Table K.8. Core functional areas during the interim period of establishing the National Water Resources Authority

Functional area	Subject matter	Responsibility	Output	Targets/comments
Public consultation and awareness	Water Policy Water Act	Dir-Gen/Director, Policy and Planning, service providers and support staff of I-NWRA	Public opinion in favour of smooth passage of Water Act by Parliament	Revised several times since December 2001 General elections in April
Institutional collaboration in implementing IWRM	Water resources planning and IWRM targets	I-NWRA and partner agencies	Core planning team derived from major water agencies Consensus for a multi-disciplinary approach	Activities are in progress in selected basins. Suspension of the ADB loan is seen as a set back
Institutional development	Water sector reforms Establishment of NWRA Mahaweli River Basin Authority	I-NWRA, water agencies, provincial and district administrations	River basin organizations and re-structuring of other agencies Satisfactory stakeholder representation in basin organizations	Slow progress, consensus reached in pilot basins for basin organizations Three Ministerial committees appointed for the establishment of NWRA, restructuring of Irrigation Department and MASL
Pilot basin studies	Comprehensive plan for water resources management	I-NWRA and basin entities	Test IWRM goals on pilot scale through implementation of water policy objectives	Ongoing, suffered setbacks due to suspension of project support from ADB
Water resources management strengthening and implementation of WRM project under ADB assistance	Assistance to improve hydrometric network, monitor surface and groundwater	I-NWRA, support to Irrigation Department, WRB, CEA and NWSDB	Provision of equipment and facilities to improve water resources management and partnership building	Partially fulfilled
Data and information	Sharing and dissemination of data & information	Major water agencies and stakeholders	Data sharing agreement	Consensus on the draft agreement reached
Training and capacity-building	IWRM dimensions	I-NWRA, other agencies and donors	Acquisition of tools and know-how for IWRM	Ongoing

4. Agency support and activities currently being carried out by I-NWRA

The Interim NWRA is currently engaged in the following activities and it continues to support a collaborative approach in building partnerships. I-NWRA has been recognized by the other sector agencies as the apex agency, to be responsible for implementation of water policy initiatives, in recognition of the implication for other agencies once established under an Act of Parliament.

(a) Water resources management policy implementation through institutional coordination in pilot basins and river basin planning through collaboration with major water agencies;

(b) Stakeholder consultation at the river basin level to set up an institutional framework for forming River Basin Committees, capacity-building for development of comprehensive basin plans for selected river basins in Sri Lanka;

(c) Represented as a core group member for formulation of land-use policy;

(d) Represented in the Steering Committee for the formulation of natural resources management policy;

(e) Technical Evaluation Committee member for EIA/IEE approval of prescribed projects on water resources management;

(f) Represented in the Steering Committee for the community water supply and sanitation project financed by the World Bank;

(g) Implementation of the Clean Rivers Programme through stakeholder participation. Designed and erected water quality display boards along the Kelani River. This will help to educate the public on water quality issues;

(h) Promoting the involvement of rural communities in soil and water conservation through the identification of critical watersheds and water management areas under the pilot basin project, as a component of the water resources management plan;

(i) Water resources improvement studies in selected river basins to recommend urgent priority action; and

(j) Member of the core planning team for the water resources component of the Western Regional Development Plan.

Table K.9 lists the projects that have been implemented with foreign assistance.

The authority of NWRA, as stipulated in the draft Water Act, is outlined in table K.10. Passing of the Act by Parliament is the most important first step in the legal establishment of NWRA from the perspective of decision-makers. It is also important to find out how soon NWRA will become an effective institution performing the role of an apex agency.

5. Ensuring the effectiveness of NWRA

Interim arrangements will have to focus on priority action to be implemented at the local level through existing institutions until the environmental and natural resources functions have been developed, and capacity has been built. These interim arrangements include:

(a) Vision-into-Action to meet IWRM goals;

(b) Translating awareness into political will and capacity to spur and sustain the efforts to conserve the natural resource base for sustainable utilization of water resources;

(c) Exploiting driving forces and scenarios to emphasize the need to change attitudes;

(d) Identification of priority action and formulation of a strategy to achieve recognition by society as an institution performing an important function;

Table K.9. Foreign-assisted projects implemented

Project	Donor and objectives	Output
Institutional Strengthening for Comprehensive Water Resources Management	Technical assistance from ADB to set up WRC and its Secretariat to formulate policy and draft Act	National Water Policy to WRM addressing water allocation, surface and groundwater management and demand management
Western River Basin Project (WRBP)	ADB technical assistance to study five river basins in the western region and make an assessment.	Training and capacity-building of WRS. Possible infrastructure for loan financing to solve priority water resources management issues such as conservation barrage across the Kelani River to protect water intake of Colombo from salinity. Construction of low-flow measuring weirs to improve data and information.
Study conducted to assess socio-cultural and environmental use of water in selected basins	Assisted by CIDA to develop policy guide lines. To incorporate social, cultural and environmental water use in the water allocation policy.	Conflict resolution in water sharing among rural communities at basin level. Recommendations to be incorporated into the river basin plan and water allocation.
Third Water Supply and Sanitation Project – Water Resources Management Component	ADB, NORAD assistance. Component implemented under the Water Resources Secretariat. Grant funding for WRS.	Comprehensive basin assessment for four river basins. Recommendations to address data gaps and analysis of water allocation conflicts.
Water Sector Strategic Plan to Establish NWRA, 2002-2005	Implement IWRM goals.	Strategic Plan for NWRA and National Water Resources Plan to implement IWRM.

(e) Adoption of best management practices to show management and technical skills in resolving issues;

(f) Mobilization of resources, enforcement and monitoring compliance; and

(g) Periodic reviews of performance and results.

6. Outline strategies related functions of NWRA

Sri Lanka's past policies on the management of water resources focused on developing such resources to maximize their utilization in irrigated agriculture and hydropower. Agencies were created with a mandate to develop water resources and with the main focus on project planning and implementation. A lack of focus on sustainability has become evident during the operations of these projects. In order to ensure sustainability of installed facilities and to continue reaping the benefits, the following institutional reforms/restructuring and capacity-building for IWRM are essential to meeting future challenges:

(a) Establish an IWRM regime through reforms of the policy, legal and institutional framework. Gain an understanding of the conflict of interests between water resources management functions and water service delivery functions when these functions are assigned to respective agencies for regulation and implementation. Accept fundamental principles in the emerging institutional arrangement;

(b) Develop policies and plans for national, regional and basin level water resources management in an open and consultative manner, taking into consideration the views

Table K.10. Legal mandate of NWRA under the provisions of the Water Resources Act

Function of the authority Policy Water resources plans Regulations Data and information Water quality	• Advise the Government on regulations and policy. • Formulate water resources development policy. • National, regional and basin plans. • Facilitation, research and commissioning. • Monitor plan implementation. • Data and information management. • Water allocation, issue permits for bulk use. • Advise the Government on flooding and drought. • Promote stakeholder participation. • Protection and maintenance of water quality. • Coordinate with environmental agencies and facilitate private sector participation. • Community-based organizations. • Establish Regional Basin Organizations. • Declare areas for protection and conservation. • Delegation of authority to regional/partner agencies.
Allocation of water resources. Use of bulk water to be allowed only with permit. Prepare regulations and institutionalize.	• Validity of permit – five years. • Review periodically. • Criteria for granting permits. • Comply with measuring device. • Hydraulic infrastructure approval. • Regulation to exempt livelihood users from needing permits. • Maintain registry of permits.
Groundwater management	• Declare areas affected due to groundwater. • Fresh planning for groundwater sensitive areas. • Monitoring of aquifers. • Administer drillers' licences.
Measures for conservation. Duty to conserve water resources.	• Duty of all persons to comply with standards. Incentives for conservation, promote recycling, re-use of water saving agreement.
Protection of water courses. Hydrological reservation. National Water Fund placed under NWRA.	• Protection of the riverine environment. Catchment areas to be declared as reservations/protected zones. • Delegate, build capacity and adopt BMP. • Contribution to water resources, and development and implementation of other target areas. • Investment to be channelled through NWRA.
Local Water Fund. Water Mediation Board (WMB).	• Provincial and local level water resources management investment and capacity-building. • Minister to appoint WMB as required. • Appeal from decision of the NWRA. • Matters related to permit granting or rejection regulations of (NWRA) affairs of the NWRA Board. • Arbitration on water disputed
Establish regional water resources management agencies.	• Establish and appoint regional director and build capacity to perform delegated functions.
Set up Regional Water Resources Council.	• Formed to represent all stakeholders in implementation of IWRM plans.
Form River Basin Organization.	• Establish RBO and empower.

of all stakeholders. Updating should be done from time to time. Identify urgent priority actions through consultations and implement them in order to establish the NWRA;

(c) Coordinate the water resources policy with other national policies and direct it towards the achievement of broad social objectives. Water resources policy will also be reflected, as appropriate, in the policies and strategies of water-related sectors. Institutionalize a of post-evaluation and feedback system for decision-making and periodic policy reviews;

(d) Management of surface and groundwater as recommended by comprehensive basin plans. Institutional development at the basin and regional levels in order to implement and monitor compliance with the plan. Identify urgent priority actions to address pressing issues at the national and basin levels. Formulation of a strategy for NWRA to convince the society of its importance as an organisation that performs important functions for society;

(e) Prepare national and multi-basin water resources plans for addressing strategic water resource issues such as national objectives (food security, industrial location etc.), coordinate the management of water resources for hydropower generation, interbasin water diversions and identification of priority river basins for more detailed planning;

(f) Water resources planning and management will be carried out by a set of national and regional agencies, which are independent from those water service sector agencies. Water resources planning have to achieve IWRM goals. It has been recognised that a complete shifting of approach to water resources planning from traditional approach is needed to achieve IWRM goals, as at present the agencies are pursuing their desire to implement projects planned under the master plan prepared in the late 1960s. I-NWRA is convinced that these projects have lost the validly in terms of social and environmental sustainability;

(g) Adopt a consultation strategy to minimize affected parties in the management of water resources. Institutional arrangements will also be made at the provincial and local levels, so that stakeholders at all levels can participate effectively in water resources planning and implementation. RBOs will be established for satisfactory stakeholder participation. Adoption of a suitable model for RBOs of the regionalized clusters of river basins is an important aspect of the empowerment of stakeholders as provided for under the latest draft of the Water Act;

(h) Other national water-related agencies are expected to continue to carry out their present functions, while bringing their activities into collaborative partnerships to implement delegated functions in line with IWRM goals as defined in the river basin plans;

(i) Organizing many water resource management functions on the basis of river basins and groundwater aquifers. Basins and aquifers are natural units for information collection, planning, water allocation and other functions. Institutional arrangements will reflect this river basin orientation;

(j) Pilot testing of recommendations under the reforms in selected basins and the adoption of an incremental implementation strategy are key factors for success; and

(k) Emphasize quantitative and qualitative management of water resources and institutionalise all essential functions. New policies are being formulated for watershed management and institutional strengthening for water quality monitoring. Since pollution control and other environmental protection functions are assigned under the National Environmental Act, a coordinated approach will be establish between NWRA and the Central Environmental Authority in monitoring, planning, administering and

enforcing both water quantity and quality. Disposal of used water is to be given due consideration when issuing water-use permits under the new Act.

VI. Strategy to achieve integrated water resources management goals

Sri Lanka's water reforms are influenced by a number of warning signs related to water availability and the non-availability of cost-effective water resources management to expand pipe water supply to the targeted population, despite massive investments in the water sector in the past three decades. Degradation of water quality and critical watersheds are among the other major issues for priority intervention, because of the warning signs and emerging competition for water, the Government has taken action on implementing reforms in the area of water resources management. However, Sri Lanka lacks a comprehensive approach to a number of major national sectors.

The five-point action plan implemented and completed in 1993 by WRS on the recommendation of the water sector institutional review study has produced the country's first-ever comprehensive policy and law for sustainable management of surface and groundwater resources. This will provide a framework for integrated basin planning, management and conservation of water resources, which will ensure efficient delivery of water services in subsectors such as irrigation, hydropower, domestic and industrial water supply, and sanitation. Important aspects of water rights, water allocation and demand management are included in the policy.

1. Integrated water resources management definition

Many countries around the world have introduced reforms through new policies and institutional reforms in the water sector, aimed at building capacity to meet the emerging water crisis. This approach, now widely known as IWRM, can be defied as "management of surface and subsurface water in the qualitative, quantitative and ecological sense from a multidisciplinary perspective, and focused on the needs and requirements of society at large regarding water".

The centrepiece of these guiding principles is the strategic approach to equitable, efficient and sustainable utilization of water resources. The concern that has been expressed over water resources at various international conferences and meetings is well justified as the per capita availability of renewable freshwater has been diminishing with the ever-increasing growth of population; pressure on natural resources is directly related to population density. If annual water resource availability of a country is less than 1,000 m^3 per person, that country is considered as being water stressed. Shortage of water adversely affects socio-economic development and environmental quality. In practice, this implies recognition of the fact that:

(a) Ecologically healthy functioning of water systems is the basis for sustainable use by man, flora and fauna;

(b) By management of these systems, all interests need to be considered in the functioning of water systems and regulation is required to guarantee sustainable use; and

(c) Interests can be best represented together with planning, coordination, decision and policing powers on a platform in which all stakeholders are represented.

2. New dimensions to be included in water resources planning

In the past, water resources planning and development considered just a few aspects such as the utilization of water to meet certain demands. There are a number of such examples in Sri Lanka and other countries. The illusion that engineers could produce water when and where it was needed led to egregious waste. Everybody is now learning that there are limits to mankind's

ability to move water from one place to another without seriously disrupting the natural balance. A new consensus is emerging on the application of rigorous project selection criteria, both long-term and short-term, and side effects are defined as effects beyond the objectives of the project. In order to eliminate negative side effects that have a direct impact on the sustainability of resources, a rigorous planning process is needed that includes analysis of the following aspects:

(a) Technical sustainability (balanced demand and supply, no exploitation)

(b) Financial sustainability (cost recovery or cost sharing application of user pays and polluter pays concepts)

(c) Social sustainability (stability of population and demand, willingness to pay)

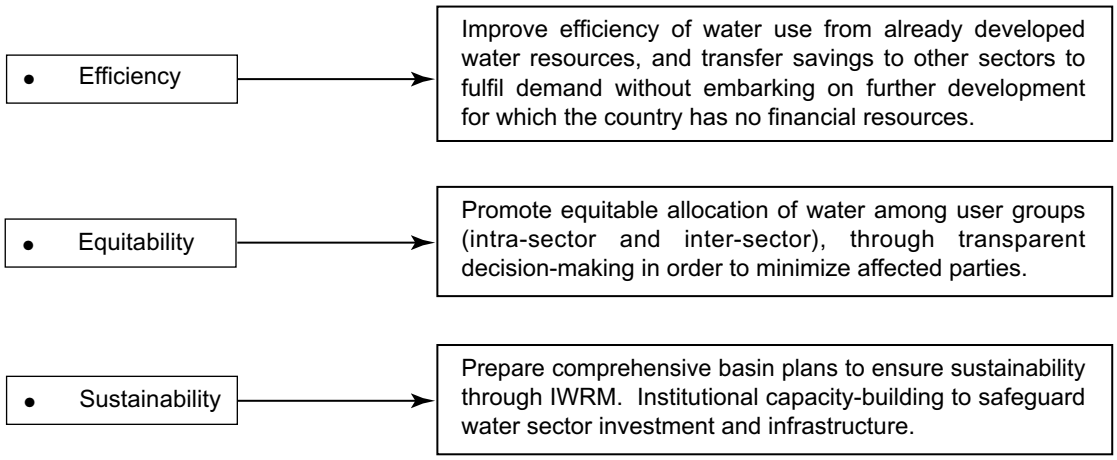
(d) Economic sustainability (water as an input to growth)

(e) Institutional sustainability (capacity to plan, maintain and operate the system)

(f) Environmental sustainability (no long-term negative or irreversible effects)

3. Primary objectives of integrated water resources management goals

A strategic approach to internationally agreed core principles, i.e., managing water resources equitably, efficiently and sustainably is shown in figure



4. Institutional approach

A new consensus is emerging out of the realization of deficiencies in the traditional approach to water resources planning and development. In the recent past, the largest government investment was in water resources development, with the focus on maximizing utilization of water as an input for various economic and social activities without much attention being given to sustainability of the resource base. Rational management of water resources for economic and social development requires an understanding of the many side effects of large-scale water development. Principal among them is the need to (a) maintain the basic water requirement of present and future generations, (b) maintain the integrity of the hydrological cycle and (c) institutionalize essential functions for the sustainability of the resource. In order to achieve these goals, an essential component is building up the capacity of formal and informal institutions to manage supply and demand by giving due consideration to the qualitative and quantitative aspects of water in the planning and development of water resources and resolution of conflicts.

This new consensus leads to water resources management based on its natural boundaries. Central objectives of the water policy and countries all over the world are now adopting new

dimensions in the process of water resources planning based on IWRM. Planning of water resources in an integrated manner by considering all related aspects will enable foresight and anticipation to be applied in the management of water. It will also ensure better responsiveness to existing and emerging issues with regard to the availability of water for a variety of important uses.

Water resources management involves a great number of activities and institutions, and has a bearing on many groups and sectors within society. This integrated or cross-cutting nature of water management has been rightly emphasized on numerous occasions. For water resources management to be effective, therefore, it is imperative that the process of planning and management is participatory. A single institution cannot tackle the functions that are required for the effective implementation of management measures. The process of planning is the best vehicle available to accomplish participation by the public, water users and water institutions.

A comprehensive river basin plan will address a number of key issues related to planning, such as the scope and content of the plan, the procedure for preparing and approving the plan, the legal effect of the plan, and the institutional framework. In general, the institutional framework for river basin management comprises the plan – not a separate institution – that is prepared according to careful and participatory procedures. For that purpose, RBCs should be established that are supported by the proposed NWRA and are closely involved in all stages of planning, including plan implementation. RBCs have a role in defining the Terms of Reference of the plan, plan preparation, monitoring and implementation. RBCs will be composed of representatives of four categories of important stakeholders and groups, i.e., water agencies (the Irrigation Department, NWSDB, CEB and CEA), provincial and local authorities, and water users such as industrial users, farmers' organizations and others. This process is an evolving one, and the long-term vision is that RBOs will emerge with the capacity to carry out all the functions related to IWRM. Initially RBCs will act as advisory bodies for a relatively long period while water agencies with planning capacity address planning issues through a collaborative approach.

Basin water resources management is being promoted because it allows:

(a) Short- and long-term demands to be met in an economically efficient manner;

(b) The inclusion of activities and objectives that are not always economically and technically feasible in separate approaches;

(c) Benefits from cost reduction through economies of scale;

(d) Identification of efficient solutions to water quality and pollution problems; and

(e) Action that facilitates reaching a consensus among the riparian countries, thereby reducing tension and conflicts.

5. Capacity-building areas and institutional collaboration

The sustainability of large investment and installed facilities will depend on the capacity of the water sector institutions to meet future challenges in the management of infrastructure and water resources. Because of the warning signs and emerging competition for water, the Government has begun implementing reforms in water resources management. However, Sri Lanka lacks a comprehensive approach to water allocation or an adequate system of water rights. Water is managed as an input to a number of major national sectors.

Economic development, urbanization and industrialization are placing increasing pressure on Sri Lanka's water resources, highlighting the need for reforms to improve overall management of these resources. In response to this challenge, the Government embarked on an Action Plan for Comprehensive Water Resources Management in order to initiate policy and legal reform and institutional strengthening. It has produced the country's first-ever comprehensive policy and law

for the sustainable management of surface and groundwater resources. This will provide a framework for integrated basin planning, management and conservation of water resources, thus providing for efficient delivery of water services in subsectors such as irrigation, hydropower, domestic and industrial water supply, and sanitation. Water rights, allocation and demand management will be part of the policy.

Partner agencies have responded positively to proposed reforms, especially transforming through restructuring to evolve as RBOs. Decentralizing central agencies to the river basin level, the formation of regional basin agencies, and capacity-building to enable them to carry out the full functions for effective and comprehensive water resources management will be an important aspect of the proposed reforms in the sector. Legal establishment of NWRA will create an enabling institutional environment for more coordinated planning and integrated development as well as fill the gaps and eliminate duplication in performing IWRM functions. Training a new generation of water professionals will focus on achieving targets and sustain the benefits of investments.

6. Partnership for water resources management

Sustainable utilization of the country's water resources will depend on how well the complexities of water and its availability are understood. Foresight and anticipation is needed by all, stakeholders and users equally, together with the building of a partnership through a multidisciplinary approach in the management of water resources in an equitable, efficient and sustainable manner. Policies have to be formulated, and capacity-building and institutional strengthening are needed for IWRM in order to address all aspects of water resources management.

Partners of the Water Resources Management and Target Group for a collaborative approach to planning and management include:

(a) NWRA – apex agency for planning and regulation
(b) CEA – environmental regulations and enforcement
(c) The Irrigation Department – water planning and operations
(d) Land-use Policy Planning Department
(e) Mahaweli Authority of Sri Lanka – change to river basin agency status
(f) Meteorological Department
(g) Ministry of Irrigation and Water Management
(h) Ministry of Environment and Natural Resources
(i) Ministry of Mahaweli Development
(j) Universities and research organizations
(k) National Water Supply and Drainage Board

Priority activities for the partnership in water resources management would include the following:

(a) Institutional agreement for improved data and information management for sustainable decision-making regarding basin and national level planning and operation;

(b) Comprehensive water resources planning for IWRM at the national and basin levels through institutional collaboration;

(c) Capacity-building for IWRM (see table K.11), including training a new generation of water professionals;

(d) Promotion of stakeholder commitment for sustainability;

(e) Establishment of water accountability through permits and implement demand management measures;

Table K.11. Capacity-building areas for IWRM

Target area	Activities	Capacity-building areas
Resource development	Activities related to further utilization of the resource, such as irrigation, water supply schemes and multi-purpose projects.	Strategic planning and management for integrated planning at national and basin levels. Institutional collaboration in functional areas for improved coordination and the avoidance of duplication. Use of modern planning tools for optimization of resources. Image processing in remote sensing and data processing. Integrated models to meet utilization for all purposes. Mitigation of side effects of development. Geophysical investigation. Techniques for establishing water balance in hydrologic units. Training on EIA and minimizing affected parties.
Resource conservation	Activities related to the reduction and/or more efficient utilization of the resource through demand management	Knowledge of demand management tools. Design of water saving technologies. Design, construction and operation of water-efficient field structures. Negotiation skills and techniques for water-saving agreements.
Resource protection	Activities related to protection of existing surface and groundwater sources, (quality and quantity) for future users	Total catchments protection strategies. Water and soil conservation structural methods. Surface and groundwater monitoring for quantity. Design and develop water quality management systems. Training on sampling testing, data gathering and transmission, using modern techniques.
Resource restoration	Activities related to the improvement an/or restoration to the existing quality of the resources	Techniques for maintenance of ambient water quality. Capacity building on enforcements and developing manuals for field operations. Promotion of user participation for restoration.
Water allocation and permits	Activities related for equitable water allocation to all the use sectors and stakeholders. Agreements for prioritization during shortages.	Water resources administration and enforce regulations. Water auditing and accountability Conflict resolution. Water resources modelling.
Resource control	Activities related to the mitigation of damage to the resources (flooding, drainage, saline intrusion).	Floods and droughts forecasting. Data and information processing. Assessment of drainage and contamination. Salinity investigation and reservoir operation modelling.

(f) Protection of investment and installed facilities through physical and economic sustainability. Safeguarding the benefits of three decades of large-scale water and hydropower infrastructure;

(g) Adoption of economic and financial principles for cost sharing;

(h) Environmental principles;

(i) Information, education and communication principles; and

(j) Technological principles.

VII. Water and national development

During the past several decades, national development projects and programmes were based on the assumption that water was a resource that was available in abundance. Water was managed by supply rather than manage by demand.

Water-related projects are a significant component of the Public Investment Programme; 30 years ago, more than 10 per cent of the national budget was allocated for water-related projects. However, the social and economic importance of water was not adequately reflected in the national accounts, which do not include its health and environmental benefits, for example in healthy drinking water supply, and effective sanitation and waste disposal. According to the United Nations Development Programme report on freshwater, Sri Lanka's annual water resources utilization is 10 billion m^3 out of 47 billion m^3 of renewable resources, since easily exploitable resources are diminishing rapidly; while water resources development costs are rising.

As a result of the major water resources development programme implemented under the accelerated Mahaweli River basin project, hydropower capacity was increased to 1,135 MW and capacity was adequate for providing 100 per cent of the country's electric power requirements up to 1990. Additional power demand since then has been supplied by thermal power generation. Currently, hydropower is able to supply only 50-55 per cent of the national power requirement.

In Sri Lanka, water in general is considered as an input to economic development. Previously, investments in the sector were mainly for further development of the resource for maximum utilization. Decision-making was centred on major subsectorial agencies to enable them to exercise their mandates. After independence, investment in water to meet food security was given high priority, and this objective was met with major irrigation settlements in the three decades from 1960 to 1990.

The most productive river basin in Sri Lanka is the Mahaweli River basin due to its hydropower and irrigation capacity. The Mahaweli development programme is the most ambitious project undertaken by the Government, according to the master plan prepared in the early 1960s with UNDP/FAO assistance. The challenge ahead is to maintain the integrity of the hydrological cycle and the sustainability of infrastructure in order to reap the benefits at a constant rate for present and future generations. Policies and strategies adopted by the following water related subsectors hold the key to the development and growth of the nation:

(a) Water and sanitation – health and quality of life
(b) Irrigation and agriculture – food security and conservation
(c) Hydropower – source of energy for national development
(d) Industry – employment, national income and environment
(e) Tourism – infrastructure and national income
(f) Forestry – conservation of quality and quantity
(g) Environment – protection and conservation of eco-system
(h) Livestock and Fisheries – employment and nutrients for a healthy society

The environmental importance of water must also be continuously borne in mind. Although social and economic development is the nation's top priority at present, the Government recognizes that development must be sustainable. Sustainable management of water, without degrading its quality or harming aquatic ecosystems, is essential to sustainable human development.

Adoption of a water policy and recommendations therein is seen as a major step in establishing a regulatory domain in the management of water resources for an integrated approach

to ensure sustainability, equitability and efficiency. It is expected that the new agency, NWRA, will act as an apex body in administering water legislation, and other agencies and provincial councils are expected to participate collectively in water resources management. Moreover, it will create an enabling environment for partner agencies to exercise their respective mandates through a collaborative approach. This will provide a framework for integrated basin planning, management, conservation, hydropower, domestic and industrial water supply, and sanitation. NWRA will be responsible for coordination, planning and regulation at the national and basin levels, water entitlements, water allocation and demand management. NWRA will not be responsible for project planning, operation and maintenance of infrastructure, or similar operational responsibilities for sector-specific water use.

NWRA will be required to analyse the actual cost of water resources management in order maintain reliable water service delivery by respective service sectors. In the initial phase, NWRA will administer a system of water entitlements for bulk users, under the provisions of the Water Act. The main objective is to regulate large-scale water users so that the customary water rights of small-scale users are safeguarded.

VIII. Water resources management financing

1. Opportunities for further development of the resource

The outlook for future water resources development is somewhat discouraging as the likelihood of realizing large-scale investments from donor assistance will possibly not be forthcoming. Moreover, further water resources development has reached the limit, as there are no more easily exploitable resources left. Large-scale water resources development will not be a viable proposal in the future, especially as world opinion is against large-scale development projects due to the complex social and environmental issues connected with such projects. Traditionally, water resources planning of the past was focused on maximizing the utilization of water for agriculture and hydropower.

Currently, Sri Lanka is facing a water shortage in other vital economic sectors and further resource development has become unaffordable as all the cost-effective water resources have been utilized. Although a number of projects were in the pipeline under the master plan of 1968, the lack of funding kept them on hold. However, decision-makers believe that implementation of the portfolio of nearly 20 projects in the water resources plan is essential for national development. Since the majority of these projects were planned over 15 years ago, opportunities to implement them are now difficult to realize as the present ground conditions may no longer be favourable.

Environmental and social concerns are posing a major obstacle to finding suitable locations for water projects, mainly due to natural resources constraints. In addition, compensation for the social costs associated with large-scale development activities is not possible. Sri Lanka was fortunate to receive massive investments for large-scale projects during 1960-1990 due to the prevailing global political scenario at that time, making it possible to implement such projects as the Accelerated Mahaweli Project. The potential for future water resources development will require analysis of current socio-economic and environmental constraints and opportunities. Management of the resource and the existing physical infrastructure in a viable manner before undertaking new projects is being increasingly emphasised. Macroeconomic policies are required for sound financial practices in the sector to create a water economy.

Grassroots level politics are often in conflict with macroeconomics, and politicians are trying to avoid problems affecting short-term gain while compromising long-term success. The core aspects of financial viability of the sector's activities need further review, and the selection of options that are socially and politically acceptable in order to bring about self-reliance is essential to promoting confidence among stakeholders. This has become imperative due to the fact that the current level

of investment mainly depends on donor support, which is totally inadequate to cater to the demands for balanced economic growth.

Availability of reliable water supplies is vital for the rapid growth of non-agricultural sectors with higher value output per unit of natural resources. Therefore, a strategic plan needs to focus on introducing new policies on investments and financing of water resources management, which is acceptable to all water users and managers.

What economic instruments are available in the Sri Lankan context to create a water economy? Most of the large irrigation, hydropower and water supply projects have been implemented with assistance, for example, from the World Bank, ADB, the United States Agency for International Development, the Overseas Economic Cooperation Fund/Japan International Cooperation Agency, the Overseas Development Administration of the United Kingdom, and the United Nations Development Programme. The Government has not been able to undertake large-scale development activities in the recent past and there is no policy for financing development in the sector.

Future donor support will be subjected to many conditions and will not be sufficient to meet the expectations of the socio-economic development of the country. In the past, Sri Lanka received outright grants to develop large-scale dam projects for irrigation and hydropower. The socio-economic development resulting from such investment enabled Sri Lanka to achieve upper-middle income developing country status with a gross national product of more than US$ 800. Current investments in the sector are insufficient to cope with the expected socio-economic development goals; therefore, the current reforms are aimed at creating an environment that is attractive to potential investors, i.e., international cooperation of bilateral/ multilateral donors or private sector participation.

2. Revenue base

In the water-related functional analysis, a broad classification may be presented to differentiate between management of the resource and delivery of services related to water. Current institutions are mandated to perform a mixture of these functions, as explained below. This has caused many important resource management functions to be ignored by the agencies as their core business is to provide water for services such as water supply for irrigation, and industrial and agricultural use. The only revenue base in Sri Lanka is piped water consumers. In developed countries, the revenue base in the water service delivery area generates funding to support resource management functions. The water sector functional analysis in table K.12 will help to distinguish between water resources management and water service delivery functions. At present, agency

Table K.12. Water sector functional analysis

Management of the Resources "Water is a Renewable resource"	Delivery of Service "Water is a Commodity"
• Policy and water laws	• Irrigation
• Water allocation/permits/rights	• Domestic and municipal water supply
• Regulations	• Industrial water supply
• Planning at basin and national levels	• Hydropower generation
• Entitlements and water rights navigation	• Navigation
• Water quality management	• Fisheries
• Assessment of the resource	• Reclamation
• Conservation and demand management	• Fire protection
• Data and information management	• Recreation
• Protection of river system	• Pollution control
• Total catchments management	• Demand management
• Ambient water quality	

mandates are not well defined or they are not assigned water resources management functions as their mandated core functions are related to water services.

Once established, NWRA is expected initially to deal with the bulk water regulation as a core function. A recent survey revealed that there were only 4,500-5,000 water users in this category. The objectives of subjecting them to regulatory measures through bulk water permits include:

(a) Establishing water accountability
(b) Resolution of conflicts
(c) Improved reliability
(d) Promotion of water conservation (agreements)
(e) Facilitation of transfers
(f) Safeguarding of third party rights

There is no opportunity to charge a service fee other than an initial nominal administrative charge for the bulk permits. At present, commercial and industrial users have free access to water.

The policy is to charge a permit fee from the bulk user based on the number of mutual benefits that could be gained with regard to large-scale users. In reality, large-scale use of water is not secure unless the users are permitted through legal rights. This is mainly due to unfavourable trends with respect to water quality, quantity and pressure from an expanding population, including various issues encountered in connection with the following:

(a) Continued donor support, promoted by institutional and legal framework
(b) Public/private participation promoted by policies and legal protection
(c) Water Fund contribution from end users produces no direct charge
(d) Permit fees not acceptable beyond nominal charge
(e) Resource fee from services – depends on sectoral policies

Table K.13 shows the current investment parameters, used in project evaluation during the planning phase, and preliminary appraisal, indicate the magnitude of financing required to sustain the services as well as the resource base.

Table K.13. Current investment parameters

Category	Irrigation	Hydropower	Water supply[b]
Interest rate[a]	10 per cent	10 per cent	10 per cent
Lifetime (years)	60	40/60 elec-mech/civil	25/50 elec-mech/civil
Rehabilitation interval (years)	10/25 pump/civil	25 elec-mech	10/20 pump/civil
Rehabilitation cost (per cent of investment)	40 per cent	25 per cent	25 per cent/15 per cent pump/civil
Annual operation and maintenance cost	SLRs. 2 500/ha Increasing Annually	1-3 per cent of investment cost or SLRs. 50 per kWh	Percentage of investment cost
Typical maximum acceptable development cost of new projects	SLRs. 60-70 000 per ha	SLRs. 80 per kWh	SLRs. 400 per m^3 SLRs. 35,000/pc capital cost

[a] Interest rates used for economic optimization in the planning phase should be set by the Ministry of Finance, assuming equal interest for all sectors.

[b] Based on information from the ADB third water supply-water resources management component study, commissioned by WRS and updated from the annual report.

IX. Strategies and main outputs

Sri Lanka's approach to water resources management in order to achieve the IWRM goals will be based on the following main actions and plans:

(a) The National Water Resources Plan comprising strategies to achieve the economic, social and environmental goals including component targets for IWRM, and institutional and legal framework;

(b) Comprehensive basin plans for selected basins and capacity-building to prepare such plans;

(c) The legal establishment of NWRA as the apex body in the water sector;

(d) Other major agencies to subscribe to the NWRA mandate in performing delegated functions;

(e) Decentralised units based on basins and water management regions to facilitate resource mobilization, participation of stakeholders in decision-making;

(f) Mobilization of users for conservation, pollution control and cost sharing;

(g) Dissemination of information and information sharing among stakeholders;

(h) Decision support system for sustainable decision-making, improved data and information;

(i) Establishment of a legal basis for water rights and bridging the gap between managers and users for sustainable utilization;

(j) Ensuring water availability for national priorities, maintaining health, food security and the economy; and

(k) Setting up a "water fund" to facilitate water resources management financing.

The most crucial stage of the process is achieving the milestones detailed in annex III. This is also considered to be the first step leading to the legal establishment of an institutional framework for future water resources management.

X. Implementation, monitoring and evaluation

Sri Lanka's water sector reforms are supported by various donors, including ADB, as IWRM and the sharing of water rights constitute a relatively new discipline in Sri Lanka. This requires expertise and concepts that are not always readily available locally as well as expertise and training in water resources planning and management, the performance new functions, the establishment of an apex agency and the setting up of a collaborative institutional framework. It is a paradigm shift from the traditional approach where agencies work in isolation and compete to maximize water utilization in their respective domains.

The urgent priority actions are as per the milestone agreement with the donors (annex III). These milestones have been subjected to readjustments several times since 2000 due to reasons beyond I-NWRA control. However, the outlook for achieving the targets in the immediate future is satisfactory as it has been given due consideration by the Government.

I-NWRA has already prepared the cadre requirement for establishing NWRA and regional water resources management agencies. Part of the expected personnel will be derived from the restructuring and downsizing process of the Mahaweli Authority, assisted by the World Bank. Transformation of MASL in to a River Basin Authority is part of the water sector reforms; a strategic planning process is being adopted for this purpose through consultation with major stakeholders. NWRA is in the process of recruiting experts to advise on organizational development in line with the proposed institutional framework comprising regional water resources management agencies headed by NWRA. (See the map showing regional basins and emerging institutional framework in annex IV.)

ANNEXES

Annex I. Chronology of water resources management and institutional reforms in Sri Lanka

- Earliest recommendations to establish an institutional framework for overall management of water resources was presented to the Government in the late 1950s.
- In 1964, the Water Resources Board was established, but without necessary institutional capacity and powers to exercise the mandate originally envisaged.
- In the mid-1980s, the water supply and sanitation decade helped Sri Lanka to extend its piped water supply coverage and sustain the service by developing financially viable institutions.
- The Government received Asian Development Bank (ADB) assistance for water supply rehabilitation in 1987. ADB recognized the importance of water rights, and the lack of such rights for abstraction was seen as a project risk.
- Second ADB loan to complete the identified sub-projects for rehabilitation was approved in 1992 and the Government was requested to implement a strategy for comprehensive water resources management through a policy, legal and institutional framework as a loan covenant.
- In 1992, the Irrigation Management Policy Support Activity study, assisted by the United States Agency for International Development (USAID), focused on irrigation management but also addressed broader water management issues and made recommendations for institutional arrangements.
- ADB approved a Technical Assistance (TA 1918) grant by way of specialist inputs to carry out a project entitled “Institutional Assessment for Comprehensive Water Resources Management” from October 1993 to January 1994. The project was executed by the National Planning Department in association with more than 30 other agencies and organizations concerned with water resources management.
- The outcome of the above project was a Strategic Framework and Action Plan for water sector reforms.
- In July 1995, the Cabinet adopted the action plan for implementation and approved setting up an interim institutional arrangement comprising a Water Resources Council and its Secretariat (WRC/WRS) to oversee implementation of the action plan.
- At the request of the Government, ADB approved further assistance, jointly with FAO and the Government of Netherlands, to support WRC/WRS. The technical assistance (TA 2422 SRI) was provided under a project entitled “Institutional Strengthening for Comprehensive Water Resources Management”.
- Objective and goal. The objective of the TA was to support the Government in establishing an improved institutional framework for water sector operations. The goal was to improve water resources management for all subsector uses throughout the country in support of sustainable socio-economic development.
- Action Plan

  The Action Plan agreed to by the Government and ADB consists of:

  1. Developing a national water policy.
  2. Establishment of a permanent institutional arrangement for water sector coordination.
  3. Preparation and enactment of a National Water Act, and amendment of water-related legislation.

4. Reorganization and strengthening of the management of water sector institutions.

5. Implementation of existing, proposed and new policies to achieve sustainability in water sector operation.

6. Establishment of the systems needed to provide the data and information required by decision-makers and others concerned, including the public.

7. Carrying out comprehensive planning in selected watersheds.

For action 7, the scope of the TA is limited to the planning, preparation of terms of reference and assistance in coordination. The Government will arrange for the implementation of such studies under separate, parallel-financed projects.

- **Water Resources Council**

As indicated above, the Cabinet approved the formation of WRC in 1995 and the appointment of members was given presidential approval in April 1996. The appointed members of the Council are: Secretary, Irrigation Power & Energy

– Secretary, Housing, Construction and Public Utilities

– Secretary, Agriculture, Lands and Forestry

– Secretary, Industrial Development

– Secretary, Ministry of Transport, Environment and Women's Affairs

– Secretary, Ministry of Science, Technology and Human Resource Development

– Mr. M.F. Mohideen, Director-General, External Resources Department (formerly Add'n Director-General, National Planning Department)

– Mr. Ken Balendra, Chairman, John Keels Holdings Ltd., representing the Ceylon Chamber of Commerce

– Mr. Hiran Cooray, Managing Director, Jetwing Hotels Ltd., representing the hotel industry, a major water user

– Mr. E.M. Abeyratne, Chairman, EMACE Foundation of Sri Lanka, representing NGOs working on environmental concerns

– Mr. Lahiru Perera, Chairman, NGOs, Water Supply and Sanitation Decade Services, representing NGOs working on environmental concerns

– Prof. D.C.H. Senarth, Senior Professor, Civil Engineering Department. University of Moratuwa, representing the academic community

– One member from a Farmers' Organization (yet to be named).

The Council has an equal number of government and private sector/NGO representatives, as called for in the project TOR. This is an indication of the Government's commitment to stakeholder participation in water resource planning and policy development.

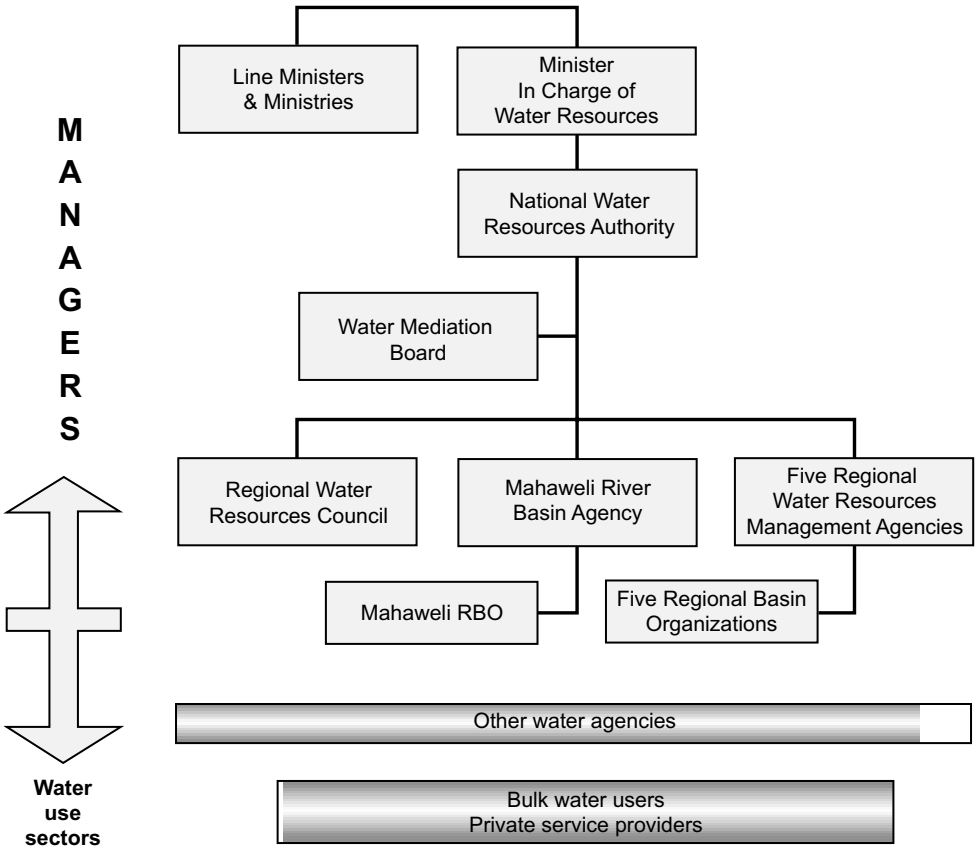
WRC has been appointed as an interim institution and does not have legal status. The Cabinet approved the following responsibilities for the Council:

– The implementation of the Action Plan under the ADB-funded TA; and

– Coordination of intersectoral and intrasectoral issues related to water resources management.

- The Water Resources Secretariat (WRS) was headed by a permanent director plus full-time and part-time seconded staff from major water agencies (Irrigation Department, NWSDB, CEA, Department of Agriculture, CEB and NPD) supported by an ADB Technical Advisor, legal consultants from FAO and the Netherlands, together with a local institutional consultant.
- The first meeting of WRC was held on 4 June 1996. WRC continued to meet periodically 4-5 times a year. WRC reviewed and approved recommendations made by WRS on policy, institutional development and the draft Water Law.
- WRS followed a process of consultation involving all the stakeholders comprising water agencies users, NGO, and provincial and local administrations. A High-level Inter-agency Coordinating Committee and working groups derived from major stakeholders on policy, institution, data and information and law facilitated the process. The consultation activity at the district and provincial levels spanned the period from 1997 to 1999.
- Major recommendations under policy and institutional arrangements were that a water resources management portfolio be created under an independent ministry.
- The Government will establish, by 31 December 2000, policies and operational procedures for the determination of water rights and the allocation of water, particularly with respect to: (a) competing uses of water for supply and irrigation purposes; and (b) groundwater use.
- The Government will, no later than 31 March 1999: (a) adopt a national water policy; (b) create a permanent institutional arrangement for water sector coordination; (c) streamline water sector functions among agencies and adopt a capacity-building plan; (d) strengthen information management in the water sector, including public information; and (e) adopt procedures for comprehensive water resources planning in priority river basins. The Government will, no later 31 March 2001, adopt a new National Water Act with amended water-related legislation.
- The objective of the project preparatory technical assistance (PPTA) will be to prepare a programme that will build the necessary operational capacity to implement the national water policy and law, specifically in the western river basins, and establish a functioning system of river basin planning, water rights and allocation. One of the key objectives is to identify priority sub-projects for water resources development, management and water service delivery in the framework of the basin plan; from this step, a project will be selected for investment in the form of future assistance. PPTA will also provide policy and institutional assistance to WRC and WRS during their transition to permanent apex body status in the water sector.

Annex II. Emerging institutional framework in the water sector (national level)



NWRA: Policy, legislation, regulations, and national and multi-basin water resources plan.

RWRC – Regional Water Resources Councils: Advisory and resources mobilization.

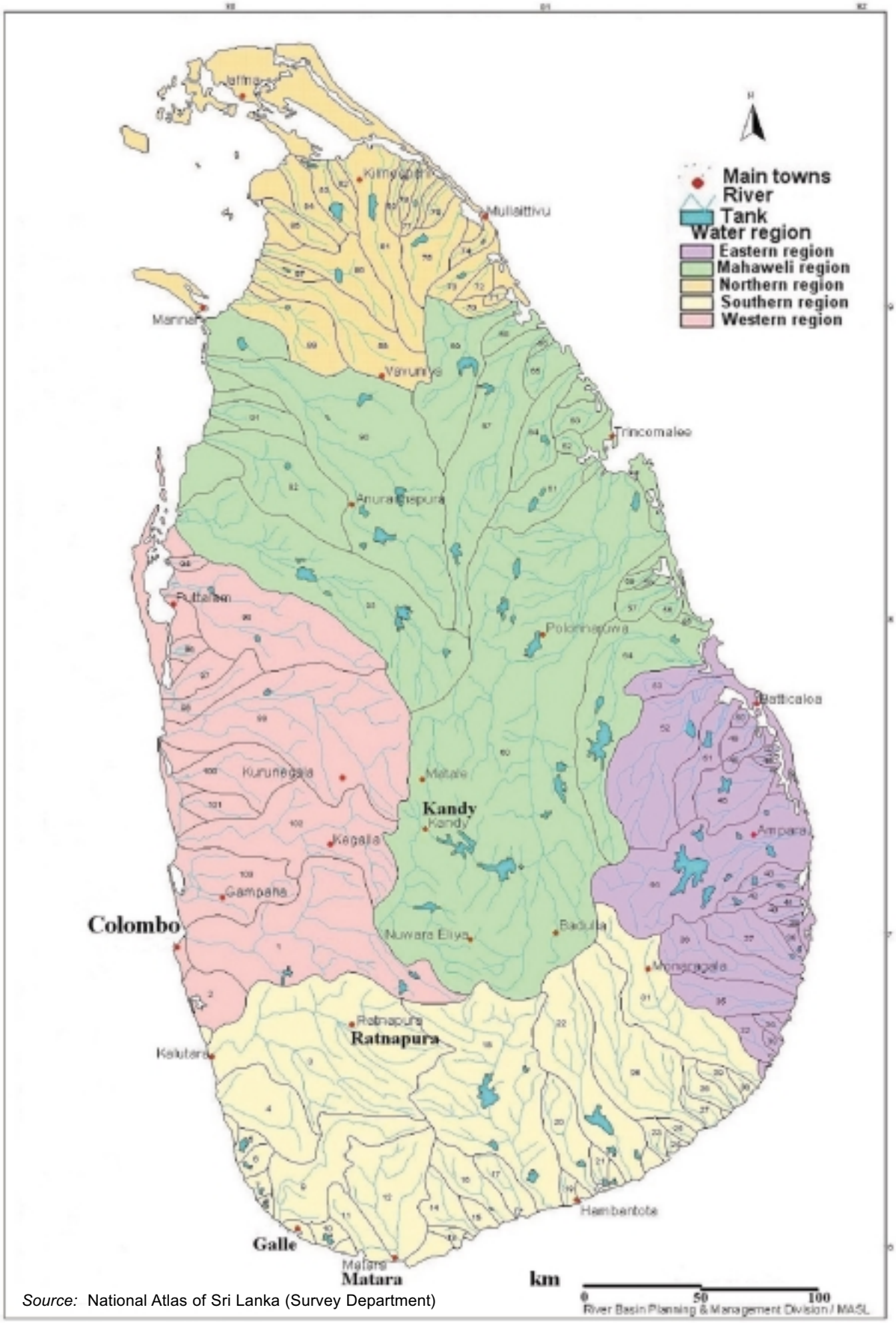
River Basin Organizations: Forum for stakeholder consultation and consensus for decision-making on water allocation, regional planning and development, protection and conservation, monitoring plan implementation.

RWRMA – Regional Water Resources Management Agency: Formulating plans and measures for solving water resources issues brought up by RBO, implementation and operation of the plan, ensuring sustainability of installed facilities (reservoirs, dams, tunnels and hydropower plants). Carrying out functions delegated by NWRA.

Annex III. Milestones in the legal establishment of a National Water Resources Authority

Activity	Process	Target	Status/revised target
Approval of revised Water Policy by Water Resources Council	I-NWRA carried out revisions to incorporate public concerns	Dec. 2002	Completed
Law drafted and ratified by WRC	Prepared and submitted	Dec. 2002	Completed
Submission of Water Policy to Parliamentary Consultative Committee	Policy was prepared in all three languages and approved by I-NWRA Board and WRC	Jan. 2003	Submitted
Submission of Act to Parliamentary Consultative Committee	Prepared by I-NWRA	Feb. 2003	Submitted
Submission of Policy and Act to all Members of Parliament for observations		Mar. 2003	Submitted
Submission of Policy and Act to National Planning Department for submission to Economic Planning Sub-Committee of Cabinet (EPC)		Mar. 2003	Submitted
Public awareness programme	A structured programme has been drawn up to be implemented using media service providers	Mar. 2003 – Sep. 2003	Ready for implementation
Consensus with partner agencies	Commenced in 2002	Continuous	Ongoing
Recasting of Act by legal consultant	Legal consultant to scrutinize and check compatibility with existing legislation	26 May 2003	Completed
Submission of Policy and Act to EPC		02 June 2003	Submitted
Approval of Policy and Act by EPC		30 June 2003	Pending
Submission of Policy and Act to Cabinet		01 July 2003	Target 31 Dec. 2003
Approval of Policy and Act by Cabinet		21 July 2003	Pending target 15 Nov. 2003
Submission of Act to legal draftsman		01 Aug. 2003	Submitted
Receipt of Act from legal draftsman		31 Aug. 2003	First draft received
Concurrence of Attorney-General for the Act		Jan. 2004	
Approval of the Act by the Cabinet		30 Sept. 2003	Target 15 Dec. 2003
Publish Act in the Government Gazette		15 Oct. 2003	Target 1 Jan. 2004
Table Act in Parliament		30 Oct. 2003	Target 15 Jan. 2004
Approval of Act by Parliament		31 Dec. 2003	Target 15 Jan. 2004

Annex IV. River Basin Map of Sri Lanka Showing Water Regions



Source: National Atlas of Sri Lanka (Survey Department)

L. WATER RESOURCES MANAGEMENT STRATEGIES AND ACTION PLANS OF THAILAND

By the Water Resources Association*

Introduction

Water professionals in Thailand, including government officials, academia, non-governmental organizations and the private sector, through the support of the Global Water Partnership (GWP) conducted a series of participatory workshops to draft the national Water Vision and Policy. The Vision and Policy were subsequently endorsed in 2000 by the Government.

The Water Resources Association was contracted by ESCAP to review the national policy and translate the policy into strategies and an Action Plan. The objective was to formulate an action programme to be tabled for the Cabinet approval and used by the line agencies in carrying out their tasks.

I. Approach

The integrated water resources management principle has been incorporated into the water resources management process of Thailand. The participatory approach is an important process for conducting river basin management and for building confidence. For the study, the building of consensus and acceptance by stakeholders is important not only for obtaining approval of the Cabinet but also for the smooth implementation of strategies and action plans. Therefore, multi-stakeholder participation was employed for this study.

II. Process

Two workshops and one meeting were held to translating the national water policy into national water strategies (annex I). The first workshop was held on 15 September 2003 with participants from government agencies, academia, the private sector and non-governmental organizations. Draft strategies were prepared by the organizer and presented to the participants, who were asked to discuss and revise the strategies further. The organizer then summarised the results of the workshop.

The second workshop was held on 24 September 2003, with participants from government agencies and academia, to further consider and revise the draft strategies of the first workshop.

A final meeting was held on 23 December 2003 with participants from key agencies, i.e., the Department of Water Resources, the Royal Irrigation Department, the Bureau of the Budget and the Office of the National Economic and Social Development Board to finalize the draft national water strategies.

III. Output

A final version of the long-term water resources management strategy as well as a short-term (three-year) strategy and Action Plan (annex II) were completed and submitted for Government consideration. The short-term strategy was needed in order to respond to the Government targets for water resources development. The Cabinet was expected to consider the submitted strategies with a view to making them the national water resources strategies.

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Annex I. Long-term national water strategy – national water Action Plan

Policy 1. Accelerate the promulgation of the draft Water Act to become the framework for national water management by reviewing the draft and implementing all necessary steps to make the Act effective, including reviews of existing laws and regulations

Objective	Strategy	Action Plan	Time frame
To introduce a Water Act as well as revise existing laws and regulations to serve as principal legislation for efficient management of national water resources.	Have a Water Law passed as soon as possible.	1. Draft water law. 2. Review and improve existing water-related laws. 3. Submit to the Cabinet and Parliament 4. Effectively enforce the law.	2004 2004 2005 2006

Policy 2. Create water management organizations at the national and river basin levels together with supportive laws. The national organization will be responsible for formulating national policies, monitoring and coordinating activities to fulfill the set policies. The river basin organizations will be responsible for preparing water management plans through a participatory approach.

Objective	Strategy	Action Plan	Time frame
To establish a national level organization responsible for policy formulation; oversee implementation of the policy by concerned agencies; and establish basin-level and local-level organizations with supporting laws.	Promote the establishment of a Ministry of Water Resources to be responsible for policy formulation, the implementation of the policy, and the establishment of basin-level and local-level organizations to be responsible for the preparation of a basin plan and management of basin water resources.	1. To establish the Ministry of Water Resources 2. To set-up basin level and local level organizations 3. To prepare basin plans 4. To prepare manual and budgetary procedure to promote public participation and capacity-building of the concerned organizations	2004 2004 2004 onwards 2004 onwards

Policy 3. Emphasize suitable and equitable water allocation for all water use sectors, and fulfill basic water requirements of agriculture and domestic uses. This will be accomplished by establishing efficient and sustainable individual river basin water-use priorities under clear water allocation criteria, incorporating beneficiary cost sharing based on ability to pay and level of services.

Objective	Strategy	Action Plan	Time frame
1. Appropriate water allocation for all user sectors at the national and basin levels.	1. Define rights and responsibility of the various user sectors.	1. To study guidelines for defining water rights and responsibility of the various user sectors. 2. To carry out a pilot project.	2004 onwards 2004 onwards

Objective	Strategy	Action Plan	Time frame
	2. Prioritize water use for the various sectors, i.e., agriculture, domestic, industry, conservation of ecosystem etc.	1. To study and collect information on water requirements of the various sectors, and forecast future trends.	2004-2005
		2. To study water resource potential and the management plan in order to set criteria for water allocation to the various sectors.	2004-2005
	3. Promote conjunctive use of surface and groundwater.	1. To study existing water potential.	2004 onwards
		2. To allocate water for the various sectors under the framework of basin management.	2004
	4. Set water-use criteria/proportions for the various sectors from national to basin level.	1. To collect and establish an information network for forecasting and warning.	2004 onwards
		2. To set criteria and measures for allocation and management under crisis conditions.	2004 onwards
	5. Prepare emergency plans (drought, flood and wastewater).		

Policy 4. Emphasize suitable and equitable water allocation for all water-use sectors, and fulfill basic water requirements of agriculture and domestic use. This will be accomplished by establishing efficient and sustainable individual river basin water-use priorities under clear water allocation criteria, incorporating beneficiary cost sharing based on ability to pay and level of services.

Objective	Strategy	Action Plan	Time frame
2. Improvement of water-use efficiency.	1. Apply economic and financial tools for water allocation, fee collection, the creation of a water market, compensation, taxes and allow users to be responsible for paying for service, wastewater treatment etc.	1. To study and set appropriate water fees for the various sectors.	2004 onwards
		2. To study the feasibility and set conditions for community organizations to participate as service providers.	2004 onwards
	2. Campaign to create awareness of users about the necessity to share costs and use water efficiently.	1. To launch a public campaign to encourage users to pay and use water efficiently.	2004 onwards
	3. Set up a water resources management fund.	1. To carry out pilot projects for the creation of a water resources management fund.	2004 onwards

Objective	Strategy	Action Plan	Time frame
	4. Introduce water reuse/recycling.	1. To study and design water reuse/recycling schemes.	2004 onwards
	5. Introduce water saving technologies.	1. To accelerate the introduction of water-saving technology	2004 onwards

Policy 5. Emphasize suitable and equitable water allocation for all water-use sectors, and fulfill basic water requirements in agriculture and domestic uses. This will be accomplished by establishing efficient and sustainable individual river basin water-use priorities under clear water allocation criteria, incorporating beneficiary cost sharing based on ability to pay and level of services.

Objective	Strategy	Action Plan	Time frame
3. To increase water management efficiency.	1. Rehabilitate existing infrastructures.	1. To repair and improve distribution systems and control structures in order to reduce losses.	2004 onwards
		2. To improve water control methods for more accurate water delivery.	2004 onwards
	2. Develop a water network/grid both within and among basins, and a distribution system to serve as many users as possible.	1. To study the water network (both delivery and distribution system), at the basin and area levels to achieve a water balance between potential and utilization.	2004 onwards
	3. Improve the organizational structure and management system.	1. To develop organization and human resources for water management.	2004 onwards

Policy 6. Formulate clear directions for raw water provision and development compatible with basin potential and demands, and ensure suitable quality while conserving natural resources and maintaining the environment.

Objective	Strategy	Action Plan	Time frame
1. To develop water resources in accordance with potential and needs of various activities, both in terms of quantity and quality with due consideration of the environment. To ensure sufficient and equitable water for the various basic needs.	1. Set clear direction for water resources development both within and outside the country by emphasizing development of water resources within the country to their full potential.	1. To prepare water resources, management and development master plan	2004 onwards

Objective	Strategy	Action Plan	Time frame
		2. To prepare knowledge base consists of data base, monitoring and evaluation system and supporting system for decision-making in water resource management	2004 onwards
		3. To develop and construct reservoir and irrigation systems	2004 onwards
		4. To encourage local organizations and stakeholders to participate in development and rehabilitation of water resources	2004 onwards
		5. To coordinate with neighbouring countries and international organizations for joint utilization of shared rivers	2004 onwards
1. To maintain natural and man-made water sources in good conditions suitable for various uses.	1. Promote community organizations in looking after water resources, to prevent encroachment and the improvement of scenery.	1. Train volunteers to watch and prevent encroachment of water sources and public streams.	2004 onwards
		2. To improve scenery at water sources.	2004 onwards
	2. Monitor and analyse quality of water sources for domestic use.	1. To monitor water quality.	2004 onwards
		2. To prepare a protection plan for water-related pollution.	2004 onwards
	3. Survey and rehabilitate water sources and waterways, including development and conservation measures.	1. To promote maintenance/dredging of inland waterways.	2004 onwards
		2. To survey polluted groundwater for rehabilitation.	2004 onwards
2. To introduce a basin plan as a master plan for line agencies; to include in Department and Ministerial plans.	1. Complete the basin plan for all 25 basins.	1. To prepare an integrated basin plan with stakeholders' participation.	2004 onwards
		2. To get agencies and basin organizations to prepare an Action Plan based on the basin plan.	

Policy 7. Provide and develop raw water sources for farmers extensively and equitably in response to water demand for sustainable agriculture and domestic uses, similar to deliveries of other government basic infrastructure services.

Objective	Strategy	Action Plan	Time frame
1. To provide water sources to meet the basic requirement for agricultural and domestic needs of farmers extensively and equitably.	1. Develop water resources to meet basic requirements.	1. To prepare a water resources development plan with the initiative and participation of local organizations, TAO and stakeholders.	2004 onwards
		2. To construct village-level water storage facilities, dredging of canal and ponds.	2004 onwards
		3. To develop groundwater in potential areas and construct irrigation systems.	2004 onwards
		4. To prepare procedures for the handover of maintenance responsibility of village-level water storage facilities to TAO and users' groups.	2004 onwards
	2. Prepare a water utilization plan for equitable agricultural and domestic needs.	1. To set water quantity to meet the basic needs for agriculture in the wet and dry seasons and for domestic use.	2004 onwards
		2. To study and project future agricultural water requirement trends.	2004 onwards
	3. Adjust cropping patterns to suit water potential and seasons of the various areas in order to justify the investment.	1. To set agricultural zones with respect to available water potential, soil conditions and return on investment.	2004 onwards
		2. To develop occupational options.	
	4. To develop an agricultural water distribution system for efficiency and effectiveness.	1. To develop a water distribute system suitable for the topography and justify the investment.	2004 onward
		2. To get the beneficiaries pay for the services.	2004 onwards
2. To extend water supply services to cover all communities and villages of the country.	1. Accelerate the provision of community and village water supply system by using groundwater.	1. Short term: To provide a water supply for 80 per cent of communities and villages	2003-2004
		2. Long term: To provide a water supply for 95 per cent of communities and villages.	2003-2006
	2. Promote private sector participation in the form of concessions.	1. To set guidelines and a model for private participation and for granting concessions.	2004 onwards

Policy 8. Include water-related topics at all levels of the educational curriculum in order to create awareness of water value, an understanding of the importance of efficient water utilization, and the necessity and responsibility for maintaining natural and manmade water sources.

Objectives	Strategy	Action Plan	Time frame
1. To create awareness of the importance of water resources and efficient utilization.	1. Include water related topic at all levels of educational curriculum.	1. To prepare course materials for both formal and informal education.	2004
		2. To prepare a water resources-related curriculum.	2004
		3. To incorporate water-related topics into the curriculum of high-level administrator study programmes such as the National Defence College, the Prapokkao Institute and the Local Administration Institute.	2004
	2. Promote public awareness and understanding of the importance and maintenance of water sources and efficient utilization.	1. To launch a public campaign and organize community forums at the national and local levels for a clear understanding of water resources potential and problems. Restructure the programme for preparation of future agricultural water plans.	2004 onwards
2. To foster good understanding among various interest groups.	1. Disseminate information and ensure correctness of water-related knowledge.	1. To produce information and media for mutual understanding, in order to avoid conflicts.	2004 onwards
		2. To organize meetings and seminars for exchanges of knowledge and opinions.	2004 onwards

Policy 9. Promote and support participation, including clear identification of procedures, clear guidelines on the rights and responsibility of the public, non-government and government organizations in efficient water management. Water management includes water utilization, water source conservation, and monitoring and preservation of water quality.

Objective	Strategy	Action Plan	Time frame
Participation of public and private organizations in the management of water resources as well as acknowledgement of their rights and responsibilities for the use, maintenance and conservation of water resources and the environment.	1. Campaign for public and private organizations to become aware of their rights and responsibilities for maintaining and conserving water resources and the environment.	1. To study and define public water rights and responsibility to pay for water services.	2005
		2. To prepare and disseminate information to the public to ensure understanding of their rights and responsibility in water resources management.	

Objective	Strategy	Action Plan	Time frame
	2. Promote participation of public and private organizations in the water resources management process.	1. To study and set a framework for public and private organizations participation.	2005
		2. To appoint users and local organizations as members of water related committees in appropriate proportion.	2004 onwards
	3. Strengthen the capacity of local organizations and stakeholders to take care of activities transferred to them.	1. To train leaders of local organizations and user groups to be able to manage and maintain the transferred projects effectively.	2004 onwards
		2. To study a mechanism for establishing a stakeholders' network that includes the Government, private organizations and the public.	2004 onwards

Policy 10. Accelerate the preparation of plans for flood and drought protection, including warning, damage control and rehabilitation, efficiently and equitably with proper utilization of land and other natural resources.

Objective	Strategy	Action Plan	Time frame
1. To have a clear flood, drought and water quality protection plan.	1. Formulate flood and draught protection and rehabilitation master plans, employing both structural and non-structural measures.	1. To prepare flood and drought risk maps of each river basin.	2004-2005
		2. To study and prepare a master plan for the protection and rehabilitation of water-related natural disasters in each river basin.	2004-2005
	2. Promote and support local organizations to be capable of reduce and solve flood and drought problem.	1. To provide training for protection and rehabilitation.	2004-2005
	3. Develop a preparatory process for protection and rehabilitation operations prior, during and after disasters.	1. To identify the risk area clearly, using the town planning law.	2004-2006
2. To introduce an efficient flood and drought protection system	1. Set up a forecasting and warning system.	1. To set up a water quantity and quality measuring network.	2004-2005
	2. Set guidelines and procedure for water related disaster warning.	2. To develop and establish water-related information and risk analysis centres.	2004-2005

Policy 11. Provide sufficient and sustainable financial support for action programmes in line with national policy, including water-related research, public relations, information collection and technology transfer to the public.

Objective	Strategy	Action Plan	Time frame
1. To ensure efficient budget allocation for water resource.	1. Set an integrated budgetary system for the water sector.	1. To set up a working group to prepare a framework for the preparation of water resources plans.	2004 onwards
		2. To monitor and evaluate implementation.	2004 onwards
2. To develop know-how and qualified personnel for water resources management.	1. Promote research, training and technology transfer for all concerned personnel.	1. To prepare a master plan for water-related research.	2004 onwards
		2. To conduct research, training and technology transfer.	2004 onwards
3. To inform and gain support from stakeholders.	1. Publicize information, knowledge, the Action Plan and projects of agencies among the public and stakeholders.	1. To set up guidelines for public relations as well as the development of information materials for concerned agencies.	2004 onwards
		2. To conduct joint public and government public relations activities.	2004 onwards
		3. To assign and develop public relations personnel within and outside agencies.	

Annex II. Short-term water strategy – Strategies and Action Plans in water resources management for 2004-2006

No.	Strategy	Action Plan	Time Frame
1.	Establish a knowledge/information base, monitoring system and decision-supporting system.	1. To set-up water resources information network and to link with CEO type of provincial management	2004
		2. To develop a more comprehensive information system	2006
		3. To establish a Water Resource Management Institute	2004-2006
2.	Study, plan preparation and implementation of provision of safe drinking water.	1. To prepare plan and implement the domestic water provision plans.	2004
		2. To have 100 per cent coverage within five years.	2004-2009
3.	Have clear water resources development plan.	1. To prepare additional water resources development plan.	2003
		2. To study the feasibility of sharing water utilization with neighbouring countries.	2003-2004
4.	Conserve, rehabilitate and improve effectiveness of natural water resources.	1. To prepare plans for rehabilitation, improvement and conservation of water sources and waterways including carrying out pilot projects in Bung Borapet, Kwan Phayao and Nong Han.	2004-2005
		2. To rehabilitate and improve efficiency and manage existing irrigation systems for maximum return.	2004-2005
		3. To encourage the users to utilize water efficiently.	2004-2006
		4. To study water demand and production of crops for cultivation of high-value crops and reduce water demand.	2004-2006
5.	Set priorities for the various water uses, which include agricultural, domestic, industrial, hydropower, ecosystems etc.	1. To study, collect information and set guideline for water allocation with stakeholders' participation.	by 2005
		2. To prepare master plan for conjunctive use of surface and groundwater.	by 2006
		3. To implement pilot projects of conjunctive use of surface and ground water.	2004-2006
		4. To study, conduct zoning and set water allocation for the various uses both at the national and basin levels.	by 2005
		5. To prepare industrial water plan.	by 2004

No.	Strategy	Action Plan	Time Frame
6.	Prepare flood and drought master plan.	1. To prepare emergency plans at provincial level. 2. To prepare long-term plan. 3. To develop warning system for critical areas. 4. To prepare operational manual for reducing the impact of water crisis.	by 2004 by 2005 by 2006 by 2006
7.	Protection of water quality.	1. To conduct pilot projects in four critical basins (Tachin, Songkhla Lake, Chao Phya and Ping Rivers) by letting the RBCs prepare warning system, monitoring, measuring and protection of pollution including water utilization from existing projects.	by 2004
8.	Prepare a comprehensive water sector budgetary plan.	1. To prepare budgetary plan for the operation of water related agencies. 2. To allocate budget for supporting activities of RBCs.	2004 onwards 2004 onwards
9.	Include water-related knowledge for the curriculum at all educational levels.	1. To prepare and include water-related knowledge in educational curricula.	by 2004
10.	Promote public participation.	1. To study and design the model, right and responsibility, conflict reduction, for the participatory process and define the petition process.	2004
11.	Promote the participation of the private sector in water provision.	1. To promote and support the private sector in the provision of water, i.e., industrial water and domestic water.	2004
12.	Draft Water Law.	1. To draft a Water Law. 2. To review and revise existing related laws.	2004 2006
13.	Set up water resources management organizations at the national and basin levels.	1. To set up a Water Resources Ministry. 2. To allocate a budget for the operations of RBCs. 3. To expand the RBC network down to the subdistrict level.	2004 2004 onwards by 2004

M. STRATEGIC PLAN FOR INTEGRATED WATER RESOURCES MANAGEMENT OF THE VU GIA-THU BON BASIN ORGANIZATION

By Dr. To Trung Nghia*

Introduction

Viet Nam is situated in the tropical monsoon region. Its water resources are relatively abundant. Total annual run-off is an estimated 843 billion m^3, of which some 323 billion m^3 originates in Vietnamese territory and 520 billion m^3 comes from other countries. Groundwater resources possess a dynamic reserve of some 1,500 m^3/s. However, water resources are unevenly distributed in area and time in the country. Annually, 70-75 per cent of the total annual flow is concentrated in the three- to four-month monsoon season while only 5-8 per cent of the total annual flow is available during the three-month dry season. Therefore, natural disasters such as drought, flooding and inundation occur more frequently and are serious in most regions of the country.

In stabilizing and promoting socio-economic development, hydraulic work development has been emphasized with increasing investments in recent decades. Hydraulic work development is, in fact, water resources development and protection and it has significantly contributed to the development of all socio-economic sectors, particularly food production under the national *Doi Moi* process. Nevertheless, the population will continue to increase, and the economy will enter a new development stage of robust changes in production structure, rapid industrialization and modernization. In addition, there will be considerable increases in the requirement for environmental protection and water demand in the economic sectors. In that context, integrated water resources management for sustainable development becomes especially appropriate.

I. Successes and constraints, opportunities and challenges in water resources development in Viet Nam

1. Achievements

a. Realizing strategic objectives of socio-economic development

Water resources development has been progressing in the right direction and has responded to the strategic socio-economic development objectives of the country in each period. This is considered a significant success that contributes considerably to demographic and socio-economic development. Irrigation, drainage, water supply systems, flood control and natural disaster mitigation are being steadily developed and their role is becoming more important in:

(a) Gaining nationally strategic results and stability in food production development, thus ensuring the success of the national food security programme plus permitting exports of 2-3 million metric tons of rice annually;

(b) Diversifying crops, developing cash crops such as subsidiary crops, industrial crops, fruit trees, and enhancing agro-product values per unit of cultivated land;

(c) Responding to the requirements of the economic structure transformation process in all regions, particularly the increasing demand for water in the development of urban areas, industry, tourism, services, aquaculture and the improvement of inland navigation; and

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(d) Water resources research, investigation, planning and design, all of which have contributed to robust development and exploitation of hydropower. A series of small and medium-scale hydropower plants on tributaries as well as large-scale projects on the Da, Chay, Se San, Dong Nai and Ba rivers have been supplying some 10 billion kWh to the national electric grid each year. Projects in the hydropower cascade plan along the mainstream and key tributaries of big river basins have been constructed or studied up to the feasibility stage by the competent authorities. All those projects were investigated and proposed by agencies in the water resources sector after planning and reversibility studies in the 1960s and 1970s. They revealed that previous planning study results were appropriate.

b. Implementation of natural disaster prevention and mitigation strategies

Implementation of natural disaster prevention and mitigation strategies has been very successful. Awareness of natural disasters has been enhanced, especially among policy-makers at the central and local levels. Community awareness and responsibility with regard to natural disaster prevention and mitigation has also been improved.

Flood control planning studies for the Red and Mekong river deltas and the Central Highlands have been finalized. Large-scale flood control systems have been strengthened every year, including the Red-Thai Binh river levees, Ma and Ca river levees, sea dyke systems, anti-salinity sluices in the north and northern-central regions, and embankments and flood channels in the Mekong delta. Large-scale reservoirs such as Hoa Binh, Thac Ba, Tri An, Dau Tieng, Phu Ninh, Thac Mo, Vinh Son prevent flooding and protect residential areas, infrastructure systems and production as well as ensure ecological improvement in large important deltas of the country in the event of major flooding and heavy rain.

c. Water resources management

Many advanced legal documents have been prepared and issued, including the Law on Water Resources, Law on Environmental Protection, Ordinance on Dykes and Levees, and Ordinance on Flood Prevention and Control, which are very important steps in national water resources management and natural disaster mitigation. There are also by-laws such as decrees and decisions that are implementation guides.

Water resources management has been emphasized, thus ensuring that water resources exploitation activities conform to the Law on Water Resources. Water resources are protected to avoid depletion and contamination through checks and supervision at pollutant production units. In preparing water exploitation and utilization projects, the environmental impact and flow regulation for environmental purposes have been taken into account.

d. Science and technology

There have been a number of successes in the following areas:

(a) Investigation and design. New technologies have been introduced, such as software for water resources calculation and evaluation, hydraulics, structural stability, infiltration, hydraulic construction, building structure, economics, drawing, documentation, databases, topographical and geological mapping etc., at the survey, planning and designing stages. Advanced international standards on structure types and new materials have been also applied;

(b) Construction. Modern and advanced equipment and technologies in construction have been applied, including foundation treatment, anti-seepage measures, tunnel digging,

beltonit dilution, 2-node anti-seepage grouting, PVC fabrication for joints, small-scale hydropower, sprinkle and drop irrigation equipment, hydraulic hoist etc.;

(c) Operation, exploitation and management. Experimental applications of observing and measuring networks, information tools as well as managing and controlling software have been utilized; and

(d) Flood control and dyke management. Hydraulic models for flood control, short- and long-term forecasts, the application of new building materials and structures in bank protection, and the application of 3-D models in natural disaster prevention and mitigation have been introduced.

e. Human resources

Sectoral human resources have experienced relatively rapid development in dealing with basic technical issues in order to ensure the application of baseline surveys, planning, design and construction, operation and management of hydraulic works as well as flood forecasting, warning, prevention and control.

2. Constraints

Despite important successes, constraints remain in each subsector.

a. Water resources development

Baseline surveys are just in the preliminary stage and therefore cannot meet the requirement for high accuracy in studies, or calculation for water resources development and management. Systematic programmes to update, complement and build a basic database are not yet identified to respond to sectoral management requirements.

Previously, integrated water resources development planning was undertaken but it focused mainly on agricultural development while other sectors were not emphasized. Since 1990, Viet Nam has enjoyed better research conditions in applying water supply and drainage to other sectors at higher levels. However, constraints still exist in responding to rapid transformation of the production structure, especially irrigation demands for upland, industrial crops, water supply for aquaculture and salt production etc.

Infrastructure construction faces difficulties including a low investment rate and uncompleted schemes (headworks and main canals completed but not on-farm systems). This means systems cannot perform at design capacity.

Investments in irrigated agriculture are emphasized but are still not satisfactory. For example, water shortages occur in the central coast region and the Central Highlands every 2-3 years, or domestic water supplies become scarce in remote, isolated areas and some urban areas.

In feasibility studies and designs, environmental assessments have been carried out but the negative impacts have not been thoroughly addressed with regard to possible damage to the downstream ecological environment.

b. Water resources and hydraulic work management

The Law on Water Resources, the Ordinance on Dykes and Levees, and the Ordinance on Flood Prevention and Control are tools and regimes for water resources and hydraulic work management; however, they are not adequate or effective. State management capabilities are not

adequate to meet requirements, and community participation in Law and Ordinance enforcement is limited.

The existing infrastructure for hydraulic exploitation management is very poor and may result in degradation and low efficiency of structures. Many localities have invested funds, human resources and techniques in new structures but have not paid attention to the management mechanism and policy, efficiency enhancement, and especially the investment mechanism and financial policy. Hydraulic work management at the local level is not appropriate to the current market regime, particularly in the mountainous areas and Central Highlands.

Water fees are usually low and are not consistently collected. This means there is insufficient income to cover operation, maintenance and management and structures are badly deteriorated and degraded, efficiency is very low (at 60 per cent of design capacity only), and harvest losses usually occur in drought years. Structure safety is not high, especially for reservoirs. In fact, about 1.3 million ha of paddy land in salinity-intruded areas of the Mekong delta, arid areas in the central region Central Highlands and mountainous areas, and water-logging areas in the northern delta are not yet served by irrigation and drainage structures.

Awareness raising and community participation in water resources development and management are very limited and appear to decrease after the completion of irrigation and dissolution of agricultural cooperatives, especially since the transformation to a market economy started.

c. Science and technology

The infrastructure of research institutes is very poor and unable to meet the requirements of industrialization and modernization in water resources development and management.

Investment effectiveness in scientific research is limited. Some research results have shown low effectiveness or are difficult to realize, so they are not broadly applied. Flood forecasting and warning as well as river training need further studies to improve accuracy and enable long-term forecasting for active and effective response to natural disasters.

d. Human resources

Staff dynamism in the market mechanism is low, and language weakness; especially in English, is a problem. Capability in updating and exploiting technical information is very poor. About 23 per cent of staff has intermediate political skills, 26.3 per cent has attended management-training courses, 8 per cent has participated in administrative management courses and 11 per cent have participated in information training courses.

The distribution of sectoral human resources between regions and localities is uneven, and human resources are very scarce in some places, especially at the district level in central and mountainous areas.

With regard to qualifications and age, few staff members aged below 35 years hold a Ph.D. degree. About 60 per cent of those who have a Ph.D. degree are aged above 50 years and are mainly located in universities, institutes, and ministerial departments but not in provincial departments. Scientists and well-skilled workers are few in number.

3. Opportunities

a. Increasing attention by the Communist Party and State

The Communist Party and State are increasingly giving more attention to water resources development and management, the implementation of agricultural, forestry and rural industrialization,

and the modernization programme. The objective is to (a) protect the national food programme against increasing demographic pressures and political fluctuations in the world, (b) protect human life and property against natural disasters, (c) establish a sound basis for stabilizing economic development, (d) eliminate hunger and reduce poverty, particularly in remote, isolated and border areas, and (e) stabilize socio-politics and maintain national security.

b. Techno-economic conditions of the country

These conditions are better developed and have greater capabilities in investment and the resolution of difficult and complex issues in research, design and construction. This enables the introduction and application of internationally advanced techniques and technologies in water resources development and management.

c. Strengthened international cooperation

Strengthened international cooperation in water resources development and management has been established in line with the extensive joint efforts by United Nations organizations, Asia-Pacific regional organizations and countries in water resources development and management. The World Bank and the Asian Development Bank have set out their water policies based on acknowledgement of the indispensable needs of integrated and intersectoral approaches in the water sector.

The Asian Development Bank water policy aims at “promoting water as economic goods with essential social values and needs to be prudently managed to sustain economic growth, equality and poverty reduction”. The Asian Development Bank has supported the reform of the water sector in some regional countries including Viet Nam. The South-East Asian Technical Advisory Committee (SEATAC) of the Global Water Partnership (GWP) has strengthened regional activities to boost integrated water resources management (IWRM) in close links with localities. The National Water Partnership has been set up in some countries on the initiative of SEATAC in order to exchange information and experiences on IWRM. SEATAC supports the establishment of the Action Plan and capacity in member countries for responding to water crises in the region.

d. Promotion of cooperation and technology transfer

Scientific and technical exchanges in water resources development and management between countries are increasing. A scientific, technical and technological market has been opened alongside the monetary financial, commodity and labour markets.

A series of domestic and world scientific and technical advances have been, or will soon be applied in production in order to promote output, quality and effectiveness.

The workforce in the other national economic sectors is being strengthened as result of previous investments, especially since 1991, and expected future investments. They workforce will be fully mobilized to form a base for the industrialization and modernization process.

In other words, the increased attention of the Communist Party and State, together with strengthened cooperation and emphasis by international and regional organizations in favour of a water-secured world, have been realized through programmes, activities, cooperation policies, and technical and financial assistance. Scientific and technological development and exchanges are real opportunities to be seized and used in water resources research, assessment, development, exploitation and utilization as well as natural disaster prevention and mitigation.

4. Challenges

a. Tendency towards water resources recession

Water resources appear to be degrading and suffering negative impacts from deforestation, pollution and global climate changes. Natural disasters such as floods, inundation, drought, high tides and water pollution are increasing, and are becoming more serious and frequent threats that can cause tremendous loss of human life and damage to assets.

b. Increasing economic growth

Increasing and higher economic growth is resulting in rapidly increasing water demands by the socio-economic sectors. This growth is also creating water-use conflicts between sectors, which require measures to ensure proper regulation so that water demands and national socio-economic development objectives can be met in the process of industrialization and modernization.

c. Higher demographic and life quality pressures

Pressure from population growth and maintaining the quality of life will increase in next few decades. The population of Viet Nam is projected to reach 98 million by 2020 and could stabilize at 120 million in the following two or three decades. Population growth and quality of life improvement will increase the demand for water in production and domestic uses. This constitutes the biggest challenge for national water resources development and management.

d. Conflicts in water use between countries sharing international rivers

Such conflicts will gradually increase. Viet Nam will experience unfavourable changes in water resources of international rivers such as the Red and Mekong rivers due to increasing use by upstream countries. This is an important challenge and the source of potential conflict over water resources.

e. Conflicts of interest over water resources between localities

Conflicts of interest can already be seen in inter-provincial and inter-district hydraulic systems. These conflicts are likely to increase.

State management of water resources is fragmentary and divided among several ministries and sectors. In addition, investment in water resources development has been decreasing since 2001 and there are now inadequate funds available for meeting development needs.

Such challenges require close coordination between the Ministry of Agriculture and Rural Development (MARD) and the Ministry of Natural Resources and Environment as well as with other ministries, sectors and localities in introducing a consistent management mechanism and appropriate water resources development and management alternatives. This is the only way to ensure sustainable development in the national interest and to ensure equality among localities and sectors.

II. Water resources in the Vu Gia-Thu Bon River basin

The Vu Gia-Thu Bon system (see map M.1), which originates on the eastern side of the Truong Son mountain range, is short and steep with a narrow riverbed, steep riverbanks and many cascades. The system meanders once or twice. In the middle and downstream reaches, the riverbed is rather wide and shallow with submerged banks in the river course. In the downstream reach, the river course changes and the riverbanks become low, allowing overflow into fields and

villages during the flood season. The Vu Gia-Thu Bon system has two main rivers, i.e., the Vu Gia and Thu Bon rivers.

The Vu Gia River has many tributaries, i.e., Dak Mi (or so-called Cai River), Bung, A Vuong and Con rivers. The length of the Vu Gia River up to the river mouth in Da Nang is 204 km, while up to Cam Le it is 189 km, and to Ai Nghia, 166 km. The catchment area around Ai Nghia is 5,180 km^2.

The Thu Bon River originates at the borders of the three provinces of Quang Nam, Kon Tum and Quang Ngai at an elevation of more than 2,000 m. It runs in a north-south direction. Towards Phuoc Hoi, the river changes its course to flow south-west – north-east and then west-east up to Giao Thuy before entering the sea through the Dai estuary. Up to Giao Thuy, the Thu Bon has a catchment area of 3,825 km^2 and a length of 152 km.

The total catchment area of the Vu Gia-Thu Bon River basin from the upstream stretch to the river mouth is 10,350 km^2. Towards the downstream area, there is an exchange of flow between the two rivers. The Quang Hue River diverts part of water from the Vu Gia into the Thu Bon. About 16 km from the Quang Hue River, the Vinh Dien River returns part of the water from the Thu Bon to the Vu Gia. In the downstream stretch, the river network is rather dense. Apart from the flow exchanges, the river system is also supplied with additional water from other branches, i.e., the Tuy Loan River in Vu Gia with a catchment area of 309 km^2 and a length of 30 km and the Ly Ly in Thu Bon with a catchment area of 275 km^2 and a length of 38 km.

The monsoon season in Quang Nam and Da Nang lasts for four months, from September to December. The dry season is from January to August. Exceptionally in May and June there is a secondary rainfall peak, which is more pronounced towards the north-western part of the study area and forms a Tieu Man flood period in the Bung River basin. The total annual rainfall in the studied area is between 2,000 mm and 4,000 mm.

Rainfall during the monsoon season accounts for 65-80 per cent of total annual rainfall. The highest amount of rainfall occurs in October and November when the volume accounts for 40-50 per cent of the annual rainfall. Rainfall in the dry season represents about 20-35 per cent of total annual rainfall. The low rainfall season usually occurs from February to April, accounting for only 3-5 per cent of the total annual rainfall.

The monsoon season starts earlier in the mountainous areas, because of the West Truong Son mountain range, than in the coastal plains. Nevertheless, the highest rainfall usually happens in October and November in the whole basin.

Similar to the distribution of rainfall, annual flows are distinguished by two distinct seasons (the flood season and the low-flow season).

The flood season commonly starts in the mid-September and ends in early January. After two weeks to one month into the monsoon season, the flood season starts. The beginning and end of the flood period as well as maximum flood period are quite consistent in Quang Nam Province and Da Nang City.

Flows during the flood season account for 62.5-69.2 per cent of the total annual water volume while flows in the dry season for comprise 21.8-38.5 per cent of total annual run-off. The water volume gauged in November, the highest flow month, accounts for 26.5-30.9 per cent of the total annual run-off while the driest period falls in months of April with flows of 2.1-2.6 per cent of total annual run-off.

In the Vu Gia-Thu Bon River basin, the flood season normally lasts from October to December. However, the flood season frequently starts as early as September and lasts until the following January.

The lowest monthly flow usually falls in April. In the years with little or no early rain in May and June, the lowest flow may occur in July and August. Low flows usually occur in April in rivers having a river basin area of more than 300 km^2, whereas they occur in August for rivers with river basins of less than 300 km^2.

The low-flow season can be divided into two periods:

(a) Sustainable flow period – discharges during this period are mainly supplied by the stored volume in the river catchment. This is the reason why the discharges first decline and then stabilize (usually from January to April); and

(b) Unsustainable flow period – from May to July annually. Flow during this time is unstable. The water supply sources for these flows are groundwater and rainfall in the low flow season (mainly Tieu Man rains in May and June), because the lowest flows occur twice a year in local rivers and streams, with the first period falling in March and April, and the second period in July and August.

The minimum monthly flow makes up for 1-3 per cent of the total annual run-off. The area having the largest discharge during the low flow season is the upstream reach of the Thu Bon and Vu Gia. The specific discharge of low flow is 25-30 $l/s/km^2$. The areas having the smallest discharge during the low-flow season are in the northern and north-western parts of the basin, where the specific low-flow discharge is 15 $l/s/km^2$.

General assessment of water resources development in the basin

Irrigation structures have not yet met production requirements. Irrigation effectiveness is very low, non-irrigated areas are still large, and drought occurrence is relatively frequent, affecting local production. The reasons for the low efficiency of irrigation structures include:

(a) Out-of-date techniques such as archaic irrigation techniques (mainly flood irrigation), and regulators and distribution structures that are inefficient or manually operated;

(b) Incomplete schemes such as headworks and main canals that have been completed while the on-farm canals and on-canal structures are incomplete. The designs of some structures just focus on irrigation and thus occasionally cause localized inundation;

(c) Degraded structures. Most hydraulic structures in the basin are small and medium-scale, having been constructed 10-20 years ago. Many headworks have deteriorated and irrigation canals are silted up, resulting in erosion and sedimentation each flood season. Therefore, they cannot meet the designed flows;

(d) Management issues such as irrational water allocation and management, which cause wastage of water, and very poor structural operation, maintenance and management that results in deterioration or untimely repairs; and

(e) Water sources. Water supplies are sometimes insufficient for structures in the Ly Ly and West Que Son sub-basins. On the plains, water sources usually suffer from saline intrusion, so pumping stations on the Vinh Dien and Ba Ren rivers have to stop working. Some other pumping stations are unable to perform at full capacity due to low water levels.

With regard to domestic water supplies, a major part of the population, both in rural and urban areas, do not have access to clean water. In rural areas, about 74 per cent of the population use water from rivers, streams or from unhygienic sources. In areas around Da Nang City and Hoi An town, only 60-70 per cent of population have access to piped water; water sources are usually contaminated by saline water, so water quality is not good.

With regard to flood control, most reservoirs are built on tributaries and have small storage capacities, as their main purpose is irrigation; thus, they are not effective in flood control. Annually, losses caused by floods and inundation amount to between Dong 220 billion and Dong 758 billion.

Drought and salinity intrusion are very frequent. Existing hydraulic structures are mainly pumping stations and weirs, except for the Phu Ninh reservoir, which has a relatively large regulation capacity. Other reservoirs have very limited regulation capacity so they cannot supplement irrigation water for the downstream areas in the dry season. That is why drought and salinity intrusion frequently cause serious losses and affect human life in many ways in the basin.

Erosion and sedimentation become very complicated, causing losses of cultivable land and property as well as changes in river flows.

III. Current and projected socio-economic development

1. Current development

The Vu Gia-Thu Bon River basin covers Quang Nam Province and Da Nang City. The basin is situated in the Central coastal region, which is heavily affected by natural and social conditions. A diversified economy of agriculture, forestry and fishery, industry, handicraft and services has been established in this basin. However, the economic starting point is very low. This, in addition to a backward and poor infrastructure, forces the local economy depend on agriculture. Industry is underdeveloped, commodity production and exchange is limited, and trade and services are developing at a low rate of growth.

Fortunately, the river basin possesses rich potential for economic development. In past years, great efforts in economic development have helped to gain results. The economy of Quang Nam Province and Da Nang City has experienced active changes with an average growth rate of 10 per cent a year and an economic structure that is in transformation towards industrialization and modernization.

Table M.1 shows the main socio-economic development objectives of Quang Nam Province and Da Nang City from 1996 to 2000.

Table M.1. Main socio-economic development objectives of Quang Nam Province and Da Nang City, 1996-2000

(Unit: %)

Item	Da Nang	Quang Nam
GDP growth rate	10.5	9
Industry and construction	15.53	14
Agriculture, forestry and fisheries	3.27	4
Services	8.18	10.7
Economic structure in 2000	100	100
Industry and construction	40.7	25.2
Agriculture, forestry and fishery	7.6	41.3
Services	51.7	33.5
GDP per capita (US$)	**488**	**230**

Land is one of the most important resources. In past years, production and living standards have gradually improved in line with renovation policies by the Communist Party and the influence of the market economy. This development has evoked increasing land-use requirements in all sectors including production, infrastructure investment. By the end of 2000, total agricultural land used in the basin amounted to 83,251 ha, including 62,920 ha for annual crops, 14,792 ha for miscellaneous gardens and 4,992 ha for perennial crops. Cultivated agricultural land represents 7.6 per cent of the natural surface of the basin but a large unused area of about 422,482 ha exists in the upper basin.

In general, agricultural production still depends on nature, especially in the upper basin. Crop yields are very low due to single cropping in unstable areas.

By 2000, aquaculture had developed strongly and comprehensively in all fresh, brackish and saline water bodies. Production models as well as raising technologies developed more diversely, especially for black tiger shrimp breeding in brackish water, which has rapidly developed and expanded. Currently, aquaculture occupies 495 ha, producing an average annual yield of 1.05 metric tons per ha.

After the liberation, industry and handicraft production in Quang Nam Province and Da Nang City developed rapidly. So far, there are a total of 16 central enterprises working in the heavy industry sector and 160 state-owned enterprises in light industry under provincial management.

The average annual GDP growth rate of industrial and construction was 12.3 per cent and 14.77 per cent during 1991-1995 and 1996-2000, respectively. The industry sector has passed the most difficult stage of early transition to a market economy. Production forces have since strengthened, a new management mechanism has been applied, and investment in technical and technological bases emphasized for quality improvement. Industrial GDP increased from 25.3 per cent in 1996 to 32.95 per cent in 2000.

The above figures also indicate that processing industries have consistently accounted for a higher proportion while key industries such as textiles and garments, leather and shoemakers, and mechanical-electronics are virtually constant.

Industrial units are usually based in Da Nang City. This hinders expansion of production facilities and causes difficulties with environmental pollution.

In summary, local industries produce key products of local specialties, which are highly competitive, while core and rural industries have not been established or emphasized yet.

a. Advantages

The advantages are:

(a) The Thu Bon River basin is located in the centre of the north-south route of the country. Da Nang City, a central city located in the central region, is also a key transport route in terms of railways, roads, and sea and air transportation routes. The city is also a gateway to the ocean region of the Central Highlands, southern parts of the Lao People's Democratic Republic and north-eastern Thailand;

(b) The area studied possesses a warm temperate climate that facilitates good crop growth and intensive agricultural production;

(c) Natural resources, including land, water, forests and vegetation cover, and fishery resources are strong points of the basin;

(d) The basin is rich in hydropower potential;

(e) There are a large number of places of interest for tourism development such as the Son Tra peninsula, Hai Van pass, Ngu Hanh Son mountain and two internationally ranked heritage sites at Hoi An and My Son;

(f) Industrial zones such as Lien Chieu-Hoa Khanh-Da Nang-Dien Ngoc-Dien Nam have been approved by the Prime Minister for foreign investment;

(g) The working age population represents nearly 50 per cent of the total population of the basin. Local people of the Quang Nam-Da Nang subregion are eager to gain knowledge. They are also well known for their traditional handicrafts, mulberry cultivation and textile development. This is an important strong key for subregional development.

b. Disadvantages

The following natural conditions of the basin are a disadvantage:

(a) A complex topography and steep slopes are major constraints in the construction and development of local infrastructures, especially those serving the transportation and water resource sectors;

(b) The major topographic features of the area are mountains and hills with poor vegetation coverage (current plant coverage is 33 per cent). Many areas have deteriorated due to slash-and-burn cultivation. Therefore, heavy rainfall will inevitably cause serious soil erosion, flow diversion flooding during the monsoon season, as well as drought in the dry season;

(c) The large land potential does not match the predominantly small-scale, fragmented agricultural production. The average landholding per capita is small;

(d) In rural and mountainous areas, the infrastructure is very poor and living conditions are bad;

(e) The economic sector is weak, resulting in a lack of competitive products in the domestic and export markets; and

(f) Incentive policies for promoting effective investment do not exist, and the current infrastructure has not been exploited fully and effectively.

2. Orientation

Based on the natural and existing socio-economic conditions of the region, it has been decided that the economic development approach will be to develop Quang Nam-Da Nang as an economic hub of the central area of the country. A diversified and balanced economic structure will be formed, based on a stable and consolidated political and national defence background.

The shifting of the economic pattern in the spirit of industrialization and modernization process will help form a dynamic production economy. In the short term, full advantage should be taken of the favourable conditions in terms of location as well as natural and human resources in order to attract investment to the industrial, agricultural, commercial, tourist, services and infrastructure sectors.

Development of the economy should be in line with the steady improvement and enhancement of the living standards of people. The gap between incomes of different classes in the society and between regions should be narrowed. Special consideration should be given to people living in remote and upland areas in order to help reduce and alleviate poverty.

Construction and development of an urban network should be undertaken, with Da Nang City as a key economic centre for the whole basin and the central region in particular (table M.2).

Table M.2. Projected socio-economic development parameters by 2010 Da Nang City and Quang Nam Province

(Unit: %)

Item	Da Nang	Quang Nam
GDP growth rate	13.5	11.0
Industry and construction	16.1	16.0
Agriculture, forestry and fisheries	4.9	3.6
Services	12.2	11.4
Economic structure in 2000	100	100
Industry and construction	46.7	42.2
Agriculture, forestry and fishery	3.2	22.0
Services	50.1	35.8
GDP per capita (US$)	**2 000**	**513**

The agricultural development approach in the coming years will see a fundamental shift from monoculture to comprehensive agricultural production that focuses on commercial trees, food crops and livestock expansion in accordance with the specific conditions prevailing in certain localities. Agricultural development will be carried in a way that emphasizes intensive and specialized farming, production of farm products and goods to meet the demand of the industrial, tourism and export sectors as well as the local population while ensuring food security in the area.

The study area has a coastline of about 60 km and two estuaries, i.e., the Han and Cua Dai rivers, which possess rich and diverse fishery potential. It also has a rather favourable climate so local fishermen can catch fish during most days of the year. In addition, surface water resources are abundant including brackish and saline water along the coast and on Cham Island, thus creating favourable conditions for large-scale aquacultural development in the next 10 years.

The objectives of the fishery/aquaculture sector is to become a robust economic sector in Quang Nam Province and Da Nang City, and to play a key role in the economic structure with a GDP share of about 10 per cent by 2010.

According to master plan for Da Nang City and Quang Nam Province, priority has been placed on industrial development to make the province one of the prosperous industrial centres of the central region and the whole country. Emphasis is put on the development of industries that create value added and are export oriented, such as the production of goods for consumption and export, construction materials, processing of agricultural-forest-fishery products, machinery manufacturing and electronics.

Industries are allocated groups, zones and sites in a way that will help develop ports, tourism and services. Industrial zones and sites have direct connections with ports at Lien Chieu and Tien Sa via Highway No. 1A and Highway No. 14B. Most of the industrial zones and sites are located in hilly and sandy areas.

Construction of four large-scale hydropower projects is planned in the Vu Gia-Thu Bon River basin: (a) Vuong hydropower plant (prefeasibility study available); (b) Song Tranh 2 hydropower plant (ongoing prefeasibility study); (c) Dak Mi 4 hydropower plant; and (d) Song Con 2 hydropower plant.

IV. Opportunities and challenges in sustainable water resources management in the Vu Gia-Thu Bon River basin

1. Opportunities

The basin has a monsoon tropical climate and possesses abundant water resources. Annual rainfall ranks one of the heaviest in Viet Nam, averaging 3,000 mm/year in the province. The total annual flow in the entire province is 23 billion m^3, whereas the total volume used for all purposes only accounts for 10 per cent of that amount. The discharge module is 70.0 $l/s.km^2$. The quality of surface water and groundwater is good enough for domestic use and production purposes, expect for the coastal are where saline intrusion is a problem.

The vegetation cover is relatively good with an existing coverage of 42 per cent. The forest cover is diversified, providing a large flow-creating factor (on average 0.68). The topographic conditions are advantageous for water resources development projects as well as small and medium-scale hydropower cascades; since 75 per cent of the area comprises hills and mountains, the conditions are ideal for hydropower cascades. At present, the area has 65 reservoirs and 250 weirs. These storage structures irrigate 30,000 ha of rice and 10,000 ha of subsidiary crops and cash-crop trees. It is planned to construct another 60 reservoirs and weirs in order to increase stable irrigation from 69 per cent to 75 per cent by 2010. Also, according to the industrial plan, Quang Nam Province can develop eight large cascades and 30 small and medium-scale cascades on different rivers (mostly in the Vu Gia River basin).

2. Challenges

The water resources in the area are not evenly distributed temporally and spatially. The rainfall regime is divided into two seasons: the low-flow (dry) season from January to August, and the high-flow (flood) season from September to December. The total rainfall volume during the flood season accounts for 70 per cent of the annual total.

In spatial terms, rainfall distribution increases from the delta up to the highland area. The south-west region has the largest annual rainfall, amounting to some 4,000 mm, followed by the north-west at 3.200 mm. The coastal area has limited rainfall of 2,200 mm. Because of this situation, there is a serious water shortage in dry seasons.

In line with the population increase and socio-economic development, water demand and water quality are rising. The water balance shows an increase in areas that are short of water, especially the southern part of the province. According to projections, water demand for various purposes up to 2010 in the entire Quang Nam Province will rise 1.6 times compared with the present demand (for the Chu Lai expanded economic zone it is 5 per cent), with irrigation water demand accounting for 84 per cent and industry a further 10.5 per cent in the near future. This is critical as the economy of Quang Nam is mainly based on agriculture.

The natural conditions and natural disasters also hinder socio-economic development in the area. The steep terrain and heavy rainfall cause flash flooding in the mountainous areas and deep inundation in large areas of the flood plain during the flood season. The flow is also low in the dry season.

The groundwater resources are not evenly distributed and have low reserves. This source of water can only support domestic needs and small-scale production. Groundwater is limited, mostly derived from open ponds and mainly in the coastal sandy area and downstream of the Vu Gia basin. However, the exploitation depth for ensuring water quality for domestic use and production is 15-30 m (due to impacts of salinity); other locations have poor reserves.

The rivers have a complex water exchange system. The basin is under the management of authorities in various localities. The Vu Gia basin is the most complex regarding transbasin water exchange. In the mid-stretch, part of flow from the Vu Gia River is diverted to the Thu Bon River via the Quang Hue River. IN the downstream stretch, part of Thu Bon River flow is diverted into the Vu Gia via the Vinh Dien River.

Part of the Thu Bon River basin upstream is in Kon Tum Province. It is noted that the downstream stretch of the Vu Gia River after the An Trach weir belongs to Da Nang and the flow reaches the sea through the Han estuary. Saline water intrusion in estuaries causes difficulties with the construction of water intakes.

The part of the Vu Gia flow that runs through Dai Loc district (Quang Nam) is unstable. The risk of the flow being cut for a new flow with higher steepness connecting with the Thu Bon River is quite high. This will result in the water balance to be broken downstream. The flow-cutting occurrence in 2001 caused enormous difficulty with water supplies for domestic use as well as industrial and agricultural production in Da Nang City.

Goldmine exploitation upstream and the dilution of cyanide and mercury into the water source are difficult to control. In addition, population growth and industrial activities in the mountainous and central areas are also causes of water pollution.

Future water disputes between the two provinces in the same basin are inevitable due to competition between agriculture, industry and domestic use. In fact, since the entire river is not within a unique administrative boundary, water-related disputes are already occurring.

Regional development policies and institutions are inadequate. The relationship between the different regions is limited, which lead to ineffective use of available resources.

3. Vision statement

a. Vu Gia-Thu Bon basin integrated plan for socio-economic development

Completing the Vu Gia-Thu Bon master plan is the basis for advanced socio-economic development of Quang Nam Province and Da Nang City and the achievement of a GDP per capita of US$ 750-800 by 2010 and US$ 1,100 by 2015.

b. Vu Gia-Thu Bon basin integrated development framework

The most appropriate institutional and legal framework for socio-economic development in the Vu Gia-Thu Bon River basin to establish a river basin organization, entrusted with the responsibility to create favourable conditions for socio-economic development in Quang Nam Province and Da Nang City.

c. Action programme and prioritized standards for water resources management activities

An action programme with water resources development and management in the Vu Gia-Thu Bon River basin is a priority requirement for creating favourable conditions for socio-economic development in Quang Nam Province and Da Nang City.

V. Organization and legal framework

1. Existing situation and development of an organizational framework

a. Quang Nam Province

Currently, the management of rivers, streams and related basins are assigned to the local authorities based on administrative boundaries. The Department of Agriculture and Rural Development (DARD) carries out state management of hydraulic works planning for water resources exploitation for production and domestic use and flood control in provincial basins.

Previously, groundwater management and planning were the responsibility of the Provincial Industry Department (including licensing); however, in 1997, that function was transferred to DARD. Then, in 2003, the function is reassigned to the newly established Department of Natural Resource and Environment (DONRE). State management of hydropower works planning in the river basin remains the responsibility of the Provincial Industry Department.

Following the Water Resources Law and the regulations of DONRE, the water resources management function in general belongs to DONRE. DARD only has state management for the implementation of management regulations and integral exploitation of river basins as in the approved plan. Therefore, water resources management and planning in river basins is unclear and confusing.

Regarding the management mechanism, at provincial level, two key bodies are involved in water resources management: DARD and DONRE. At the district level, especially in mountainous areas (four districts of southern Tra My, northern Tra My, Tay Giang and Dong Giang), the Land and Economic Department undertakes the management functions for agriculture, rural development, natural resources and the environment. For the other districts (town and delta districts), two departments are involved: one for agriculture, and the other for natural resources, environment and science technology. However, the direct management of the basin and water resources is still the responsibility of DARD under the direction of the relevant People's Committee.

Upon the exploitation and management of water resources for domestic use and production purposes, DARD does not govern the exploitation and supply units of groundwater for industry and domestic uses. At present, two types of hydraulic works are managed by the provincial irrigation management company (IMC): (a) medium and large-scale hydraulic works and interdistrict works (including irrigation and water supply facilities). There are nine irrigation management enterprises in different districts under the IMC. The remainder comprises small-scale hydraulic structures, either permanent or semi-permanent, for agricultural irrigation and dyke protection, and anti-salinity intrusion barrages. Depending on the location, the structures will be managed by respective authorities then by the communes, villages and water user groups.

b. Da Nang City

From 1975 to 1996 (prior to the separation of Quang Nam-Da Nang Province into two), the Water Resources Department was in charge of surface water, and the Industry Department was responsible for groundwater.

From 1997 to 2002, the Fisheries, Agriculture and Forestry Department was responsible for both surface and groundwater resources.

Since 2003, DONRE has been in charge of water resources. The Fisheries, Agriculture and Forestry Department is responsible for river planning and management, while the Department of Transport is responsible for navigation.

2. Legal basis

The most important legal instrument is the Law on Water Resources and other related decrees and circulars, including:

(a) Government Decree No. 179/1999/N§-CP, 30 December 1999, concerning enforcement of Law on Water Resources;

(b) National Assembly Standing Board Decree on the exploitation and protection of hydraulic works, 4 April 2001. This is a substitute for the Decree on the Exploitation and Protection of Hydraulic works, issued in 1993. The new Decree was issued in order to adapt to the Law on Water Resources and the practical situation;

(c) Government Decree No. 143/2003/N§-CP, 28 November 2003, regarding the detailed enforcement guidelines to some articles in the Decree on the Exploitation and Protection of Hydraulic Works;

(d) National Council Decree on dyke management, 9 November 1989. This decree was approved and modified by the National Assembly Standing Board on 24 August 2000;

(e) Decree on control and protection from storms and floods, which was approved by the National Assembly Standing Board on 8 March 1993. It was amended and supplemented on 24 August 2000; and

(f) Government Decree No. 91/2002/N§-CP, 11 November 2002 concerning the regulations on the functions, tasks, mandate and organization mechanism of DONRE.

So far, the Quang Nam Provincial People's Committee (PPC) has issued several decisions concerning the regulations on water resources management in the province, including:

(a) Decision No. 06/2004/Q§-UB, 16 January 2004 by Quang Nam PPC regarding water fee collection and water payment; and

(b) Directive No. 12/2004/CT-UB, 1 April 2004 concerning the collection of environment fees from wastewater dischargers in the province.

Although the Vu Gia-Thu Bon rivers connect to the administrative borders of several provinces (Kon Tum-Quang Nam-Da Nang), particularly the portion of the basin in Da Nang City, no document has been issued stipulating the solution to disputes/conflicts in the water resources.

Water resources distribution through hydraulic works involves different administrative boundaries. The water resources distribution structures include the An Trach weir (between Quang Nam and Da Nang), which raises the water level upstream to provide water for pumps and gravity irrigation in some areas. The operation of this scheme is based on the regulation procedures of MARD (not yet approved) under the management of the Water Users' Council (not yet formed).

In the Tam Ky River basin, the Phu Ninh irrigation system (involving five districts) is managed and regulated by IMC. All water conflicts will be solved by IMC or PPC (as no Water Users' Council exists).

Multipurpose works (for irrigation, power generation, aquaculture and tourism) will be managed and operated by the management agency responsible for the main purpose. Disputes that cannot be solved locally will be submitted to the relevant People's Committee by the affiliated exploitation companies.

The management, distribution and solutions to water-related disputes in the province concerning the water resources in the Vu Gia-Thu Bon rivers and Tam Ky system are the responsibility of management units based on approved procedures. All disputes that cannot be solved by the exploitation units will be reported to DARD or PPC for settlement.

The management, protection and exploitation of water resources, the control and solution of water-related damage, and the monitoring and control of water resources law enforcement are all assigned to the People's Council, PPC and the related administrative levels.

3. Problems with the legal framework and organization in the Vu Gia-Thu Bon basin

In general, there is a lack of synchronization and cohesive coordination among the various localities and related agencies in the management and exploitation of water resources.

The exploitation and protection of existing water resources is not well handled. Groundwater is still freely and randomly exploited. Projects for small-scale surface water exploitation are carried out without any approval by the water resources owners. The sanction for these violations, which affect the quality of the water, is provided by the environmental authorities. There has been no cooperation between related localities and departments.

The absence of an intermediate agency similar to the Water Users' Council in the basin is another obstacle to sustainable water resources exploitation. It also means there is no mediator available for future conflicts and disputes.

VI. Proposed River Basin Organization

1. Detailed tasks of a River Basin Organization

With the continuing rise in water demand, the issues of protecting and developing water resources are becoming ever more urgent. According to the Law on Water Resources, the Vu Gia-Thu Bon River Basin Organization (RBO) is a consulting agency with legal entity, a stamp and a bank account for transactions. The organization has no state management function, which is the reason why it has no mandate or tools to regulate enforcement of the law. The organization and operation of the RBO is based on the "Regulations for the Organization and Operation of RBOs" approved by MARD in Decision No. 14/2004/Q§-BNN-TCCB, 9 April 2004. The regulations are:

(a) To establish, submit and monitor the planning of the Vu Gia-Thu Bon system to ensure integral management of basin planning for sustainable regional socio-economic development;

(b) To establish a database on the demand and supply of water resources in the whole basin;

(c) To organize the participation of the community in planning in a regular, continuous and systematic way;

(d) To maintain a close relationship with the National Water Resources Council in order to create an effective consulting system on water resources; and

(e) To solve and recommend solutions to water-related disputes in the basin.

RBO activities should be oriented to the following requirements:

(a) To serve as a forum where local government and departments can raise opinions and discuss the relevant issues in integrated water resources management;

(b) To enhance stakeholders' capacity in integrated water resources management;

(c) To create inter-provincial coordination in integrated water resources management in the basin; and

(d) To create a convenient environment for external investment in socio-economic development.

2. Structure of the Vu Gia-Thu Bon River Basin Organization

The Vu Gia-Thu Bon RBO comprises the organization itself and the RBO Standing Office (administrative and technical support office). Its members comprise representatives from central and local governments and departments. These members are responsible for reviewing construction and planning in the river basin. The river basin is large and inter-provincial, so the planning and management of this basin are under ministerial management.

An RBO has no right to impose any option on the river basin. However, it may influence the decisions of the Government and PPC through its recommendations. The RBO structure must follow the regulations of the Law on Water Resources and be in accordance with the Vietnamese administrative system. The RBO personnel structure is arranged in such a way that each member will be involved on a part-time basis only. However, the RBO office will operate full time.

The members of the Vu Gia-Thu Bon RBO should be drawn from central level offices in charge of water resources, PPC and key water users. It should comprise a Vice-Minister of MARD as the chairperson, and the Quang Nam PPC and Da Nang City chairpersons or vice-chairpersons as the two RBO vice-chairpersons. The RBO members should comprise the heads of the Water Resources Department, Dyke Management Department, Institute of Water Resources Planning as well as the leaders of DARD and DONRE in Quang Nam and Da Nang City. In addition, representatives from central and local offices and related experts, and leaders of districts, communes and towns in the river basin should be invited to become non-standing RBO members.

The Vu Gia-Thu Bon RBO Standing Office will be located in Tam Ky town of Quang Nam Province (or in Da Nang City) and has its own stamp. The office will have 20 members who are responsible for regular tasks. They will comprise technical experts working in various sectors (international experts may also be needed) such as water resources, agriculture, forestry, natural resources, environment, hydrometeorology, industry, fisheries, construction and health. The director of DARD (or the director of the water resources sub-department) will also be the director of the office; a specialized vice director of the office will be nominated. The office will include four divisions: (a) integrated planning; (b) accounting and administration; (c) information and propagation; and (d) system model and database management.

Depending on various requirements, the RBO can form working groups, either regular or irregular, and sub-organizations at the sub-basin level with participation by the local governments in the sub-basin. The membership, mechanism, mandate, duty and function of the working groups and sub-organization will be determined by RBO.

If the replacement of any RBO members becomes necessary, this replacement should be submitted to the RBO chairman for approval. The RBO members can authorize lower level staff to work on their behalf.

VII. Action programme

1. Immediate action programme

In preparation for the incoming RBO of Vu Gia-Thu Bon in 2004, the proposed action programme was as follows.

a. Department of Water Resources

- August 2004: Collect necessary information on the two provinces of Quang Nam and Da Nang regarding the formation of the RBO.

- September 2004: Work with the two provinces regarding the membership and RBO office. Seminars will be held for common agreement.
- November 2004: Submit the plan to the Personnel and Legislation Departments in MARD.
- December 2004: The final decision on the formation of the RBO will be made by the Minister of MARD.

b. Da Nang fisheries, forestry and agriculture department and DARD of Quang Nam Province

- The Da Nang Fisheries, Forestry and Agriculture Department and DARD of Quang Nam Province will submit the request for RBO formation to MARD by December 2004, together with the draft regulations for RBO operation. Seminars will be held to reach common agreement on the regulations.

2. Long-term action plan

The formation of the Vu Gia-Thu Bon RBO will be decided by the Government. This is a non-productive and consulting agency under the administration of MARD. The RBO has legal entity and its annual financial plan is allocated through MARD.

RBO plenary sessions are scheduled to be held at least twice a year. In addition, ad hoc meetings will be arranged for special issues that arise during the course of the year.

The RBO will develop a strategy plan both for itself and for river basin planning. The strategy plan will be outlined by the Chief of the Administration Office and submitted to the Minister of MARD for approval. The initial draft of the strategy plan will be submitted by the end of the first year of operation, and will be amended and resubmitted within a period of not more than two years.

The plan for the Vu Gia-Thu Bon River basin is to be developed and submitted to the National Water Resources Council for reviewing and to the Government for approval during the first two years of RBO operation. After that, based on the periodical socio-economic development plan of the province, the basin plan will be updated and submitted for approval every five years.

The basin plan will consist of many sub-plans for different sectors. These contributing plans will be combined to constitute a general framework. Some related plans concerning sub-basin issues and subsector issues in the approved general plan are also to be included.

The outline of the general plan concerns the general targets and specific goals of integrated water resources management in the basin. At the same time, the plan also mentions the priority goals. The outline of the general plan identifies the difficulties, challenges and opportunities that may influence goal realization. The development of a plan framework for component plans will facilitate its management. The relationship between component plans and IWRM results in the basin should be clarified. The component plans should detail the plans for the allocation, protection and exploitation of surface water as well as the management of groundwater, hydropower generation, basin management, water quality and environment.

The RBO should develop and maintain a database for the information of water resources and other natural resources in the basin. The aim is to integrate the data meeting requirements in management, multipurpose exploitation of water resources in the basin. This database will be issued in a suitable form and be accessible by the researchers and staff concerned.

First, a technically and administratively competent RBO should be established. The RBO will integrate the water resources baseline and carry out basic investigations. It can also efficiently

adopt the water resources models and support the decision-making process. The RBO will also stimulate and give guidelines to the communities as they participate in the programme for realizing IWRM goals in the basin.

Following its formation, the RBO should carry out the following activities:

(a) Develop the strategic plan for the RBO and its Standing Office;

(b) Set up a database and information network for updating, disseminating and exploiting data;

(c) Establish the model for planning management and support for the decision-making process;

(d) Develop the integrated plans and component plans for the basin and sub-basins;

(e) Set the basic principles for water resources exploitation in the basin; and

(f) Carry out inter-sectoral coordination activities in basin management.

The specific results would be:

(a) Adequate information on the assessment of water resources, both in terms of quality and quantity, surface water and groundwater in the basin;

(b) Plan for the development, allocation and protection of water resources;

(c) Identification of water rights of water users in the basin;

(d) Solutions to water conflicts among water users;

(e) Solutions to other conflicts over water;

(f) Water resources management and protection measures; and

(g) Coordination management measures between sub-basins.

Regarding the relationship with localities, the local RBO members should be active and positive in the RBO decision-making process. The local members will be responsible for:

(a) Providing and updating all information concerning the development of local water resources for RBO;

(b) Disseminating all the RBO information and decisions as well as setting up the local data network for the distribution and exploitation of RBO data;

(c) Stimulating the participatory approach in the local basin water resources management process;

(d) Formulating water resources development plans based on provincial borders, in accordance with relevant basin and sub-basin information;

(e) Carrying out RBO decisions related to the local basin; and

(f) Joining RBO activities as required.

The responsibilities of the RBO towards the local authorities will bee:

(a) To provide all necessary information on water resources development planning to the province, and providing access to the database of various purposes;

(b) To review all the local recommendations on water resources development;

(c) To recommend solutions to water-related disputes between provinces or within the province; and

(d) To facilitate the participation of provinces in RBO activities.

The formation of relevant sub-organizations for sub-basins is necessary. He Vu Gia-Thu Bon basin is a large one, and it includes small sub-basins. Each sub-basin covers more than one locality (province, district); in addition, each sub-basin may have its own issues regarding the water resources development and dispute settlement mechanism. Therefore, it is necessary to form sub-basin organizations for each sub-basin, to be operated under RBO coordination and monitoring.

Initially, it is recommended that some sub-basin organizations be set up for typical sub-basin coordination in management. The selection of these sub-basins will be carried out during the later operation of the RBO. The scope and mechanism for the operation of these sub-basin organizations will be completed based on actual demand and specific features of each sub-basin.

3. Financing and cost estimates

Regarding the organization style of the Vu Gia-Thu Bon RBO, it will be a non-productive and consulting agency under the administration of MARD.

The financing for RBO operational activities comes from the State budget, which is annually provided in accordance with the financing plan approved by MARD; the financing sources are domestic and international organizations that have interests in the water resources development projects in the basin.

Salaries and other costs for RBO operation are based on the annual financial plan. According to this plan, the Vietnamese staff of the RBO and its Office will be paid as stipulated in the domestic payroll and current payment regulations. International staff will be paid as agreed between the chairman of the RBO and the experts. The payment should be also approved by the authorities.

Based on the payment rate for staff working in state-run organizations:

(a) The cost estimate for the operation of RBO (part-time allowance) is 20 people x D 8 million/year/person = D 160 million/year; and

(b) The cost estimate for the operation of the Office: 20 people x D 12 million/year/person = D 240 million/year.

The regular costs are estimated at D 400 million/year. They do not including the cost of engaging international experts and other costs for study or research, training; those costs will be calculated after the RBO has been formed.

The cost for initial procurement for the RBO Standing Office, covering the cost of machines, equipment, vehicles, office accommodation, is estimating to be D 3 billion.

4. Reporting, inspection and assessment regime

a. Administrative activities

The RBO will convene every half-year. The Standing Office will report on the progress of the basin to the chairman on a quarterly basis; and the related offices will report to the RBO Standing Office once a month.

Content of the reports will be on the outcome of the previous mission and the proposed plan for the next mission. The proposed plan will be prepared based on the general plan of the RBO, which will be approved annually.

The Standing Office will be responsible for the preparation of meeting agendas, both for the RBO and the Standing Office.

Inspection activities will be carried out either regularly or irregularly. Regular inspections will be carried out quarterly for the RBO and once a month for the Standing Office.

The assessment of working results will be executed half-yearly while the annual evaluation will be made on all RBO units.

Periodical reports and inspections will be made at all levels. The lower levels will report to the upper ones. RBO reports will be submitted to MARD and the National Water Resources Council.

b. Technical and professional activities

Reporting on, and inspection of professional activities will be carried out in accordance with current regulations of non-productive organizations for the related functional sectors.

Technical activities will be carried out based on the actual requirements of each project and the assigned tasks.

VIII. Conclusions and recommendations

Vu Gia-Thu Bon is one of the 10 largest systems in Viet Nam. The river has long been the basis for the creation of wealthy communities. The river was also the location of Tra Kieu, capital of the Champa Kingdom, the Cham port of Hoi An and Da Nang harbour.

The socio-economic development of the basin is getting into high momentum. However, the basin is also facing major challenges such as pollution, resources degradation and exhaustion, and conflicts over water resources. Moreover, flooding and flash floods are becoming more and more serious. The river channel and banks are losing their stability. The use of water resources is not economical and appropriate.

The early formation of the Vu Gia-Thu Bon RBO is necessary for effective and sustainable management, protection and exploitation of the water resources of the river as well as for the socio-economic development of the related provinces.

As a basis for the establishment and operation of the RBO, it is recommended that:

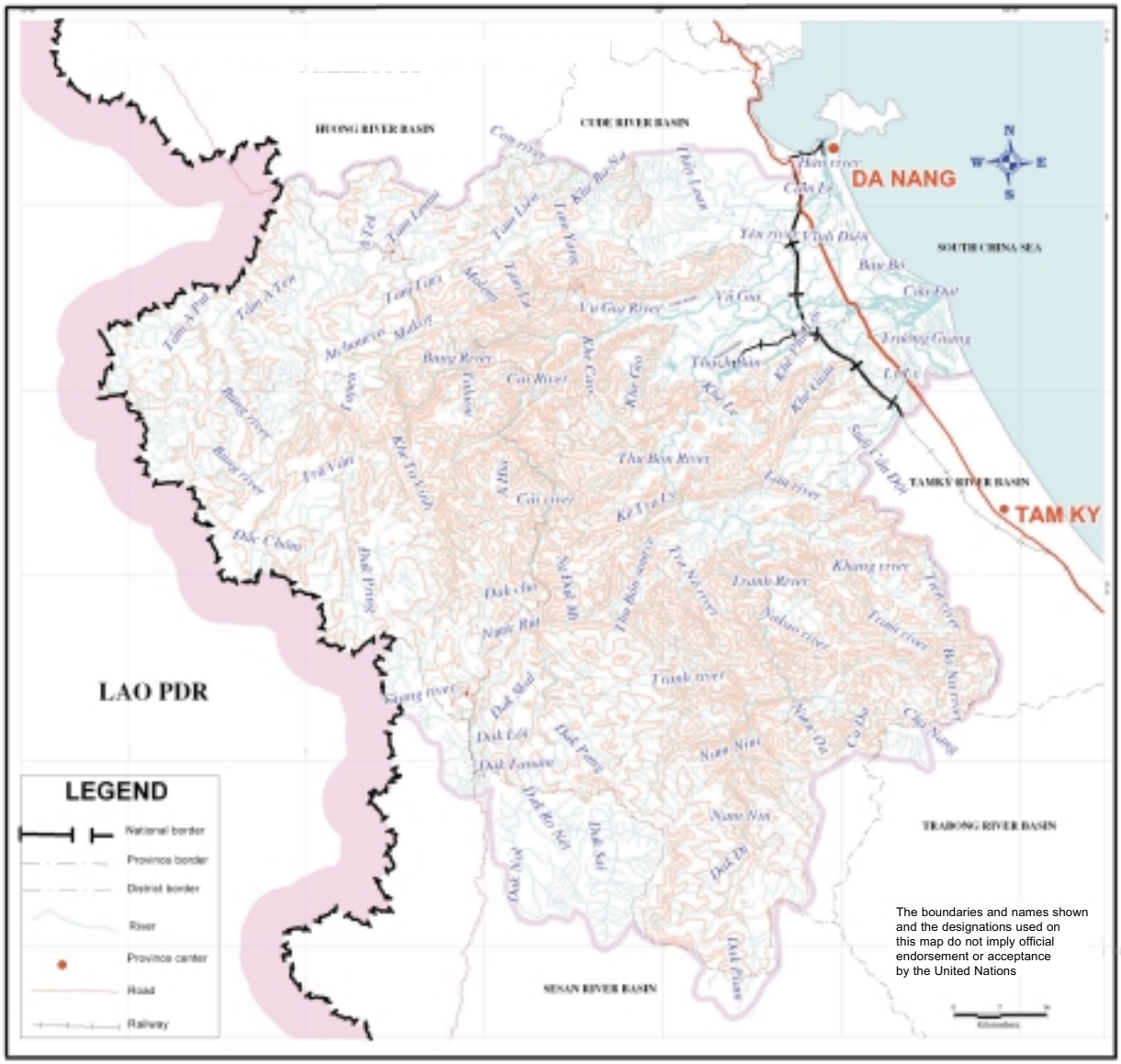
(a) The Law on Water Resources be the basis for MARD and related ministries to undertake state management of water resources at all levels as well as of non-productive consultant organizations;

(b) Agreement on the organization mechanism should be reached among water resources management organizations, from the central to the local level;

(c) The National Water Resources Council should create close relationships with local RBOs;

(d) The Government and related ministries should pay more attention to capacity-building, especially professional training for RBO staff; and

(e) International organizations should support or assist the Vu Gia-Thu Bon RBO upon its establishment and development as effectively as has been done with other RBOs for the Red River and Mekong River.



Map M.1. Vu Gia-Thu Bon River basin base map, Viet Nam

N. EXPERIENCES IN WATER RESOURCES MANAGEMENT: SURVEY OF ISSUES FOR WATER RESOURCES MANAGEMENT IN THE PACIFIC SUBREGION

Paul Taylor*

Introduction

This report gives a brief overview of experiences in water management in the Pacific subregion. It draws on information in recent reports completed for ESCAP on natural resources and environment in the Pacific, web-based information, and reports and papers on the assessment, use and protection of water resources in the Pacific and in small tropical islands.

The countries of the Pacific subregion, as defined by ESCAP, are listed in table N.1.

Table N.1. Countries of the Pacific subregion

Country or State	Political status
American Samoa	United States territory
Cook Islands	Independent 1965, New Zealand affiliated
Federated States of Micronesia	Independent 1979, United States affiliated
Fiji	Independent 1970
French Polynesia	French territory
Guam	United States territory
Kiribati	Independent 1979
Marshall Islands	Independent 1979, United States affiliated
Nauru	Independent 1968
New Caledonia	French territory
Niue	Independent 1974, New Zealand affiliated
Northern Mariana Islands	United States Commonwealth 1976
Palau	Independent 1981, United States affiliated
Papua New Guinea	Independent 1975
Pitcairn Islands	United Kingdom territory
Samoa	Independent 1962
Tokelau	New Zealand territory
Tonga	Independent
Tuvalu	Independent 1978
Vanuatu	Independent 1980
Wallis and Futuna	French territory

Source: Adapted from *Modalities for Environmental Assessment: Pacific Island Subregion*, Economic and Social Commission for Asia and the Pacific, 2001.

Countries within the Pacific subregion exhibit significant differences in their territorial and physical characteristics, which are reflected in the characteristics of their water resources. For the purposes of water resources management, they can be grouped into at least two subgroups: (a) small island countries, comprising low-lying and limited areas, where groundwater is the primary water resource; and (b) countries that have elevated land and larger territories, and consequently

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possess significant surface water resources. In contrast to the low-lying atoll-based territories, other islands are of volcanic origin and may possess mountainous areas with steep slopes and short, fast-flowing streams.

I. Surface water and groundwater resources

The relative importance of surface water and groundwater in the countries of the Pacific subregion differs significantly, depending on the territorial nature of the country. Those States possessing elevated and mountainous terrain as well as significant surface water resources include Papua New Guinea, New Caledonia, Fiji and Samoa. Other States, in contrast, have no significant surface water resources; those countries comprise small low-lying islands where groundwater is the only usable resource, occurring in the form of freshwater lenses no more than several metres deep, frequently lying above seawater. This resource is highly vulnerable to damage through overuse, inappropriate use or pollution and degradation. Examples of such countries are Nauru, Tuvalu and Kiribati.

The two types of territory at these extremes clearly have very different water management characteristics and requirements. The expertise needed for the assessment and management of surface water and groundwater is found in different technical fields, and the expertise required for resource protection tends to have more commonality regardless of the nature of the resource. The management issues are also different, although related.

Some land in Pacific island countries is not suitable for habitation, being either too rugged or in the form of small islands without adequate water resources for any purpose, or are low-lying and subject to frequent flooding (Economic and Social Commission for Asia and the Pacific, 2001a).

Groundwater is the critical water resource for small, low-lying islands. Some countries in the subregion are composed entirely of such islands. Freshwater lenses are very shallow on coral atolls and bore drilling is normally kept within 20 metres.

> "Decades of research have shown that small, low-lying islands over a minimum size (300 metres in width) have a layer of freshwater floating on top of seawater inside the sand and sediment of the island. This layer, called an aquifer, is only a few metres thick and is derived from rainwater falling on the porous coral rock and sand of the island. The thickness of the freshwater aquifer increases as the width of the island increases. The basic relationships seem to remain the same from one island to the next, so research begins by assuming an unexplored island follows the same rules (Economic and Social Commission for Asia and the Pacific, 2001a)."

The only alternative to groundwater in these circumstances is localised rainwater harvesting, which is not reliable in the long term, and may not be adequate for current needs. In such cases, particularly in the case of very small islands, the management requirements include:

(a) Technical capability (hydro-geological) to investigate and evaluate the occurrence (location boundaries) and behaviour (movement and influencing factors) affecting superficial (near the surface) groundwater bodies;

(b) An understanding and knowledge of the causes and chemical impacts of pollutants on groundwater as well as the technical measures for preventing such pollution;

(c) The ability to develop measures to prevent or minimise activities on land overlying groundwater areas, which will result in pollution; and

(d) Mechanisms for preventing the mining or exhaustion of groundwater in superficial deposits. (This may involve a good technical understanding of how the water should be extracted in the case of small bodies of freshwater overlying seawater).

Those countries whose territories are not limited to small low-lying islands have surface water in additional to groundwater resources. Some States have steep mountainous terrain characterised by short fast-flowing streams that may be suitable for water storage and hydropower generation.

II. Climatic impact on water resources

Two major types of climatic events pose serious threats to water resources and water supply in the Pacific subregion:

(a) Medium- to long-term fluctuations in climatic conditions, which include extended dry periods with little precipitation, leading to drought (water scarcity); and

(b) Extreme weather events, such as storms and cyclones, which cause damage to water supply facilities and water sources, and which may cause the pollution of water resources either temporarily or permanently.

Both these challenges affect surface water resources and facilities directly, but can have indirect impacts on groundwater also.

1. Water scarcity and drought

Scarcity[1] of surface water due to lower than normal precipitation is not infrequent in the subregion. Precipitation is heavily reliant on weather patterns prevailing across the Pacific Ocean and extended dry periods have occurred. In many countries, the absence of mountain ranges sufficiently high and extended to cause atmospheric uplift and regular precipitation means that the subregion is subject to the general weather characteristics for rainfall.

A specific example is that of Kiribati, where the climate is dominated by the dry equatorial zone. Rainfall varies considerably, not only between islands, but also from year to year. In an average year, annual rainfall in the Gilbert group ranges from 1,000 mm in the vicinity of the equator, to 2,000 mm on Tarawa and 3,000 mm in those islands furthest north. In the Phoenix Islands, annual rainfall is 1,000 mm while in the Line Islands it ranges from about 700 mm on Kiritimati to about 4,000 mm on Teraina Island, located about 400 km to the north-east of Kiritimati. The central and southern Gilbert group, the Phoenix Islands and Kiritimati are subject to severe droughts lasting many months. At such times, as little as 200 mm of rain may fall in a year (Economic and Social Commission for Asia and the Pacific, 2001a).

Where scarcity affects domestic water supply, including drinking water, serious social consequences may follow. Such scarcity is usually accompanied by crop failure in areas where agriculture is largely rain-fed.

Periodic water scarcity may occur in the region for two main reasons: (a) prolonged drought, i.e. periods with less than “normal” precipitation; and (b) natural disasters in the form of tropical cyclones, flooding and other types of storm event.

Droughts as well as storm events have led to calls for international assistance in the Pacific subregion. For example, in 1988 the Cabinet of Fiji declared a natural disaster situation in areas affected by prolonged drought, and requested international assistance (United Nations Office for the Coordination of Humanitarian Affairs, 1998). A mission by a United Nations Disaster Assessment and Coordination (UNDAC) team concluded that “the current drought is far from unique”. The team

[1] “Scarcity” is defined as a situation where water availability is less than water demand.

noted that there had been five severe drought events in the previous 30 years and that more could be expected in the future. Some of the impacts registered at the time of the mission were:

(a) The requirement in some regions for up to 90 per cent of the population to be supplied with food and water rations;

(b) The devastation of agriculture, with 60-90 per cent losses and coconut trees destroyed; and

(c) Health problems possibly linked to contamination of water supplies.

A drought period similar to that in Fiji was reported in the Solomon Islands in 1997 (United Nations Office for the Coordination of Humanitarian Affairs, 1997).

In such circumstances, groundwater becomes a substitute for surface water, to the extent that it is available and can be exploited rapidly. Since there is likely to be minimal investigation, one potential problem may be the rapid development and extraction of groundwater during drought from areas where such withdrawals may result in long-term impacts on the aquifer.

The prediction of long-term water availability in these localities depends on the analysis of meteorological records. However, local variability in rainfall can cause conditions to differ considerably, even within short distances. In the countries with larger territories, such as New Caledonia, Papua New Guinea and Fiji, surface water gauging is desirable to complement and verify analyses of long-term water availability from the meteorological record.

2. Other natural disasters

Natural disasters in various forms have been identified as threats to water resources and the management of water. Small islands in particular are subject to “extreme exposure and vulnerability to natural disasters including cyclones/typhoons, earthquakes, tsunamis, droughts, floods and the threat of rising sea levels” (United Nations Disaster Assessment and Coordination, 1998). Some of the impacts identified by missions responding to calls for humanitarian assistance in the wake of natural disasters include:

(a) A lack of domestic water supply, leading to health and hygiene problems

(b) Crop losses

(c) The destruction of the water supply infrastructure

III. Surface water development and storage

The surface water storage capacity in the subregion is not known, but the major purposes of water storage are believed to be (a) urban and domestic water supply, (b) mining water supply, and (c) mining tail-water. Supplies for industrial purposes may be provided through town water schemes or, in some cases, separately. Large-scale irrigation schemes are not a feature of the subregion – in contrast to the Asian region.

The scale and impacts of existing surface water storage in dams has not been raised as an issue in recent reports and may not be significant as a factor affecting the environmental health of rivers and streams.

However, some water storage dams have been constructed for the purpose of containing mining waste and wastewater, as distinct from water supply. There are cases where serious environmental degradation and pollution have been the result. Large mining operations in the subregion have been the subject of conflict (e.g., Bougainville) or law suits partly or chiefly because of their impact on water resources. For example, OK Tedi, in Papua New Guinea, has been sued for pollution of the Fly River after local fishermen reported mine waste had contributed to the loss of the important Barramundi fishery industry (Economic and Social Commission for Asia and the Pacific, 2001a).

IV. Environment trends relevant to water resources

The following trends, which are included in a recent survey of environmental issues in the subregion (Economic and Social Commission for Asia and the Pacific, 2001a), are particularly relevant to water resources:

(a) Continuing degradation of near-shore fisheries and ecosystems;

(b) Water supplies are as polluted as ever;

(c) Sewage is still untreated in most areas, and sanitation remains poor;

(d) Populations continue to increase;

(e) Forests are still being cut down faster than they can re-grow (which may have consequences for reliability of stream flow and water quality);

(f) Mines are still polluting rivers and coastal areas;

(g) Pesticide and herbicide use is increasing;

(h) Erosion problems are escalating; and

(i) Sea levels are rising and freak weather is commonplace.

There may be a link between near-shore water quality and freshwater stream flow and quality, as has been detected in studies of the eastern coast of Australia and the impact of river outflow on the barrier reef. Pollution of freshwater results in sediments, pesticides, agricultural wastes and other contaminants being carried into coastal waters.

The issues listed above reveal difficulties in several general areas. The extent and condition of physical water supply and sewerage infrastructure are of concern. However, other problems arise not only because of the lack of adequate control of "point source" mining and industrial activities, but also from broader watershed conditions which are closely linked to the exploitation of natural resources.

V. Social and economic trends and the water sector

Rapid urbanisation is claimed to be a significant factor in the Pacific subregion. The following statement was made at the Environmental Summit of Asia-Pacific Mayors in 1999 (Verlaan, 1999):

> "The steadily increasing migration to urban areas of Pacific islands is not yet generally appreciated. The urban growth rate is 50 to 100 per cent higher than the already large overall population growth rates of 2.3 per cent/year. In the early 1990s, seven of the 13 independent Pacific island countries (Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu) were more than 50 per cent urban; the others were more than 25 per cent urban. The urban centres are usually coastal and national or regional capitals. The population density in rural parts of the "capital" island and on outer islands is very low. Thus, sustainable development of Pacific islands mandates substantial attention to managing issues of urbanization, of which water resources are considered to be among the most pressing."

Population growth in the subregion is forcing migration from rural areas, where land is limited, towards urban areas. Therefore, the region is experiencing a relatively high rate of urban growth, with the associated issues for water resources including:

(a) The need for augmented urban water supply schemes;

(b) The need for increased sanitation; and

(c) Urban-sourced pollution of surface waters and groundwater.

However, in some cases, (for example, in Polynesia and Micronesia) population growth is almost completely offset by emigration.

ESCAP (2001a) quotes the United Nations Food and Agricultural Organization (1997) with regard to the economic situation and accompanying attitudes to environment and sustainability in the subregion, claiming that to the subsidised and subsistence affluent, enjoying a high quality of life on many Pacific islands, future economic and environmental disasters are of little concern. However:

> "Factors contributing to this situation include low population densities, fertile soil, a benevolent climate, effective traditional resource management, and social systems that provide a safety net for disadvantaged members of society. Recently, however, high birth rates, unsustainable commercial practices in regard to natural resource use, increasing dependency on the cash economy, labour migration, and the deterioration of traditional authority and social systems, are having a negative impact on the quality of subsistence life on many islands. Nevertheless, the fact that widespread poverty has not emerged in response to the gradually deteriorating economic conditions in most Pacific island countries gives some indication as to the effectiveness of the traditional social support systems."

VI. Development of water resources

Water resources in the Pacific subregion are generally developed by governmental bodies, with the possible exception of water development for mining. Freshwater resources are also important for agriculture and wildlife.

1. Urban and domestic water supply

There is a sharp dividing line between subsistence-scale water development in rural areas (for drinking, domestic use and some stock) and large-scale water development systems for urban areas. Urban water supply schemes have been constructed and are managed by centralized departments, which have concentrated less on the condition of water supply in rural areas. It appears from various reports that there is a backlog in the provision of sanitation in areas that are supplied with piped water. A relative lack of adequate sewered wastewater disposal, including treatment, for areas with water supply schemes is typical of developing countries and was even the case in significant urban fringe areas in Australia up until the 1980s.

Rural water supplies are usually in the form of small communal wells, rainwater catchment systems, or water from a nearby river or stream.

2. Agriculture

Agriculture in the subregion is characterized by a combination of large-scale commercial production of cash crops and a smaller sector providing food crops for local consumption. This structure is in transition, driven by changing world markets, trade imbalances, the quest for food security and growing human populations. (Fagoonee, 1992, quoted in Economic and Social Commission for Asia and the Pacific, 2001a).

Large-scale agricultural schemes have frequently failed. For example, in the Solomon Islands, other than copra and oil palm, such schemes have been major failures. Large rice farms,

developed in the 1970s are now abandoned and almost all rice is imported. Cattle herds have declined steadily over the past decade. Land disputes were often at the heart of the inability to develop economic agriculture, but many other factors have contributed to the failures including the unsuitability of western farming techniques, storms and pests.

The subregion is characterized by the relative absence of traditional or modern irrigation schemes when compared to Asia or Australia and New Zealand. Thus, the irrigation departments found in the neighbouring Asian region are not a feature of the water sector in the Pacific subregion,

Agriculture relies to a larger degree on rainfed cropping and is thus more exposed to climatic fluctuations without the buffering facility of large water storage dams.

3. Industry and mining

Commercial mining is common to Pacific islands and includes:

(a) Metals (gold, silver, copper, cobalt, nickel, chrome and iron) from the high volcanic islands;

(b) Oil and natural gas from Papua New Guinea;

(c) Phosphate from remote small islands such as Nauru; and

(d) Construction materials for roads as well as fill and cement aggregate from all islands.

Water supplies for mining have not been identified as a major issue. On the other hand, mining has the potential to cause severe pollution of water resources, whether freshwater or marine. (Note the reference above to large mining operations and disposal of tail water). Apart from siltation, the release of mine tailings into rivers and streams adds mineral substances to the water, and mining may have a direct impact on water at the excavation site. In cases such as the phosphate mines on Nauru and Banaba (Ocean Island) and the copper mine on Bougainville, the effect on local water systems has been so catastrophic that essentially they no longer exist in their original form (Brodie and others, 1984).

However, according to ESCAP (2001a), large mining operations are not the only threat to water resources:

> “Small-scale mining, especially for construction materials, is important to every country. In smaller islands, land is increasingly scarce and building materials in short supply. There is a constant need for new sources of sand for concrete, fill for construction, and gravel for road building.
>
> On the large high islands in New Caledonia, Papua New Guinea, Fiji and the Solomon Islands, building materials were often taken adjacent to coastal or river areas. Sedimentation from quarries washed into the rivers and coastal waters during heavy storms, damaging important ecosystems. Other related activities include sand dredging for construction and coral rock mining for cement manufacture, which are widespread types of activities in the subregion. Impacts include loss of agricultural land, siltation of coastal waters and siltation of neighbouring freshwater streams and rivers.”

These management problems appear to be similar to problems occurring in other regions, which also experience difficulty exerting adequate control over activities such as excavation within river beds or banks and the foreshores of lakes and lagoons, or excavation on floodplains, where there is a potential to affect rivers and streams. These activities cause siltation, turbidity and erosion, affecting both the quality of water and altering the characteristics of river channels and,

subsequently, the rate of flow. Frequently, such activities are uncontrolled because there is no legislation or clear accountability within government at various levels for such controls; even where accountability exists, there are technical and socio-cultural difficulties in determining and enforcing a protection regime.

VII. Water quality

Water quality issues fall into several categories. There are particular water quality threats to groundwater resources on small islands, which require local management to recognise the relationship between domestic activity and the quality of the water resources. Similar conditions may apply to surface water resources in rural areas, where there are no piped water schemes and no sanitation schemes.

There are likely to be many rural areas where water resources are limited, but where management practices are lacking or detrimental activities are affecting the quality of water. In relation to small islands and their groundwater resources, water protection practices are stated frequently to be poor (Brodie and others, 1984). For example, open wells, through long usage, have developed depressed areas around their sides and become drainage areas; since they are often situated within the village, faecal matter from pigs and children are readily washed into the well by rain.

The development of many small islands may be limited by the quantity of potable water present. Therefore, it is essential that every effort is made to efficiently utilize the limited freshwater resources, and that the pollution of such resources is kept to a minimum. Brodie and others (1984) identified the following sources of water pollution in small islands:

(a) Contamination of rain and roof catchments (lead, zinc from paints and galvanised surfaces)
(b) Industrial discharges
(c) Agricultural discharges
(d) Domestic waste
(e) Mining discharges

In small tropical islands, water for drinking is usually from roof catchments or shallow groundwater. (Prasad and others, 1984). Many wells are dug close to the coasts and centres of human habitation. Thus, there is a high risk of contamination of the water by salt (from seawater intrusion) and bacteria and viruses (from human and animal wastes deposited nearby).

Prasad commented that “there is little industry on most small islands but on those with intensive industry, such as Guam and Oahu, high-technology solutions and extensive environmental monitoring are required to prevent pollution of groundwater. A number of problems have emerged on other islands. On atolls with major airfields the leakage of underground fuel and oil tanks and pipelines into the groundwater lens has occurred”.

Other noted sources of groundwater pollution include timber industry wastes (copper/chrome arsenates and chlorophenols), landfills and military activities.

There is some evidence to indicate that elevated levels of certain metals, particularly zinc, cadmium and lead, in rainwater samples may result from galvanized iron roofs or those painted with lead-containing paints that are used as catchment areas for drinking water. Analytical data on such water is scarce but paint containing 0.6 per cent lead has been sold as “lead-free paint” in Tonga and painted on roofs used for water catchments (Brodie and others, 1984).

The use of fertilizers on small islands and in the region is limited, and at present this source is probably not a problem. Pesticides, however, are of more immediate and serious concern.

There is a widespread lack of legislation in small island States and an almost complete lack of residue monitoring and operator training. There is also little control over the disposal of unwanted pesticides and the reuse of pesticide containers for the storage of food and water. Most evidence for pesticide spills and their effects is anecdotal, and even where literature references are cited the original information is generally anecdotal and not derived from formal scientific investigations. Mowbray (1988) cites some typical incidents:

(a) "Accidental" spillage of lindane and DDT into the lagoon on one of the Tokelau islands led to fish kills;

(b) Endrin contamination in the Truk lagoon;

(c) Endrin and sodium arsenate leakage from storage containers into a stream, and hence into the lagoon on Yap, led to fish kill and the deaths of seabirds, chickens and rats; and

(d) Considerable quantities of DDT given to the Kingdom of Tonga present a difficult disposal problem as DDT use in Tonga is now banned.

Health may be affected by infections spread through water supplies and in situations of poor hygiene resulting from a lack of water. These include:

(a) Infections transmitted through an aquatic invertebrate animal;

(b) Water-based diseases;

(c) Infections spread by insects that depend on water, i.e., water-related insect vectors; and

(d) Infections primarily due to defective sanitation.

As noted above, water protection practices are often poor. A further problem may result from the dependence of many islanders on lagoonal shellfish and other invertebrates, which accumulate bacteria, viruses, metals and organic chemicals and which may be faecally contaminated as a result of poor or no sanitation. (Brodie and others, 1984).

The management and monitoring of water quality are discussed below.

VIII. Management of watersheds

Good watershed condition is essential for maintaining the regular flow and the quality of water in streams and rivers. Local watersheds may also be harvested for domestic water supply. Apart from the growth of urban areas, watersheds in the subregion are threatened by two types of activity: (a) large-scale natural resources development, such as forest clearing and logging; and (b) encroachment by subsistence garden-based farming. Increasing populations and inefficient subsistence garden techniques have led to constant encroachment of farms onto marginal land areas unsuited to agriculture but essential for the protection of watersheds and biodiversity (Economic and Social Commission for Asia and the Pacific, 2001a).

Another aspect of watershed management is the control of activities that cause erosion or degradation of river beds or banks, as mentioned above. Also identified is the encroachment into watershed areas of subsistence gardening. There is an urgent need throughout the region to improve subsistence gardening techniques to increase productivity and reduce soil erosion and infertility. Although techniques for sustainable agriculture are readily available, most agricultural research facilities are unfamiliar with them.

One problem facing the management of impacts of such activities as forestry on water resources (and the environment in general) is the restrictive policies of governments on the release of information (e.g., Papua New Guinea and the Solomon Islands). Where high-profile industries and government cooperate to limit information, it is difficult or impossible to identify the impacts such activities will have on water resources in the long term. Indices such as stream quality (turbidity in particular) may be good indicators of the impact of upstream forest operations, provided the information can be collected and reviewed for management purposes.

IX. Water information, assessment and monitoring

With regard to the assessment of small island groundwater, ESCAP (2001b) states that:

> "Assessment and monitoring of freshwater resources on small islands is a progressive process, moving from empirical estimates based on examples from similar islands, to field studies, to monitoring during trial extraction, and finally to computer simulations based on long-term monitoring of a wide range of water-related parameters. Numerous detailed investigations of atolls…have enabled the construction of a general model for atoll water lenses and refinement of empirical estimates. It is now possible to make reasonable assessments of water lens parameters of unstudied islands based on readily available physical data and preliminary field assessments."

Government, itself located in the urban areas, understandably places greater emphasis on the assessment and monitoring of urban water supply systems. The most widespread or comprehensive monitoring in the water sector appears to be for the purposes of health and drinking water – namely the monitoring of water quality parameters. However, even here, it has been stated that such information does not always lead to useful analysis and follow-up (United Nations Disaster Assessment and Coordination, 1998).

Verlaan (1999) identified the lack of strategic information as a problem for environmental management – that is, data may be relatively abundant but are not organised usefully for the purposes of decision-making, analysis and management on the basis of the resources. (See annex VI.)

Various studies appear to have been undertaken in the subregion on water resources in localised areas, particularly small island groundwater resources. In the immediate situation, such studies may be very useful for management (such as where decisions on how much water may be extracted are based on monitoring data), and may also provide relatively good guidance on the behaviour of water resources in comparable situations (such as in small groundwater lenses). However, on the broader scale, it is not clear to what extent information is usefully available.

The usual difficulty when assessing small island resources is the lack of long flow records. There is rarely time or money to spend on collecting these data, so some plausible form of flow data generation or transposition must be adopted.

Water monitoring (either quantity or quality) for catchment management or pollution prevention on a strategic basis appears weak. Some factors raised in reports include:

(a) Focusing on urban areas and their water sources, while excluding rural areas;

(b) A lack of administrative responsibility for such monitoring (i.e., for planning or management purposes);

(c) Limited resources (technical and financial); and

(d) A perceived lack of significance of water problems outside urban areas.

Normally, the Health Department monitors drinking water sources and drinking water in most island urban areas. Rural water supplies are monitored either on a less frequent schedule or in the event of suspected contamination (e.g., from the incidence of waterborne disease in a specific area) (Economic and Social Commission for Asia and the Pacific, 2001a). Recommendations made by UNDAC (1998) regarding water quality management in Fiji included:

(a) The need for following up monitoring data that reveal bacterial or other forms of contamination of drinking water supplies; and

(b) Improved procedures for bacteriological monitoring by health authorities to ensure follow-up to identify and rectify the source of the contamination, and not just to report the contamination.

These recommendations imply the need to strengthen management procedures as well as capacity through training, in order to ensure follow up when data are received that identify a potential water quality problem.

X. Information management

Information needed for the successful management of water resources takes various forms. Technical information of the type obtained through scientific study and measurements is only one form. The extent to which comprehensive and strategic data on surface water or groundwater are collected and archived in subregional countries probably varies considerably.

Information is also required about day-to-day practices, activities and general practices of the people who use and affect water resources as well as their views on such issues as:

(a) Rights to, and ownership of water, land and local products (trees, vegetation and crops) that rely on both water and land, including matters that are considered for compensation;

(b) The community view of the effect of their daily use of natural resources at a subsistence level on the resources, including impacts on water resources;

(c) An understanding of the need to avoid pollution of water, by whatever means; and

(d) An understanding of the need to contribute to the maintenance of local water supplies and sanitation facilities, and the rights and obligations of various community members in making such contributions.

In regard to type (d) information, ESCAP (2001a) argues that the process of gathering information can, in itself, harmonise economic and environmental policy, providing that all concerned parties:

(a) Are involved right at the start in deciding what information needs to be collected;

(b) Participate in the information-gathering process;

(c) Have access to the results; and

(d) Have a say in the policy formed from the information.

The development plans and environmental strategies of the Pacific islands, as well as Agenda 21, stress over and over again the need to gain the cooperation of the people who make the actual day-to-day decisions on resource use – the people of the communities who depend on the resources for survival. This highlights the importance of local governance for the successful management of water resources – that is, the practices and accountabilities of local communities are critical to maintaining water quality and, in other cases, water supply, where water resources are located in small and vulnerable reserves.

XI. Planning in the water sector

Information and planning are closely related. ESCAP (2001a) suggests that planning in the environmental field is widespread but the implementation of plans is poor. Verlaan believes that there is inadequate linking of information and that improved governance is necessary.

Planning for water supply scheme development is naturally undertaken by the urban water agencies (e.g., Public Works Departments), but such planning covers water sources only to the extent that water for urban supply is concerned.

A fundamental difficulty for governance in the subregion is the low levels of funding for the implementation of plans and strategies. However, it is suggested that when environmental threats are obvious, they have been frequently acted upon (mainly by denying the go-ahead for proposed activities). Yet, when the threat is not clear, little or no action is generally taken (Economic and Social Commission for Asia and the Pacific, 2001a).

Plans and strategies have been developed for environmental management and, in some countries, in respect of groundwater; however, their effectiveness is not known. It is uncertain to what extent countries in the subregion have comprehensive environmental planning schemes that are followed and that will, in practice, allow water resources management to be implemented.

XII. Technical capacity

ESCAP (2001a) reported that technical capacity for (environmental) research, investigation and monitoring is quite limited, except in countries associated with the United States and France, as they have larger budgets and staffing for such activities. A great deal of study is done by international organizations and consultants. Ongoing technical capability is therefore low for such activities as:

(a) Surface water and groundwater resources assessment and modelling;

(b) Water quality monitoring and analysis; and

(c) The capacity to analyse data from technical investigations and translate such information into guidelines or decisions for the management of water. (For example, the translation of information to practical measures for controlling the enhancement of water resources quantity and quality).

Technical capacity may be needed, not so much due to the need for hydrological or hydro-geological assessments, which may already exist in some areas, but more to lack of experience in interpreting such studies and translating them into guidelines for water resources development or protection (United Nations Disaster Assessment and Coordination, 1998). In relation to Fiji, the same report states:

> “Good hydro-geological studies are already on file. District-level officials have little confidence in interpreting actions to take. The Ministry of Resource Development should conduct training or seminars to help decision-makers interpret MRD hydro-geological studies at the district level to [enable them] to know how to apply the various maps and data to the selection of the best water supply system.”

This comment reveals a problem of capacity in regional areas, where officials are not sufficiently trained nor have technical support to make decisions that require technical understanding and judgement.

XIII. Administrative and management capacity

Administrative capacity is low because of the small numbers of people employed in many governments in the Pacific subregion, as noted by ESCAP (2001a):

> "Pacific island governments, spread out over many islands separated by large distances, are run by a very small number of people. There are only 428 management personnel for the entire Government of Tonga with backup from 3,840 professional, technical and related workers. Each one of these persons has a work load that would be difficult to accomplish if, that is, they had time to do it. As it is, many executive-level government staff members are in continuous meetings, workshops, and seminars. They travel overseas regularly to attend meetings or to obtain training, leaving their duties to the next lowest tier of staff members. In the case of environmental agencies, there may not be another professional staff member."

In addition, the effectiveness of environmental programmes is affected by national-local political and administrative tensions and conflicts (Lamour, 1999). Since the local level of government and administration in the subregion is extremely important for historical and cultural reasons, solutions devised at the national or central levels, even in small countries, may not be readily adopted in outlying areas. The bringing together of central and local levels in such programmes as water resources awareness, pollution control and water monitoring measures is always resources- and time-consuming.

For these reasons, the implementation of programmes for water management may be very difficult to advance. Examples of the types of activities that may be needed, but which are difficult to cover because of personnel shortages, are:

(a) The resolution of water rights and rights to water associated with rights to land (where conflicts over water arise, or where it is desirable to introduce or codify water rights systematically);

(b) The enforcement of laws governing the taking of water and the pollution of water sources (enforcement may be difficult for other reasons also);

(c) Community consultation for decision-making, which is labour- and time-intensive; and

(d) Education and awareness programmes, including programmes to encourage demand management, minimization of water wastage and water-use efficiency improvement.

XIV. Institutional factors

The management of water resources in the subregion appears to be predominantly the responsibility of urban and domestic water supply departments, usually the Public Works Department. It is an activity undertaken for, and from urban centres in which lesser attention is paid to rural water resources.

According to ESCAP (2001a), most of the water policy, information and management decision-making for water resources in Pacific countries rests with a combination of public works, health and, possibly to a limited extent, environmental agencies. In the past 50 years, the development of water resources has been primarily for urban water supply and industrial purposes. Whereas water supplies for mining operations may be constructed by the private sector, urban water supply is a public function. Therefore, water comes chiefly under the public works portfolio as a development matter. The focus of water sector expertise and attention has been allied to drinking/urban water supply and sanitation.

The rural water and irrigation departments that characterise many other countries do not exist in the Pacific island subregion. In many countries, the irrigation department or ministry also takes responsibility for stream flow gauging and surface water monitoring, although the same function may be undertaken as an adjunct to meteorology. Surface water monitoring on the broad scale, therefore appears not to have been developed for most subregional countries.

Responsibility either for the management of surface water resources as a whole or for groundwater appears not to be explicitly assigned. To some extent, environmental agencies may fill the gap, but they will not undertake technical functions such as strategic surface water monitoring, flow gauging, and modelling surface water and groundwater behaviour. Nor will they necessarily exercise control over water abstraction, which could be critical, particularly for groundwater.

Where monitoring studies and water-related investigations are sponsored and undertaken by academic and research organizations or by external agencies, a comprehensive or strategic outcome does not result – rather, research, investigations and studies focus on particular and usually localized problems. In some cases (such as behaviour modelling for small superficial groundwater lenses), it may be relatively safe to derive information by extrapolation from previous known examples.

The administrative responsibility for managing the exploitation and protection of water (both groundwater and surface water) as a resource, in a similar manner to that for forests, minerals or even ocean products, is not well-developed in the Pacific subregion. Therefore, two questions arise:

(a) To what extent should water management be identified as a specifically organized function of government?

(b) How the management of water resources should best be organized, from the perspective of joining water use/exploitation and water resource protection, since it is certain that pressures on water resources are increasing and will increase further with time?

Institutional arrangements and capacity are closely related. The water sector requires expertise in technical areas, which is very difficult for small countries to obtain and retain. Therefore, cooperative unions have been entered into and it seems difficult to imagine an alternative way of covering the need.

In conclusion, water management, to the extent that management attention has been paid to water as such, is dominated by the urban water sector. The Pacific subregion does not have a well-developed irrigation industry or culture, in contrast to Asia. According to ESCAP (2001a), urban water supply organizations dominate the water sector, so that an urban-rural divide may occur where water supplies for towns are being provided through piped schemes, while surrounding rural areas are largely left to continue with traditional “subsistence” practices, which include obtaining domestic water from streams or wells.

XV. Cultural and social issues

ESCAP (2001a) argues that many initiatives originating at national government level and impelled by international initiatives on environment have failed because they have ignored the local community and its beliefs and social practices. Similarly, Lamour (1999) points out the considerable role of local communities in the Pacific. ESCAP goes so far as to say:

> “Ignoring the economic and social policies of the resource owners and users is a chronic problem in all Pacific island countries. It is becoming an acute problem, as local policies are stressed by population growth and economic desire.”

A strong case is put for paying attention to social organization at the local level. The report argues that many initiatives have failed because they have been designed and applied by the central level and have not affected the thinking or actions of people in villages where the difference would occur.

For water management programmes to work outside urban areas, therefore, it would appear that careful development of such programmes is required, incorporating and acknowledging the participation of local communities.

An ESCAP (2001b) case study of water resources in Kiribati concluded that: "The most critical need for attaining sustainable development of water resources in the South Pacific region is to improve the way in which water-related officials form partnerships with the community for the assessment and management of the water resources." This view resulted from the analysis of the reasons why water supply schemes were not working effectively. The failings in scheme management were put down to the inability of government agencies and officials to recognize or work with local communities and obtain their cooperation.

Most importantly, more than one commentator argues the need to involve communities in water management activities such as assessment and conservation. ESCAP (2001a) proposes that "The process of assisting with water quality tests improves community education and awareness of a range of ecological relationships. It has proved unexpectedly useful as a focus for creating government and community partnerships." This implies that the active engagement of the community at a very local level is crucial in subregional nations for successful water management.

ESCAP concluded therefore that social and cultural issues for water management were very important "and should be included as part of the feasibility study of water projects. Based on experience, neglecting the social and cultural aspects at the inception and implementation stage can result in slow implementation and total failure of water supply systems."

XVI. Legislation

Falkland (1984), (see annex V) makes the following comments on water legislation for small islands worldwide (including the Pacific subregion):

> "Legislation concerning water resources and supply systems on small islands varies from being almost non-existent to very detailed. Often the latter type is outdated, redundant, ambiguous or difficult to enforce. Many problems have arisen due to non-recognition of problems caused by inadequate or non-existent legislation, difficulties in enacting new legislation, and difficulties in enforcing existing legislation. There are many cases where inadequate legislation has prevented government water authorities from effectively controlling and managing water resources and supply systems."

Specific problems identified by Falkland include inadequate control of extraction of groundwater and inadequate protection of groundwater quality where legislation is frequently lacking. However, Falkland also commented that legislation alone was not sufficient to ensure that management of water was adequate, since "there also needs to be community education and information programming about water conservation and protection."

The issues raised in the earlier sections of this report appear to indicate that legislation dealing with the management of water resources in the subregion needs to include management capability for local management of water supplies in rural areas and for dealing with water quality-related activities. That is not to say that legislation alone will solve the problem of poor practices such as those described above. However, this need should be recognised in the development of legislation.

The recent approach to water law internationally includes the following features:

(a) Establishment of guiding principles based on sustainable management of water resources and equitable allocation, conservation of water resources, water for the environment and related principles;

(b) Comprehensive coverage of water resources and water sector management that may include, to varying degrees, the management of water supply schemes but which emphasises the management of water as a natural resource;

(c) The introduction or closer definition of water rights schemes and clarification of the relationship between land ownership or occupation and the right to take and use water;

(d) The institutional set-up and functions of government agencies with water-related responsibilities; and

(e) Regulatory powers, enforcement and control mechanisms, for the protection of water resources and the application of water rights.

Water legislation may include, to a greater or lesser degree, protection measures for areas of land that need to be controlled for water quality reasons. Such controls may be included in legislation for the environment or under planning and development law. The lack of effective linkages between different legal instruments is a common problem when implementing such protective measures.

Legislation may also cover the development of the major water sector schemes, namely urban water supply and sanitation, irrigation, power generation and other aspects (which might include freshwater fisheries in those countries where it is significant, and navigation, environment and health). In the case of the Pacific subregion, it would be advisable to consider the interface between surface freshwater and coastal waters, since coastal fisheries and marine products are so important to the economies and lives of people in the subregion.

It has not been possible to identify whether specific-purpose water legislation exists in subregional countries, or to what extent environmental legislation may cover the same ground. However, legislation of this nature appears not to have been generally enacted in the Pacific subregion. ESCAP (2001a) also comments (in relation to the environment) that laws of former Australian and English colonies based on British models are generally outdated and further that two competing sets of law frequently exist – those remaining from the colonial era and newer national laws, which may not be mutually consistent. Another legal issue is the recognition of rights systems that pre-date colonial law and thus may continue to apply, if only in the thinking of the inhabitants of the island countries.

Environmental law is fragmented and administration may be assigned in parts to numerous agencies; however, laws pertaining specifically to the management of water resources are not common. Problems identified for environmental legislation are that:

(a) Regardless of the merit of such laws, they are seldom enacted and almost never enforced.

(b) Environmental agencies have few people and practically no operational funds; and

(c) The mandates of such agencies are frequently to advise line ministries, which rarely ask for advice.

Other identified problems with environmental legislation include a general lack of monitoring and enforcement. ESCAP has suggested that cultural reasons are responsible for the lack of

enforcement in many cases. These problems would cause difficulty for the implementation of a comprehensive water resources management law, if it were in place. However, the Pacific island subregion is not unique in this regard.

XVII. International and regional organizations

Although the countries of the Pacific subregion have been assisted by external and international bodies, they have also developed regional organizations to maximize the resources that they do have. Several international and regional organizations assist the Pacific island nations with water prospecting and development systems. The South Pacific Commission and the South Pacific Applied Geoscience Commission (SOPAC) both have regional water programmes. The World Health Organization has an ongoing water monitoring network throughout the Pacific Islands and participates in community education activities. ESCAP has sponsored important regional water conferences that have assisted the smaller islands in obtaining new information and technology. At present, SOPAC, in Suva (a foster organization of ESCAP) is spearheading a Pacific island regional water association to facilitate the interchange of information and to standardise and supply water related hardware in the region.

Regional organizations with some relevance to water resources include:

(a) The South Pacific Commission
(b) The South Pacific Forum
(c) The South Pacific Regional Environment Programme
(d) The Forum Fisheries Agency
(e) The South Pacific Applied Geoscience Commission.

SOPAC has supported the formation of the Pacific Water Association, which comprises urban/domestic water supply and sanitation organizations. This pattern follows the trend of domination of water resources by the urban sector. SOPAC is a technical support organization, which has become involved in organizational and management issues for the water sector and the management of water resources. Regional consideration of the management and sustainability of water resources has also been covered under environmental programmes such as the South Pacific Regional Environment Programme.

The following areas have been identified as requiring technical support from SOPAC at the institutional, government and community levels (*SOPAC Newsletter,* July 2001):

(a) Water resource assessment, development and management, including rainwater harvesting, surface water, groundwater abstraction, desalination etc.;

(b) Water demand management and conservation including asset inventories, leakage assessment and repair, hydraulic modelling, tariff studies and public conservation awareness programmes;

(c) On-site sanitation facilities including appropriate sanitation community level surveys, public awareness campaigns, and sustainable village level operation and maintenance;

(d) Off-site sanitation systems including urban sewerage collection systems and treatment process works;

(e) Wastewater quality and environmental monitoring; and

(f) Hygiene assessment and promotion including community participation surveys, socio-cultural assessments, water storage and purification practices, and washing and cleaning practices.

Regional cooperation is essential for those small island countries that do not have adequate resources or capacity in their own right. A key issue is how best to configure regional cooperation for the purposes of water resources management. As noted above, the Pacific Water Association is an urban water-based organization that could expand its scope to include consideration of broader water management issues. This may or may not be the most suitable approach.

1. Role of management in the subregion

An ESCAP (2001b) case study of groundwater resources in Kiribati (see annex IV) concluded that the management of water resources required more than engineering approaches. The following summary of one groundwater area serves as an illustration:

> "…the Tarawa Water Supply scheme, which at present is serving more than 26,000 people, is an exemplary case of a fully-developed groundwater lens. The use of properly-constructed infiltration galleries and the use of positive displacement pumps is an effective groundwater extraction method with minimal thinning effect on the freshwater lens."
>
> "…From an engineering viewpoint, this is true; the project harvests the water sustainably".

However, ESCAP notes that:

(a) At least 50 per cent of the product and the investment never reaches the people but is lost through leaks and poor water conservation;

(b) Diarrhoea is still the number one cause of death on South Tarawa;

(c) The Government continues to battle land owners over water reserves and is unable to stop people from building and farming over the easily polluted water lenses on land that the government has leased as water reserves; and

(d) The Government is unable to collect any money for the provision of water to the people.

ESCAP concludes that "the project is unsustainable from an economic, developmental, social and health perspective. It is an excellent example of great science but dismal political, economic and sociological performance." This example reinforces the ESCAP argument that the inclusion and cooperation of local communities is critical to all aspects of environmental and water resources management in the subregion, and that the lack of such involvement and cooperation explains many of the current deficiencies in management.

XVIII. Water resources management issues

Some work related to the principles for managing natural resources has been accomplished in the subregion. According to ESCAP (2001a), many Governments "have accepted sustainability as a central policy, but real action towards achieving this goal has been slight…governments with wide domains and a democratic intent were unable to change many of their own unsustainable ways of using resources. They have had practically no luck at all in changing the behaviour of their peoples". This general statement most likely applies to natural resources such as forest products, fisheries and marine products, but could also apply to the management of water resources.

The following compilation of issues draws on recent meetings and workshops that have discussed the management of water resources in small islands in the subregion.

1. Strategic Action Programme

In 1997, 13 Pacific subregion countries participated in the work of the Global Environment Facility to create a Strategic Action Programme (SAP) for their international waters (annex I). SAP was endorsed by their Heads of Government at the twenty-eighth South Pacific Forum, at Rarotonga, Cook Islands, 17-19 September 1997. They were the first countries to address the needs of islands in a SAP. A discussion of the outcomes of SAP (Verlaan, 1999) identified the water management-related issues for small islands. These issues are outlined below.

a. Need to closely manage the freshwater and marine water interface

Although freshwater policies are usually developed without significant attention to the interface with marine waters, some commentators believe that fresh-marine water impacts are sufficiently important to warrant attention (Verlaan, 1999). This is the promotion of "whole island management" for small islands whose offshore waters may be affected by onshore activities including the pollution of freshwater resources.

Because water resources are so inextricably intertwined, their threats must be managed simultaneously. Hence, effective water resource management requires whole island management. This is a concern of SAP and is explicitly based on the physical continuity of "international waters". It envisions interdependent flywheels of watershed/coastal and offshore/oceanic processes, each with cogs influencing the other. Although the mechanisms governing these relationships are not yet well understood, they cannot be ignored.

b. Management deficiencies – a root cause of threats to water

Both ESCAP (2001a) and Verlaan (1999) argue that management deficiencies are a key problem for water resources in the subregion. Verlaan puts improvement of governance and improving understanding as priorities; governance requires developing institutional mechanisms to integrate environmental concerns, development planning and decision-making, while improving understanding requires creating whole island ecosystem awareness throughout all levels of the population.

c. Key information gaps are not in basic data

Verlaan also believes that the most important information gap is not inadequate data on basic science or economics, but "a lack of appropriately presented, strategically oriented information to assist decision-makers, resource users, managers and communities in deriving optimum benefit from their water resources…"

A lack of strategic, analytical and consistently planned information is a characteristic of many countries, including those where reasonable basic data exists. As a general comment, which may apply in the Pacific just as elsewhere, water quality data tend to be more piecemeal than water quantity data in respect of (a) its distribution, which frequently relies on localised projects or issues, and (b) the numerous organizations collecting, but not coordinating, it.

2. Workshop on Water Issues for Small Islands, and Small Island Water Information Network

A workshop was held in Suva, Fiji in February 1996 on "Technologies for Maximizing and Augmenting Freshwater Resources in Small Islands", under the auspices of the Commonwealth organization, the Small Island Water Information Network (annex II). The workshop identified the following characteristics of very small islands (island States) that might cause difficulty for water management:

(a) Very limited freshwater resources;

(b) Isolation and difficulty in travel and communications;

(c) Fragile ecosystems;

(d) Extreme exposure and vulnerability to natural disasters (including cyclones/typhoons, earthquakes, tsunamis, droughts, floods and the threat of rising sea levels); and

(e) A shortage of trained staff in the water sector.

The participants in the workshops made specific recommendations (table N.2).

Table N.2. Recommendations of the Workshop on Technologies for Maximizing and Augmenting Freshwater Resources in Small Islands, Suva, 1996

Recommendation	Comment
Island countries should concentrate on the rational and systematic assessment, development and management of naturally occurring freshwater resources (such as groundwater, rainwater and surface water) before other, more expensive and complex technologies are planned or introduced.	This could apply to all countries in the subregion (and in other regions).
The enactment and enforcement of appropriate water resources and environmental legislation should be supported and encouraged to protect, conserve and manage naturally-occurring water resources and associated fragile ecosystems.	The enforcement of legislation may be problematic in the subregion for reasons identified in ESCAP.
Conjunctive use of different sources of water should be encouraged to optimise the use of freshwater (e.g., combining the use of rainwater and groundwater).	Conjunctive use policies need to be carefully designed to avoid unintended consequences.
Continuous and thorough review of established technologies and practices is required to allow the practical application of appropriate water resources development alternatives.	Traditional and well-known technology versus high-technology solutions is an ongoing debate and the institutional and cultural aspects need to be sorted out before high-technology solutions will work.
Community consultation and participation in water development and management is essential.	Fully supported.
Continued and continuous demand management measures, including leak detection, minimization of unaccounted-for water losses, use of water-saving devices, public education and awareness campaigns regarding water conservation, and economic pricing policies, are required in order to maximize the use of existing, developed water sources.	This is consistent with recent thinking worldwide and is very pertinent where further opportunities to develop water sources are limited or non-existent.
Water supply and sanitation should be considered in an integrated fashion, including consideration of alternative systems that act to conserve water and minimize pollution of soil and water (e.g., composting toilets, particularly on small coral islands).	Domestic wastes and pollution, both at the local/village level and in urban areas appear to be growing problems in subregional countries.
Adequate hydro-meteorological and water-quality monitoring systems are essential to properly evaluate the behaviour of fragile island water resources and water development projects utilizing these resources.	Such systems need to be carefully targeted (for cost reasons) and also well maintained (which raises capacity issues).
Intersectoral involvement of water resources, land management and agricultural agencies staff and community representatives for integrated water management are required.	This is supported but re-thinking of some current institutional organization and linkages is required.

XIX. Water management issues (small islands)

An ESCAP meeting held in 1983 on water resources development in the South Pacific identified the following major problems throughout the region:

(a) Island governments required information on resource assessment techniques in small islands/atolls to assist in defining groundwater characteristics;

(b) Limited financial resources made it necessary for water supply and sanitation systems to be low cost;

(c) Water losses ranging from 30 to 50 per cent as well as wasteful use of water by consumers were among the causes of water shortages and high costs of water, and required serious and immediate attention;

(d) Maintenance and repair of existing water supply systems, plant, equipment and instruments was poor and getting worse due to the lack of funds, trained manpower, improper or inadequate operations, and maintenance and repairs;

(e) Over-pumping of aquifers and groundwater lenses floating on seawater were threatening freshwater supplies with salt-water pollution;

(f) There were concerns – but little data – on the impact of industry and agriculture on groundwater;

(g) Most countries had insufficient data to carry out a proper assessment of their water resources;

(h) Most countries lacked a national water policy within the framework of and consistent with the overall economic and development plans of the country;

(i) Most countries lacked adequate institutional arrangements to ensure that the development and management of water resources took place in the context of national planning. There was poor coordination among all bodies responsible for the investigation, development and management of water resources; and

(j) Comprehensive water legislation providing guidance on a coordinated approach to water resources development was lacking.

These issues identify management both for water supply schemes and for the broader management of water resources. The detailed conclusions of this meeting are given in annex III.

XX. Conclusions

The physical water resources of the Pacific subregion vary considerably between those nations whose resources are limited to small groundwater bodies and those with significant surface water resources. The subregion is subject to periodic water scarcity caused by drought, and also suffers from severe climatic events. Water quality, however, is an equal challenge. Some common themes appear to be:

(a) The need to broaden perspectives beyond water supply for urban areas;

(b) Improved management of water supplies, particularly those that rely on local management;

(c) The need to consider all aspects of water management and consider whether legislation or the identification of institutional responsibility would cover the gaps;

(d) Further consideration of the implementation of existing legislation and the factors that militate against enforcement in important areas;

(e) The general approach of government bodies to implementation of water schemes and management measures, the need to include local communities as participants in the management of water and recognition of longstanding local views of water rights and obligations;

(f) The strengthening of technical and administrative capacities and the way forward for regional organizations;

(g) The strengthening of capacity in the information area, in particular the analysis and use of existing information as well as consideration of more strategic information collection;

(h) The consistent linking of national objectives and planning with plans and decisions for the water sector and the management of water resources; and

(i) The need for increased awareness, both within government and among the population, of serious threats to water resources, and for encouraging the avoidance of activities that contribute to such threats.

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ANNEXES

Annex I. Strategic Action Programme for International Waters of Pacific Islands: Summary of analytical framework

In 1997, 13 countries participated in the work of the Global Environment Facility to create a Strategic Action Programme (SAP) for their international waters. SAP was endorsed by the Heads of Government at the twenty-eighth South Pacific Forum, Rarotonga, Cook Islands, 17-19 September, 1997. Table N.3 below lists freshwater-related issues and actions.

Table N.3. Strategic Action Programme goal: Integrated sustainable development and management of international waters

Priority concerns	Degradation of water quality Degradation of associated critical habitats Unsustainable use of resources
Imminent threats	Pollution from land-based activities Modification of critical habitats Unsustainable exploitation of resources
Ultimate root causes	Management deficiencies: (a) Governance (b) Understanding
Solution	Integrated coastal and watershed management
Integrated coastal and watershed management activity areas:	• Improved waste management • Better water quality
Targeted actions	• Management/institutional strengthening • Capacity-building • Awareness/education • Research/information for decision-making • Investment

Source: Verlaan, 1999.

Annex II. Recommendations of the Workshop on Technologies for Maximizing and Augmenting Freshwater Resources in Small Islands, Suva, 1996

The meeting recommended that the selected items listed below be given urgent attention.

A. Assessment of water resources

- Establish an inventory of currently available water resources data.
- Establish the minimal additional data collection system needed to meet development objectives, taking into account water quality, including sea-water intrusion of groundwater.
- Determine areas requiring immediate assessment of water resources to satisfy current and future needs.
- Establish a project to determine optimum water resource availability and management on atolls including water balance studies, techniques of assessment and evapo-transpiration from coconuts, taro pits and natural vegetation, and develop guidelines on the above.
- Establish observation networks and strengthen existing systems and facilities for measuring and recording fluctuations in groundwater quality and level.

B. Conservation on water and efficiency of water use

- Establish the best ways of educating consumers to conserve water.
- Establish a training programme for the detection and repair of leakage in water supply systems and subsequent repairs.
- Establish a programme to improve water supply distribution.
- Establish a programme for siting and design of groundwater extraction points and withdrawal rates to avoid salt water intrusion.
- Prioritize water demands on smaller atolls and communities.
- Survey and monitor water sources for pollutants.
- Establish guidelines for security of water supplies and waste disposal systems during floods and cyclones.
- Consider water requirements of industries in planning for new development.

C. Policy, institution, legislation and technology

- Establish a national water policy within the framework of the economic, social and environmental conditions.
- Develop a water plan suited to the country.
- Study local communities and promote their involvement in the design, construction, financing and operation of the local water supply.
- Establish institutional arrangements for the promotion and co-ordination of assessment, development and management of water resources, and where possible appoint trained locals to control individual water systems.
- Establish simple and enforceable legislation to cover all aspects of water resource management and, in particular, groundwater extraction, pollution and protection of surface water sources.
- Identify and promote appropriate technology for water resource assessment, water quality monitoring and water supply system construction and operation, including the use of solar power and wind power.

D. Public information, education and training

- Develop public awareness through suitable means, including audio-visual media programmes, to promote the protection of water quality and the conservation of water.
- Organize training programmes for water managers, water supply technicians and water resource assessment professionals, hydrological technicians, and village-level managers for water supply and wastewater treatment.

Annex III. Suggested monitoring parameters for water resources in the subregion

According to ESCAP (2001a), freshwater is often a limiting factor on the smaller Pacific islands, especially the low-lying atolls where it is either collected as rainwater in catchment tanks or taken from a thin layer of rainwater that floats on seawater within the sandy soil of the islets.

Because the rainwater rapidly filters down into loose, porous soils, most low-lying islands have no permanent surface water. A second, related, problem is that pollutants on the ground (faeces, urine, agricultural chemicals and solid waste residues) contaminate the water. Pumping from the water lens incorrectly or too quickly contaminates the water with the underlying saline water.

The larger, high islands have greater rainfall and surface water streams and rivers. Because of the mountainous nature of the high islands and their steep slopes, rivers tend to be short and rapid. Droughts quickly lead to water shortages. Most high island countries, including Samoa, Fiji, Papua New Guinea, the Solomon Islands and New Caledonia, have built dams to create reservoirs for drinking water and hydroelectric power generation.

Water resources assessment and monitoring has two aspects: (a) avoiding destruction of the thin water lenses of atoll islands; and (b) monitoring freshwater for pollutants.

Note the distinction made between the small islands and other islands and areas. Note also that the measurement of the quantity and quality of water resources is proposed as a key environmental indicator, “because of the ease of measurement and its sensitivity as an indicator for sustainability” in the subregion. This would apply more to surface water than to groundwater, which is not always easy to measure.

A. Small island groundwater supplies

Assessment of the water resources for small, flat islands and atolls involves defining and measuring dynamic movements of rainwater through catchment systems and groundwater storage areas. Assessments include:

(a) Physical parameters

- The size, shape, and topography of the island, derived from aerial photographs, topographic maps, and field surveys.
- Subsurface geology.
- The volume and rate of rainfall measured by rain gauges.
- Recharge rates calculated from a wide range of environmental data.
- Volumes of water storage areas in tanks and in the ground.
- Losses to the system through mixing with seawater and evapo-transpiration.
- Vegetation cover.
- Tide range and sea level.

(b) Delivery parameters

- Potential sustainable extraction rates.
- Size and distribution of population.
- Availability of building materials, pumps and spare parts.

(c) Economic parameters

- Costs associated with treatment and delivery of the water.
- Economic capacity of the target population to pay for water services (income, household expenses and employment).
- Competition from free water sources (even when polluted).
- Government income from foreign aid or other activities, used to subsidize water delivery.
- Government institutional efficiency and capability.

(d) Social parameters

- Conditions of health and water quality (parasites, diseases, poisons, salinity, chlorine content and cost of health care for waterborne diseases).
- Population growth versus ability to expand water supply.
- Pollution of the water lens through poor sanitation, animal wastes, fertilizers and pesticides.
- Maintenance of water supply system, detection and repairs of leaks.
- Dependency versus self-actualisation of the people.

B. Large island surface water assessment and monitoring

Assessment of surface water is important for drinking water supplies, for monitoring agricultural, forestry, industrial and mining activities, and for determining the impact of these activities on nearshore fisheries resources.

Because of the ease of measurement and its sensitivity as an indicator of sustainable resource use, assessment and monitoring of surface water should be a primary tool in the Pacific islands. Systems for community involvement in stream and river assessment are now well developed and in wide use in Australia and the United States. Thousands of volunteer groups, including school children – even primary school children – conduct scientifically useful water quality tests. In Australia, this information is compiled by States and nationally into one of the best environmental information networks in the world. The parameters measured vary depending on the nature of the water body – streams, rivers, lakes, wetlands or estuaries. In general, however, they include:

(a) Physical parameters

- Watershed map derived from topographic maps, aerial photographs and ground surveys.
- Detailed map and physical description of station locations.
- Substrate observations.
- Flow rates.
- Water colour.
- Smell.
- Turbidity.
- Acidity.
- Nitrates/nitrites.
- Phosphates.
- Biochemical oxygen demand (BOD).

(b) Biological parameters

- Invertebrate fauna index of water quality (the most common parameter measured as it provides comparable information, even internationally, on long-term water quality of a stream, river or lake).
- Algae (species and distribution).
- Fish (more difficult to measure consistently without poisons or electric shock equipment).
- Vegetation along the banks of the river.
- Coliform bacteria and viral contamination of the waterway.
- Invasion by introduced plants and animals.

(c) Socio-economic parameters

- Pipes entering the water.
- Zones of activity on or adjacent to the water body (agriculture, forestry, urban, industrial, residential, construction, parkland etc.).
- Recreational uses of the waterway and its shores.
- Commercial uses (fishing, tourism or water cooling of power plants).
- Use of water for bathing or drinking.
- Land values adjacent to the waterway.
- Dredging and filling activities.

Annex IV. Recommendations of the Kiribati case study

The most critical need for attaining sustainable development of water resources in the South Pacific region is improvement of the way water-related officials form partnerships with the community for the assessment and management of water resources (Economic and Social Commission for Asia and the Pacific, 2001a).

ESCAP has the opportunity to assist member countries by developing water resource management training materials to train government workers in:

(a) Sound principles of team management and interagency relations;

(b) Understanding the value and process of setting up volunteer programmes to involve communities in:

- Collecting water quality data on groundwater including salinity by using hydrometers, chlorinity, odour, pan evaporation, rainfall, solid wastes in wells etc. In the case of surface water, the accepted parameters are those of GREEN or Waterwatch;
- Identifying the location of water leaks, and repairing household and building above-ground leaks;
- Quantifying water use from wells and water tanks;
- Identification, quantification, and reduction of non-point source pollutants;
- Developing village-level public awareness programmes on water conservation;
- Tree and garden planning to minimize erosion and reduce transpiration from key recharge areas;
- Regular clean-ups and maintenance of wells, water distribution systems and sanitation systems; and
- Regular clean-ups of non-point pollutants, litter and control of livestock to minimize water lens contamination.

(c) Facilitating meetings and workshops, and related public communication skills;

(d) Establishing a volunteer monitoring support team;

(e) Creating and conducting a volunteer training programme that teaches the volunteers about their local ecological conditions, the project's objectives and the methodologies;

(f) Helping volunteer groups develop a clear purpose for their studies (for example, establishing networks that actually want and will use their data such as a national SOE programme or the international GREEN programme;

(g) Working with volunteer groups to set and meet clearly defined data quality objectives;

(h) Preparation of a quality assurance project plan;

(i) Effectively rewarding volunteer efforts;

(j) Providing a system to use the data collected by the volunteers in a way that the volunteers (and the community) will understand and appreciate; and

(k) Building the capacity of government personnel in the interpretation and use of assessment and monitoring information for economic decision-making.

This training course should utilize computer-aided teaching methods in association with training workshops conducted by professionals (government or corporate) with experience in volunteer monitoring.

Annex V. Issues identified by the South Pacific Applied Geoscience Commission for its further development

In addition to areas of technical need, i.e., water resources assessment, water demand management and conservation, sanitation and wastewater management, and hygiene and awareness promotion, SOPAC will focus on:

(a) National policy and legislation advice

(b) Non-governmental organization consultations, coordination and technical support

(c) Regional representation, coordination, and a resource and information centre

These seven strategic areas will be addressed by integrating the responses detailed below in a holistic approach to sustainable water resources and sanitation management in the Pacific.

(a) At the national government level, SOPAC WRU will identify existing national water policies, where operative, and discuss with the countries their plans for enhancement, improvement or development. SOPAC will support national governments in identifying and designing appropriate proposals for funding from major donors (the Asian Development Bank, the World Bank, the European Union Commission, Ausaid, and New Zealand Official Development Assistance);

(b) Interventions will be designed to increase sustainable capacity in the country. This will include: training on data collection, capture and storage, interpretation and decision-making, use of identified problems as on-the-job training opportunities while providing technical solutions;

(c) Community-level involvement of governments and regional organizations is logistically difficult. SOPAC will identify non-governmental organizations in the region with whom collaboration can be achieved in identifying and implementing rural and peri-urban programmes of intervention at the lowest possible level;

(d) Many of the interventions will be pilot projects that can be replicated in the region. Dissemination of this information to other communities and countries in the region is a vital. Workshops on priority issues, report distribution and the maintenance of SOPAC web sites will be continual activities; and

(e) Regional initiatives require close liaison and collaboration with the other regional agencies, notably the South Pacific Regional Environment Programme, the South Pacific Commission, the World Health Organization, the World Meteorological Organization, the United Nations Educational, Scientific and Cultural Organization, Ausaid, New Zealand Official Development Assistance, the National Institute of Water and Atmospheric Research of New Zealand and the Pacific Water Association. The objectives will be to prevent duplication of work programmes, optimize interventions and maximize available donor support.

Annex VI. Small Island Water Information Network

The Small Island Water Information Network organized a regional workshop for the South Pacific on Fiji from 5 to 6 February 1997. The workshop was attended by water professionals from the Cook Islands, Niue, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu, Samoa, American Samoa, Fiji and Hawaii. They produced the following recommendations:

(a) Financial

- Data are needed on the economic value of water provided to various clients, i.e., industry, domestic, agriculture and recreation.
- Charging mechanisms need to be put in place that will reflect the true cost of developed water.
- Proper billing procedures need to be developed to properly account for water usage.
- Customer service has to be improved to bring it into line with the increased costs for services provided.
- Equipment and spare parts management also needs attention, with the development of lists of potential suppliers being an important part of the management system.
- Information is required on the potential agendas of donor agencies to enable project proposals to coincide with their priorities.

(b) Institutional

- Public awareness campaigns need to be developed for educating water users on the proper usage of water.
- Management of information needs to be prioritized.
- Training and certification programmes for technicians should be developed as part of the capacity-building process.
- Standards, performance and efficiency targets need to be developed to enable monitoring to be effectively carried out.
- A system for skills sharing will enable islands to obtain required skills from participating members of the network.

(c) Operational

- Regional standards for water quality and waste treatment are required.
- Specifications are required for equipment and model contracts.
- A system to determine the effectiveness of leak detection programmes is necessary.
- Demand management is required.

(d) Technical – supply

- Potential for, and costs of alternative water supply options need to be elaborated.
- Exploitation of freshwater lenses.
- Use of shallow groundwater as well as wastewater for agriculture.
- Roof catchments and runway systems.
- Desalination.
- Small-scale pumping including hand-pumps.
- Dual supply options.

(e) Construction

- Water well design.
- Network design (including software).
- Drilling techniques, training for drillers.
- Rehabilitation of wells plus community maintenance.

(f) Quality

- Potential for, and costs of alternative sewage systems need to be elaborated.
- The effect of waste disposal on water quality analysis needs to be considered.
- Linkages are required between natural environments and health.