H. STRATEGIC PLAN ON INTEGRATED WATER RESOURCES MANAGEMENT IN MYANMAR

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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.

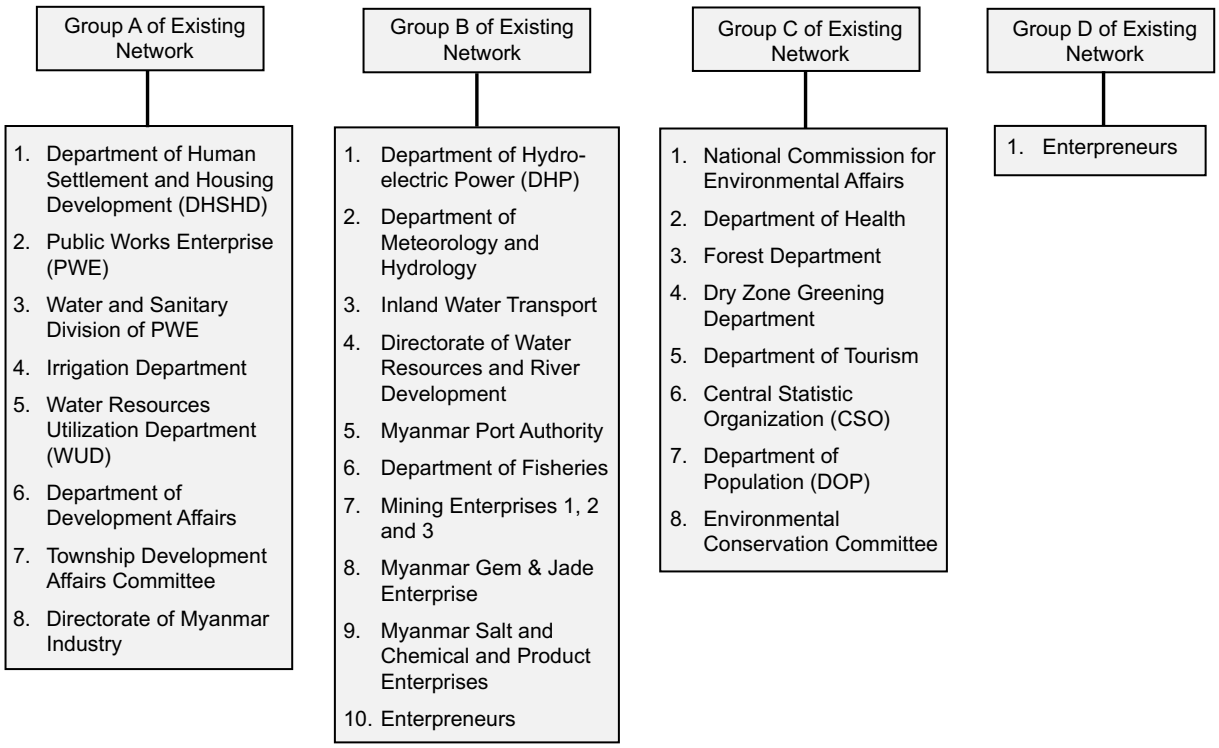
Another achievement during the past three years has been the effort by the Department of Development Affairs to sink tube wells for community development in rural areas, financed by public donations. The cost of sinking tube wells for drinking and domestic water supply amounts so far to K 691.94 million 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