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Ministry of Water Resources & Irrigation
Planning Sector

*Towards Rationalization of Water Resources
Management in Egypt*

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Towards rationalization of Water resources Management in Egypt

1 Introduction.

While measures towards water resources management in Egypt are visible, still they are not adequate to address the key water sector challenges facing the country. These challenges can be grouped in the following:

- Deterioration of water quality.
- Growing demand-supply gap.
- Intensification of inter-sectoral and inter-regional waters allocation problems.
- Inadequacy of governmental investments.
- Poor cost recovery and operational performance.
- Excessive government involvement and bureaucratic control.

These challenges and weaknesses require a strong emphasis on improving the management of water resource based on well prepared policies and strengthened institutional arrangements. Water policies, in this respect, should be prepared within the context of integrated framework. This framework takes into account the interdependencies among sectors and protects aquatic ecosystems. It also helps in establishing improved coordination among institutions, consistent regulations, and sound policies. The integrated framework will improve the efficiency in water management through greater reliance on decentralization, user participation and privatization.

On the other hand, an institutional reform program should be created to facilitate cross-sectoral actions to improve management of water resources. Institutional reform should rely on legislation that ensures that regulations are coordinated and enforced as necessary components of this reform.

This paper is prepared to highlight some of the measures, MWRI is taken towards the required management changes. Section 2 of the paper gives a brief review of the concept of integrated water resources management. The following sections are devoted to present the Egyptian experience with respect to management changes of the water resources that improve and lead to the integrated management of the resource

2 Integrated Water Management: Demand management.

Water management strategies have always focused on developing new supplies to satisfy the ever-increasing demands from all sectors and on building infrastructure to convey and distribute these supplies to different users. Till recently, very little

attention was given to reduce the demand or to improve the water quality. Now, and particularly in Egypt, almost all the supplies have been developed. Demand and quality management evolved as the complementary solutions to solve the problem. Demand management seeks to optimize the allocation of available water at any particular time to the competing user groups. Quality management seeks to maintain the usability of the resource by controlling pollution. Environmental protection has become the focus of water management in many countries. However, preserving the ecology of the water resources system should not prevent its development for the benefit of other sectors. A compromise can easily be reached if the spirit of cooperation prevails during the planning and management activities.

Egypt's newly developed water resources management strategies have become more integrated in the sense of looking at the water scarcity from all its different sides. Current policies of water resources management looks at the whole set of technical, institutional, managerial, legal, and operational activities required to plan, develop, operate, and manage the water resources system on both the national and local scales while considering all the sectors of the economy that depend on water. Sustainability is one of the major objectives of these policies in the sense that the utilization of resources by future generations should not be limited by the use of current generations in any way. Suggested projects and programs do not necessarily have to serve only one sector. Conversely, by better understanding the system and better cooperation between all stakeholders, projects can be multi-purpose; it can serve reclaim new lands, build new communities and industries and generate hydropower for these activities while conserving the ecological system for both humans and habitats.

One of the fundamentals of integrated water resources management is the involvement of all stakeholders as much as possible in the various management activities. As water is essential to all forms of life and prosperity, competition for water among users is already escalating as growing needs outstrip the limited resources. The objective should be to transform the competition between stakeholders into a form of cooperation that achieves the largest overall revenue with the least sectoral harm.

MWRI can no longer singly assess the resource, match supply to projected demand and finance, design, build and operate water resources systems. Decisions must be made on the best use of water by evaluating the economic, social and environmental costs and benefits of alternatives. As a prerequisite, these alternatives should be first considered fair when negotiated with stakeholders, which are continuously kept well informed about opportunities, limitations and viable trade-offs, including quality considerations. Accordingly, it is important to build a good partnership between water managers and a well-informed public as conflicts increase. Beyond the expectation of optimized benefits, this collaborative approach to water resources development is also considered to be more acceptable to the public.

Fortunately, the demands of most sectors are not absolute, but amenable to management, which should aim at optimizing the return from the various allocations under the expected conditions of scarcity. In this respect, non-engineering demand-oriented measures, such as inter-sectoral collaboration, building public awareness and

economic incentives will have an important role in order to match demand with available supply.

Demand-oriented approach looks at the real demand for water and tries to urge the users to make better use of water. This can be achieved by creating awareness among the users that the resource is precious for example by letting them pay for it, or pay the costs to treat and deliver it.

Over the agricultural, the industrial, and the municipal sectors, the technical/structural demand-oriented measures to save water include:

- Deficit Irrigation
- The application of modern irrigation technologies
- Structural improvement of irrigation systems and public water supply systems
- Weed control in irrigation/drainage channels
- The introduction of low in-house water using appliances
- Wastewater treatment
- Drainage reuse
- Groundwater abstraction
- Building small reservoirs for night irrigation
- Improving the irrigation distribution/conveyance efficiency
- Leakage detection and repair in the public water supply system

Institutional measures include public awareness programs for water conservation and environment protection, user participation in O&M, and role of water users' associations. The legal/economic measures (or the so called; implementation incentives) in the agricultural sector include:

- Crop-specific land taxes (e.g. for rice & sugarcane). This can be based on a per-cubic meter of water land tax (using the estimation of water duty of the cultivated crop, and the estimation of water value). It can be applied only for area violations, or for the entire area.
- Crop production charges (per ton). Also can be applied only for area violations, or for the entire area
- Volumetric water pricing (by metering at the tertiary canal level).
- Regulation of the farmers' quota (such a regulation should be extended up to the distributary's level at which farmers need to economize on water use).
- Effluent fees (only applicable at the agricultural drainage point sources, by estimating/metering the effluent load).
- Subsidies (or price flooring) of market-farm-gate prices of the less water intensive crops (e.g. maize).
- Taxes (or price ceiling) on market-farm-gate prices of the water intensive crops (e.g. rice & sugarcane)
- Release constraints on the volume of rice imports (e.g. through releasing import taxes).

- Taxes on farm inputs of water intensive crops and/or subsidies for farm inputs of less water intensive crops.
- Taxes (or at least release subsidies on) on the pesticides/fertilizers that mostly pollute the agricultural drainage.
- Subsidies for equipment and material needed by farmers to line up their canals beyond the tertiary canal level.

In the municipal sector, the applicable "implementation incentives" include:

- A per dwelling water-tariff (metering only up to the dwelling level) then adjusted for each household based on; 1) number of rooms, 2) size of family, or 3) hedonic (property) value (as a fair indicator on the householder income).
- A per household water-tariff (through a meter in each household).
- Subsidies for low water using in-house devices.

In the industrial sector, the applicable "implementation incentives" include:

- Effluent charges based on concentrations in the outlet (sewer or drain). These charges have to be coupled with metering the water-intake of the firm otherwise the firm will use more water to dilute the effluent.
- Effluent charges based on the effluent load. These will provide a dual-function incentive. The firm will favor internal reuse/treatment not only to improve the quality of the effluent but also to economize on water use at the intake.
- Subsidize firms on internal reuse/treatment facilities.
- Product charges for specified firms/outputs based on their pollution impact and/or their water usage.
- Tax the polluting input materials used by the firm, and/or subsidize the non-polluting inputs that can substitute the polluting ones.
- Regulation of the water quota to industries
- Effluent permits; 1) through regulation on effluent load, or 2) through tradable effluent permits (pollution certificates).

These measures could contribute to improving the irrigation system efficiency. A clear distinction has to be made between the economic efficiency and the technical efficiency. Economic efficiency means to produce maximum economic benefits for a given amount of water. Technical efficiency means to produce the maximum yield using the same amount of water. Actually, if the system reaches the point where the process is technically efficient, it need not be economically efficient.

3 Egypt's Experience.

In recent years, there has been a major shift towards a market driven economy. To move to this type of economy, Egypt has endorsed privatization, which means less government involvement in terms of subsidies, expenditures, administration, etc. Essential elements in the policy are the control role of the private sector, human

resources development, the transition to an information based community, conservation of the environment in general and in particular the promotion of water conservation. Water conservation is considered to play an essential role in the development of the country's natural resources and should include water use at home, irrigated agriculture and in the industry.

To insure more effective management of water resources and more efficient water use, the MWRI has adopted a policy to increase the participation of water users in water management and in operation and maintenance of the irrigation and drainage system.

The success of water users participation depends on setting the proper institutional structure, clarifying relations with existing authorities as well as other users organizations and issuing the necessary legal regulations. MWRI realized the importance of adopting privatization process in water management where several initiatives were implemented to pave the road for this approach. The following are the brief description of the main initiatives related to privatization in MWRI

3-1 Increase Egypt's Share of the Nile Water.

3-1-1 Nile Basin Challenges and Opportunities

The Nile River is shared by ten countries: Burundi, Democratic Republic of Congo (DRC), Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. The river serves as home to world-class environmental assets, such as Lake Victoria (the second largest fresh water body by area in the world) and the vast wetlands of the Sudd. It also serves as home to an estimated 160 million people within the boundaries of the Basin, while about twice that number - roughly 300 million - live within the ten countries that share and depend on Nile waters.

Generally, rivers and their associated ecosystems and biological diversity provide life support for a high proportion of the world's population. Worldwide, poor management of land and water resources in many river basins has led to major floods, water shortages, pollution, and loss of biodiversity.

Despite the extraordinary natural endowments and rich cultural history of the Nile Basin, its people face considerable challenges. Today, the Basin is characterized by poverty, instability, rapid population growth, and environmental degradation. Four of the Nile riparian countries are among the world's ten poorest, with per capita incomes in the range of USD 100-200 per year. Population is expected to double within the next 25 years, placing additional strain on scarce water and other natural resources. It is interesting to note that only one other river basin (the Danube) is shared by more countries than the Nile, and the transboundary nature of the river poses complex challenges. Yet the Nile holds significant opportunities for 'win-win' development that could enhance food production, energy availability, transportation, industrial development, environmental conservation, and other related development activities in the region.

The future will bring opportunities as well as serious challenges. One of which is climate change. The 1995 report of the Intergovernmental Panel on Climate Change came to the conclusion that, as a result of man's interventions in the biosphere, the climate of the earth will change considerably over the next 100 years, with important consequences for man. The consequences of these climatic changes will be felt through impacts on human health, agriculture, forests, coastal zones and species and natural areas. Intimately linked to all of the above will be changes in the distribution and quality of the earth's water resources.

3-1-2 Evolution of cooperation in the Nile Basin

Cooperation started in the form of bilateral agreements since the beginning of this century, however, countries of the Nile Basin have been engaged in regional cooperative activities over the past thirty years. One of the early regional projects in the Nile Basin was Hydromet, which was launched in 1967, with the support of UNDP. Followed by the Technical Cooperation Committee for the Promotion of the Development and Environmental Protection of the Nile Basin (TECCONILE) started by 1993, which was formed in an effort to focus on a development agenda. Also in 1993, the first in a series of ten Nile 2002 Conferences commenced with the support of CIDA. In 1998, recognizing that cooperative development holds the greatest prospects of bringing mutual benefits to the region, all riparian, except Eritrea, joined in a dialogue to create a regional partnership to facilitate the common pursuit of sustainable development and management of Nile waters. The transitional mechanism was officially launched in February 1999 in Dar es Salaam, Tanzania by the Council of Ministers of Water Affairs of the Nile Basin States under the title of NBI.

3-1-3 NBI Vision and Actions

The shared vision of the Nile Basin Initiative is:

"To achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources."

To translate the Shared Vision into action, the riparian has developed a *Strategic Action Program* that focuses on two complementary ideas - *a shared vision* and *action on the ground*. The ideas are mutually reinforcing. A common vision provides a framework for activities on the ground, and, in turn, these activities realize the vision. These ideas are being translated into actions through two complementary programs: (i) a basin-wide Shared Vision Program (SVP) to create an 'enabling environment' for cooperative action through building trust and skill, and (ii) Subsidiary Action Programs (SAP) to plan and implement investments and activities 'on the ground' at the lowest appropriate level, taking into account the benefits from, and impacts of, these activities in all riparian countries.

3-1-4 The International Consortium for Cooperation on the Nile

The first meeting of the International Consortium for Cooperation on the Nile (ICCON), took place from June 26-28, 2001, in Geneva, Switzerland, to celebrate cooperation between the ten countries of the Nile Basin and to establish partnerships that will lead to sustainable development and management of the River Nile for the benefit of all. The ICCON meeting was a major milestone for the Nile Basin Initiative. The meeting, for the first time, brought together Ministers and senior officials from Nile basin countries with broad range of bilateral and multilateral donors and other interested parties, such as civil society, professional organizations, media and NGOs. The meeting also offered an avenue for raising and coordinating funding from a variety of sources. As a first step, around 140 Million US Dollars was raised to support both programs of SVP and SAP for the Basin.

85% of the Nile water originates from the Ethiopian highlands through the Sobat River, the Blue Nile River, and the Atbara River. The reminder originates from the Equatorial Lakes Plateau through Bahr El-Ghabal. A very small portion comes from western Sudan through Bahr El-Ghazal. Egypt's share of the Nile's water was fixed at 55.5 BCM/year by the Nile water treaty. Studies showed that a large amount of the Nile water is lost before it reaches Aswan, therefore, there is a modest potential to decrease these losses through implementing joint projects with other countries in the Nile basin. Three projects had been identified, namely Jongli Canal, Bahr El-Ghazal project, and Mashar Marshes Project, that would add about 9 BCM/year to Egypt's share of Nile water. However, the MWRI does not depend on these projects, as they will be implemented outside the borders of the country and requires great efforts in political negotiation and cooperation between Nile countries. In addition, these projects will be facing the protest of changing the ecological system of the Nile basin, which can have a high vote against such projects at donor countries.

3-2 The Use of Non-Conventional Water Resources.

It is obvious from the former discussion that the river Nile is the main source of fresh water in Egypt that can be used for sustainable development. However, there exist other sources of water that can be used to meet part of the water requirements. These kinds of sources are called non-conventional sources, which include:

- The renewable groundwater aquifer in the Nile basin and Delta
- The reuse of agricultural drainage water
- The reuse of treated sewage water

It is worth mentioning that these water sources cannot be considered independent resources and cannot be added to Egypt's fresh water resources. In fact, using these sources is a recycling process of the previously used Nile fresh water in such a way that improves the overall efficiency of the water distribution system. The level of improvement of the overall efficiency depends on the amount and number of recycling times of the water. Furthermore, these kinds of sources should be used and managed with care and its environmental impacts must be evaluated to avoid any deterioration in either water or soil quality.

3-2-1 Ground Water Development Strategies.

The groundwater policy aims to encourage agricultural development of desert areas. These areas will be the basis for initiating new communities that can absorb part of the highly concentrated population in the Nile valley and Delta. Such approach will increase the future demands for groundwater, which consequently will necessitate continuous monitoring and evaluation of the groundwater aquifers to avoid any possible deterioration in these aquifers due to misuse. Groundwater strategies depend on the type of the aquifer, whether it is renewable, as the aquifer underlying the Nile valley and Delta Region, or non-renewable as the aquifers of the Western Desert and Sinai.

- *The Renewable Aquifer underlying the Nile valley and Delta*

The groundwater in the Nile valley and Delta region cannot be considered an independent resource as it gets recharged only from seepage losses from the Nile main river, canal and drainage networks, and from deep percolation losses of irrigated lands. The strategy of groundwater depends on the conjunctive use of Nile surface and groundwater through:

- Utilizing the aquifer as a storage reservoir is used to supplement surface water supply during peak periods and recharged during the minimum demand periods.
- Use of modern irrigation methods in the new lands (sprinkler or trickle) that uses groundwater as the source of water to prevent water logging and keep the groundwater table far from the root zone.
- Use the vertical wells drainage system in Upper Egypt to prevent the groundwater table from reaching the root zone avoiding water logging and increasing productivity.
- Groundwater could be used as a source of water for artificial fish fields as it has consistent and steady temperature and good quality.
- Augment the canal water supply by pumping groundwater pumped from low capacity private wells at tail ends of long mesqas where water shortage is experienced.

- *Groundwater Aquifers in Western Desert and Sinai*

Groundwater occurs in at great depths and needs large investments to be utilized; therefore, future strategies for groundwater utilization in the Western desert and Sinai include:

- Use of the modern technologies for determining the main characteristics of each aquifer, its maximum capacity and safe yield. This data should be the basic criteria for selecting the most suitable projects that could use such aquifers as a sustainable source of water.
- New small communities (2000 to 5000 feddans) in the desert areas should be designed to utilize all the available natural resources through integrated planning.
- Use of non-conventional sources of energy (solar and wind energy) to minimize the costs of pumping.

- Use of the new technologies for farm irrigation in desert areas to minimize field losses especially deep percolation due to the high porosity of such soils.

3-2-2 Reuse of Agriculture Drainage Water.

MWRI is considering drainage water reuse as a main source to meet part of the irrigation water demands. The reuse of drainage water increases the overall efficiency of the water system but it must be regulated to prevent any future environmental impacts due to such use. Future strategies for drainage water reuse include the following measures:

- Increase the amount of drainage water reuse from about 4.5 BCM/year to 7.0 BCM/year by year 2000 and to 9.0 BCM/year by year 2017 with average salinity of 1170 ppm. This could be achieved through implementing several projects to expand the reuse capacity at different areas. Main future projects include El-Salam canal project, El-Omoom drain project, and El-Batts drain project.
- Improve the quality of drainage water especially in the main drains that are included in the ministry's plan of drainage water reuse. It is recommended to implement a series of small treatment plants on secondary drains or at the locations of the reuse pump stations.
- Separate sewage and industrial wastewater collection systems from the drainage system.
- About 50% of the total generated drainage water in the delta should be drained to the sea to prevent seawater intrusion, and to maintain the salt balance of the system.
- Implement an integrated information system for water quality monitoring in drains using the existing data collection network after updating and upgrading.
- Continuous monitoring and evaluation of the environmental impacts due to the implementation of drainage water reuse policy specially on soil characteristics, cultivated crops, and health conditions.

3-2-3 Reuse of Sewage Water.

One way of augmenting irrigation water resources is the reuse of treated domestic wastewater being used for irrigation with or without blending with fresh water. The increasing demands for domestic water due to population growth and improvement in the life standards and the growing use of water in the industrial sector due to the future expansion in the Egyptian industry will increase the total amount of wastewater available for reuse.

An agricultural project was implemented to northeast of Cairo to use primary treated wastewater in irrigating about 2500 feddans as early as 1915. Currently, it is estimated that the total quantity of reused treated wastewater in Egypt is about 0.7

BCM in 1995/96 of which 0.26 BCM is secondarily treated while the rest (0.437 BCM) is only primarily treated.

Wastewater treatment could become an important source of water reuse and should be considered in any new water resources development policy but proper attention must be taken for the associated issues with such reuse. The major issues associated with treated wastewater reuse include public health and environmental hazards, as well as, technical, institutional, socio-cultural and sustainability aspects.

The MWRI future policy for utilization of such source could be summarized in the following:

- Increase the amount of secondarily treated wastewater use from 0.26 BCM/year to 2.8 BCM/year by year 2001 and to 4.5 BCM/year by year 2017.
- Limit the use of treated wastewater to cultivate non-food crops like cotton, flax, and trees.
- Separate industrial wastewater from domestic sewage, so that it would be easier to treat domestic sewage with minor costs and avoid the intensive chemical treatment needed for industrial wastewater.

3-2-4 Harvesting Rain and Torrent Water.

Studies indicate the possibility to conserve about 2.0 BCM/year from flash floods. MWRI put the flash flood on the top priorities of the national agenda, because of its economical and social hazards. The ministry future strategies for flash flood risk assessment and utilization considers the following:

- Use of modern technologies in remote sensing and GIS to study the basic characteristics of the stream network that contribute in flash floods.
- Adjust High Aswan Dam daily releases should be based on the climatological conditions, i.e. reduce release in the occurrence of flash floods over a certain area that drains its water to the Nile River.
- Avoid hazards from flash floods by implementing risk zone maps for major bottlenecks on the basin streamlines and identifying areas that lie in risk zones to take proper precautions to avoid any possible hazards.

3-2-5 Desalination.

- *Desalination of Sea Water*

Desalination of seawater in Egypt has been given low priority as a source of water. That is because the cost of treating seawater is high compared with other sources, even the unconventional sources such as drainage reuse. The average cost of desalination of one cubic meter seawater ranges between 3 to 7 L.E. In spite of this, sometimes it is feasible to use this method to provide domestic water especially at remote areas where the cost of constructing pipelines to transfer Nile water is relatively high.

Egypt has about 2,400 km of shorelines on both the Red Sea and the Mediterranean Sea. Therefore, desalination can be used as a sustainable water resource for domestic uses in many locations. This is actually practiced in the Red Sea coastal area to supply tourism villages and resorts with adequate domestic water supply where the economic value of the unit of water is high enough to cover the costs of desalination.

The future use of such resource for other purposes (agriculture and industry) will largely depend on the rate of improvement in the technologies used for desalination and the cost of needed power. If solar and wind energy can be utilized as the source of power, desalination can become economic for other uses. It may be crucial to use such resource in the future if the growth of the demand for water exceeds all other available water resources. Nevertheless, brackish groundwater having a salinity of about 10,000 ppm can be desalinated at a reasonable cost providing a possible potential for desalinated water use in agriculture.

- *Desalination of Brackish water*

The MWRI is looking for the utilization of the low salinity brackish groundwater in irrigating certain seasonal crops. This water is available at shallow depths in the Western and Eastern Deserts and at the borders of the Nile valley. The average salinity of such water varies from 3000 to 12000 ppm. The ministry future strategy in that regard takes the following into consideration:

- This source of water can be considered an independent resource that can be used as a supplementary water supply source to meet part of the water demands in Desert areas especially near to the northern shoreline. The level of treatment of this water will depend on the type of use whether it will be for municipal or agriculture. This water could be used with minor treatment to irrigate certain perennial or seasonal crops.
- Non-conventional sources of energy, e.g. solar and wind energies, would be used in the treatment process to minimize the cost and increase its economic value.
- This source will be used as a supplementary source to rainfall water to increase land productivity by cultivating two crops per year instead of one.

3-3 Public Awareness.

The MWRI is responsible for managing major activities that are directly linked to the social and economical development. These activities include operation and maintenance of irrigation and drainage networks, implementation of basic infrastructure and pump stations for new agricultural lands as well as survey works for horizontal expansion and other development projects. In addition, the ministry is responsible for making all studies and research in the fields of water resources through the National Water Resources Center (NWRC) and its twelve institutes. Moreover, the ministry, through the Nile Water Authority, coordinates with other Nile basin countries to secure Egypt's rights to Nile water.

However, these important responsibilities are not well known to the public. Therefore, the ministry launched a public awareness program to inform citizens with the importance of water resources role in the development plans and to invite water users to positively participate in the decision making process. This will help improve the performance of the ministry while conserving its water and financial resources. Meanwhile, it will enhance the public acceptance of the ministry's policy as they have participated in its formulation. The main objectives of this public awareness program are:

- Informing the public, through media, with the role of the MWRI in water management, its major achievements in that field, and proposed and nearly accomplished projects.
- Propagating the significance of water saving in irrigation and domestic uses by demonstrating water saving consequences to people, thus, advocating a new culture of water saving among the whole society.
- Popularizing new water saving techniques
- Demonstrating, through media and in the parliament, a simplified version of the water resources policies and its associated strategies and MWRI future plans to execute these policies, so that people get aware about what the MWRI is aiming to do.
- Achieving public participation and commitment to water policies and programs. Increasing the knowledge of people about new technologies in farm irrigation, and domestic uses to conserve water for future development.
- Increasing the awareness of the environmental issues related to water resources utilization.

To achieve the above-mentioned objectives and to support other MWRI policies, the following framework for media publicity strategies has been outlined:

- Propagate water resources issues and challenges and promote users' participation in the decision making process to secure transparency and accountability.
- Propagate environmental issues related to water resources utilization and future impacts that might result from specific patterns of water use.

- Highlight and promote promising and successful experiments for water conservation to encourage repetition of such models by other users.
- Encourage any positive recommendations that come from water users concerning better management of water resources by expanding users participation in the decision making process.
- Demonstrate and highlight the consequences of misuse of available water resources and its future impacts on different sectors.
- Encourage research activities that aim to close the gap between planning and application in the water resources sector by defining and highlighting the real problems facing water resources' end-users and motivating certain patterns of water use.

3-4 Stakeholder Participation.

Given the long history of irrigated agriculture in Egypt, a number of traditional forms of farmer participation provide a good background for formal participation of private sector in water management. Major informal forms of participation include the "munawba and motarafa" system and the "saqia" ring for collective pumping of water. The participation of stakeholders in water management have been developed over the past decade to allow more cooperation and coordination between the different stakeholders and the MWRI in the water management process to achieve maximum utilization for the available resources.

3-4-1 The National Water Resources Plan (NWRP).

The National Water Resources Plan will have to consider all components of Egypt's water resources system and all functions and water using sectors involved. Therefore, one of the essential elements in developing the plan is to create the necessary co-ordination mechanisms to develop consensus on the objectives and implementation of the NWRP between all stakeholders involved in the development and use of Egypt's water resources, both governmental (ministries, regional authorities) and non-governmental (e.g. industry, water users organizations).

The development of a National Water Resources Plan (NWRP) means addressing many aspects of water related issues. Water demand and water pollution are the result of a wide variety of activities of the society. Dealing with these activities can only be effective in good cooperation. Because limitations have to be faced with respect to available resources (both physical and financial resources), not all demands of society can be fulfilled. In that case it is even more important to involve the stakeholders in the process leading to selection of a water management strategy. This involvement should warrant that all relevant interests are taken into account in a balanced way and is intended to create a broad acceptance of the resulting plan, at the end facilitating the implementation.

In the NWRP a distinction is made between different stakeholders based on their level of involvement in water resources planning:

- *Stakeholders at Central Government level:*

All ministries which have a responsibility with respect to the supply of water of sufficient quality or which have a specific task to represent the interests of categories of water users. In Egypt this means that in principle some 12- 14 ministries are involved.

- *Stakeholders at Regional Government level:*

These are the Governorates (26) and in each Governorate the elected Local Council, representing the population, and the Local Unit representing the ministries concerned.

- *Public and Private Water Users:*

1. Agriculture: farmers (sometimes organized in Water Users Associations or in Water -Boards) and fishermen: irrigation, drainage, desalination, environmental Issues;
2. Organizations responsible for providing drinking water and sanitation (General Authorities, Economic Authorities and Companies);
3. Industry (public and private): water supply, environmental issues;
4. Citizens: the public at large: awareness, drinking water and sanitation, leakage prevention.

At the Central Government level the stakeholder involvement in the development of the NWRP has been organized through the establishment of a number of committees. An Advisory or Steering Committee within the MWRI chaired by the First Under-Secretary to ensure the embedding of the process within the ministry responsible for development of the plan.

An Inter-Ministerial High Committee, chaired by the Minister of Water Resources and Irrigation. The members of the committee represent the most important ministries involved and are of sufficiently high level to be able to take decisions on water resources planning issues.

An Inter-Ministerial Technical Committee for Water Resources Planning, chaired by (the Head of the Planning Sector, MWRI. This committee consists of staff members of the Ministries represented in the High Committee, who are involved in water resources planning activities in their Ministry. This committee should prepare all proposals for the High Committee and be responsible for the actual co-operation between the Ministries.

3-4-2 Environmental Policy & Institutional Strengthening Indefinite Quantity Contract (EPIQ) Project

The management of water resources with the escalating population growth rates, a desire for agricultural expansion, and increasing demands on surface water supply put a great pressure on the MWRI in order to meet all these growing demands with the available limited water resources. Both MWRI and USAID are cognizant of the need to develop policy reform that will effectively address these and other issues that determine the utilization efficiency, productivity, and protection of water resources in Egypt. Through this project, the Ministry developed a "water resources results policy package" to produce four major results:

- Improved irrigation policy assessment and planning process
- Improved irrigation system management
- Improved private sector participation in policy change, and
- Improved capacity to manage the policy process

A water resources results package has been designed aiming at policy analysis and reforms to improve water use efficiency and productivity by Specific objectives as:

- To increase MWRI knowledge and capabilities to analyze and formulate strategies, policies and plans related to integrated water supply augmentation, conservation and utilization, and to the protection of the Nile water quality.
- To improve water allocation and distribution management policies for conservation water while maintaining farm income.
- To recover the capital cost of mesqa improvement, and to establish a policy for the recovery of operation and maintenance costs of the main system.
- To increase users' involvement in system operation and management
- To introduce a decentralized planning and decision making process at the irrigation district level.

APRP (agricultural policy Reform program) is a broad-based policy reform program involving five GOE ministries (Ministry of Agriculture and Land Reclamation (MALR), MWRI, Ministry of Trade and Supply (MOTS), Ministry of Public enterprise (MPE) and Ministry of International Cooperation, APRP has the goal of developing and implementing policy reform recommendations in support of private enterprise in agriculture and agribusiness. USAID supports the MWRI in five program activities under APRP. These five activities are:

- Water policy analyses.
- Water policy advisory unit
- Water education and communication, 4. Main systems management, and
- Nile River monitoring, forecasting and simulation

For the water policy analyses USAID supports the Ministry's efforts to achieve the following benchmark: "The GOE will develop a policy to allow the formation of water user associations in areas that have not participated in the Irrigation Improvement Program (IIP), and begin to promote such associations". In support of

this policy benchmark activity, a task to study the feasibility and popular interest in formation of water user organizations at the mesqa level was included in the EPIQ water Policy Reform Program project implementation plan.

3-4-3 Irrigation Improvement sector.

A package of demand-oriented measures have been prepared and applied to the Egyptian agricultural sector under the Irrigation Improvement Project (IIP). Research and field trials in pilot areas have been undertaken by the National Water Research Center (NWRC) and MWRI to improve the overall efficiency in the old lands. The Irrigation Improvement Project (IIP) comprises improving control structures, using modern methods in land leveling/tillage, on-farm development, rehabilitation of main and branch canals and most of all mesqas, promoting equity of water distribution, and attaining a form of cooperation between the irrigation directorate and farmers, by forming water users associations.

In a closed water system of conjunctive resources, such as in Egypt, improving the use efficiency in part of the system will generally not improve the overall efficiency as it reduces the amount of water available for reuse. However, there are many other impacts of the IIP on both local and national levels such as cost sharing and farmers' participation in the water management process.

Despite the fact that IIP is having a limited impact on the overall water use efficiency, it has various other benefits in the command areas where it has been applied. These benefits include:

- Increasing water distribution efficiency in most command areas by 30% to 40%.
- Reducing the costs of pump operations by 25 to 40 LE/feddan for one crop. Most of the cultivated area in Egypt is cropped twice a year, which means that total savings range between 50 and 80 LE/feddan each year-
- Reducing the time required to irrigate by 50% to 60% for each irrigation
- Reducing the number of working pumps on the mesqa from 10-30 pumps on the old mesqa to only 1-3 pumps on the improved mesqa, which helped reduce the annual maintenance costs for the mesqa.
- Attaining equity of water distribution among all the farmers on the mesqa eliminating the tail-end problem by using a single-point lifting at the head of the mesqa and letting farmers schedule irrigation among themselves. This was directly reflected in the improved productivity of all farmers.
- Eliminating direct pumping from secondary canals by nearby farmers as they have reliable continuous supply which had also reduced excessive irrigation that previously lead to water logging and drainage problems and thus the productivity increased.
- Transferring the new irrigation technologies to the farmers to see its real effect on their income. This encouraged farmers in other unimproved areas to look forward for this improvement and be willing to share in the costs.

- Participation with higher level organizations of the branch canal and cooperation with the district engineer.

3-4-4 The Water Boards

At the branch canal level, under the Dutch government aided program to Egypt, the water boards project has been formulated to develop an approach, which has a general validity to the diverse irrigation and drainage system in Egypt. The Fayoum Water Management Project's initiative to establish experimental "local Water Boards" at the Secondary Canal was quite successful and between 1995 and 1998 a total of 10 (ten) "local Water Boards" were established. Eight of these follow a "joint management" model, whereby users and Ministry staff (District Engineer) form the Board. These are established by Decree of the Under-Secretary of State for Fayoum of the MWRI. For the two remaining, the Board consists of users only and is formed under law 32/1964 on Private Organizations and Unions.

The positive outcome of this experiment first lead to the formulation of a project to expand the experiment beyond the Fayoum (the Water Boards Project) and secondly in expansion of the experiment to the level above the Secondary Canal during the third phase of the Fayoum Water Management Project.

The Water Boards Project was formulated to develop a viable national policy and legal framework for Water Board development. This is a clear indication that the Government of Egypt has decided that for the future the users need to be formally involved in water management. The limited impact of earlier experiments due to the absence of a legal framework for user organizations at secondary level and above has been duly recognized and this was included in the Terms of Reference of the Water Boards Project.

The Water Boards Project will base its recommendations for a national policy for participatory water management at the secondary level on existing experience and the establishment of 8 (eight) additional experimental "Water Boards" spread over the country. This combined experience will form the basis for the formulation recommendations for a national policy and a legal framework for user participation in water management at the secondary level.

In this context the Agricultural Policy Reform Program (APRP) has formulated two important benchmarks for the Ministry of Water Resources and Irrigation. One is the Benchmark No.5: "Revision of Law 12/1984 on Irrigation and Drainage", and the other one is Benchmark No.4 "Irrigation Management Transfer". These Benchmarks are implemented in the MWRI with the assistance of the Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIC). Benchmark No.5 is scheduled over a two-year period and would result in a law that recognizes Water Boards as user organizations for water management at the Secondary Canal level and above. By-laws for this revised Law 12 will include the detail of Water Boards. Benchmark No.4 is an experiment to expand the concepts of participation and privatization in the water sector even further.

- Most of all, transferring new spirit of cooperation between farmers with the introduction, of water user associations.

Water users' associations that were established under the irrigation improvement project serve as an excellent example of the effect of user involvement and cooperation on the system management. Although all the users here are farmers who belong to the same economical sector, it is the concept of stakeholder involvement in decision making during the various stages of planning and implementation, which is emphasized. When the user is involved from an early stage, it is evident that he will accept the proposed improvements and will be able to operate and maintain them easily afterwards. Moreover, they resolve conflicts between themselves automatically as they have to share a common resource.

In order to achieve the user involvement objective, a department for water advisory service was established under the irrigation improvement sector. The main functions of this department are:

- To help farmers and irrigators by information and illustration to setup the association.
- To help in all the stages of planning, design, construction, operation, and maintenance of the improved mesqa.
- To help transfer the management of the mesqa to farmers and help them resolve conflicts and problems.
- To provide farmers with new technologies such as laser leveling of fields, and new water distribution gates.
- To encourage farmers to develop better links with agricultural production agencies such as the agricultural extension service, the agricultural investment bank, agricultural cooperatives, irrigation and drainage districts, pump maintenance companies, and the local authorities.

The success of the project in forming water users' associations forced the parliament to issue a legislation of such associations in which it was defined as private organizations owned and operated by its members of the water users of the water course for their own benefit, and work in the field of water use and distribution and all the related organizational activities for the purpose of raising the agricultural productivity.

The main functions of water users' associations:

- Participation in planning, design, and construction of improved mesqas.
- Operation, maintenance, and follow-up of the improved mesqas.
- Improvement of water use activities on the mesqa level.
- Identification of roles and responsibilities of mesqa's head and setting up rules to resolve conflicts.
- Establishment of linkages for coordination with other agriculture and irrigation concerned agencies.
- Establishment of linkages for coordination with other water users' associations.
- Development of financial resources of the association in order to improve operation and maintenance.

field experiments testing concepts on three branch canals in the Fayoum Governorate. Basically, the MWRI has approached these new innovations in a pragmatic systematic step-by-step approach. The incremental approach seems to work best in Egypt and many other countries. Efforts are now under way to register these private WUA's with the Irrigation Departments.

For this purpose, a new law must be enacted to reflect the latest developments, concepts, visions, and inputs related to water use management. The EPIQ water policy reform program (WPRP) is supporting the implementation of a benchmark to review and make necessary improvements to law 12/1984 on irrigation and drainage and its supplementary laws, to improve effective water resources management. In order to achieve the above target the MWRI with the support of the EPIQ water policy team have formulated draft law in coordination with the governmental authorities concerned with water resources and irrigation affairs.

The proposed law containing 116 articles distributed over the following main parts:

- Part I Defining water resources and water uses;
- Part II Ensuring the rights of use of private sources and irrigation and drainage systems.
- Part III Water Distribution
- Part IV: Developing and improving irrigation and drainage systems
- Part v: Irrigation of New Lands
- Part VI: Groundwater
- Part VIII Protection of Water Resources, Navigation and Shares
- Part IX Penalties
- Part X General and Final Provisions

The MWRI will prepare the necessary actions for getting the formal approval of this new law that is intended to achieve the following objectives:

- Highlight the concept of integrated water management for different sources, types, and uses considering the social and economic aspects.
- Develop new water resources.
- Define the responsibilities and authorities of governmental and non-governmental bodies at all central, regional, and local levels.
- Encourage water users to participate in water resource management under the supervision of MWRI officials. Private companies should be encouraged to assume this function, passing associated costs and expenses on the end users'.
- Complete the tile drainage networks so they can reach all the existing farmlands and replace the old ones.
- Expand the use of drainage water for irrigation purposes after conducting field studies to determine suitability for use in their existing condition or after mixing them with freshwater.
- Expand use of groundwater stock for drinking and irrigation purposes.
- Improve and integrate surface irrigation systems modernizing them on the old lands.
- Continue to implement replacement and renovation projects; improve the performance of hydraulic installations erected on canals and drains and the water

2. Share the responsibility of providing the different services between the Government and the private sector to ensure sustainable high quality services.
 3. Reduce the government administrative and financial responsibilities as a service provider for water resources
 4. Restructure the services to enhance them and make sure that they will be of highest quality and lowest cost
 5. Restructure MWRI mission to put more resources in the planning and policy making processes rather than in the implementation process of these policies.
 6. Use state-of-the-art technologies to provide the users with high quality services that match the international standards
- Contribute to the overall national plan for restructuring the Egyptian economy to allow for effective and efficient participation from the private sector.

4 Concluding Remarks.

The foreseeable worsening mismatch between water demand and water supply in the (near-) future requires that important decisions to be taken now. Like other countries facing the same dilemma, Egypt also has no other viable option, but to reduce the Government's role in the management of its water supply system.

The obvious and most logical scenario is for the Government to gradually withdraw higher up in the system. This means that the Government will be responsible to provide and supply agreed quantities of water (and other defined services) to user management units, which will, over time, step-wise increase in coverage. Participation of all stakeholders at early stages in the planning and management processes has great impacts on the success of the management

The MWRI has already implemented several steps towards privatizations and these steps required institutional and legal reform in the ministry mandates and domain of activities. The experiences gained through the establishment of several projects for decentralizing water management in pilot areas is a good evidence on the successfulness of this approach to water resources management. Nevertheless, other countries' experiences should be studied for applicability in Egypt and approaches similar to the Irrigation Improvement Project should be thought for the municipal and industrial sectors.

The ministry launched a public awareness program to inform citizens with the importance of water resources role in the development plans and to invite water users to positively participate in the decision making process. This will help improve the performance of the ministry while conserving its water and financial resources. Meanwhile, it will enhance the public acceptance of the ministry's policy as they have participated in its formulation.

The development of the New National Water Resources Plan is involving all stakeholders concerned with the development and use of Egypt's water resources, both governmental (ministries, regional authorities) and non-governmental (e.g. industry,

water users organizations). The involvement of the stakeholders in the process will lead to selection of a water management strategy that take into consideration all relevant interests in a balanced way will create a broad acceptance of the resulting plan. A distinction is made between different stakeholders based on their level of involvement in water resources planning.

A package of demand-oriented measures have been prepared and applied to the Egyptian agricultural sector under the Irrigation Improvement Project (IIP). The project comprises improving control structures, using modern methods in land leveling/tillage, on-farm development, rehabilitation of main and branch canals and most of all mesqas, promoting equity of water distribution, and attaining a form of cooperation between the irrigation directorate and farmers, by forming water users associations.

The Water Boards Project was formulated to develop a viable national policy and legal framework for Water Board development. This is a clear indication that the Government of Egypt has decided that for the future the users need to be formally involved in water management. The limited impact of earlier experiments due to the absence of a legal framework for user organizations at secondary level and above has been duly recognized and this was included in the Terms of Reference of the Water Boards Project.

The current applicable laws governing the government's control of water resources and related installations are incapable of meeting of the government's needs in a manner consistent with its policy reform and economic plan. Therefore, it has become necessary to formulate new rules and amend current laws, including law 12/1984 and 213/1994. The EPIQ water policy reform program (WPRP) is supporting the implementation of a benchmark to review and make necessary improvements to law 12/1984 on irrigation and drainage and its supplementary laws, to improve effective water resources management.

With the government trend in encouraging privatization in all sectors, the future involvement of the private sector in water management will be increased with time and the level of involvement will vary depend on the type of service to be provided. Therefore, MWRI established recently a taskforce to study the future vision of the ministry towards privatization with the technical assistance of Prof. Dr. Mohamed Shohieb, Deputy Chairman of Cairo University, and together with a Task Force established from key decision makers of the MWRI. The taskforce provided technical assistance to the ministry in formulating a privatization strategy, which needs to be implemented, by the ministry. It is highly recommended for MWRI to take advantage of this study and build an experienced working team, which may become an advisory unit within the ministry concerning privatization issues. This unit can be established within the planning sector as a focal point in dealing with privatization issues in the ministry. The main objectives of this unit can be summarized in the following:

- Formulation of long-term and short-term plans for the private sector participations in water management
- Set the priorities for services to be privatized

distribution system; adjust water balances; and replace or renovate irrigation and drainage pumps at the end of their life span-

- Continue to conserve the use of irrigation water and apply modern irrigation systems such as sprinkling dripping and other improved methods adopted pursuant to law No. 12/1984 as amended.
- Benefit from rain and floodwater.
- Amend the organizational structure, job description, and the ministry previous title, now called the Ministry of Water Resources and Irrigation to reflect the new water policy philosophy.
- Toughen the penalties for the violations of the law concerning water resources and irrigation regardless of the court's right to impose other penalties legislated by the penal code or other criminal laws.

3-6 Privatization Strategy for MWRI.

The privatization policy of the MWRI aims at continuing the support to the different stakeholders of water resources (farmers, industry, municipal, investors...) and improving their performance through the discipline of private partnership, as well as to raise revenue without raising taxes. Private Sector Participation will ensure providing better services with least cost to raise the net outcome from the available water resources. Also, the private sector participation will accelerate the modernization of the water resources management through the transfer of modern technologies, especially in instrumentation, operations controls, computing and communications, and modernization of labor and maintenance-intensive equipment. This will lead to a substantial improvement in the quality of services provided to the end users, which will reflect positively on the net product.

The ministry will utilize its accumulated experiences in the field of water resources management, that have been built up since its establishment, to ensure and protect the end user rights in getting adequate service of highest possible quality. The ministry will ensure that the private sector participation will lead to improvement in the water quality and environmental conditions of the water resources and follow up closely the privatization process to avoid any violation that may occur.

Human resources within the ministry are considered the most important assets in implementing the privatization process. This process includes the design, implementation, and follow-up of the activities of the privatization plan. It also includes the evaluation of the results and impacts on the performance of the system as well as the achievements of the strategic objectives to make sure it complies with the national objectives.

The following are the strategic objectives of MWRI privatization policy:

1. Ensure strong involvement of the end user (mainly the farmers) in managing the water in their area and carry on the responsibility of updating and improving these services

- Packaging and marketing the services that will be privatized.
- Exchange knowledge about privatization with the other ministries
- Continuous orientation and re-orientation of high-level officials to achieve the privatization goals.
- Human resources development and training in implementing privatization mechanisms.
- Provide technical assistance to the other departments and sectors of the ministry that are concerned with privatization.

The privatization of certain services in water management should be studied carefully before implementation in order not to add more burdens to the farmers with unnecessary rules and legislation. The MWRI should also implement policies, which provide incentives to the private sector to encourage the participation and involvement in water management. This participation should be monitored and evaluated carefully with time to learn valuable lessons and make any needed enhancement to maximize the benefits of it in the national level.

The ministry should keep the responsibility to maintain quality standards, equity standards and environmental standards. The ministry should provide the proper environment for the private sector participation to function optimally. This implies the passing of the necessary laws and the delegation of the required powers to the private sector. The transfer of responsibilities should go hand in hand with the transfer of resources while the MWRI staff need to be prepared to take up their modified role in parallel. The proposed changes in law and legislations should provide good opportunities for government-private participations and create a joint feeling among all the stakeholders that cooperation is the only way to safeguard their individual interests in the future.