Framework for Action for the Mediterranean: Achieving the Vision for the Mediterranean

FRAMEWORK FOR ACTION FOR THE MEDITERRANEAN:
A DRAFT FOR CONSULTATION

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THE FRAMEWORK FOR ACTION FOR THE MEDITERRANEAN REGION

PREFACE

This document introduces the draft Framework to achieve the sustainable goals of the Vision for Water in the Mediterranean. Actions proposed in this paper to move towards the sustainable scenario have resulted from an initial process of consultation in the countries of Northern Africa, the Islands in the Mediterranean, the countries in the Levant Region of the East Mediterranean and the countries of the North of the Mediterranean. The proposals have been prepared by a team of experts from Jordan, Turkey, Croatia, Cyprus, Tunisia, Egypt, and Morocco after a process of collection of information and consultation with Government officials, experts and other interested parties, in all Mediterranean countries, co-ordinated by the MEDTAC.

The approach chosen in the Mediterranean is as follows:

- To recognise the variety of water conditions in the Mediterranean
- The need to have experts from the subregions doing the work. Proposals had to come from the knowledge currently existing and knowledge generated *ad hoc* in the countries.
- The need to build on existing practices and current good practice experience in the Mediterranean
- The need to ensure consultation and participation on the basis of a sound process.

Proposals have been circulated for revision to the networks and organisations that are members of the MEDTAC (Plan Bleu, IME, MIO-ECSDE, METAP, CEDARE, MWN, CIHEAM). These draft preliminary proposals are intended to provide a structure that would allow the debate to open up. They are expected to be reviewed and further developed through consultation with Governments and major stakeholders in the region, especially regarding proposals for priority actions and immediate steps.

The key message we seek to get across is that the water situation in the Mediterranean will again never be the same again, as it has been in the past. Expected increases in water demand cannot be met in most cases by developing additional water resources since such water is increasingly not available. There is a need to cope and avoid the water crisis that, in some countries, is already a reality. We need to do so with actions that help us to solve the most urgent problems and avoid the water crisis. We also need to start working today for more sustainable water in the future with actions that help to prepare us for the transition towards Integrated Water Resource Management.

In this FFA for the Mediterranean we are proposing two groups of actions:

- Actions that will help us to avoid the water crisis, such as strengthening water institutions to be able to manage water in an efficient and effective way; a combination of water supply and demand measures; introducing water conservation in agriculture; promote co-operation between countries sharing water resources; protecting water quality; being prepared for major risks such as droughts and floods; generating knowledge and helping in the uptake of existing information in relation to water use efficiency and water pollution.
- We are also proposing actions that prepare us for the transition towards sustainable integrated water management. This includes the development and strengthening of institutions and legislation for Integrated Water Management; generating and incorporating knowledge for sustainable water management; promoting awareness of risks ahead and influencing social and cultural values at the same time as investing in people (human resources).

There are five types of components in this draft Framework for Action for the Mediterranean:

- **Key sustainability issues in the Mediterranean.**
- **Objectives towards sustainable water management.**
- **Strategies for avoiding the water crisis and securing equitable access to water.**
- **Strategies for preparing for the transition and IWRM**
- **The way ahead for the FFA for the Mediterranean.**

A) INTRODUCTION - KEY SUSTAINABILITY ISSUES IN THE MEDITERRANEAN REGION

Scarce Water resources

Water scarcity has always been part of the history of the Mediterranean. Throughout history, water has been the essential element for economic and social development and for the stability of Mediterranean cultures and civilisations. As a basic element for food production, economic development and for life itself, water has been an axis and a symbol of our cultures. It is the essential element which is impossible to replace, expensive to transport and store, and difficult to purify. Water in most countries and regions of the Mediterranean is a limiting factor. For that reason cultures and civilisations have been striving to adapt their lives and agricultural practices to situations of scarcity and to increase their catchment and storage capacities to prevent the worst consequences of irregular water cycles.

In the Mediterranean there are and there have always been water crisis and the resulting famines and water conflicts that have needed to be confronted. We have done so in the Mediterranean by mobilising water so as to increase the welfare of our nations and its peoples. We see now however how solutions linked to water mobilisation bring about less benefits and greater impacts as water scarcity increases.

The Eastern Mediterranean, belongs to one of the most arid regions of the world. The average annual rainfall varies considerably across the region, ranging from less than 30 mm in the Arab area spanning Southern Israel and Jordan and the Syrian Desert in the east, to the rather small high rainfall area of Lebanon in the North, where 1,000 mm are recorded. Because of the aridity in the region, the Levant is among the poorest regions in the world in terms of water resources. The average internal renewable water resources are estimated at 15,080 million m^3/yr and the per capita share from these resources is 446 m^3/yr, which is below the international standard "water poverty line" of 500 m^3/yr.

The desert occupies a considerable part of the region in the East of the Mediterranean and the North of Africa. In the former it occupies approximately 80% of total land area. The Syrian Desert (Badiat El-Sham) occupies the Eastern parts of Syria and Jordan, and the Negev desert encompasses the southern part of Israel extending South to the city of Eilat on the Gulf of Aqaba.

The arid and semi-arid countries of the Mediterranean combine a low rate of rainfall and a high rate of evapotranspiration therefore only a smaller amount flows into rivers or percolates to aquifers. The availability of water may significantly vary during the different seasons of the year, and from year to year. The arid and semi-arid regions of the Mediterranean are subject to extreme recurrent droughts. Scarcity is aggravated by variability of exploitability (especially with ecological security requirements), vulnerability, and partition among different countries.

High level of exploitation and the options for the development of water resources

The level of exploitation of water resources is generally high in most countries and pressure over water resources is increasing. Exploitation ratios over 50 %, or even nearing 100 % in many parts of Mediterranean countries (Egypt, Palestinian Authority, Israel, Libya, Malta, Tunisia, most Islands and the Eastern regions of Spain). Exploitable amounts of water are decreasing, and may become scarce in time or region. Disruptions between water demand and renewable conventional supply may increase. Overexploitation of local character is a reality leading to widespread salt-water intrusion.

Most countries in the Mediterranean have built large dams to capture water in the wet season and store it to insure drinking water supply to the growing cities and to irrigation projects, during the long hot summer. These are also built to regulate floods and generate hydroelectric power. Modern water transfers distribute the waters from major dams and need not to be confined to moving water within a river catchment system. Increasingly, they move water between river basins. Most countries have developed "conventional" water resources up to the possible technical and economic levels. In spite of the high levels of exploitation unaccounted for water is high both in urban and irrigation distribution systems and there are important potentials for water savings.

Most North African and Eastern Mediterranean countries envisage an increase in pressure over their water resources because of the high population growth in the region. This is specially important because population could be doubling in the next 20 years and rural urban migration could provide additional pressures on the water supply and management systems in the big cities that are already badly stressed and on coastal areas where most population concentrates.

National water authorities are faced with these increased pressures at the same time as having to face increasing technical difficulties and the associated increasing financial costs of mobilising conventional water supplies. Yields are decreasing for the same financial investment. The best sites have already been used. Still further development of conventional water sources is in the agenda of most countries. Those countries such as Egypt and Morocco that have relied heavily on mobilising surface water are turning into the possibility of relying more on groundwater resources.

Water scarce countries in the Mediterranean have made different options for the development of their water resources, determined to a greater extent by the characteristics of the natural availability.:

- In the East of the Mediterranean groundwater comprises a major part of the internal renewable water resources in the region. In general it can be stated that most of the groundwater resources in this region are fully exploited and some aquifers are overexploited, particularly in Jordan and the Palestinian Authority.
- In the North of Africa, Egypt and Morocco rely mostly on surface water, other countries use both surface and groundwater resources (Algeria and Tunisia). Libya has opted for a model of mining their considerable groundwater resources.
- Full exploitation of water resources is generalised in the Mediterranean Islands. Most Islands use all renewable groundwater and overabstract their resources at an increasing cost as the water table goes down. Some Island are dependent on expensive transportation of water from mainland to deal with structural shortages (Greek Islands, Croatian Islands) or during droughts (Mallorca has had to import water by boat at $2 per m3). Surface water has also been fully exploited in most Islands where there is a possibility of building reservoirs.

(Source: Subregional FFAs for the Mediterranean)

In the countries of the North with no problems of water availability (France, Central and North Italy, Internal part of Greece, North of Spain, Turkey and the Balkans) there is no widespread need (except in some specific situations in coastal areas) for costly alternative solutions to provide water. In some cases there are even over-investments in providing for new sources of water. These situations could be avoided without reducing, however, the optimal levels of the provision of water. Over-expensive future water schemes would need to be well analysed from the social, economic, political and environmental aspects before final decision would be made.

Shared Rivers

Some countries depend on the natural resources of other countries. This is the case of Egypt, for nearly 100%, but also of Syria, with 80% or Israel with 55%. The Nile is the second largest river in the world covering 10 riparian countries. Five countries of the region share the Jordan basin, a relatively small river, those are: Jordan, Israel, Palestinian Authority, Syria and Lebanon. Spain and Portugal have a number of shared river basins.

Management of shared river basins has contributed to some regional tension but has also lead to some important specific agreements in the region to allocate water resources. Today issues of water quality are also important in the management of shared water resources

"In the East of the Mediterranean, only the Euphrates river boasts a substantial water surplus. The ability to use this surplus however is compromised by substandard water quality. Urban and industrial waste, back drainage from irrigation and salination resulting from evaporation constitutes major factors to water resource degradation of the Euphrates waters"

Source: Draft Subregional FFA report for the East Mediterranean

Important role of agriculture and prospects for the sector

The role of Agriculture in Mediterranean water scarce countries is a main issue in relation to sustainable water management. National water policies have aimed at water mobilisation to realise the important potential of irrigation agriculture to increase agricultural productivity and deal with increasing food requirements of the population. Given that rainfall is low and that the evapotranspiration rate is high, the crops have to be irrigated for most of the year, and more so in summer. Irrigation agriculture is the biggest consumer of water.

The expansion of irrigated areas is expected to continue in some countries such as Morocco and Tunisia to provide with food both for the internal and export markets. The increasing reliance on the world market for food supplies is felt to be a weakness of the region. The dependency on grain was 33 % in 1995, but it is likely that this dependency may rise to 50 % or more by the year 2025. Countries expect that major adjustments in the agricultural sector may need to take place to cope with increasing trade liberalisation. There is a challenge for modernising irrigation agriculture to be able to turn into high value export products. There are also major possibilities to improve technical efficiency in distribution and water use in the region.

- Agriculture is a bigger contributor to most of the North Africa nations GDP than in other subregions of the Mediterranean. It ranges from 13% in Morocco to 17% in Egypt. It is important, however because of the share of the population that lives on agriculture. Employment in the agricultural sector ranges from the 26% of Tunisia to the 39% of Morocco. A major concern in these countries is that insuring livelihoods in rural areas would help contain urban growth stabilising population in rural areas.

- In the countries of the East of the Mediterranean agriculture is the principal user of water. In Syria, agriculture has the most relevance and accounts for 26% of GDP, 40% of labour force and 94% of water withdrawal. In other countries agriculture plays a relatively small to moderate economic role: in Lebanon, it contributes 4% of GDP, 7% of labour force and 67% of water withdrawal; in Israel, 2% of GDP, 2.6% of the labour force and 62% of the water withdrawal; in Jordan, 6% of GDP, 2.6% of labour force and 75% of water withdrawal; in the Palestinian Authority 33% of GDP, 13% of labour force and 64% of water withdrawal.

- Agriculture is a small contributor to GNP in the Islands and the Mediterranean Europe. In spite of this there has been little reduction of water allocated to irrigation in water scarce countries and the percentage use of water in irrigation varies from 50% in Malta to 80% in Cyprus, and Spain.

(Source: Draft subregional FFAs for the Mediterranean)

There have been major improvements in countries such as Israel, Cyprus and in some areas of Spain, Tunisia, etc.. in achieving technical efficiency in water distribution and on water use by farmers. In Israel there has been important research and technical investment in irrigation efficiency to increase crop per drop and value per drop.

In the above countries and in the Mediterranean Islands the food sector is open with a high level of imports and exports to other countries. In Islands many farmers work part-time, especially in the summer (for example in Malta there are 1,000 farmers employed full time and 20,000 part time). “Resizing” irrigation agriculture is part of the water management agenda of countries, either through restructuring of farm production systems promoted by the public sector or through "some kind of transactions" where water is transferred to high value added users. In Spain a recent law allows for publicly supervised water transactions. In Israel the need to cope with extreme scarcity has been dealt with by periodic public allocation of resources and stringent controls on water consumed and associated penalties for overconsumption.

In the Islands, in Israel and the EU countries of the Mediterranean the economic diversification, the variety of economic opportunities, the degree of openness of the economy and the opportunity costs of avoiding water demand management and water reallocation are obvious. The opportunity costs have been made more clear when those countries have had to engaged in desalination, when the water demand options or water reallocation could be cheaper in many occasions.

In the countries of the North of Africa and in some East of the Mediterranean, the structural conditions that would make possible a change in orientation of agricultural policies possible are mostly absent. There is a strong dependence on agriculture both in terms of contribution to GDP and in terms of employment. The food system in less integrated than in the other countries of the Mediterranean and the diversification and employment opportunities outside agriculture are limited. Accordingly, most counties are still engaged in supply expansion strategies of water management to increase irrigation.

In spite of the fact that the structural conditions are not there, there are countries such as Tunisia, Egypt, Jordan that have water demand management strategies. The most critical part of the demand management policy to implement has been related to price increase.

The commitment of countries to the modernisation of the agricultural sector could facilitate the implementation of proposals such as *resizing* of the agricultural sector linked to increases in efficiency in water use. The application of more stringent water pricing is on the agenda in some countries of the Mediterranean (especially the Islands) It is expected that this would need to be dealt with at a political level. Here then the ability of Institutions to produce enough information and advice in relation to risks ahead and opportunity costs of not using these options seem vital. Farmers would need to be better informed about trends in prices of agricultural products and more flexible in terms of decisions on crops, more able to control inputs and their application and better organised for the marketing of their products. Advisory services seem key to this transformation.

Rural development is affected both by access to the free international market to develop efficient farming enterprises and by the potential of other sectors of the economy to generate jobs and absorb the rural migration. Policy makers are unlikely to make the necessary changes in policy if this would lead to increased poverty in some sectors of the society.

Drinking water and sewage

In most of the region, drinking water supply reaches the population. There has been a major effort in most countries to improve drinking water supply and sanitation services although there are still major deficits in rural areas in countries such as Morocco and Egypt. Still, providing safe water and sanitation services to the doubling population in the North of Africa and the East of the Mediterranean will remain in itself a major challenge for these countries.

In spite of widespread water scarcity in the region there are important losses in distribution systems that range from 20 to 50% in some cities due to poor maintenance or to the age of networks. This is potentially a great waste of resources. In addition some cities are struggling with sub-standard services and water cuts because of management and financial problems of existing organisations. Good service is provided often where water distribution services have been privatised or delegated to an specialised agency. Here it is in the interest of water providers to reduce losses in order to show better financial results. A number of water saving incentives could be implemented in this field.

Sewage treatment facilities have tended to lag behind. There are two dangers for water resources in the region. The first one is the direct health risk of discharges of untreated sewage to underground and surface water resources, particularly when un-regulated settlement occurs in the drainage basins or when fields are watered with raw sewage. Second, there is a threat to marine ecosystems, as well as to wetlands and other transitional ecosystems which are crucial for maintaining the ecological balance, in case of the discharge of un-treated sewage. Dry sanitation and/or wastewater treatment would need to be introduced and improved. The latter would need to be looked at because it provides further opportunities to increase use of wastewater in agriculture and substitute good quality water for less quality demanding uses.

Risk Management

The effect of climate uncertainties-decreasing precipitation, higher frequency of extreme rainfalls and droughts-is a reality in the region and climate change is considered a long term risk. Flooding is an important issue: frequent and dangerous. Droughts are recurrent events, more difficult to deal with as scarcity increases.

Risk management is not sufficiently developed in many countries of the region. Floods and other natural disasters related to water are not being confronted by adequate risk management measures. Considering the size of damages done by these disasters it could be considered as a hindrance to sustainable development in the sub-region.

Water conservation and water demand management

Water conservation measures have not been widely applied in most countries of the region. In spite of the increasing difficulties in the development of new water resources through conventional means the technical efficiency of water distribution networks is low. There is an important potential for improvement in most countries. Reducing loss of water both in urban and irrigation networks can provide from 30-50% saving of irrigation water and from 28% to 50% in urban water. Also the introduction of water saving devices in urban areas, and most important, the changes of on-farm water irrigation techniques and models of application and changes in crop patters can also lead to important water savings. Very often, population is unaware of high water losses and the potential for saving.

Pricing schemes need improvement and there are problems in its implementation; in some urban areas, because of their design, and in agriculture because of resistance from farmers and governments much do not want to see farmers incomes reduced.

However, the lack of adequate financial resources is seen to be one of the main causes of the lack of proper maintenance in distribution systems in urban areas and agriculture, has lead to poor maintenance and explains water losses or excessive consumption.

Irrigation pricing proves especially difficult and countries that are applying it are following a policy of slow increases in prices, in parallel to subsidies to promote the incorporation of new technologies for irrigation. Implementation of increases in prices is part of the political debate also because increases in prices in urban and rural areas can be perceived by the population as the result of inefficient management and can lead to political defeat.

Where water demand measures have been implemented in Islands such as Cyprus and Malta or in countries such as Israel and Tunisia, the most successful measures have been those aiming to increase efficiency in water use using a combination of incentives (metering, pricing, subsidies and penalties), information (extension services and education campaigns) and regulatory measures (control of water use and quotas).

Islands such as Malta are in the process of implementing measures to substitute the use of existing drinking quality water for urban uses requiring less quality (gardens, toilets). This is a potential solution, but only in those regions with good financial possibilities.

Water demand management is on the policy agenda of most countries. Some water savings obtained through increased efficiency in the irrigation sector could be reallocated to other uses in areas where there is competition for the resource, which is particularly strong in coastal areas.
(Source: Draft Subregional FFA for the Islands)

Non-conventional water resources

Wastewater reuse will not be a substantial contributor to the water supply of the water scarce Mediterranean countries. However, wastewater reuse has strategic value because it substitutes good quality water for those uses that do not require it (gardens, some irrigation, etc.). It may allow a reduction for local overexploitation of aquifers. It can be important in coastal areas where there is strong competition for the resource.

Desalination and wastewater reuse is becoming a major option particularly in the Islands where the effects of sever droughts cannot be overcame by expensive transportation of water from the main land. The desalination option is still expensive but most Islands are using it to cover from 18% to 50% of the water use in the domestic sector. The costs of the desalination option is still high as compared to other conventional sources of supply. Research on increased energy efficiency and use of renewal energy is achieving important results and is expected to make this option increasingly implementable, with the possibility of reducing stress on existing water supplies. Plants being built can deliver water at less than 50 cents of $ per m3. The costs of desalination is high but it provides a reference for the “opportunity costs” of implementing water demand measures, including pricing and resizing of irrigation agriculture.

Desalination is also used in Spain, Israel, Cyprus, Malta, Tunisia, Egypt and Libya and there are plans in most of these countries to develop further this option further, especially for urban areas.

Health of aquatic ecosystems

Over-abstraction of groundwater and high mobilisation of surface water has had an important impact on the health and integrity of aquatic ecosystems. Although little information has been provided some countries (Tunisia) apply restrictions of water use form lakes, etc.. to insure that ecological needs are provided for. Others (Spain) require that rivers have a minimum ecological flow. Artificial water recharge and use of aquifers as storage of surface water during the rainy years has also allowed Tunisia to increase the level of the Water Table and improve chemical water quality. Compatibilisation of uses needs to be a main option.

> "Wetlands rely on river flows of water and silt high water tables to sustain their unique hydrology and profuse wildlife. Any disruption to these sources and flows can have serious consequences.
>
> Pressures to maximise water resources for human use are creating an increasing threat to natural ecosystems based on water, notably wetlands. In addition, supply of clean water to both humans and natural systems may be threatened by pollution. There is an urgent need to find a balance between the use of water resources, water quality and the maintenance of wetland functions"
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> *(MedWet Strategy)*

Institutional aspects

A Key challenge for sustainable water management in the region is the effective functioning of the water services and the proper maintenance of water networks in urban areas (except for the richer countries of the North of the Mediterranean). The creation of specialised public organisations or the delegated management together with BOT and BOOT systems are seen as important options. There are important examples of good practice such as ONEP, SONEDE, ONAS. These options would require, in turn, the reinforcement of the regulatory functions of government organisations and the effective enforcement's of regulations. Countries need institutional, educational, and financial support to insure effective operation of institutions.

The fragmentation of the Institutional framework and the complex co-ordination mechanisms have been pointed out as a characteristic in many countries of the Mediterranean. Many sub-sectors of the water sector are dealt with by the different government ministries and agencies, without too much linkages among them. It is often the case that one Ministry is responsible for water supply, another for irrigation and a different one for water pollution and treatment. In addition at operational level one authority may be responsible for operation, another for maintenance and possibly another for billing and fees collection.

The implementation of Integrated Water Resources management is on its way in most countries. Technically, there is a widespread agreement that River Basin Level type of management is the most appropriate one. The institutional and legal framework for IWRM is in place in many cases. There are Basin Authorities and advanced water laws in countries like Algeria, Libya , Morocco, France, Italy, Spain ... and a mature systems of Water User Associations that have been in place from more than one century in countries such as Tunisia, Spain, etc.. So far a strategic approach to water planning and management is present in almost all the countries. There are major strategies for water demand management in countries such as Israel, Cyprus and Tunisia and the preparation of Integrated Basin Management Plans has been a reality for some time in Spain, Algeria, etc. Problems emerge with the effective functioning of these created IWRM institutions, especially at the time of effective enforcement of water laws, related to control of water use and to pricing or environmental protection. These are fundamental for the implementation of water demand management strategies.

Other Implementation issues look at legal obiuty in relation to water rights, water pricing etc. The main problem is that if water rights in some countries are not clear, water is de facto being used as common property and in the case of groundwater this is leading to overexploitation, seawater intrusion and pollution.

Integrated Water Resources Management is an encouraging opportunity. However, it will succeed only where there are good possibilities for active and effective stakeholders involvement. What is missing is the management system that will allow the interests of all stakeholders (in addition to major water users) to be fully integrated in the collective decision-making processes, especially if issues related to water quality and

protection of health and integrity of aquatic ecosystems, or coastal area management, are going to be integrated effectively in plans and projects.

Strong State Budget deficit control is also an important institutional issue in most North African and East Mediterranean Countries. There is stronger competition in countries for funds from the State Budget. There are incentives now to attract private capital and to implement schemes where there is a greater contribution from users. but it also may constrain some other important proposals for action.

Other factors that determine each country's strategy to face its food and water needs:

- Energy dependence. Southern and Eastern countries generally have plenty of fossil energy along with an important solar potential at their disposal. This represents an advantage when it comes to developing energy consuming technologies (desalination, waste water treatment, etc.) and to ensuring the transition towards "virtual water" imports.
- Growing dependence on foreign countries for the financing of the water sector. Delays in public investments (hydraulic equipment and supply systems) and debt build up are considerable in the South and in the East, much more so than in the North. Northern developed countries have a large hydraulic capital.
- Dependence on foreign markets and in particular on food imports.
- Demography will determine to a large extent other factors such as the type of economic development Mediterranean countries will undergo. It will also decide the conditions under which the association between the South and East banks of the Mediterranean sea with the European Union will take place within the framework of the free-trade area, defined at the Barcelona conference of November 1995. This means the capacity for the Eastern and Southern countries to catch up and succeed in their attempt to be a part of the globalisation phenomenon.
- Important influence of EU directives, and policies in EU countries, and countries in a process of integration (Slovenia, Malta, Cyprus). The future water framework directive probably adopted in 2000 will set common rules to the Northern Mediterranean countries
- The agricultural sector is influenced in the North by the CAP and in the South and East by the agreements of agricultural exchange, and with the future free trade area (probably adopted in 2010 though agriculture products are excluded).
- It will be necessary to watch that the strengthening of the economic partnership by the set up of a Mediterranean zone for free trade by the 2010 and through a more determined financial co-operation between the North and the South does not create environmental worsening in the management of natural resources, and water in particular, whilst ensuring security in terms of food supply for the most vulnerable countries.
- The political context and social change dynamics impact the success of any revision of the water management framework. Water demand management through a sole sectoral reallocation can give rise to political unrest. Political frameworks are being reformed in a number of countries, under external influence (Europe, Funding agencies).
- Minimum population growth would introduce strong social, cultural and behavioural dimensions in water management.
- Private firms might have to increasingly respect environmental and social constraints in their terms of reference, and also through regulations.
- In most countries, particularly in the most populated ones, and although widely recognised as a legitimate objective, the evolution towards a market economy must be controlled to avoid social instability, particularly in the agricultural sector.

TABLE 1 Summary of some Key sustainability issues in different subregions of the Mediterranean

	LEVEL OF EXPLOITATION OF WATER RESOURCES AND TRENDS	*ROLE OF AGRICULTURE*	*WATER QUALITY AND ECOSYSTEMS*	*WATER DEMAND MEASURES*	*DESALINATION AND WASTEWATER*	*INSTITUTIONS AND LEGAL SYSTEM*	*REALLOCATION ISSUES*	*OTHER ISSUES*
North Africa	High level of exploitation and overabstraction of groundwater leading to salt-water intrusion. Major deficits of drinking water supply in rural areas of some countries (e.g. Morocco, Egypt)	Important contributor to GDP in most countries. Provides high levels of employment. Expansion of irrigated areas is in the agenda Modernisation is needed	Little information. Increasing concern	Not widely applied. Problems with the implementation of price schemes. Tunisia has got examples of successful water demand management.	Still a small contributor to total water supply. Desalination is being used in Tunisia, Egypt and Libya.	The institutional legal framework for IWRM is in place in many countries Improvement in the efficiency of some institutions is needed. Need for effective enforcement of the law and regulations	Water savings in agriculture could be reallocated in other areas where there is competition for the resource.	A key challenge is the effective functioning of the water services in urban areas. Need for educational, institutional and financial support Strong state budget deficit control is a reality.
Islands	Full exploitation and overabstraction of groundwater Some islands depend on transported water at high prices and suffer from shortages.	The importance varies with size of Island. Little reduction of water allocated to irrigation. Technical improvements are being put in place for some years.	Little information. Increasing concern	Implemented in some islands (Cyprus). Problems with the implementation of price schemes. Successful combination of incentives (economic, legal, education...).	It is becoming a major option for most islands, as Cyprus and Malta.	Fragmentation of the institutional framework common even in places where IWRM institutions are in place Problems of legal indefinition User rights not clearly defined in some cases	Resizing the agriculture sector is in the agenda More stringent water prices. More information and advice about risks is necessary	Need for increased co-ordination of institutions Need for effective integration of stakeholders and water users.
North Mediterranean	No overexploitation, except in East Spain and South Italy. Overinvestments and expensive solutions for water supply would need to be avoided. South Europe countries face shortages in coastal areas, aggravated by the affluence of tourists and irrigation practices	Agriculture is not a large contributor to GDP but responsible of high consumption of water in South European countries (Spain, Italy, Greece and Turkey). The other countries do not use largely irrigation. It is now increasing in France.	They come mainly from the lack of adequate wastewater treatment, threatening underground and surface water resources and marine ecosystems, as well as wetlands. In water scarce areas quantitative impacts is an issue.	South European countries use economic instruments including conservation prices and markets. The rest are making slow progress thanks to the increase of water prices. Very often, population is totally unaware of high water losses.	Wastewater treatment is insufficient in most countries (except France and Italy, Spain and Greece improving fast), causing harm to ecosystems and ground and surface water.	Institutional framework is fragmented Co-ordination mechanisms are insufficient and too complex IWRM exists in most countries but in Balkans need long term management plans and strong financial support. Effective integration of coastal areas management is also missing	Resize agriculture, using its water savings for redistribution to other sectors is economically, socially and environmentally more feasible than in other regions. Markets are starting to be used.	Risk Planning is not sufficiently developed, particularly related to floods and droughts.
East Mediterranean	High level of overexploitation of groundwater due to severe shortage of rainfall in many areas High seasonal and interanual variations worsen the problem.	Small to moderate role of agriculture in the region GDP but agriculture is the main consumer of water Important water losses in irrigation	Decreasing quality of water as a result of industrial discharge and insufficient water treatment mechanisms Problem of salinisation of surface water Lack of adequate monitoring to measure the loss of quality. Quantitative impacts are being considered.	Water conservation pricing structures, promotion of water saving technologies, public awareness campaigns on the importance of saving water and programmes for reduction of losses in distribution are being implemented or are in the agenda of some countries. Some good practice experience in the region	Wastewater reuse implemented in the subregion. Desalination plants are widely used in Israel and considered in other countries. Potential of Wastewater reuse and substitutions of good quality water is increasing with increased Wastewater treatment.	There is a variety of organisations involved in planning, regulation, delivery, etc.. in many countries. Co-ordination mechanisms efficient in some of them . Need to reinforce regulatory functions and enforcement of standards. Some good practice experience in the region	Water savings use for reallocation of water. System of water periodically revised of water quotas in Israel . No permanent Water Rights.	River basins and aquifers are shared by more than one country creating conflicts of interest High population growth in the area will affect water availability in the future.

B) THE OBJECTIVES FOR SUSTAINABLE WATER MANAGEMENT IN THE MEDITERRANEAN

Vision Statement

"A peaceful future where socially, economically and environmentally sensitive water allocation and management underpin people's well-being with secure and equitable access to safe water for everyone." (Bari, MENA Water for Food Consultation Meeting, May 1999).

General Objectives of Water Policy

According to the vision statement the general objectives of sustainable water management policy in the region are:

- To secure equal access to water for everyone in the region
- Insure that water allocation and management underpins economic and social well-being in the region
- Insure environmentally sensitive water allocation.

These general objectives translate into:

1.- Insuring that appropriate water services are provided to both the urban and rural population, insuring equity and that disruptions of water supply to the population and economic activities do not endanger the prospects for economic development and diversification in the region.

2.- Agricultural and rural development is a priority with expansion of irrigated areas, however, dependent on natural resources and socio-economic improvement.

Sustainable water management means to increasingly balance the ratios of water quantities used by economic activities according to their contributions to development (measured by GNP), thus using their capacity to take over internal and external costs of water resources management. At the same time as minimising and dealing with social and economic problems that may emerge as a consequence and in the context of alternative economic opportunities.

3.- Limit water stress in the region to preserve the ecosystems and natural resources

- Limit the stress on resources where it might increase, with acceptable effects on the environment and moderate unsustainable management of irregular surface water;
- Stabilise the stress at its present level, where increased exploitation may put at risk the health of aquatic ecosystems, the survival of local communities and traditions, and local economic potential. Decrease present stress where exploitation levels are high and hinder prospects of economic development and diversification in the region.
- At the same time, prevent disruptions between water demand and supply (and the water scarcity it implies) in a context of sustainable development and environmental security.

Operational "action oriented" objectives

In order to achieve these objectives, and considering the key sustainability issues in the region, the following operational objectives can be drawn from the vision document :

The specific socio-economic objectives could be the following:

- Use economic opportunities to achieve sectional employment shifts that will secure optimal employment structure in order to reduce water demand and prevent water scarcity crises in the future.
- Modernise agriculture to realise water savings and improve competitiveness while considering long term sustainability of water use practices in relation to soil conservation.
- Whenever possible reduce water consumption in agriculture in water scarce areas of the region by reducing subsidies and creating employment opportunities in other economic sectors;
- Gradually remove trade barriers in agriculture and introduce alternative policies for regulation of subsequent environmental and social impacts;
- Support the development of economic activities less intensive in water use and less polluting.
- Increase explicit commitment to IWRM at political level and increase awareness of the risks of inaction for the general public.
- Increase social awareness of risk ahead in relation to existing water use and maintenance and health of ecosystems.

The specific institutional objectives:

- Increase the operation and financial efficiency of existing water management and service delivery organisations.
- Increase and strengthen existing co-operation in the management of shared water resources.
- Separate engineering and service delivery functions from management and regulatory functions of existing public and Basin Management organisations.
- Strengthen management and regulation functions of public agencies and reinforce co-operation.
- Improve the legal framework for IWRM, clarify water use rights system and insure enforcement.
- Introduce participatory water management and increase transparency.
- Keep investments in water steady but flexible with regard to shifting priorities.
- Bring water tariffs gradually closer in line with the economic cost of water development, production and distribution.
- Reduce subsidies and bring political objectives more in line with the economic realities.
- Improve information and assessment of water systems.

- Prepare long term water management plans at basin level with measures for the protection of aquatic habitats.

Specific technical objectives are the following:

- Decrease overexploitation and pollution of aquifers.
- Introduce measures that allow the reduction of water losses though evaporation
- Continue with recharge of aquifers and its use for storing winter water surpluses.
- Increase water use efficiency throughout the region.
- Introduce improvements in on farm irrigation systems, distribution networks, irrigation techniques and types of crops to achieve increases in crop per drop and value per drop.
- Introduce drought, pest and salt resistant crops in water scarce parts of the region.
- Introduce and continue with the use of the non-conventional water supplies, particularly through wastewater re-use and desalination of water, in the water scarce parts of the region, as well as in locally critical areas (large urban areas and tourism areas) of other parts of the region.
- Reduce pollution of water sources as well as coastal waters by reducing water use (dry sanitation, dry processes and recycling of water in industry) and by constructing sewage treatment facilities at the level that will optimally correspond to the economic development level.
- Preserve ecosystems by securing the compatibility of uses and preventing the overexploitation of water resources (considering the socio economic impacts of altering existing water use systems).
- Improve drought management and flood protection.

What types of appropriate actions

- Actions need to be related to the main challenges in the region, take present unsustainable trends and risks of inaction into account, and build on and reinforce existing good practice.
- Actions could be taken at the local and national levels, by private and public organisations. It involves important changes from household and companies to policy levels. Mediterranean peoples would need to accept and be ready for an increased weighting of water in their public and private budgets if they account for their social and environmental security.
- Actions proposed for the implementation of the strategies proposed are institutional, economic, technical, knowledge and social.
- In some of the richer countries and the Islands there are the structural conditions to move into IWRM. The economic diversification, the variety of economic opportunities, the degree of openness of the economy, the financial possibilities, the political stability and the opportunity costs of avoiding water demand management and water reallocation are obvious. In other countries the structural conditions that would made the transition possible are mostly absent. There is a strong dependence on agriculture both in terms of contribution to GDP and in terms of employment, the food system in less integrated than in the Islands, and the diversification and employment opportunities outside agriculture are limited. The types of strategies and the speed of their implementation would be different. These countries are also subject to strong financial

constrains. They would need international support if they are to meet the often much greater challenges they face.

- We are aiming at realistic actions. Examples from less populated countries (e.g Israel, Cyprus, Malta), show that, where there is a more rapid transition towards urbanisation and integration in the international market, water demand management and partial reallocation of water to other sectors is possible. The example of Tunisia show that, even where many of the structural conditions are not there, it is possible to engage in water demand management and other strategies towards Integrated Water Resources Management.

C) STRATEGIES TO AVOID THE WATER CRISIS AND SECURE EQUAL ACCESS TO WATER.

This includes the following strategies:

- Strengthening water institutions to be able to govern water efficiently and effectively;
- Implement a combination of water supply and demand measures;
- Reforming and modernising agriculture;
- Promoting co-operation between countries sharing water resources;
- Improving sanitation and protecting water quality;
- Improving our capacity to tackle major risks in the region such as droughts and floods;
- Generating knowledge and helping in the uptake of existing knowledge in relation to water use efficiency and water quality.

Strengthening and reforming water management to be able to govern water efficiently and effectively

In the Mediterranean water scarce countries, the role of governments in the region has included a wide range of functions: resource assessment and monitoring, planning and allocation, development and distribution of water and the mobilisation of sector investments. They have been very successful in mobilising water resources and making them available for use by cities and irrigation projects in implementation of national policies.

Public organisations' role heve had the role to safeguard national interests, and governments have been often reluctant to delegate water sector management service functions to the private sector. There is, however, a general trend that today a significant reorganisation of the water agencies would help in increasing efficiency and responsiveness. Among the main requirements for facilitating and accelerating achievement is an institutional framework compatible with the complexities of the water sector generated over the years and a management system that best serves them. The performance of the water sector, like that of any other, depends heavily on the strength of its institutions. There is a need to continue the current trend of institutional restructuring with measures such as delegated management of service, increase of private sector involvement together with the impeovement of the regultory role of public sector supported by adequate simple and efficient legislation, effective law enforcement and strong human resource development.

Strengthening and further development of organisational set up

The organisational structure of the water supply and main water policy decisions is centralised in most of the Mediterranean countries. Virtually all management and planning functions are controlled by the Central Government where the agriculture sector often plays the most important role in water scarce countries. Yet in some cases decision making and responsibilities are fragmented and overlap among different parties and levels of government. The main actors are the local governments, the water users associations, the state-owned enterprises and the governmental agencies.

Apparent duplication of efforts and lack of co-ordination among concerned government entities occurs in some countries of the region. Also water resources assessment, policy, and planning functions are not clearly separated from water and wastewater services. In practice, regulators often also represent many water users, thus creating conflicts of interest. In some cases performance of water supply organisations suffer because of financial and administrative constraints. Improved co-ordination at Basin and National level, delegated management and greater direct participation of users in management decisions have been applied in many countries of the Mediterranean in order to address the above problems.

Actions proposed

- Improve co-ordination between different organisations at policy, planning and operations level.
- Governments to Improve efficiency by eliminating or minimising duplication, and upgrading human resource skills and capabilities.
- Emphasise financial viability in water sector planning and operations
- Governments to separate the regulatory and supervisory roles (including monitoring, evaluation and planning) from service and operational roles;
- Governments to promote decentralisation of engineering and service delivery functions to specialised public or private companies through delegated management
- Increase regulation functions of existing public organisations and better enforcement of existing legislation.
- The challenge for many water organisations is how to retain staff, once they are given the requisite capacities, since they might be attracted by better remunerated employment or become atrophied from lack of use. It is costly to cavvy any over-training process. Create incentives to keep good professionals up-to-date.

Improving financial performance

Financial issues are related and dependent upon the institutional structure. Regional and national financial strategies would need to be developed in line with other government strategies in the national development plans; such as in economic development, poverty alleviation, environmental protection and energy production.

Water laws and regulations in countries have often been modified to reflect market principles; moreover they are revised to give more attention to water quality management and key policies based on the economic value of water such as polluter pays, user pays, cost recovery for O&M with the use of economic incentives to improve efficiency and introduce recycling and reuse.

Delegated Private Performance Based Management Contract for the Provision of Water and Wastewater Services in Amman Governorate and Zai Treatment Scheme

In Jordan, the Ministry of water and Irrigation has successfully negotiated and signed a private management contract for water and wastewater services for Amman Governorate and Zai Treatment scheme. This contract is an initial step towards greater private sector participation in the delivery of water services in the country. It is expected that management contract will improve the reliability and efficiency and performance of services and will increase its financial viability.

The objectives of the Management Contract are:

- Increase operating effectiveness, create financial sustainability for the sector and reduce the unaccounted for water.
- Improve reliability of supply to all subscribers in the service area
- Attract capital for improving and refurbishing the water/wastewater infrastructure in the service area
- Improve water quality
- Reduce average response time for customer complaints

The Contract has the following characteristics:

- Duration of four years
- Participation of the Jordanian private sector
- Ownership of assets remains solely with Water Authority of Jordan
- The Government of Jordan is responsible for setting water tariffs and associated fees over the duration of the contract
- The operator's fee consists of a fixed fee and a performance incentive for improved system efficiency and financial performance

The service area covers:

- 37% of the total population of Jordan
- 9% of the total area of Jordan
- 43% of the total number of subscribers in Jordan
- 37% of total municipal water consumption in Jordan

Additional components include:

- A Management Contract Directorate (MCD) is established at the Water Authority of Jordan and is entrusted with the management of the contract and to act a contact point with the operator
- An Operational Investment Fund is established and financed through a World Bank loan. The operator manages the fund to provide for the procurement of equipment and vehicles, water meters, pipes and other water related supplies.
- A Technical and Financial Auditor is contracted to evaluate the technical and financial status of the operator's services
- An extensive training program is developed to improve the regulatory skills of the MCD staff.

Project Current Status:

The contract was awarded to JV Suez Lyonnaise Eaux, Montgomery Watson & Arabtech Jardaneh on 31st of July 1999
The operator took responsibility on 31st of July 1999.
(Source: Draft Subregional FFA for the East of the Mediterranean)

However at the implementation level, there is much to do to ensure financial self-sufficiency of the irrigation and water supply and sanitation sectors since still there is a heavy dependence upon central government. This is a pre-condition to good institutional performance. Where finances are not resolved this leads to a low level of quality of services which, in turn, makes consumers unwilling to pay for less than adequate services and it is associated with lack of maintenance of networks and wastage of water.

Actions proposed

- Insure accountability and transparency of managers to water users.
- avoid cross-subsidy between sectors
- allocation of incomes generated to the agencies.
- realistic water tariffs with provisions for the poor and for the gradual increase in prices to encourage water conservation
- Improved efficiency in day-to-day application
- demand-responsive approaches

Reforming and modernising agriculture, insuring food security in the region and optimising water use

Agriculture is the most water consuming activity in the Mediterranean. Agricultural production has lagged behind population growth and food requirements are expected to increase beyond the existing production capacity.

Countries may have to resort to increasing the potential of existing agriculture. With increasing population growth in the North of Africa and the East of the Mediterranean, food security would be the result of a number of critical issues:

- Agriculture would need to be modernised and operated more as a business with more specialised agriculture technicians taking into account the state-of-art soil and water conservation techniques. The untapped potential of dry agriculture would need to also be considered given the increasing limits to water mobilisation (particularly considering environmental requirements).

Water users associations in Tunisia

The Tunisian experience in the field of management of collective hydraulic infrastructures dates from the previous century when water users and owners associations were created. Between 1901 and 1906, irrigation unions for the management of Central Tunisia waterways (Sbiba, Zeroud, and Marguellil) were established. From 1912 to 1919, land-owners associations were created for the management of the oases of Nefta, Tozeur, and Gabès. They were aimed at solving water resources management problems and to ensure a better water distribution. In 1987, with the move toward transferring the services to the users, activities of water users associations (WUA) aimed at implementing, operating, and maintaining irrigation-drainage or potable water supply infrastructures were redefined. From 1987 to 1996, 2033 WUAs were created of which 564 irrigation WUAs managing around 57 000 ha of irrigated perimeters, 1400 potable water supply WUAs, and 70 joint associations. In 1996, out of 290 Mm^3 allocated to drinking water supply, 256 Mm^3 were distributed by SONEDE and 34 by WUAs. The current trend is to extend the creation of WUAs. Some WUAs consider enlarging their responsibilities for provision of agricultural inputs, marketing products, and financial operations. This step needs training and education in order to build the required capacities as well as financial support. Large irrigated schemes are still, however, under the responsibility of the public institutions (CRDA).
(Source: Draft country FFA for Tunisia)

- At the same time food security may depend more on international trade as it is increasinly the case. This would depend on the ability of the countries to diversify their economy and generate the foreign exchange necessary though tourism, high value added agriculture products, etc.. The current situation of producing and exporting cash-crops, while purchasing food supplies at low prices, is considered as a good opportunity.

- Free trade itself can become, and is actually becoming, a major opportunity for developing more efficient export oriented farming enterprises.

As envisaged in the vision statement (above) the strategy has been one of agricultural and rural development with expansion of irrigated areas, whenever possible. The evolution towards a market economy seems inevitable but it is considered that it must be controlled to avoid social instability, particularly in the agricultural sector. The modernisation of agriculture will depend on the ability of other sectors to generate jobs and absorb potential rural migration.

Modernising agriculture means to optimise the use of available water resources in irrigation agriculture, promoting the introduction of efficient water technologies, safe wastewater reuse, plant stress monitoring, weather monitoring, organisation of irrigation to avoid excessive evapotranspiration, automatisation of watering shifts, planning and changing crop patterns according to market and water availability, introducing salt resistant crops, improving marketing and information collection, and adequate use of nutrients and considerations of soil conservation in water use.

Modernising agriculture, as water stress increases, would have to rely heavily on farm agricultural extension services to help farmers to optimise the potential of dry agriculture, implementing drought resistant crops, control of plant stress, and organisation and programming of production and water application.

Specific actions Proposed to

- Government to implement institutional reforms strengthening and improving the financial and management practices of water users associations and promoting their creation as a model that can help manage water more efficinetly is some cases.
- Government with Water User associations to establish and improve on farm advisory services to farmers for day to day advise and information on irrigation technologies and best practices for use of fertilisers, markets, weather, crops . Exchange of information could be facilitated by existing co-operation research and projects.
- Government with the help of international organisations to promote and facilitate private and public funds to be available easily for farmers for viable projects.
- Government and Water user associations to make programmes for improving financial and managerial skills of Water User Associations.
- Governments, with the help of existing specialised institutions in the region, to improve research and information development and dissemination on salt and crop resistant crops, markets and market monitoring, weather and land monitoring, increased efficiency in water use and management of irrigation areas. Existing good practice in the region to be disseminated with joint regional research and co-operation projects. There is a role international organisations to help on this.
- Governments and international organisations to identify, disseminate and reinforce existing best practice in relation to economic, social and environmental criteria.
- Governments to analyse new Government funded projects on the basis of social cost benefit criteria.

Strategy to insure water availability in the region. Combined water demand and water supply strategy

Increases in water availability in the region is expected to come from a combination of water demand and water supply options which includes:

- Water from gains in water efficiency in distribution and management and reduced demand.
- Optimisation of existing water resources.
- The development of additional resources, mainly non-potable water quality.
- Eventually, water deriving from changes and modernisation of agriculture.

It is necessary:

- To simultaneously reduce demand or at least slow down its increase.
- To harmonise demand and supply possibilities as far as possible.
- To co-ordinate and maximise multiple uses of limited water resources.
- To alter the factors governing water requirements and assess the water used by different sectors, promoting the most effective use of the resource.

Water demand management

Water Demand Management is about achieving a reduction in the use of water resources, normally through increased efficiency of water application. The instruments used in water demand management include:

- Building and replacing infrastructures to reduce leaks in distribution networks, installation of metering, etc..
- Consumer education to encourage behaviour modification, insuring that the public are aware of the value and importance of appropriate water use.
- Introduction of conservation tariffs encouraging less water use and penalising the consumers that consume more water, as well as providing enough revenue to carry out investment and maintenance of infrastructures.
- Greater efficiency of application and water use through the introduction of more efficient water appliances, more efficient processes in industry or drip irrigation, etc.. in agriculture.
- Management changes such as changes in water shifts, water recycling in industrial plants, etc..

One of the most important sources of water is the possible savings through reduction of leakage in the distribution networks. The age of the pipes or insufficient maintenance is often the cause of leaks in pipes. Good maintenance and replacement of pipes is essential to deal with this problem. Overall efficiency in urban areas is poor in the Mediterranean, unaccounted for water is attributed not only to systems leaks but also to illegal connections, malfunctioning water meters and unbilled uses.

Most water used in urban areas is for domestic purposes. The use of water savings devices in home can help reduce demand in urban areas and this is often information that is not available. There is potential for reduction of between 50 and 80% of water use in toilet washing and introduction limiting devices in showers can reduce water use from 10 to 40%. Introducing water meters for individual households can also lead to reduction in water demand.

The water lost or wasted is an unexploited water bank that is of strategic importance in the water scarce Mediterranean countries. The potential for water savings must be looked from abstraction to distribution to final water use. It is technically possible to conserve an important amount of water lost or wasted and this could costs less than building new infrastructures. With demand management the need for building expensive infrastructure can be postponed and the result could be a improvement in water security and reduced water abstraction of economic and social uses, reducing stress on water resources.

It seems important that education campaigns and raising public awareness would need to be given priority. Education campaigns are important because they increase the level of acceptability and support of the population for water demand measures. Pricing often has effect when combined with education campaigns.

Demand management in agriculture is about looking for greater efficiency in the irrigation system but also to adopt criteria of sustainable agriculture in terms of water conservation, protection of the environment and economic viability and social acceptability.

The measures could include:

- Those aimed at improving existing infrastructures: lining of main irrigation channels, placing localised irrigation systems, levelling of plots, improvement of drainage, etc..
- Those not related to infrastructure aspects such as improvement of management and organisation of irrigation, improvement in knowledge about appropriate water quotas for different crops and about water looses and returns, tariff systems (better volumetric than per hectare to increase efficiency in water use).

The global efficiency in water use in irrigation depends upon the efficiency of abstraction, the efficiency in distribution and efficiency in application and it is normally expressed as the product of these three. Drip irrigation often means a reduction on the water abstracted.

For all the Mediterranean North Africa countries water savings obtained by more rational water use management could be a significant volume. The most beneficial savings in terms of volume would be in the irrigation sector. Reducing losses during transport together with greater efficiency. Next in order of importance is better recycling by industry. Then reduction of loss, leakage and wastage of drinking water in local communities, although these would be of greater value in view of the higher cost of producing and distributing drinking water.

In the countries of the Levant (East of the Mediterranean), water conservation is expected to bring immediate and measurable water savings. If irrigation efficiency alone is improved by 10%, the savings would amount to 1,654 million cubic meters a year which is substantially more than the total water use of Jordan and the West Bank combined. Financially, conservation and efficiency measures can reduce the need for expensive water supplies to provide additional water.

Many areas in the Balkans suffer from intermittent water supply, in spite of their abundant water resources. In some cities the situation is so critical that, even though almost all urban households are equipped with running water, shortages are frequent. In addition, water losses in the cities of the North of the Mediterranean are high and range from 20 to 70%. Water policy does not necessarily have to reply upon construction of new water supply systems, but could rather be based on better use of available water. The implementation of this strategic option could bring steadier water supply to large portions of the population, (particularly in coastal urban and tourist areas), more rational use and less pressure on water resources, more economic use of water resources, reduce losses of water and positive modification of water demand.

In the islands, water conveyance and distribution efficiencies in irrigation and distribution systems are very low. Losses occur through the channels or the old piped systems, or due to operational problems or due to change in style of life. In some islands water supply systems show unaccounted water around 50%, out of which 35% are losses and the other 15% is the difference in water meter measuring or water taken without being recorded. The unaccounted for water can be reduced up to 15%. Similar conditions exist in irrigation distribution systems, where losses occur through conveyance and distribution channels or old pipe systems, or wasted in distribution systems which cannot be regulated. Irrigated agriculture being, even in most islands, the biggest consumer of water, improving the efficiency would save big quantities of water. In areas where irrigation consumes 60% of the total resources with efficiency around 60% (which is often the case) an increase of 10% of the irrigation efficiency will increase the availability of water by 10%. Water saved can be either used for irrigation or for satisfying other demands (see water reallocation measures). In those countries where irrigation efficiencies are low the irrigation water may be considered as the Bank for meeting increasing demands.

*Some major challenges for introducing water demand management include**:***

- Institutional and legal since there is often no legislation requiring adoption of this practices.
- There is little technical experience in carrying out this measures as compared with water supply measures; water demand measures are more complex in implementation..
- There is also economic barriers because water prices are low and do not incentivate water savings, there is lack of public financing for this and water companies incur in looses when there is reduction of consumption in the third block.

Structure and Effectiveness of Conservation pricing in urban areas in Tunisia

In urban areas, water services are almost entirely metered and tariff charges are graduated upward based on consumption. In 1962, a uniform rate was applied to all the uses (0.040 DT m^{-3}). In 1974, the principle of graduated tariff charges was adopted and two blocks were distinguished. In 1992, 5 blocks (0-20 ; 21-40 ; 41-70 ; 71-150 ; >150 m^3/quarter) were adopted. Rates vary from 0.121 up to 0.700 DT (1 DT ≈ 0.85 US$) per cubic meter for domestic, public, and industrial uses. The cubic meter is charged 0.700 DT for tourism and 0.380 DT at stand-pipes. Tariff charges do not actually cover mobilisation costs. This tariff structure, based on social equity, spared low and medium consumers (<70 m^3/quarter) and affected the large consumers who reduced significantly their consumption through water recycling or by using other water sources such as groundwater (not yet charged). The rate of evolution of the overall water consumption decreased then with the change in the tariff structure : it was 7.0% per year from 1974 to 1982 and 2.5% per year from 1987 to 1992. Sanitation charges are also included in the drinking water billing. They are progressive and depend on use (domestic < industry < tourism) and degree of water pollution for the industrial sector (0.396 - 0.626 DT m^{-3}). They do not cover the treatment costs. These progressive and differentiated rates were effective in water demand management.
(Source: Draft Country FFA for Tunisia)

The actions proposed to implement a water demand strategy in response to the main challenges are:

1.- Promote the incorporation of water demand management in national water strategies as well as in other sectoral policies by:

- Promoting awareness on the benefits associated with water demand management, at the highest level of Government.
- Promote co-ordination of relevant sectoral decision makers and water policy makers.
- Carry out national studies on the potential of water savings.
- Promote investment in water savings by establishing new priorities for expenditure in water related investments: where expenditure in reduction of leakage and water looses in the distribution networks, improvement in the efficiency of water use, and wastewater reuse takes priority over increase in supplies
- Incorporation at a national policy level of targets for leakage and water loss reductions and for improvement of efficiency in water use and encourage that expenditure in a lower level priority measure would be subject to achievement of minimum in the previous one.
- Incorporate new actors and companies interested in investment in water savings into the policy debate.

2.- Improve information to facilitate the adoption of water demand management measures

- Introduce ongoing assessment of water demand and its evolution and estimate the potential of water demand measures. It should be taken into account with respect to time and level of success/or implementation of each measure.
- Improve information services to farmers, to consumers and utilities regarding water saving technologies
- Improve and disseminate information to industries to increase water recycling by industry and the adoption of "drier" production processes.

3.- Introduce legal and institutional measures that facilitate the introduction of water demand management.

- Develop specific legislation in relation to minimum standards of water efficiency for water devices in urban areas and for irrigation.
- Develop specific rules to promote efficiency in water distribution networks and water use in urban areas and irrigation, establishing water use quotas per hectare and per type of crop in different irrigation areas.
- Introduce and enforce legislation requiring metering in urban and agricultural uses.
- Incorporate in the urban planning laws requirements for suitability of sites in relation to availability of water resources and potential pollution.
- Establish objectives and a programme of water savings at a basin level, fixing targets and monitoring its implementation.
- Develop the co-ordination mechanism between water basin authorities and water utilities and irrigation farmers to implement water demand measures.
- Strengthen services of basin authorities, utilities and advisory services to farmers in relation to monitoring water availability and water use, so as to be able to give more area focused and precise information.

4.- Establish incentives for the renewal of installation and domestic devices.

- Establish incentives to incorporate in house water saving services by the marketing of water saving fixtures, by providing legislation and economic incentives on the purchase and installation as well for the replacement of existing fixtures (subsidies or tax exemptions or reduced connection charges).
- Remove existing disincentives to water utilities for investments in improvements in water distribution networks
- Provide funding for research and development on such matters.
- Implement gradually water tariffs in domestic or irrigation water or for other uses,. This would need to be on a *per unit volume* of water consumed

- For domestic water supply recovery of cost would need to be sought to insure correct maintenance and financial sufficiency.
- The tariff system should also provide signals of the need to use water carefully. Conservation prices (increasing block rates) can serve this purpose.
- The tariff system should be such that economically weak parts of the population are given special consideration.

Water Resource Management & Conservation Israel
(Source Y Shevah and G. Kohen, Israel Water Commission)

Water resources in Israel are managed through a combination of legislative, administrative and operational measures. These include:

- Conservation and rehabilitation of aquifers by controlled exploitation, redistribution of pumping, artificial recharge, and hydraulic barriers
- Conjunctive use of surface water and groundwater, including artificial recharge, aimed at seasonal and long-term storage, drought alleviation and quality upgrading.
- Administration of water systems and river basins by legislation, licensing, pricing, and adequate organisation structures
- Water metering. Water metering is compulsory in Israel without exception.
- Water rates. Control of water rates and the establishment of water rates adjustment fund, to reduce differences in water charges in various parts of the country.
- Control of water losses in the supply system and provision of incentives for water saving by consumers.

Water Conservation

Water saving measures in Israel have centred around the following issues:

- Controlled exploitation, spatial distribution of new boreholes, replacing old boreholes
- Water metering is compulsory for all types of consumption and consumers
- Abstraction licenses are on a yearly basis and the annual and peak month abstraction rights are adjusted to water resources replenishment
- A three-block rate pricing system and a penalty for exceeding allocation rights are applied.
- Use of on-farm advanced micro-irrigation systems.

  Household pressure reduction devices, pull handle taps cisterns with double quantity dispensers.
- Public awareness and media campaigns.

5.- Implementing specific measures to improve water use efficiency of irrigation water:

IMPROVING IRRIGATION EFFICIENCY IN TUNISIA

Surface irrigation methods (75% of the irrigation systems) are applied with on-farm irrigation efficiencies of 50-60%.. Owing to the water scarcity, measures have been taken to convince the farmers to adopt more efficient irrigation techniques and methods. Incentives for acquiring irrigation water-saving technologies varying between 40 and 60% of the equipment costs have then been created as well as tax exemption for some imported hydraulic equipment. Research programmes related to improvement of irrigation efficiencies and use of efficient irrigation systems are also under development.

The viability and the strategy of pricing irrigation water-the case of Tunisia

With the creation of new irrigated schemes, water was often distributed almost free of charge at the beginning of the supply to encourage farmers to use it, then at a fixed price per hectare before evolving toward a price per cubic meter of water used. Cost of water sold to farmers vary from one scheme to another (0.030 - 0.120 DT m^{-3}). Charges are meant to cover some (60% in 1996) of the operation costs (operation, maintenance, salaries, and energy). They are supposed to evolve progressively toward the real cost (including capital costs of irrigation). Cost recovery of irrigation water supply may induce a better development of irrigated perimeters, create incentives to farmers to invest in water-saving technologies and to shift to less-water consuming crops. Cost of wastewater is less than that of conventional water.

(Source: Draft Country FFA for Tunisia)

- Increases in prices could be gradual to facilitate adaptation of farmers practices in relation to typed crops.
- Water meters and control of water used could be generalised with a system of penalties to control overconsumption, if necessary.
- Substitute, whenever possible, water tariffs per hectare to per unit volume of water use.

7.- Implement public education, public awareness programmes and information on water scarcity and the value of water

- Education could start at the level of primary schools in a systematic way and including the importance and economy of water in the school curricula. This could be done in partnership with NGOs, local authorities, etc..
- Public awareness should be continuous through the mass media, newspapers, TV, radio etc.
- Local authorities campaigns through leaflets with the water bills etc..
- Special publications, exhibitions, seminars, conferences, special discussions, forums or competitions etc.
- Facilitate access to information on water prices and charges and on water availability.
- Establish adequate funding mechanisms, incentives and penalties to facilitate investments in water saving.
- The investment can be subsidised by the respective governments in part or paid by farmers. If paid by farmers governments need to insure that the banking system is willing to provide the required financial assistance. This may require government guarantees.
- The establishment and or improvement of adequate on farm permanent advisory services focusing on introduction of water efficient irrigation techniques, advice on water application and management, and on crop varieties and markets to insure water savings.
- In the case of irrigated water prices could be such as to encourage use of water on productive crops and to discourage wasteful use.

Irrigation Advisory Service in Jordan

The agricultural sector consumes most of Jordan's water sources, about 73%. Prudent management at the on-farm level is a must if agriculture is to remain a viable sector of the economy. Farmers are taking the initiative and shifting from low technology surface irrigation to high-technology micro-irrigation systems. However, there is no single organisation is tasked with assisting them in the transition. A pilot irrigation Advisory Service, to assist farmers with their new irrigation systems, has been established in the Jordan Valley. Irrigation Advisory Service staff are visiting farms, conducting system evaluations to identify problems, and working with the farmer to solve these problems. Ministry of Agriculture Extension agents have been trained in problem identification. Training programmes on micro-irrigation system design, operation, maintenance, and evaluation are being conducted for farmers, extension agents, and other interested persons.

Success for all activities in the Irrigation sector hinges on the farmer. Until he has sufficient knowledge to manage and maintain his irrigation system properly, success in water conservation is hard to attain. On-farm studies have shown that farmers do not use irrigation water efficiently. Micro-irrigation systems evaluated by IAS agents show that after the first year of operation distribution uniformities (DU) typically fall to the poor or unacceptable classifications (<62%). Other research shows that farmers use too much water. A typical citrus farmer uses from 50% to 100% more water than is indicated by Penman-Monteith, class A evaporation plan, or Hargreaves evapotranspiration estimation method. A vegetable farmer in the Jordan Valley has began using WATERMARK sensors to determine soil moisture levels. He has reduced his water use on cucumber and tomatoes by 40% with no yield decrease. Jordan is a country experiencing a demand for water in excess of supplies, a country that cannot continue to allow excessive applications and waste of irrigation water. An Irrigation Advisory Service is seen as one method for tackling the problems.

(Source: Draft Country FFA for East of the Med.)

8.- Improve technical training to facilitate the adoption of water demand management measures

- Capacity building with training aimed at improving technical maintenance.
- Improve the management and operation skills of managers and technical employees in the water sector,

9.- Promote exchange of experience and disseminate existing good practice on water demand management in the region:

- Promote, with the help of international funding, regional projects focused on documenting existing good practice and facilitating its adoption.
- Mek good use of existing regional centres and networks, experts, utilities and NGOs to facilitate exchange of information.
- Facilitate collaboration and exchange of experience among managers of utilities and River Basin Authorities.

Water supply optimisation and water resources development- water supply options

Water demand is expected to continue to increase both for domestic water supply and for food production due to population growth and improvement of the standard of living and change in life style. This demand growth will be more limited in those countries of the North, since most of these countries will exhibit slow, or even negative, population growth (except Turkey). However, a number of areas of the North will also face water scarcity problems, such as large urban areas, and coastal and tourist settlements, particularly eastern Spain and the South of Italy. Even though water demand management has important potential and would need to have priority, some water supply options would also need to be implemented.

Surface water supplies contribute substantially to the region's total water resources. There has been heavy investments by national authorities in the construction of storage reservoirs and water transport and distribution infrastructure, enhancing surface water supplies is still an option contemplated by countries of the region.

With increasingly limited and costly (in economic and environmental terms) water supply options, the strategy of increasing water supply will have to use sophisticated methods aimed at increasing water supply to the final consumer where needed, but minimising the pressure on existing water sources. This means an emphasis in the optimisation of existing water resources. However, no single action can remedy the water shortages in the countries of the region. Rather an integrated approach is needed to ensure water availability, suitability and sustainability.

Water Resources development in Israel
(Source Y. Shevah and G. Kohen, Israel Water Commission)

Future domestic supply will depend on the diversion of freshwater resources from agriculture and the development of additional resources, mainly non-potable water quality. The ultimate solution for water supply would be large-scale desalination of seawater. However for the next decade, it is assumed that water needs could be met by developing marginal sources such as:

- Harnessing stormwater. This water is collected in artificial seasonal lakes (120 lakes built in the past decade) and is used for irrigation and, when possible for recharging groundwater aquifer).
- Wastewater reuse. This is the largest water resource that yet to be intensively developed. More than one third of treated wastewater is currently used in irrigated agriculture, mainly for cotton and fruit. The rest is either recharged to groundwater or discharged into watercourses and the sea for lack of storage possibilities.
- Desalination. Israel has some 30 desalination facilities today, mostly in the Eilat area. The largest facility uses reverse osmosis to treat 27,000 cubic meters per day of brackish water (half of Eilat's needs). All available brackish water in the Eilat-Arava region is currently desalinated. The future of desalination focuses on seawater as a source and depends on finding ways to make the process cost-efficient.
- Cloud seeding. Seeding clouds with silver iodide crystals, carried out over the Lake Kinneret basin, has increased annual rainfall in the area by 15-18%

Water supply options include:

- Optimisation of existing water supplies.
- Re-use of treated wastewater in areas with chronic shortages.
- Desalination and other non-conventional water supply options.
- Use of lower quality water for gardening, park maintenance
- Aquifer recharge
- Develop water surface resources where appropriate.

1.- Optimisation of existing water resources

Most of the rainwater that falls in the region is lost through evaporation from the soil and water surfaces or runs rapidly into the sea. Development of appropriate storage facilities including underground storage, water harvesting, and soil and water conservation measures to improve the water retention capacity of the soil and to reduce the stilting in water storage facilities will be the types of measures that may be useful.

This option includes:

- Optimise the development and use of surface water through supply enhancing measures, including surface and subsurface storage.
- Minimise losses of water by surface evaporation and seepage.
- Protect surface water supplies from pollution

USE OF AQUIFERS FOR STORAGE IN TUNISIA

Artificial groundwater recharge is practised for groundwater protection and underground storage of surface water in rainy years. From 1992 to 1996, 25 aquifers were concerned by recharge practised in riverbeds, quarries, using infiltration basins or through well injections. 262 Mm^3 have thus been recharged plus 22 $Mm^3\ yr^{-1}$ through water and conservation structures. Recharge increased underground water levels (from 1 to 5 m) and improved the chemical water quality

(DGRE, 1997c).

Soil and water conservation measures have been and are now used in some areas. With the change in cultivation methods, and movement of the population the mountain areas have been depopulated and abandoned. In the islands of the Mediterranean, for example, that have steep soil slopes and short length riverbeds, runoff has very short travelling time, with most of the flood flow being discharged rapidly to the sea. Floodwater flow could be delayed for increasing groundwater recharge, for soil conservation and soil water recharge and for surface water impoundment. This measure is a multi-purpose measure contributing towards soil and water conservation and ecological sustainability.

Groundwater in urban areas in some parts of the region is often unsuitable for drinking purposes but it can be used for other uses, such as for toilet flushing, and for gardening. This water, which is found usually not very deep and could cause major disruptions during floods, is a considerable resource, usually recharged from rainwater, return water from irrigation and losses from water supply and sewage systems. Promotion and implementation of measures for the use of lower quality water, found in aquifers in the inhabited areas, and which cannot be used for drinking purposes, can save for each dwelling up to 30% of its water consumption, thus reducing the demand on the fresh water resources.

Augmentation of water supply in this way is also possible by treating and reuse of domestic grey water within the house perimeter and by installing water storage facilities in the roof of houses (water harvesting). These are measures that are being elaborated in Malta.

The actions that would be necessary include:

- For these purposes large-scale land levelling and terracing on the steep slopes of the island, needs to be carried out.
- Encourage agriculture that promotes soil conservation.
- Costs and economics of these measures are not well known and special studies need to be carried out on a case by case.
- Groundwater can be abstracted by drilling boreholes in the inhabited areas and installing pumps.
- There is a need to provide the necessary installations and plumbing systems for utilising the water for toilet flushing and for gardening.

2.- The use of desalinated water depending on cost

In areas where water is insufficient to cover domestic water demand and other vital important needs, and where water transportation is not possible, the desalination of sea or brackish water would need to be considered. Promotion of this approach is based on the relative costs of the non-conventional methods of water supply (desalination or transport). The economic development and ability to pay for high cost water etc. The cost of desalinated water is relatively high now being around one US Dollar with a downward trend as a result of technological improvements (some estimates suggest that $0.25-$0.5 could be achievable in the forthcoming 5 years).

On the other hand it is a high energy demanding process, and it is usually based on non-renewable energy resources that often need to be imported. The price of fuel and its fluctuations plays a decisive role on the cost and the feasibility of generalising the use of desalinated water. In addition, the use of fossil fuels increases carbon dioxide emission to the atmosphere polluting the atmosphere and contributes to the green house effect.

This approach has been used in most large Mediterranean islands, Cyprus, Malta, Majorca, Sicily and few Greek islands. In Malta the desalination plants provide water for half of the total annual consumption. In Cyprus the contribution is now 5% with plans to be increased to provide 15% of total water supply in the next year. In Mallorca desalinated water provided 5% of total annual consumption.

Brackish water can be used after desalination or directly in irrigated agriculture where it can be mixed with freshwater to achieve specific salinity levels appropriate for certain crop types. Also, certain industries can utilise brackish water effectively. Estimates of stored volumes of brackish groundwater for major aquifers suggest immense resources, but not all of these quantities will be suitable for utilisation.

Desalination technology has been developed to a point that can provide a reliable source of water at a reasonable cost. The desalination option may prove to be cheaper than building new dams and pipelines to provide water to urban centres. Desalination costs are expected to continue to decrease and become more attractive compared to most other options.

Constraints to the development of brackish water resources in the region include lack of reliable data regarding cost and economic feasibility, technology transfer, training, capital and operation and maintenance costs.

Desalination in Spain

Desalination started to be used in 1969 . Today it provides a total of 222 Hm3 per year of water in Spain (95 Hm3 from sea water). Some major cities in the Islands and main land depend on desalinated water and there are projects for its use in agriculture (Mula, Campo de Cartagena)

Desalination in Tunisia

Desalination of brackish groundwater (3.8 g L^{-1}) using reverse osmosis is in operation on Kerkennah Islands and in the city of Gabès to supply the population with drinking water. It is under implementation for the cities of Zarzis and Jerba. 7 Mm^3 of desalinated water was thus provided in 1996. This volume is supposed to be around 49 Mm^3 in 2030.

The Middle East Desalination Research Center

The concept of the Middle East Desalination Research Centre emerged from within the Working Group on Water Resources of the Multilateral Middle East Peace Process. The availability of water is an increasingly important issue throughout the Middle East/North Africa region (MENA) and has been an important issue in the Peace Process. The Government of Oman recognised this and took a leading role in the area of desalination in this Working Group. In 1993, Oman undertook the compilation of The Worldwide Desalination Research and Technology Survey, published in April 1994, in order to ascertain the current status of desalination technology; identify needed research to improve desalination and reduce the cost of desalination; and determine a strategy to accomplish the research. In April 1994, as a result of this survey, Oman proposed that a research centre be established in the Middle East with the goal of encouraging the development of new technology to reduce the cost of desalination. Oman further proposed that the centre be established in Oman and offered to be the host of the centre. The formal proposal to establish a research centre in Muscat, Oman was then submitted and endorsed by the Working Group on Water Resources. Initial funding for the Centre was obtained through significant contributions from its founding members: Oman, Israel, United States, Japan, and Korea. The European Union has also pledged project funds towards research activities sponsored by the Centre, and is expected to become a member of the Centre. The Establishment Agreement, formally creating the Centre, was signed on December 22, 1996 by the founding members who provided initial funds for the Centre.

The objectives of the Centre are:

- To conduct, facilitate, promote, co-ordinate and support basic and applied research in the field of water desalination and related technical areas with the aim of discovering and developing methods of water desalination which are financially and technically feasible;
- To conduct, facilitate, promote, co-ordinate and support training programs so as to develop technical and scientific skills and expertise throughout the region and internationally in the field of water desalination and its applications and related technical areas.

The Programme of the Centre:

- The Centre has adopted a Research Agenda and Program Plan (RAPP) which sets for the programmatic and budget priorities for years 1997, 1998 & 1999. The core research program is the most substantial activity of the Centre. There are 10 topic areas within the research program.
- The Centre has also established activities for Training, Communications and Technical Assistance. The total commitment of the Centre is US$ 23.68 million over the three-year period.
- The Centre intends to be a self-sustaining international research institution, which is global in scope and regional in focus. In addition to the technical mission, the Centre will contribute to increasing the capacity for research to be carried out within the MENA region, to build and foster co-operation between individuals, organisations and institutions within the region and to serve as a global clearinghouse for information regarding desalination technology.

Presently, laws and regulations for the extraction, treatment, and management of brackish water are absent. There is also no established policy for the distribution of the produced freshwater as well as the disposal of the resulting brine.

Actions that need to be taken to implement this option include:

- Assess potential brackish water resources in terms of technical, economic and environmental feasibility in the different ground basins in the region.
- Develop and implement programs for effective conjunctive use of fresh and brackish water particularly for agriculture and industry
- Encourage regional and international co-operation for the promotion of research, development and, exchange of information as well as training in the field of desalination.
- Establish adequate financing mechanism for new projects.
- Encourage the development of specific legislation regulating the extraction, treatment, and management of brackish water and for the distribution of the produced freshwater as well as the disposal of the resulting brine.

3.- Implementing measures to generalise the re-use of treated domestic effluents:

The amount of treated wastewater is on the increase in view of increasing population and the social and economic development of the countries of the region. As available freshwater resources grow increasingly limited, treated wastewater will play an ever more important role in the sector. Of course, the employment of wastewater on increasingly larger levels constitute a najor management challenge. The use of wastewater might become environmentally threatening if not properly treated or used.

Environmental as well as social and health considerations are of major concern in the reuse of wastewater. In order to assure safety, expensive treatment is required and this is a limitation in countries with scarce financial resources.

Proper treatment and reuse of wastewater for irrigation can partially offset limitations on irrigated agriculture. By recycling wastewater, the negative effects of water shortages can be minimised.

Some factors to consider in this alternative are that:

- Domestic effluents according to an EU Directive would need to be collected, treated and disposed safely, by applying the "polluter pays principle". This gives an opportunity in EU Mediterranean countries (Spain, Greece, Italy, France) of a reliable supply of treated
  water of a certain quality, which can be used for irrigation, thus augmenting the existing water supply. The use of such water, that is estimated to be as much as 50-70% of the total domestic consumption, thus relievs good quality water for domestic water supply.
- The implementation of more environmentally adequate dry sanitation alternatives in the future could diminish the potential of this option.

Wastewater reuse in the countries of the East of the Mediterranean

In all countries of the East Mediterranean, treated wastewater is expected to contribute significantly to available water supplies in the future.

- The quantity of wastewater that is currently generated in Syria is estimated at 610 MCM/yr. Of this quantity, approximately 370 MCM/yr is treated and almost 100% of the treated wastewater is reused in irrigated agriculture.
- In Lebanon, about 165 MCM of wastewater is produced, of which 130 MCM is of domestic origin and 35 MCM is of industrial origin. The quantity of wastewater that is treated is about 4 MCM/yr, of which 2 MCM are used for informal irrigation.
- In Israel, the total quantity of wastewater that is currently generated is 385 MCM/yr, of which 250 MCM are treated to varying degrees and utilised in irrigation. The balance is discharged to watercourses and the sea for lack of treatment and reuse facilities.
- In Jordan, the total amount of wastewater produced is estimated at 232 MCM/yr. Approximately 70 MCM/yr are treated at fourteen treatment all over the country. Almost 100% of the treated wastewater is utilised in irrigation either directly at the outlet of the treatment plants or after being discharged into watercourses. The reuse of treated wastewater in Jordan is among the highest in the world and provides a major resource potential for the country to meet the future needs of irrigated agriculture.

The main challenges for the implementation of this option include:

- The responsibility for developing and operating wastewater treatment facilities and reuse in irrigation projects is not clearly defined.
- There is a need to establish standards for treated effluent uses and in harmony with local conditions.
- More research work is needed to develop improved management techniques and on ways to reduce the cost of treatment processes and increase their efficiency.
- Criteria need to be established for pricing treated wastewater according to quality and type of use.
- Regulations often do not exist for utilisation of sewage treatment sludge in agriculture.

Wastewater reuse in Tunisia

Wastewater treatment has been practised for a long period of time in Tunisia (the first wastewater treatment plant dates to 1910-20 ; La Cherguia-Tunis was built in 1958). The sanitation coverage in the sewered cities is about 78%; this rate, related to the whole urban population (5.8 million), is 61%. The connection rate of the urban and rural households to a sewerage network is 40%. Of the 237 Mm^3 of wastewater discharged annually, 123 Mm^3 are treated in 52 treatment plants. Five treatment plants are located in the Tunis area, producing about 62 $Mm^3\ yr^{-1}$ or 54% of the country's treated effluent. Several of the plants are located along the coast to protect coastal resorts and prevent sea pollution; they currently discharge around 88% of the treated effluent. Municipal wastewater is mainly domestic (about 88%) and processed biologically up to a secondary treatment stage; at present, no further treatment is made due to economic constraints. Sanitation master plans have been designed for several towns. The National Sewerage and Sanitation Office (Office National de l'Assainissement, ONAS) plans to equip other towns, including those in the *Eleven towns* project (some have already been implemented) to protect the Sidi Salem's dam (serving water supply and irrigation of Tunis, Cap Bon, Sousse, and Sfax areas) from eutrophication due to diverse pollution sources. Furthermore, "compact" treatment plants are planned for small towns (<20 000 inhabitants). The annual volume of reclaimed wastewater is expected to reach 200 Mm^3 in year 2010. The expected amount of reclaimed wastewater will then equal approximately 10% of the available groundwater resources. This could be used to replace groundwater currently being used for irrigation in areas where excessive groundwater overdraft is causing salt water intrusion in coastal aquifers.

Compatibilising the needs of Tourism and Agriculture in "Marina Baja" of Alicante (Spain)

In Benidorm (50,000 inhabitants and peak summer of 300,000) and Villajoyosa, farmers and city authorities agreed to exchange in the summer good quality surface water previously used by farmers for water from the urban treatment plant.
The tourist industry sponsored the new distribution infrastructures and the pumping and maintenance cost of treated water.

Actions to be taken to facilitate the implementation of this option:

- Countries to develop wastewater master plans, establishing targets for providing wastewater collection systems and treatment facilities to unserved areas.
- Establish detailed legislation governing the reuse of treated effluent in agriculture and for other uses.
- Establish quality standards for treated effluent and its different reuses.
- Develop and carry out plans to strengthen and improve management efficiency, including improving the performance of wastewater collection and treatment facilities.
- Connect treatment plants to the distribution systems of fields for irrigation.
- Tertiary treatment plants and the distribution systems shall be provided at the expense of the central governments.
- Re-use water could be provided at special prices when irrigators are agreeing to exchange drinking water quality water for wastewater.
- Establish adequate financing mechanisms.
- Promote exchange of information and the set up of common standards for wastewater reuse in Mediterranean Countries.
- Support the technical exchange of experience through existing regional organisations.

4.- Develop conventional infrastructures to mobilise and transport water resources.

Depending on the availability of non developed water resources and the cost required for their development, conventional water resources could be developed for augmenting water supply. Such water could be surface water resources in certain catchments, or groundwater in aquifers that still are not fully exploited. In some cases water has been set aside for environmental needs and if this is the case it would need to be respected.

Plans for water transportation would need to be prepared and ready for implementation in case of water shortage. This solution has been applied in Mallorca for three years, where water was transported from the mainland to meet domestic demands that could not be met due to drought. This solution was also applied in Sicily. Water transportation can be made on a permanent basis by transporting water from areas with excess water to areas with water scarcity or from another country or from the mainland as occurs now in the islands of the Adriatic Sea.

The cost benefit analysis of conventional options would need to be compared with that of other options. Obtaining investment resources to mobilise additional water resources is a major implementation issue for this option.

WASTEWATER MANAGEMENT IN JORDAN
(Source: The Ministry of Water and Irrigation)

Background

Since the early 1980's, the Government of Jordan has developed and carried out several plans towards improving the management of wastewater primarily in relation to the improvement of public sanitation. Approximately 65% of the urban population and 50% of the total population has access to wastewater collection and treatment systems. These plans have resulted in improved sanitation and public health conditions, and safeguarded surface and groundwater resources in the areas that are served by wastewater collection and treatment systems.

Treated wastewater, generated at eighteen wastewater treatment plants, constitutes an important share of Jordan's total water resource base. About 70 MCM per year (1998) of treated wastewater are effectively reused in irrigation, of which 76% is generated from the waste stabilisation ponds of Al-Samra Treatment. In 1998, the As-Samra Plant has served a population of 1.65 million (approximately 72% the total served population) which reside in the capital Amman and the neighbouring city of Zarqa. By the year 2020, when the population is projected to be about 9.9 million, it is expected that about 240 MCM per year of wastewater will be generated throughout the country.

The characteristics of wastewater in Jordan are considered to be different from that of typical domestic waste stream. The average salinity of municipal water supply is 580 ppm, and the average domestic water consumption is low. These factors result in high organic loads and salinity levels. In addition, treatment of wastewater using natural systems such as stabilisation ponds (treating 85% of the total generated wastewater) support high water losses through evaporation, thus increasing salinity levels in the effluent.

Wastewater in Jordan is relatively low in chemical pollutants such as heavy metals and toxic organic compounds due to low levels of industrial discharges to sewage systems. It is estimated that 10% of the biological load comes from industrial discharges.

The major receiving streams for wastewater have very low base-flows with wastewater comprising a significant portion of the total discharge. As a result, bathing and fishing in these streams are banned. Much of Amman's wastewater treated effluent is discharged in the Zarqa River and impounded in King Talal Reservoir, where it gets blended with fresh floodwater. Subsequently, stored water is released for irrigation use in the Jordan Valley.

Strategies to improve sanitation and protecting the quality of surface and groundwater

Management of rapidly growing volume of wastewater due to population growth and urbanisation is a challenge affecting main cities in the region. The amount of wastewater is on the increase in view of increasing population and the social and economic development of many of the countries of the region. This combined with current poor facilities in some cities represent a major challenge for the region.

Disposal of untreated sewage from main cities to water courses poses serious health risks because it affects downstream uses: drinking water supplies and irrigation. Countries would need to improve existing sewage and treatment facilities, develop wastewater master plans for cities and urban areas, which will establish targets for providing wastewater collection systems and treatment facilities. This requires important financial resources.

As available freshwater resources grow increasingly limited, dry sanitation and treated wastewater will play an ever more important role.

Actions that need to be taken

- Cities to develop and carry out sewage and wastewater plans that consider financially viable solutions adapted to the specific climatic conditions of the Mediterranean.

- Governments to insure adequate financing exists.
- Government to monitor that new developments in cities are built with the adequate facilities
- Governments with the help of International Institutions to strengthen and improve management efficiency of sanitation services, including improving the performance of wastewater collection and treatment facilities. Promote delegated management.
- Regulatory bodies to control that adequate standards are met.
- Government and international organisations to promote and disseminate research on appropriate sanitation for water scarce countries.

Quality of surface and groundwater is threatened by the uncontrolled disposal of polluted effluents (domestic, industrial etc.), un proper disposal of solid and toxic wastes, and from agricultural and other human activities. Groundwater resources are also threatened especially in the coastal areas by seawater intrusion caused by overpumping and reduced recharge This is especially problematic because water quality deterioration affects the availability of water resources that cannot be "afforded" in the region given their scarcity. It is important to adopt and implement pollution prevention measures with the disposal of liquid and solid wastes in a safe non-polluting manner both for surface and ground water. Concerning surface and groundwater protection from liquid or solid waste pollution, countries would need to consider to adopt and implement legislation in relation to emission limits and facilitate the adoption of best practices and techniques by industry and farmers.

Actions that need to be taken:

- Establish licences, discharge standards, modernisation of industries and treatment of industrial effluents
- Restrict the use of pesticides
- Pollution abatement at source: clean technologies
- Control of economic penalties (PPP)
- Modernisation of state-run companies

The importance of protecting groundwater

The unsustainable abstraction of groundwater and depletion of groundwater aquifers is one of the major problems facing the region. Uncontrolled groundwater abstraction, leads to groundwater depletion or sea intrusion. This is a matter that could be dealt with in the context of the safe yield of the aquifer and measures aimed at controlling pumping in quantity and in location. In the islands and in the East of the Mediterranean most of the water resources come from groundwater. Here it is imperative that for sustainable development groundwater use needs to be sustainable.

Some measures to promote sustainbale groundwater use include:

- Regulatory measures such as the designation of overexploited aquifers and the implementation of special measures limiting and controlling extraction to the level of safe yield.
- Indirect measures include imposing a charge on the volume pumped, removing any subsidies that may have been given for high water consuming activities, limit the area that can be cultivated, and if necessary impose a tax for causing environmental damage.

A legal framework could be prepared and implemented if groundwater quantity and quality status is to be safeguarded. Artificial recharge with freshwater or treated effluent water is now in the process of averting permanent damage to aquifers.

Action that may need to be taken:

- Establishment of integrated programs to assess the availability and exploitability of groundwater resources at rates that can be sustained over long periods of time.
- Restrict issuance of groundwater to all but high priority uses, enforce terms of existing licenses, and modify licenses to be in accordance with groundwater basin management plans

- Encouragement of the use of groundwater conjuctively with surface water in places where such joint use has the potential for increasing the available groundwater supply.
- Undertake necessary measures to control groundwater pollution through developing and enforcing legislation, public awareness and incentives.

Promoting co-operation between countries sharing water resources;

Major water resources in the region are shared between countries. This includes the Jordan Basin, the Nile Basin, the Tigris and Euphrates Basins, and international aquifers such as the Eastern Erg, the Nubian Sandstone aquifer, etc..

Co-operation between riparian countries of shared international waters is important. In the absence of such sound and viable co-operation, the potential for conflicts among riparian countries is likely to intensify in the future as water scarcity increases. While national and customary laws exist to deal with conflicts at the local and national levels, and many countries are signatories of International Conventions, existing international laws may not always fully address conflicts between countries and among riparian countries.

The success of countries in the implementation of the proposed Strategies will depend on political will, collaboration on sharing information, technologies, best practices and knowledge, leading to joint planning and eventual joint management of shared resources.

Proposed actions

- Establish joint projects including those where there is common data collection and analysis that can serve as basic agreed data for negotiations.
- Promote debate to agree on the doctrine to be adopted concerning international water issues.
- Promote the development of shared water management agreements and treaties and support existing ones.
- Set up and support agreed dispute resolution systems.

Peace Process Related Projects

As part of a declaration of principles and understanding of co-operation in water related issues between parties directly involved in the Peace Process (Jun 12, 1996) and the program adopted by the Water Resources Work Group in the multilateral negotiations emerging from the peace negotiations in the Middle East, the Norwegian Government committed itself to certain activities of the Water Agenda, whereby it will execute several projects in the water sector through the Centre for Environmental Studies and Resource Management (CESAR). These projects are:

The Water Net: Local Project

This project was initiated by the Norwegian Ministry of Foreign affairs through the facilitation by CESAR as the funding for this stage through the end of the year 2000 was made available.
Project Objectives:

- Developing a computerised water information system and supplying each of the concerned parties in the peace process with this system. This system shall be a user-friendly one with the flexibility in water information retrieval and management, such a system shall also be given high degree of importance since it will be used by directorates and institutions in each of the concerned countries and shall also be capable in providing positive and constructive information in order to develop the regional co-operation in water related issues
- Building of mutual confidence and promoting co-operation between parties in the water resources field at a regional level.
- Establishing a water research centre in Amman.

The first two objectives have already been executed, the establishment of the research centre will be negotiated in early January 2000, where Norway and USA will finance this stage during the year 2000.

King Abdullah Canal (KAC) Early Warning Project

The objective of this project is to provide a continuos flow of information concerning the water quality in the canal to enable proper and timely measures of treatment to be taken at Zai Plant.
This flow of information should contain 10 parameters including Bacterial and algae growth in the canal aiming at improving the quality of the canal water through taking proper measures. The project consists of installing 6 early warning stations along the whole extension of the canal (Yarmouk River, Dajania, Wadi Al- Rayyan, Abu-Seido, Deir Alla and Zai Plant), the purpose of which would be to automatically transfer water quality information to the main control centre at Zai Palnt. This centre shall have the capability of controlling all of the above mentioned warning stations. All stations have already been installed and expected to be handed over during the first quarter of the year 2000.

Risk management in the region- Preparation of emergency plans for drought mitigation

The region is confronted with two contrasting types of natural disasters: recurrent droughts and floods. Droughts are a main concern in the Islands, in the countries of the North of Africa and in countries of the East of the Mediterranean. In the countries of the North droughts are mainly confined to coastal areas, although in some, such as East and South of Spain and southern Italy it also reaches inland. They result in water shortages and are caused by climatic extremes, but they are aggravated by inadequate water use practices. Due to large and sudden influxes of water and thanks to the geography (typical situation is the narrow coastal strip with high mountain ridge behind, interspersed with stream or river valleys), floods are a frequent phenomenon in most of the region. Floods are frequent phenomenon in northern Italy and the Balkans. In the South they are rarer but of a greater intensity. Floods can have a serious impact as water resources, such as: soil erosion, pollution transport, changes of ecosystem characteristics, etc.

Periodic shortages will become more frequent in areas where the index of water exploitation is high and where more "irregular" water is mobilised. Structural shortages in normal years occur due to excessive demands, increased by population growth, or other activity, and due to permanent and insufficient water availability. In islands such as Malta, freshwater is not enough to meet domestic needs even under normal climatic behaviour. This might develop in other areas if the climatic trends already recorded become permanent. In Cyprus over the last 15 years the rainfall, as recorded, shows a decrease of 14% from the long-term average and runoff to the existing reservoirs and aquifers has decreased by 35-40%.

With water shortages now occurring, (periodic or structural) and with increasing water demand due to population growth, tourism and food production, it is more probable that shortage will occur more often and will be more critical unless plans are made ahead to combat and mitigate against such events. The Strategy has to provide for short-term solutions, for the prevention of damages from the floods, as well as to create the basis for preparation of long-term plans to reduce negative effects of droughts. The latter is getting more and more important since droughts are likely to spread and increase in the coming years.

The strategy could result in the reduction of damages from floods, increased water supply security in the case of the implementation of drought mitigation plans, improved food security, and reduced pressure on water resources. The types of actions necessary for being prepared to deal with natural disasters in the region include: collecting data and information to prepare indicators that help forecast floods and droughts, construction of protective structures and creation of strategic resources, interconnection of supply systems and use of non conventional resources, adoption of economic instruments and emergency regulations, physical planning to avoid occupation of flood prone lands, preparation of comprehensive flood and drought management plans.

The actions proposed are:

- Governments to set up or designate national centres for the assessment of data and monitoring of floods and droughts.
- Governments and basin level authorities to gather information and experience on a national level concerning monitoring of emergency situations, analysis of existing knowledge on preventive measures adopted and their effectiveness.
- Countries to carry out specific studies on droughts and floods: actions, impacts (social, economic and environmental impacts), and strategies,
- Government and International organisations to establish a programme to exchange experience and adopt common protocols for the collection and analysis of existing data, for the assessment of the usefulness of existing measures in countries, for the preparation of drought and flood preparedness plans.
- Countries to prepare plans for droughts and flood management and appropriate structures and instruments to implement them.
- Existing networks to help provide with permanent exchange of experience.
- Governments to develop a legal framework to cope with droughts and floods.

Generating knowledge and helping in the uptake of existing knowledge in relation to water use efficiency, ensuring food security and water quality

Given the shortage of water resources in the region and the growing threat of pollution, it is of extreme importance to carefully monitor and assess the region's water resources. It is also important to help develop and disseminate knowledge in relation to water use efficiency and protection of water quality.

In order to manage these resources effectively, the responsible agencies need to have accurate data collection and analytical capabilities. Planning and policy formulation for the supply and use of water would need to be based on comprehensive and reliable data, including data on water quantity, quality and water use. Surface water, groundwater and treated wastewater supply and use need to be carefully monitored. The importance of shared surface water supplies and shared groundwater aquifers demand a careful and consistent assessment and monitoring of these resources. Non-conventional water resources, particularly brackish water resources, need to be assessed, as desalination becomes more economically feasible.

Time series data for monitoring the variations in rainfall, streamflow, and groundwater reserves have significant implications for the planning and management of water resources. Knowledge of the variation of quantities and qualities of water and factors that affect them can only be obtained by intense and sustained data collection and monitoring efforts.

Israel

Water resources assessment and management in Israel is primarily the responsibility of the Water Commission. It is responsible for the administration of water under Israeli water law. Reporting to the Water Commission are several agencies that carry out the monitoring and assessment functions. The primary agency is the Hydrological Service, which operates a network of 3000 groundwater observation stations and 100 streamflow stations. Also reporting to the water Commission are two Israeli companies, the Mekorot Water Company and Tahal Company.

The Israel Meteorological Service maintains the country's climatological database through a network of 400 rainfall, evaporation and climatological stations. These data, especially on rainfall and evaporation, are essential for establishing the overall water balance of an area and detecting trends in water availability.

Jordan

The key agencies involved in water data collection in Jordan are the Ministry of Water and Irrigation (MoWI) and its two authorities; the Water Authority of Jordan (WAJ) and the Jordan Valley Authority (JVA). While the Ministry of Transportation, through the Meteorological Department, collects climatic and meteorological data and operates the national data bank.

WAJ records streamflow data at 20 locations and operates 14 meteorological stations. Also, WAJ is responsible for collecting data on the location and physical description of all wells in Jordan, groundwater levels, spring discharge rates and water volumes going into water supply system and volumes delivered to consumers.

JVA collects data on water flows going into the irrigation system in the Jordan Valley as well as volumes delivered to the farmers.

The Central Laboratory of the MoWI carries water quality analysis for all drinking water sources and effluents from wastewater treatment plants. JVA Labs monitors water quality of streams and reservoirs feeding the irrigation system.

Prior to 1967, the Jordanian Water Authority monitored wells, streams and springs in the West Bank. After 1967, the Water Department of the Israeli Civil Administration monitored some 300 points in the West Bank for both quantity and quality determinants. Currently, the Palestinian Water Authority is responsible for all water monitoring activities in the West Bank and Gaza Strip.

In addition to monitoring water supplies, there is also an important need to measure water consumption. Performance data on irrigation, accounting for municipal water deliveries, and monitoring of groundwater abstractions provide important information to water managers on the efficiency of water use and have implications for policy.

Actions to be taken in relation to water assessment and monitoring in countries where this is not already in place:

- Governments in partnership with specialised organisations to establish national monitoring and assessment systems with centralised entities which will ensure the collection and analysis of necessary water resources data and avoid duplication. International donors may have a role funding and helping making existing know-how accessible.
- Governments in collaboration with specialised organisations to revise legislation and develop protocols to promote consistency in water monitoring and assessment
- Develop specific monitoring programmes for water utilisation and efficiency
- Upgrade water monitoring system networks and equipment, including labs of Basin Authorities to control water quality parameters.
- Establish a central water database management system accessible to all users

Actions to be taken in relation to development and dissemination of knowledge for increased efficiency in water use and reduce pollution

- Promote the establishment of applied research programmes in existing agricultural research organisations and water utilities
- Promote links between existing research centres for agricultural research in collaboration with existing international research and training centres.
- Promote local projects to show the application of cleaner technologies and more efficient processes of water application and soil conservation.
- Establish information and advisory centres for clean technologies and for best appropiate agricultural practices linked to research centres.

D) PREPARING FOR THE TRANSITION TOWARDS INTEGRATED WATER RESOURCES MANAGEMENT

- **Pormote political awareness and political will.**
- **Social and cultural change strategy.**
- **Adopt the necessary institutional reforms to implement Integrated Resources Management approach at a River Basin level.**
- **Establish the appropriate legal framework for IWRM.**
- **Establish the information framework for IWRM.**
- **Promote new practices and reinforce good practices. Disseminate results.**
- **Encourage the creation of new knowledge for IWRM and disseminate results.**

Introduction

The transition in the Mediterranean from a water supply expansion phase, where water resources development was the major focus, to an Integrated Water Resources management phase, focusing on the management of water resources, and considering the social, economic and environmental demands, would require major transformations. The values of policy makers and water practitioners, the policy framework, the institutions, the legal framework, the skills, the actors involved, and the patters of consumption and production my require important reforms to adapt to the new phase.

The water supply expansion policies have been successful in achieving many of the social and economic goals that they were designed to serve. In light of the past success, policy and institutional reform and other major reforms may prove especially difficult and it would need a sustained effort and gradual change.

It is for this process of gradual change that it is important to start preparing for. Some of the actions that move us away form the water crisis help in this direction (water demand management, modernisation of agriculture, etc.) and there are others that may be useful to move towards a more ambitious IWRM and importantly some that can start now.

IWRM management is under way in the region and there are important steps that have been taken in terms of policy awareness and implementation with a more holistic approach, including Water demand management, agricultural modernisation, the development of Basin Management organisations, the incorporation of stakeholders us decision making, the promotion of water user associations, the development of specialised organisations for water management in urban areas. They are important stepping stones in the transition.

In this section of the FFA for the Mediterranean we focus on the types of actions that prepare the way for sustainable water management.

Promote political awareness and political support

Political decisions need to be taken and have often been taken, at the higher level to adopt a legal Framework for River Basin level, to crete River Basin Authorities and to decide on the adoption of the IWRM approach in planning. The process of insuring that there is political Committment impractice, goes hand in hand with the development and dissemination of new information about the risks ahead.

In the Mediterranean people are highly aware of the importance of water. The quality of water (salinity and sodicity, pollution, organic matter) and its impact on health. General water availability has also always been a concern. Now, especially in the most water stressed areas in the East of the Mediterranean but also in the North of Africa and the East of Spain and the Islands, caring for the quality of the resource is fundamental. The question cannot be avoided by making available new freshwater resources.

Questions related to the health of ecosystems are still low in the agenda and need to be raised as a political concern in the process of progressing towards IWRM. The collection of new data and carrying out research on

the impact of antropogenic activities on freshwater availability, quality and health of aquatic ecosystems, and the importance of preserving the environmental functions of water may help. The risk associated with ignoring of some of these important functions of water in environmental but also economic and social terms may help in bringing the necessary awareness to policy makers; particularly where the irreversibility of impacts may be important.

The dissemination of new information and research in the mass media, educational establishments, etc. may raise the necessary support for policy makers and politicians to take explicit decisions in these matters, without risking political defeat.

Social and Cultural Change Strategy.

The vision on water can be achievable if IWRM is not only part of the political agenda but there is a real social and cultural change. There is a need for a change in the modes of operating of government, water managemers, the private sector and the water users.

The vision can only be achieved if stakeholders support it and play the correct role. The role that each stakeholder will play in the implementation of the actions proposed (the government, the public, the private sector, the NGOs and the users) are key to moving towards IWRM.

In particular the following would be necessary:

- Measures such as public awareness campaigns, education, and training.
- Measures to make socially and culturally acceptable the co-operation in the management of water resources. This could be facilitated through joint research and development, in emergency plans such as drought mitigation plans, regional co-operation on shared water resources management, etc
- Measures to promote community and stakeholder participation in water management and make acceptable management decentralisation.
- Measures to make the participation of the private sector in the development and distribution of the scarce water resources socially and culturally acceptable.
- Measures to strenghtened the regional and national comptences of NGOs and create the participating institutional framework for their activities.

Adopt the necessary institutional reforms to implement Integrated Water Resources Management (IWRM) approach on a River Basin level.

Although thinking about development, the environment, and water has changed conceptually over the last decade in the Mediterranean, the practice remains unchanged in many countries. This constitutes one of the bottlenecks in moving to implement sustainable policies. The development of Basin Management Authorities is clearly a reality in the Mediterranean but because organisations have concentrated on resource development, there seem to be a level of non-compliance between the written and the applied relating to water quality, control of water use, pricing,...

The actions proposed are:

- To facilitate the creation of River Basin Authorities where they do not exist.
- Create adequate mechanisms to incorporate major stakeholders into decision making processes in the Basin Authorities
- Introduce measures to strengthen the state's role as regulator and controller with the needed participation of the private sector for the commercial aspects of water, i.e. distribution, sanitation, dams and wells management. However the private's sector role must be subject to more and more constraints (social and environmental) which may make some markets less attractive.
- Creating co-ordinating commissions on an interagency level.
- Change of focus of water bureaucracies from engineering aspects to water management and regulation functions
- Decentralisation of water management responsibilities of drinking water system, sanitation facilities, irrigation drainage, flood control, energy production, nature protection, etc.
- Decentralisation has to be achieved by the definition of clear legislative powers of each partner, devolution of revenue systems, provision of enforcement powers.
- Inclusion of coastal areas in IWRM's geographical and activity scope
- Improved training for all aspects of water management for water professionals (in integrated water management planning; water demand management; economic aspects of water management; agricultural water management; use of GIS and remote sensing in water management; use of decision support systems; enforcement of water standards, effluent standards and regulations, etc.), building up of local and regional training capacity (support to national institutes that could provide training for local and national experts).

The Basin Approach to IWRM

Besides EU countries, where a water directive requires such an approach, this approach is also being followed by some other countries such as Algeria, Libya, Morocco, Spain. Italy, France, Slovenia, Croatia, Bosnia and Herzegovina etc. The approach requires adoption of clear legislative measures that will make the tasks and powers of river basin organisations (RBOs) clearly defined, but also allow for their integration into a more holistic management system (forestry, agriculture, fisheries, coastal areas management, etc.), as well as allow participation of all stakeholders with interests in water management.

Examples include:

- The SDAGE in France. Managing role of RBOs will have to be accompanied by clear financial means to fulfil their task. Committee for the River Basin Rhone-Mediterranean-Corsica has FFR 5 bill. yearly to implement the plan.
- In Spain there are 11 RBO since the 1920´s to develop, allocate water resources and control water use and pollution at basin level with water user participation in governing bodies and advisory stakeholder participation at national and basin levels.
- In Italy, RBO's planning role is more limited. In Croatia, RBOs have large powers in managing and planning for water resources.
- Local water management organisations (user associations), particularly in agricultural areas (Spain, Turkey, Greece, France), are a good example of water management and "bottom up" stakeholders' involvement.

Establish the appropriate legal framework for IWRM.

This legal framework would include:

- Provisions for the creation of water co-ordinating organisations at National and Basin level.
- Precisely defined powers and responsibilities of water actors that need to be ultimately control by democratically elected authorities.
- Provisions so that IWRM organisations have legal and executive powers to implement integrated water resources management plans and programmes
- The legal framework would need to also define the rights and responsibilities of the public and the users.

- Incorporating into the legislation principles such; as “polluter pays”, integrated coastal area and river basin management, public participation, environmental management, water and coastal area protection,.
- Provide adequate enforcement mechanisms to Basin Authorities.

Establish the appropriate basic information framework for IWRM

This includes:

- Improvement of the understanding of water resource systems including: development of reliable meteorological and hydrological monitoring networks, using existing systems, or installing new networks; keeping an inventory of available water resources; making assessment of the future water needs and demands, including use of different scenarios as management tools, hydrological modelling using GIS, optimum reservoir operation, decision support systems, etc

- Develop and keep an inventory, at on a river basin level, of the natural water resources. The assessment would need to be made and revised periodically for surface water, groundwater, treated sewage water and imported or desalinated water. The assessment would need to be based on meteorological and hydrological data and if such data are not available, provisions would need to be made for the installation and operation of a network of data collection.

- Establish a system of monitoring groundwater extraction rates, volumes, and quality in relation to safe yields and maintenance of standards of quality. Establish targets to monitor overpumping and that pumpage monitored to reach the safe yield.

- Evaluation of water demand for existing and projected environmental, domestic, industrial, commercial, irrigation and other uses, defining minimum and maximum levels. Water demand should not be simple arithmetic figures but different figures should be considered under different conditions of supply and different level of development. This is an exercise taking into consideration the future development of the country or the island, considering the social, economic and environmental constraints, especially under conditions of water being the major limiting factor.

Promote new practices and reinforce good practices. Disseminate results

- In relation to reallocation of available water resources

The ratios of water quantities used by the different economic sectors would need to be better balanced with their contributions to development (measured by GNP), thus calling on their capacity to take over external and internal costs of water resources management.

It is obvious to many water experts that, for example, in the Islands in the Mediterranean the present existing allocation of water to the irrigation sector is not proportional to its contribution to the GNP. On the other hand more competitive sectors of the economy demand more and more water creating an unequal competition among the various water sectors. Food security is no longer be ensured by self sufficiency in the Mediterranean Islands and food imports and high value and product exports (from the agricultural sector and tourism) would need to be put in the same perspective.

A major aspect on the management of demand in some islands especially in the large ones is increasing water savings in agriculture. Water savings could be obtained as explained previously by the increase in efficiency in water conveyance, and distribution. This would not affect the net water availability on the farm. In addition improvements in irrigation efficiency and the reuse of treated urban effluents by agriculture can lead also to substantial savings.

Reallocation is possible. For example Cyprus has been reallocating water for almost the last 10 years in an effort to mitigate drought and minimise social, economic and environmental adverse effects.

The recent reform of the Spanish water law (1999) makes it possible for farmers to sell water use rights to other types of users to deal with structural and temporary shortages and hence obtain compensation for reducing the irrigated area

Reduction of income to agriculture could be avoided, in part, by improvement of irrigation methods or introducing higher water efficient crops. This requires adaptation by farmers facilitated by economic instruments, availability of finances and appropriate on farm advisory services.

Demand management can have results in reducing the share of the resources allocated to irrigation to the benefit of the urban demand. Water reallocation, implying "resizing" of the irrigation sector, would require a new irrigation policy to be developed with the joint perspective of integrated rural development and environmental polices in a global manner, giving priority to social and environmental matters.

Reallocation of water resources must be a slow but continuous process taking into consideration the changing volumes of available water, the changing water demand, and the changing priorities due to the evolution of environmental, social, economic and other factors.

Implementation issues.

- Implementation of such policy would require the consent and participation of those affected it would take considerable time and he expensive to implement. Most probably a smooth transformation would require more than 20 years.
- Before implementation, a complete feasibility study would need to be carried out based on strategies defined at the national level and a political decision would need to be taken at the highest level. If a long-term continuous process is not achieved there is the possibility of social and economic instability with adverse effects on the water resources management and the sustainable development in general.

The actions need to prepare for water reallocation include:

- Develop a new irrigation policy with the joint perspective of ***integrated rural development*** and environmental polices in a global manner.
- Prepare long term plans for water demand management, and modernisation of irrigation, considering the need for soil conservation.
- Carry out research for new more efficient water use crops, on training and education of farmers, on the practices of planting and growing the new crops if necessary, marketing of new crops, study social, economic and environmental repercussions from the proposed changes etc.
- Develop instruments to facilitate compensation to farmers who are affected by resizing of the sector.
- Disseminate cases in which reallocation has occurred without major social and economic disruptions.
- Disseminate information about the social benefits of resizing agriculture.

- In relation to the Protection and restoration of the resource

It is widely recognised in the region that there has to be a major emphasis in conserving natural resources of ecological importance in order to avoid irreversible degradation of biodiversity in the Mediterranean adn preserve the environmental wealth (wetlands, for example).

Specific actions proposed include:

- Evaluate and disseminate information about the life-supporting functions of ecosystems.
- Allocate part of the water resources to maintain the ecosystem (practices in Tunisia with Ichkeul basin, GMRP to restore depleted aquifer, protection of the River Nile Law)
- Actions to speed up the process of understanding and assimilation of existing policy including: participatory process, raising awareness, education.
- Improve enforcement of existing policy.
- This would need to be supplemented by campaigns to increase awareness of the issues and risk of inaction.
- Information deficits would need to be addressed.
- Other actions in the Ramsar Conventions would need to be considered.

Encouraging the creation of new knowledge for IWRM and Disseminating the information.

This includes:

- Research in relation to agriculture. Especially that emphasising the impact of modernisation of agriculture on soil quality and the ability of soil to retain water and nutrients. Pilot projects and demonstration projects at regional level could show the impact of existing irrigation practices on soil quality and the need to recuperate some traditional sustainable forms of agriculture present in the region.
- Research could also focus on water stress an salt resistant crops and on water technology related to water efficiency and improved water application and management.
- Research on health of aquatic ecosystems is fundamental as well as promotion of pilot and joint regional projects on this matter. Improved knowledge is needed on the impacts of water abstraction and pollution on freshwater ecosystems including wetlands and the appropriate management systems to make social and economic use of water compatible with the maintenance of freshwater ecosystems. Emphasis could be made on region wide projects.
- Part of the research could focus not only on technology development but also on good management in relation to the above matters.

Table 2 Summary of some of the Proposals for sustainable water management in the region-

	INSTITUTIONAL REFORMS	*WATER DEMAND MEASURES*	*WATER SUPPLY MEASURES-AVOIDING DISRUPTIONS*	*FOOD SECURITY AND MODERNISATION OF AGRICULTURE*	*PROTECTING THE QUALITY OF WATER AND AVOIDING ENVIRONMENTAL DEGRATION*	*RISK MANAGEMENT*	*SOCIAL, CULTURAL AWARENESS*	*WATER REALLOCATION*
Northern Africa	Integrated water strategies (like Tunisia); Incentives to keep up-to-date professionals and retain them in the civil sector Improve co-ordination Need for financial support and improved financial performance; Increase regulatory role of government and implement delegated management. Enforcement of existing legislation	Improve transport of water networks Improve water recycling Improve efficiency in irrigation Adequate pricing of water for irrigation and domestic supply	Shared water resources Mobilisation of water supply Optimising water supplies Wastewater reuse Desalination	Agricultural and rural expansion Expansion of irrigated areas Integration in the international market Institutional reforms Water user associations	Information about life-support functions of ecosystems Budget allocated to maintain the ecosystems Tight enforcement of the laws	Drought management plans Flood prevention plans	Generate and disseminate information Political support Public awareness campaigns	Possibly of water savings in agriculture
Islands	Facilitate integrated water resource management approach on river basin level Enforcement of existing legislation Ensure political awareness Basic information framework for IWRM Improve co-ordination Increase the regulatory role of Government	Technical efficiency Incentives for water savings Improve efficiency in irrigation Reduce water lost in distribution Public education Reuse of water Water pricing	Reuse of domestic treated effluents Use of lower quality water for toilet and gardening Transport of water from other areas Desalination and other non conventional Floodwater and protection of the environment	Proposals linked to demand management and changed role.	Regulations and tight enforcement of the laws Limit groundwater abstraction Industrial control and information Application of BAT Modernisation of industry Water and soil conservation measures hand in hand.	Data collection on droughts Adoption and monitoring of indicators Study on drought management Development of a legal framework	Promote community participation Co-operation in water management Dissemination of good practices	Develop integrated rural development and environmental policies Long term plans for water demand management. Research on more efficient crops Training and education to farmers
North of the Mediterranean	IWRM enhanced where it exists and introduced where it doesn't Better co-ordination among institutions and decentralisation Improve legislation PPP	Increase water tariffs Economic incentives Study the potential transferable water rights Setting up markets for surface water	Reuse of treated wastewater Use of lower quality groundwater for gardening, etc Imports of water in big cities Reduction of water loss in distribution Aquifer recharge Avoid over investment	Progressive price increases on the price of water in agriculture Remove trade barriers in agriculture Promote water saving in irrigation Training to framers on efficient water use	Reduce the generation of pollutants Use of clean technologies Tradable discharge permits Limit the use of agrochemical Emission limits Coastal area management	Flood and drought management plans Avoid occupation of flood prone lands GIS and other systems to forecast and controls floods and droughts	Campaigns to raise public awareness on water scarcity Educational campaigns at school	Relocation of water use through economic measures and long term plans
East Mediterranean	Minimise the duplication of roles and improve co-ordination Separate regulatory and supervisory bodies Delegate management of services. Improve financial performance Strengthen policy and planning capabilities Continue investing in skills	Increase water charges based on water availability Review and adjust tariffs Enforce and update legislation on rational water use Water metering Incentives to consumers for water savings	Reduce water losses Desalination is a major option to increase water supply Wastewater reuse Cloud seeding Harnessing storm water Protect surface water from pollution Surface water and groundwater storage Exchange experiences between countries	Reduce water losses in irrigation Use of wastewater in agriculture Modernise agriculture	Establish national monitoring systems and a central database Revision and enforcement legislation on water protection Control groundwater overabstraction and pollution	Water storage	Enhance public awareness through campaigns in order to control groundwater pollution and best practices in water use	On-going process in the region. Starting with water savings in agriculture. IN some countries there is no fixed water allocation.

E) THE WAY AHEAD FOR THE FRAMEWORK FOR ACTION IN THE MEDITERRANEAN

This draft Framework for Action in the Mediterranean constitutes a background consultation paper that has incorporated the work of several experts in the region. There are a number of pending tasks for the development of this Framework

1.- Proceed to a wide ranging consultation process of the Mediterranean FFA with Government officials, experts and stakeholders in the region to check the validity of the proposed actions and the approach followed.

2.- Contrast proposals in the draft FFA document with those of International organisations and programmes on going in the Mediterranean (World Bank, Water Initiative, United Nations, Networks of the Medtac, Medwet, etc..). Incorporate their proposals as appropriate.

3.- Proceed with a wide ranging consultation process on the basis of the subregional and country draft FFA documents.

4.- Evaluate in depth the major challenges identified, developing the major implementation challenges for the proposed actions of the FFA document for the Mediterranean.

5.- Proceed to collect and incorporate information about financial flows and expenditure in the region.

6.- Detail the proposals according to the different agents that may be the protagonists of the different actions proposed.

7.- Check and develop targets and milestones and monitor indicators.

8.- Contrast major priorities of existing financing mechanisms in the region (i.e. MEDA programme) with the proposals of this draft FFA to study the possibilities of funding some of the key major proposals.

9.- To proceed with the drafting of a comparative analysis of the existing actions plans in the Mediterranean and produce a draft Action Plan that develops the Framework for Action. This is to be presented and discussed by all stakeholders.