

INECO

Institutional framework and decision-making practices for water management in the Damour River Basin, Lebanon

Towards the development of a strategy for water stress mitigation



March 2009

Prepared by Conseil et Développement s.a.l.

INECO ("Institutional and Economic Instruments for Sustainable Water Management in the Mediterranean Basin") is a Coordination Action Project supported by the European Commission through the 6th Framework Programme (Contract No: INCO-CT-2006-517673).



PREFACE

Lebanon is characterized by relative water abundance; however, it is currently projected that available water supply will not be adequate to meet future water needs. Even nowadays, water stress problems are often encountered at the local (river basin) level. These can result from lack of infrastructure, inter-basin transfers required to meet water needs in other, rapidly developing, areas, and degradation of surface and groundwater bodies, as a result of pollution and overexploitation. The Damour River Basin is a typical example of this situation.

Damour is a coastal village located 20 km to the south of Beirut. The population of the area is around 76,000 inhabitants. The River Basin covers an area of 333 km², and is facing a considerable decrease in the total amount of surface and groundwater of adequate quality available to meet the local domestic, irrigation and industrial demand. The problem becomes particularly acute in the downstream irrigated coastal plains of the basin, where farmers complain about the lack of water during the peak summer period. Groundwater resources are also under stress, due to the increasing volumes of water extracted to meet demands inside and outside the River Basin.

This volume of the INECO publishable reports outlines the analysis of the institutional framework and decision-making practices for water management in Lebanon and Damour. Furthermore, it highlights the main water management challenges faced in the River Basin today, describing the different issues that contribute to the exacerbation of water stress problems. The intensity of these issues, which will probably worsen in the near future, calls for the development of an Integrated Water Resources Management approach, particularly focused at resolving conflicts over water allocation and use, improving efficiency in water use and raising awareness of all water users and decision-makers on the problems currently faced in the area. In this context, the INECO project implemented a participatory approach for achieving consensus on options suitable for the management of water resources in the region. The outcomes of this process, which are summarized in the second part of this volume, can provide lessons on how the constructive engagement of stakeholders can foster the development of win-win solutions, acceptable by all parties concerned.

This volume has been prepared by Conseil et Développement s.a.l. The authors would like to thank all stakeholders contacted during the implementation of this effort for their willingness to cooperate and their continuous support through data exchange, information sharing and participation in the INECO process. Special thanks are also extended to officers from the Damour and Meshref Municipalities, and from the Ministry of Environment of Lebanon, to the General Director of the Ministry of Energy and Water, to farmers from the Damour and Meshref villages, and officers of the Beirut Water Authority, the Ministry of Agriculture, the Metn Water Office and NGOs of the Damour River Basin.

March 2009

Conseil et Développement s.a.l.

CONTENTS

| | |
|--|-----------|
| Part I: Water Management in the Damour River Basin: Setting the Scene..... | 5 |
| Overview of the Damour River Basin..... | 7 |
| Sharing water in the Damour river basin..... | 9 |
| <i>Intra-regional water allocation issues: Surface water allocation and pollution</i> | 9 |
| <i>Inter-regional water allocation issues: Groundwater exploitation patterns</i> | 10 |
| <i>Efficiency in water distribution and use</i> | 12 |
| Governing Water– The context | 13 |
| <i>Institutions with a role in water management</i> | 13 |
| <i>Legislation</i> | 15 |
| <i>Institutional arrangements for water management in the Damour River Basin</i> | 18 |
| Valuing water – Framework and challenges..... | 19 |
| <i>Policies and drawbacks</i> | 19 |
| <i>Cost recovery & infrastructure development in the Damour River Basin</i> | 20 |
| Concluding remarks | 20 |
| Part II: The INECO Lebanon Case Study: Engaging in a participatory approach for water stress mitigation in the Damour River Basin | 23 |
| Background and motivation..... | 25 |
| Discussing with local stakeholders – The overall approach | 26 |
| Problem analysis | 27 |
| Defining policy objectives | 31 |
| Identification and analysis of options for water stress mitigation | 32 |
| <i>Regulation of groundwater abstractions</i> | 32 |
| <i>Control of industrial and domestic pollution</i> | 33 |
| <i>Reaching agreement on surface water allocation</i> | 34 |
| <i>Improving efficiency in water use</i> | 35 |
| <i>Strengthening the socio-economic and Institutional environment</i> | 36 |
| Option Evaluation | 36 |
| <i>Prioritization of suggested instruments</i> | 36 |
| <i>Further considerations towards option implementation</i> | 38 |
| Cost recovery and cost sharing issues | 38 |
| Framework for water management..... | 40 |
| Regulation of abstractions and discharges | 41 |
| Incentives towards water saving | 42 |
| Industrial pollution prevention and control..... | 42 |
| Water conservation in irrigated agriculture..... | 43 |
| Public participation and stakeholder involvement..... | 44 |
| Concluding remarks | 45 |
| Key indicators on water stress in the Damour River Basin..... | 47 |
| References | 48 |

PART I: WATER MANAGEMENT IN THE DAMOUR RIVER BASIN:
SETTING THE SCENE

OVERVIEW OF THE DAMOUR RIVER BASIN

The Damour River Basin (Figure 1) covers an area of 333 km². The Damour village, an important tourist destination, is located in the lower part of the basin, at 20 km south of Beirut. The area is a necessary crossroad, linking Beirut to the Shouf Caza in the Mount Lebanon, and to other southern cities and villages, such as Saida, Tyr and Nabatiyeh. According to the records of the local municipal authorities, the total permanent population of the River Basin is currently around 76,000 persons. Table 1 presents key indicators for the Damour River Basin in comparison to the other river basins of Lebanon.

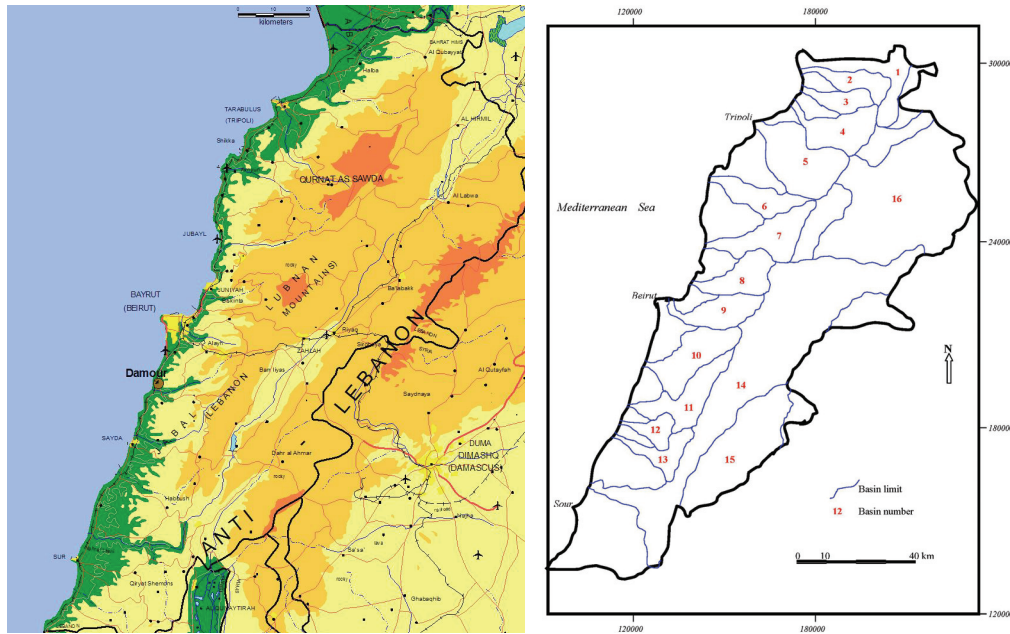


Figure 1: Location of the Damour River Basin (No 10)

The Damour River is a perennial river with a length of 40 km. Its watershed extends over an area of 305 km² and has a maximum elevation of 1948 m, from which the river originates (Dar Al-Handasah, 1996). Its lithological characteristics comprise both karstic (27%) and non-karstic formations (73%). Two major springs, Es Safa and Barouk, contribute to river discharge. Additionally, the river is formed by the convergence of three minor rivers: Es Safa, Zeble, and el Hamam. The average annual discharge, recorded for the years 1992-1993 and 1994-2001, was about 100 million m³/yr, with an average annual flow rate of 8.2 m³/s. Groundwater resources mainly exist in the Sannine Aquifer, which is protected from direct contact with the sea by the Chekka formation. In the Saadiyat area, the aquifer is recharged through infiltration of precipitation and run-off from the Damour River.

The River Basin has an agricultural profile, with bananas and vegetables being the main cultivations. In this regard, the Damour River is of socioeconomic significance as it is used for the irrigation of the agricultural coastal plains. Two dams, upstream and downstream, were constructed to divert water for irrigation. Currently, the water is diverted at a rate of 1100 m³/hr downstream, and 650 m³/hr upstream.

The overexploitation of river water by upstream users leads to downstream water shortages, especially during the summer season. In turn, this affects downstream agricultural activities and induces conflicts between the Damour Municipality and upstream users, given also the

lack of proper legislation for water allocation. A rough approximation of the Water Exploitation Index, using solely abstraction data for the Damour Municipality, gives values ranging between 10 and 20%, depending on annual precipitation levels. This reveals that there are pressures exerted on water resources, even without taking into account abstractions from the other municipalities of the area, for which data have not been made available. Moreover, environmental violations committed upstream affect river water quality, which in turn can adversely affect crop production in the downstream plains.

It is noteworthy that the political instability in Lebanon led to the displacement of the majority of the Damour population, especially during the Lebanon Civil War and after the Damour massacre. This caused the loss of human and financial resources essential for the development of the area. Given the current relatively more stable situation, the displaced population could return to Damour, causing a large increase in water demand. In addition, the recently developed Saadiyat area lacks proper access to water supply and sanitation. It has been reported that the village inhabitants do not have sufficient resources to pay municipality fees for water supply, and thus prefer to use their own private wells.

Table 1: Summary of key indicators for the Lebanon River Basins

| No. | Major water course | Area (km ²) | Population (million persons) | Input | Output | |
|-----------|------------------------|-------------------------|------------------------------|---------------------------------------|--|-----------------------------------|
| | | | | Precipitation (km ³ /year) | Evapotranspiration (km ³ /year) | Discharge (km ³ /year) |
| 1 | El-Kabir River | 195* | 0.08 | 0.111 | 0.053 | 0.086 |
| 2 | Estwan River | 146 | 0.057 | 0.135 | 0.071 | 0.065 |
| 3 | Arka River | 121 | 0.036 | 0.116 | 0.058 | 0.064 |
| 4 | Al-Bared River | 284 | 0.038 | 0.233 | 0.141 | 0.168 |
| 5 | Abou-Ali River | 482 | 0.126 | 0.483 | 0.258 | 0.369 |
| 6 | El-Jauz River | 196 | 0.038 | 0.120 | 0.114 | 0.082 |
| 7 | Ibrahim River | 326 | 0.095 | 0.371 | 0.225 | 0.498 |
| 8 | El-Kalb River | 237 | 0.069 | 0.348 | 0.165 | 0.251 |
| 9 | Beirut River | 216 | 0.276 | 0.248 | 0.118 | 0.101 |
| 10 | El-Damour River | 333 | 0.076 | 0.337 | 0.198 | 0.256 |
| 11 | El-Awali River | 291 | 0.062 | 0.312 | 0.160 | 0.284 |
| 12 | Siniq River | 102 | 0.024 | 0.101 | 0.057 | 0.011 |
| 13 | El-Zahrani River | 140 | 0.038 | 0.137 | 0.080 | 0.202 |
| 14 | Litani River | 2170 | 0.68 | 1.517 | 0.682 | 0.370 |
| 15 | Hasbani River | 680 | 0.058 | 0.612 | 0.287 | 0.134 |
| 16 | Al-Assi River | 1720* | 0.32 | 0.688 | 0.323 | 0.429 |

In the above context, the following paragraphs summarize the main challenges currently faced in the Damour River Basin. Emphasis is given to the “**Sharing**” dimension of water management problems, i.e. inter-regional, intra-regional water allocation issues, which are the main source of conflict among stakeholders in the River Basin. Furthermore, subsequent chapters in this section focus on the “**Governing**” and “**Valuing**” aspects of water management in the area. The situation is first detailed at the national level, in an effort to describe the overall framework for policy formulation. Then, further information is provided for the River Basin, in order to portray additional constraints faced at the local level.

INTRA-REGIONAL WATER ALLOCATION ISSUES: SURFACE WATER ALLOCATION AND POLLUTION

Recent records indicate that there has been a decrease in the volume of the water discharged at the mouth of the river between the years 1992 and 2001. In the year 2000-2001, about 96% of the discharge occurred during the wet season (December-April) with a total yield of 55.468 million m³/yr. This amount corresponded to a 55.07% reduction when compared to the average annual yield of 100.717 million m³/yr. In addition to the drop in precipitation levels, the recorded reduction is also attributed to the overexploitation of groundwater (springs and/or aquifers), which contributes to surface run-off, especially during the summer months.

In addition to overexploitation, another key issue of conflict between downstream and upstream users is related to the deterioration of river water quality, due to the discharge of waste from domestic and industrial sources. Table 2 and Figure 2 outline the results of a water quality survey undertaken in the river. Two of river samples (D2 and D3) show pollution from sewage (as indicated by the presence of fecal coliforms) and pollution of industrial origin (as indicated by the elevated COD concentrations). There are several industrial activities in neighbouring villages, such as olive pressing, stone cutting, and concrete and asphalt production. The corresponding industries tend to dispose of their waste in the river, as confirmed by the detected Chemical Oxygen Demand (COD). Additionally, there is also sewage disposal from restaurants and residences, due to the lack of wastewater treatment plants. The concentrations of phosphates are attributed to the agricultural activities along the river course and in the coastal plains. It should be further noted that water quality data is very limited, as no systematic monitoring is undertaken by the institutions responsible for water management in the area.

Table 2: Water quality results for the Damour River¹

| Sample ID | TDS (mg/l) | Chlorides (mg/l) | Nitrates (mg/l) | O-Phosphates (mg/l) | Fecal Coliforms (CFU/ 100 ml) | COD (mg/l) |
|---------------------------------|------------|------------------|-----------------|---------------------|----------------------------------|------------|
| D1 | 547 | 174 | 30 | 0.18 | 0 | N/A |
| D2 | 239 | NA | 19 | 0.27 | 126 | <2 |
| D3 | 222 | NA | 12 | 0.17 | 13 | 16 |
| D4 | 1850 | 1240 | 14 | 0.11 | 0 | N/A |
| D5 | 313 | 20 | 5 | 0.1 | 0 | N/A |
| D6 | 667 | 239 | 16 | 0.13 | 0 | N/A |
| D7 | 612 | 212 | 12 | 0.27 | 0 | N/A |
| Guidance Value | - | 25 | 25 | 0.4 | - | - |
| Maximum Admissible Value | 500 | 200 | 50 | 5 | 0 (domestic) 200 (irrigation) | - |

¹ Guidance and maximum admissible values are those of the Ministerial Decision 52/1 issued by the Ministry of Environment, except for TDS where the EPA standards are included and fecal coliforms where the EPA standards for irrigation are used.

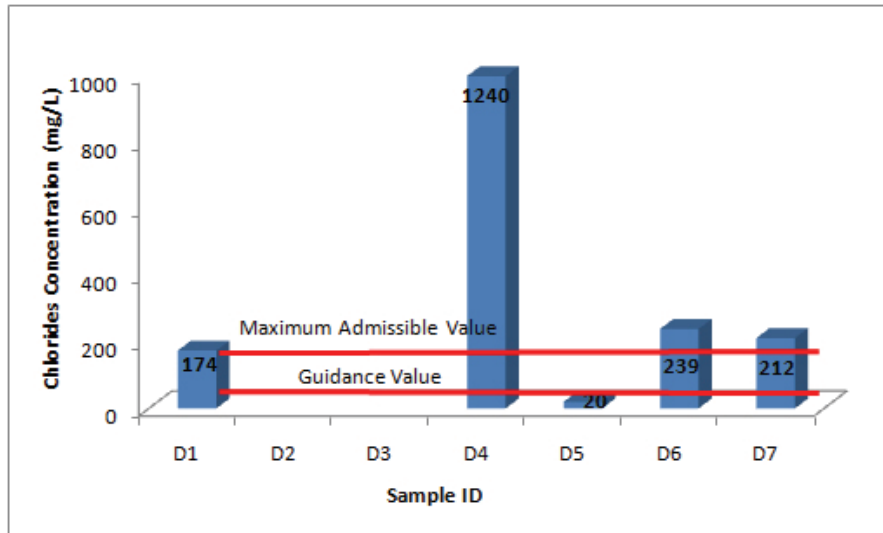


Figure 2: Concentration of chlorides in water samples from the Damour River

A recent report [MoE/ELARD, 2003] highlighted the different environmental violations in the Damour River Basin (Figure 3), which include disposal of untreated sewage and effluents from most villages, including restaurants and other similar facilities, industrial wastewater, used oils from gas stations, farm waste, and use of pesticides and fertilizers.

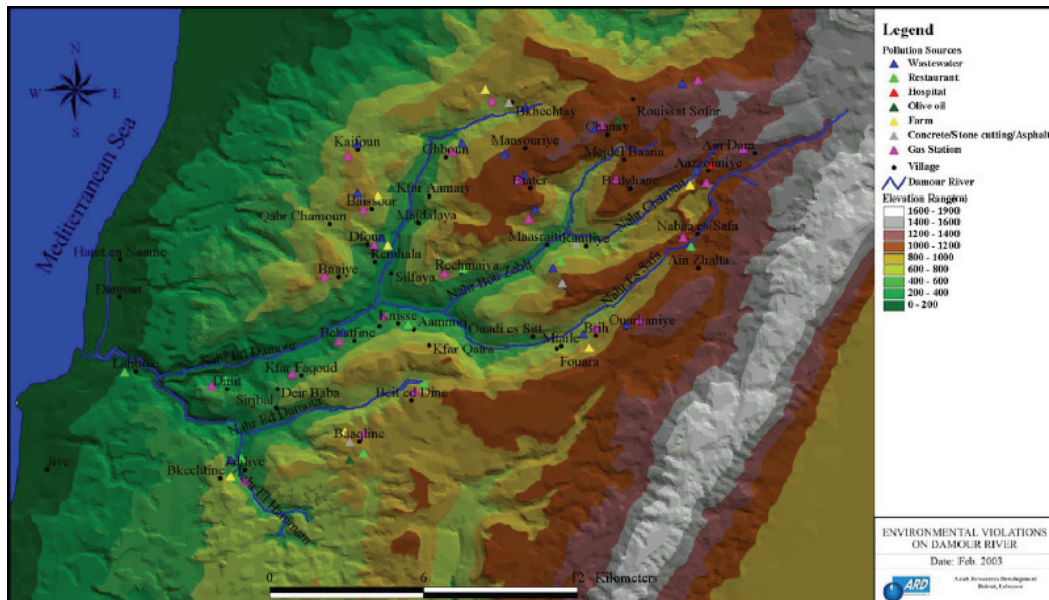


Figure 3: Sources of Environmental violations in the Damour River Basin

INTER-REGIONAL WATER ALLOCATION ISSUES: GROUNDWATER EXPLOITATION PATTERNS

Groundwater is the main source of drinking water supply in the area. Only in the village of Damour, there are 64 public and private wells. Sixteen (16) public wells, fourteen (14) belonging to Beirut Water Authority (BWA) and two (2) municipal wells, are used for domestic supply. With regard to private wells, 44 are used for domestic purposes, whereas 6 are used for irrigation. Forty-two (42) private wells are utilized in Saadiyat Area for meeting domestic water demand.

Water extracted from the fourteen BWA wells (Figure 4) is used to meet water needs outside the river basin for a 6-month period (typically from July to January). The volume of extracted water reaches up to 7.2 million m³/yr. Eighty percent (80%) of the water extracted from the 14 BWA public wells is delivered to Beirut and Ain el Delbi. This practice puts pressure on the aquifer, leading to seawater intrusion, as confirmed by the elevated TDS and chlorides levels in well water samples.

On the other hand, the Saadiyat area is an agglomeration of displaced population residing in illegal dwellings and depending entirely on private wells for domestic water supply. The heavy reliance on these wells, due to the lack of a public water supply system, and the uncontrolled utilization of groundwater has led to the abstraction of excessive amounts of water. Daily values of water consumption reach 340 to 400 l/capita/day, by far exceeding the typical average consumption of 150 l/capita/day.

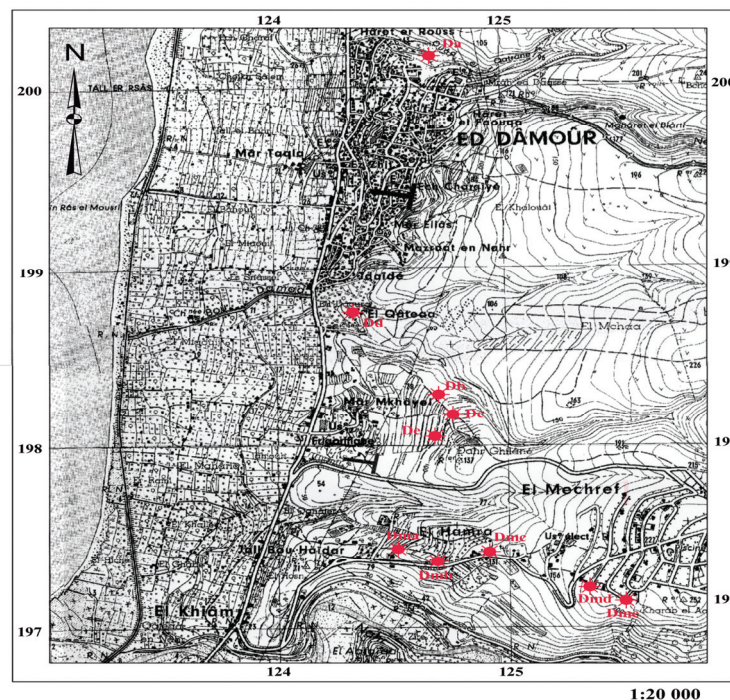


Figure 4: B Public wells in Damour operated by the Beirut Water Authority

A summary of the above data is provided in Table 3. The total annual volume of water exploited from all the 64 monitored wells ranges between 1.14 million m³ to 8.9 million m³, under the condition that the Beirut Water Authority wells operate from July until January.

This groundwater exploitation pattern has led to the degradation of the quality of water resources in the area. Water quality measurements have revealed an increasing trend in the levels of chlorides over the years (1990-2003) in the water samples taken from the public wells of the BWA, which confirm seawater intrusion (Figure 5). Water samples analysed from municipal and private wells in the area further confirmed seawater intrusion, as chloride and TDS levels were found to be high, exceeding the Guidance Value and the Maximum Admissible Value of the MOE, and ranging between 20 to 1240 mg/l and 239 to 1850 mg/l, respectively. The highest chloride and TDS levels were detected in Saadiyat due to the existence of numerous wells and the direct contact of the Sannine Aquifer with the sea.

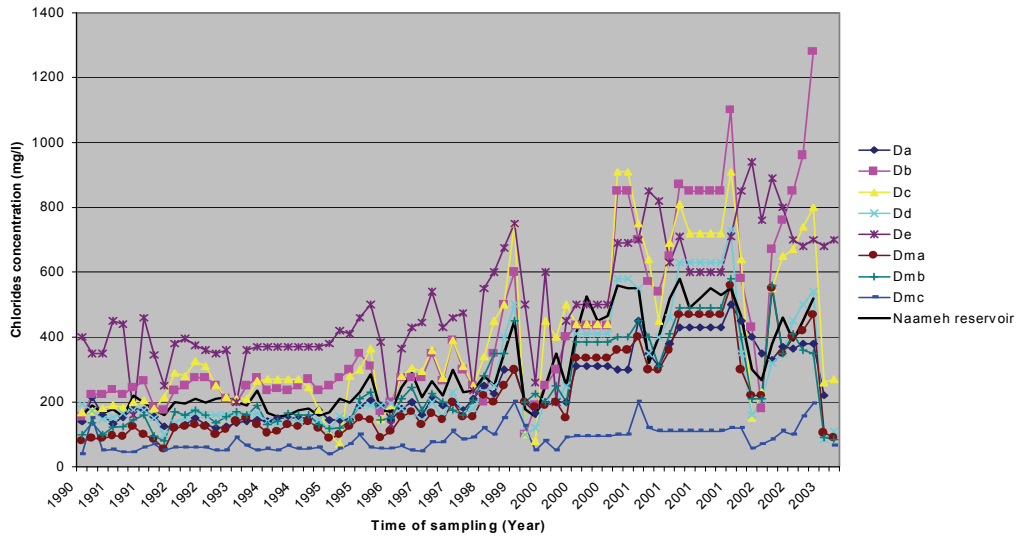


Figure 5: Concentration of Chlorides in the BWA Wells of Damour (1990-2003)

Despite the deficiencies in sanitation services, contamination by sewage was not detected in any of the well and network samples. However, this does not necessarily mean that there is no risk of groundwater contamination, as the majority of the population is served by septic tanks.

Table 3: Results of Well Survey in Damour [MoE/ELARD, 2003]

| Type | Uses | Aquifer Tapped | No. of wells with known pump discharge | Average Pump Discharge (m ³ /d) | Exploited volume (million m ³ /year) | |
|----------------------------|------------|----------------|--|--|---|------------|
| | | | | | Min | Max |
| Beirut Water Agency | Domestic | Sannine | 14 | 3115 | - | 7.2 |
| Barouk Water Agency | Domestic | Sannine | 2 | 2376 | 0.29 | 0.58 |
| Private | Domestic | Sannine | 44 | 310 | 0.31 | 0.41 |
| | Irrigation | Sannine | 6 | 1958 | 0.54 | 0.71 |
| Total | | | 64 | - | 1.14 | 8.9 |

EFFICIENCY IN WATER DISTRIBUTION AND USE

Around 80% of the total population of the River Basin is connected to the public water supply system. By estimate (the metering system presents many deficiencies), distribution network losses range between 25 and 50% during the winter and 45 and 61% during the summer. This is comparable to the general situation in Lebanon concerning water losses.

The agricultural sector depends mainly on the Damour River, in addition to few artesian wells for irrigation. Results confirmed the overexploitation of the river water and the wells, when comparing actual water consumption values with theoretical ones. The highest level of water consumption occurs during the summer season and is combined with the application of inefficient surface irrigation techniques.

INSTITUTIONS WITH A ROLE IN WATER MANAGEMENT

The water sector is currently governed by a centralized system and is under the jurisdiction of the Ministry of Energy and Water (MEW), the Ministry of Environment (MOE), and the Ministry of Public Health (MPH).

Other institutions, such as the Ministry of Agriculture (MOA), the Ministry of Public Works and Transportation (MPWT), the Ministry of Interior and Municipalities (MIM), the Ministry of the Displaced (MOD)², the Regional Water and Wastewater Establishments, the Litani River Authority (LRA), and the Council for Development and Reconstruction (CDR) also have an important role. Local municipalities are responsible of implementing water projects according to the National Master Plan elaborated by the MEW.

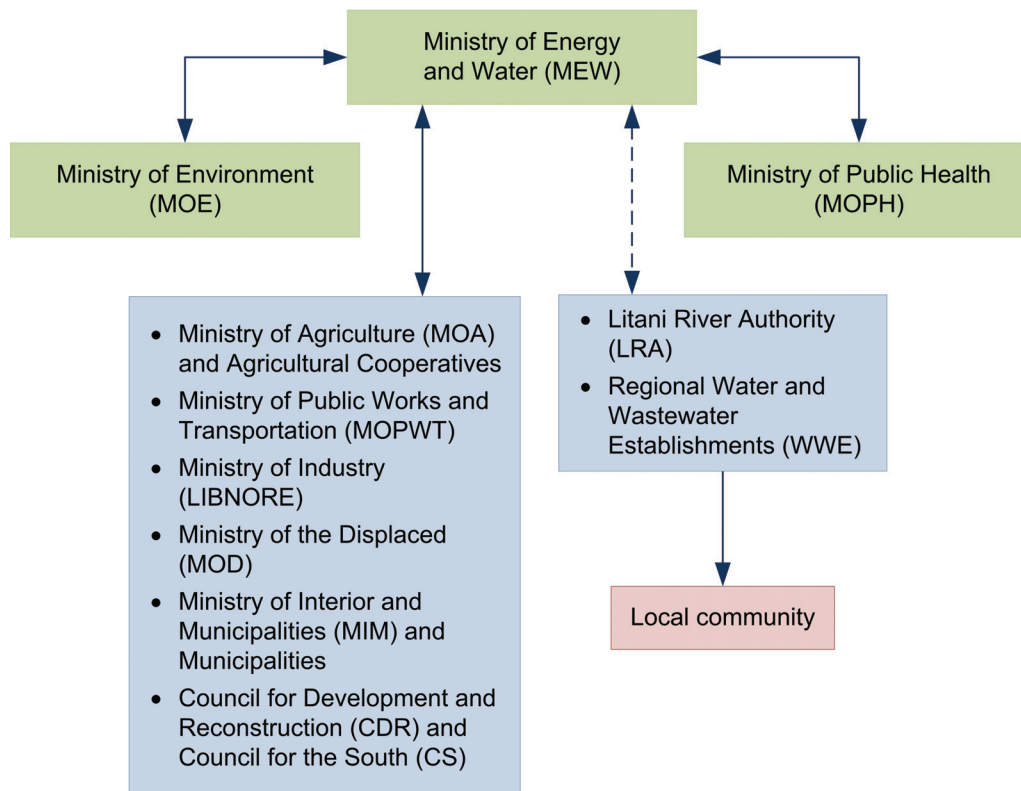


Figure 6: Institutions dealing with water management issues

The MEW is responsible for the development of the National Master Plan for water management. Additionally, the MEW undertakes by law the responsibility of supervising and coordinating the activities of all institutions dealing with water management issues. Coordination, however, remains limited due to the lack of human resources and the fact that the corresponding cooperation and coordination mechanisms are not defined in the pertinent legislation. Table 4 below provides an overview of the responsibilities of the different authorities in water management operations.

² The Ministry of the Displaced is a temporary ministry that aims at the rehabilitation of displaced areas destroyed during the period of “political instability” (1975-1989). Once its mission is completed, the ministry will be liquidated.

Table 4: Water Resources Management and Planning Matrix

| ACTIVITY | M E W | M P H | M O E | M O A | M O P W T | M I M | B & M L W W A | B I W A | B W A | M U N I C I P | L R A | C D R | G P L A N | L I B N O R | M O D |
|---|-------------|-------------|-------------|-------------|-----------------------|-------------|---------------------------------|------------------|-------------|---------------------------------|-------------|-------------|-----------------------|----------------------------|-------------|
| Surface waters | | | | | | | | | | | | | | | |
| Use Regulation | X | | | X | | | X | X | X | | | | X | | |
| Storage | X | | | X | X | | X | X | X | | | X | X | | |
| Groundwater recharge | X | | | | | | X | X | X | | | X | | | |
| Diversion (recreational water) | X | X | | | | X | | | | X | | | | | |
| Quality monitoring | X | | X | | | | | | | | X | | | | |
| Assessment | X | | | | | | | | | | X | | | | |
| Groundwater | | | | | | | | | | | | | | | |
| Use Regulation | X | | | | | | X | X | X | | | X | | | |
| Storage | X | | | | X | | X | X | X | X | | X | | | X |
| Recharge | X | | X | | X | | X | X | X | | | X | | | |
| Quality monitoring | X | X | X | | | | X | X | X | X | | | | | |
| Assessment | X | | | | | | | | | | | | | | |
| Well permits | X | X | | | | | | | | | | | | | |
| Irrigation network | | | | | | | | | | | | | | | |
| Rehabilitation | X | | X | X | | | X | | | | | X | X | | X |
| Modernisation | X | | X | X | | | X | | | | | X | X | | X |
| Drainage water management | X | | X | | | | | | | X | | X | | | X |
| Wastewater management | X | X | X | | | X | | | | X | | | | | X |
| Desalination | | | | | | | | | | | | | | | |
| Introduction of technology | | | | | | | | | | | | | | | |
| Promotion of efficient water use | | | | | | | | | | | | | | | |
| Domestic sector | X | X | X | | | | X | X | X | | | X | | | |
| Industry | X | | X | | | | X | X | X | | | X | | | |
| Agriculture | X | | X | X | | | X | X | X | | | X | | | |
| Legislation | | | | | | | | | | | | | | | |
| Regulation and codes | X | X | X | X | | | | | | | | | | | |
| Standards | X | X | X | | | | | | | | | | | X | |
| Policy setting | X | | | | | | | | | | | | | | |
| Water allocation | X | | | | | | | | | | | | | | |
| Project financing | X | | | | X | | | | | | | X | X | | X |
| Project design | X | | | | | | | | | | | X | X | | |
| Project implementation | X | | | | | | X | X | X | | | X | X | | |
| Project operation and maintenance | X | | | | | | X | X | X | | | | X | | |
| Pricing (tariffs) | X | | | | | | | | | | | | | | |
| Enforcement | X | X | X | X | X | X | | | | X | | | | | |
| Water data records | X | X | X | X | | | X | X | X | X | X | | X | | |

LEGISLATION

The Lebanese law governing the water sector dates back to the Ottoman and French regimes. The out-of-date law, coupled with the political instability that the country faced during the period 1975-1989, brought about many problems associated with the mismanagement of the water sector (MOE & others, 2004). However, the recognition of the significance of sustainable water management urged policy makers towards the development of new laws addressing:

- **The management of the water sector (Law No. 221 of 2000 and its amendments)**, which led to institutional change and defined the main responsibilities of the different institutions dealing with water management issues (mainly those of the Ministry of Energy and Water and those of water and wastewater utilities). However, the law was not based on an in-depth assessment that would consider the political, legal, socioeconomic and environmental situation of the country. This had several drawbacks, requiring the modification of many laws, decrees and decisions, which are often contradictory to each other, and resulted in the definition of conflicting rather than complementary roles among institutions with a role in water management.
- **Environmental protection (Law No. 444 of 2002)**, which emphasized the role of the Ministry of Environment (MOE) in promoting the sustainable use of natural resources and the prevention of environmental pollution and degradation, in relation to public safety. However, the lack of enforcement decrees and mechanisms for this law results in its ineffective implementation.

Water-related legislation is summarized in Table 5.

Table 5: Legislation governing the water sector in Lebanon

| Reference | Focus | Content | Implementation Status |
|--|---------------|--|---|
| Decision No. 320 of 1926 | Water Quality | Emphasizes on the prohibition of the direct or indirect disposal of animal manure and the formulation of wastes depots within the haram (protection zone) of water springs used for public supply. | Not implemented since it is outdated |
| (General Health Rules) Legislative decree No. 16/L of 1932 | Water Quality | Emphasizes on the development of a protection zone around a well or a spring used for drinking water supply, and the prevention of any activity of potential risk within the protection zone. | Not seriously implemented since it is outdated and not revised. |
| (Protection and Use of Public Water Properties) Decree No. 2761 of 1933 (articles 5&6) | Water Quality | Emphasizes on the prohibition of the direct or indirect wastewater discharge and waste disposal into the sea and water streams. | Not implemented due to lack of enforcement mechanisms |
| (Drinking water abstraction projects) Legislative decree No. 227 of 1942 (articles 2 &4) | Water Quality | Emphasizes the authorization of the usage of water resources for drinking purposes and the identification of protection zones. | Not implemented |

| Reference | Focus | Content | Implementation Status |
|---|----------------|---|--|
| (Water Sources Protection Zone delineation) Decree No. 10276 of 1962 amended by decree 7007 of 1967 | Water Quality | Emphasizes on the identification of protection zones for water resources, based on the results of geological studies. | Implemented but the council responsible of determining the protection zone does not have the resources required. |
| (Water Sector Management) Law No. 221 of 2000, article 2, paragraph 11 | Water Quality | Indicates the responsibility of the MEW in the assessment of water quality. | Implemented by the regional water and wastewater establishments for few physical and chemical parameters. |
| (Environmental Protection) Law No. 444 of 2002, article 35 &36 | Water Quality | Indicates the coordination between the MOE and MEW for developing an Integrated Approach towards the management of natural resources, in addition to setting the criteria for implementing and supervising appropriate disposal and discharge methods of pollutants of potential risk to water sources. | Not implemented due to the lack of coordination mechanisms between the ministries |
| (Guidelines and Criteria for Permitting the Construction and the use of Industries) Decree No. 8018 of 2002, article 20 | Water Quality | Indicates required distances of industrial zones from surface and groundwater bodies. | Inadequate legislation |
| (Criteria for the Use of Sand and Rock Quarries) Decision No. 182/1, 183/1, 184/1, 185/1, 186/1 of 1997, Articles 2 | Water Quality | Emphasizes on conducting EIA studies for proposed quarrying sites (to protect water resources and the environment). | There is no implementation decree |
| (Wastewater treatment plants liquid waste and air pollution standards) MOE, Decision 8/1 of 2001, Appendix 4 & 5. | Water Quality | Involves the criteria and standards of wastewater and air pollutants discharged or emitted from a wastewater treatment plant for the protection of the water resources and the environment. | Partially implemented |
| Decision No. 320 of 1926 | Water Quantity | Emphasizes on the problems of water usage and allocation. | Still implemented |
| (Environmental Criteria to Permit the Construction and the Use of Tanneries) Decision No. 75/1 of 2000, article 3, paragraph 1-3 | Water Quantity | Emphasizes on: a) the rationalization of water use along industrial production processes, and b) water reuse. | There are no specific guidelines. |

| Reference | Focus | Content | Implementation Status |
|---|--------------------------------------|--|--|
| (Environmental Criteria to Permit the construction of buildings within the protection zones of rivers) Decision No. 90/1 of 2000, (article 2, paragraphs 1&2) | Water Quantity | Emphasizes on rationalizing water use in construction activities. | Not implemented due to the lack of enforcement mechanisms. |
| (Environmental Criteria to permit the construction and the use farms, dairy processing plants, plastic industries, and fruit processing plants) Decision No. 3/1of 2000, (article 3, paragraphs 1&3), Decision No. 5/1 of 2000, (article 3, paragraph 1&3). Decision No. 16/1 of 2001, (article 3, paragraphs 1&3), Decision No. 29/1 of 2001, (article 3, paragraphs 1&3) Decision No. 61/1 of 2001, (article 3, paragraph 1&3), | Water Quantity | Indicates water conservation methods to limit water consumption in production and cleaning in industrial settings. Examples are: dry cleaning, high pressure nozzles, and the " BATCH" method used for cleaning fruits and vegetables. | Not implemented due to the lack of enforcement mechanisms. |
| (The Management of Water Abstraction and its Use) Decree No. 14438 of 1970, articles 2, 11, 16 | Water allocation (water abstraction) | Emphasizes the necessity of obtaining a 4 -year permit for groundwater abstraction (springs), and drilling boreholes exceeding 150 m in depth. The permit should also include the purpose of use (domestic, agricultural, industrial). | Not completely enforced. |
| (General Health Rules) Legislative decree No. 16 of 1932, article 14 | Water allocation (Domestic use) | Indicates that a minimum drinking water quantity of 5 l/cap/d is to be allocated for an area of at least 500 inhabitants. However, the exact amount of required domestic and drinking water has not been yet estimated. | Not implemented, as the law is outdated. |
| (General Industrial Health Criteria) Decision No. 6/1 T of 1936, appendix 2 | Water Allocation (Industrial use) | Emphasizes the prevention of the use of wells or cisterns/tankers as sources for water supply. Instead, water should only be supplied from the public piped water network, or springs. | Not implemented since the government cannot secure enough water. |
| (Management of Water Abstraction and Its Use) Decree No. 14438 of 1970, article 9 | Water tariffs | Indicates the annual fees for water abstraction in public (1,000,000 LL/yr) or private (500,000 LL/yr) properties. This also includes the cost of property damage and the cost of utilizing the property. | Implemented. |

| Reference | Focus | Content | Implementation Status |
|---|--|--|--|
| (Water Use System in Tripoli) Decree No. 10231 of 1955, article 1, paragraph A | Water tariffs (domestic use) | Flat annual rate is charged for areas without a metering system. | Not yet implemented. |
| (The Management of Water Abstraction and Its Use) Decree No. 14438 of 1970, article 15 | Water tariffs (Agriculture and industry) | Indicates the annual rates per 1 m ³ of the total amount of water licensed for irrigation (100 LL/m ³), and industrial activities (600 LL/m ³). This may also include the cost of damage of the property. | Not enforced. |
| (Water Sector Management) Law No. 221 of 2000, (article 4, paragraph 1) | Water tariffs | Indicates the necessity for recommending a new tariff structure for drinking and irrigation, taking into account the socioeconomic situation. | Partially implemented. |
| Decision No. 320 of 1926 | Water Rights | Emphasizes the problem of water rights | Implemented as water code. |
| (Public Property) Decision No. 144/S of 1925, article 2 | Water Rights | Indicates the water resources owned by the public sector (shores, lakes, waterfalls, rivers, dams, hydraulic infrastructure used for public supply, etc). | Implemented. |
| (The Law of Real Estate) Decision No. 3339 of 1930, article 60. | Water Rights | Indicates that water springs that cannot be used for the public benefit can be owned by individuals. | Implemented. |
| (Environmental Protection) Law 444 of 2002, article 57 | Sanctions | Identifies the set of sanctions to be imposed by the MOE, which include: a) payment for the restoration of damaged sites, b) annulment of permits, c) setting mitigating measures for projects to reduce their impacts, d) penalties. | Not implemented due to the lack of enforcement mechanisms. |
| (The Law of Penalties) Legislative decrees No. 340 of 1943, paragraphs 745-749 | Sanctions | Imprisonment of those who executed any offensive activity, such as unauthorized drilling, pollution of water source. This also involves the definition of penalties. | Implemented. |

INSTITUTIONAL ARRANGEMENTS FOR WATER MANAGEMENT IN THE DAMOUR RIVER BASIN

The main authority responsible for the management of water resources in the Damour River Basin is the Ministry of Energy and Water (MEW). The MEW is responsible for setting the planning framework for sustainable water management at the river basin level. MEW has planned to construct a major dam in the Damour River for inter-seasonal storage, but the project has not yet been implemented. While the Council for Development and Reconstruction (CDR) could play a role in mobilizing resources for the execution of this, and similar projects, no progress has been made thus far.

The Beirut and Mount Lebanon Water and Wastewater Establishment (BMLWWE) is responsible for supplying potable water to its subscribed customers. While the Damour Basin falls within its jurisdiction, groundwater from Damour is pumped to supply water to Beirut but apparently without adequate consideration of safe yields; groundwater salinity has been increasing, indicating possibility of seawater intrusion.

The Ministry of Environment (MOE) is the authority responsible for controlling sources of pollution; however at present it has limited capacity to monitor the numerous environmental violations within the basin. The Ministry of Public Health (MPH) also monitors the safety of drinking water. The same applies for local municipalities. In addition, the Damour municipality operates groundwater wells to supply potable water to the Damour village.

VALUING WATER – FRAMEWORK AND CHALLENGES

POLICIES AND DRAWBACKS

Law 221 empowers regional water authorities to define and collect water tariffs for domestic and agricultural use. Subscription fees for domestic water supply vary among Water Boards and are determined according to water availability and distribution costs, as distribution by gravity is the cheapest, while distribution requiring pumping is far more expensive.

Most households undertake additional expenses to meet their water needs. Assuming that households with a 1 m³/day gauge subscription actually receive and consume this amount of water per day, such households would be paying the equivalent of US\$0.12/m³ to US\$0.42/m³ of water. In fact, most households end up paying much more per cubic meter supplied, for two main reasons:

- Frequent and periodic water shortages (some areas report receiving water only a few hours per day), combined with the
- Need to buy water from private haulers, at costs typically ranging between US\$5 and US\$10/m³ supplied.

In particular, secondary residences pay the full annual subscription fee, even though they use the residence only a few weeks or months during the year. As long as water meters are not installed, water fees will be independent of actual water consumption, and subscribers will continue to pay the same amount, regardless of the quantity of water actually delivered and consumed. Users have no incentives to conserve water and wasteful water use will continue.

In view of the projected water shortages that Lebanon will face, the MEW has initiated several projects to better manage Lebanon's water resources, through the formulation of a 10-year plan (period 2000-09) for water and wastewater management. The plan includes actions for water management and for energy infrastructure. Nearly two-thirds of the budget is allocated for the development of additional water resources (i.e. supply-side measures). In parallel, efforts should be made for improving water efficiency (water metering, elimination of illegal connections, introduction of on-farm practices for the efficient use of irrigation water), and for developing alternative water resources, such as use of treated wastewater.

On the other hand, and while the Government has been supportive of private sector participation in many sectors including water, there are many impediments, which include the lack of explicit policies and action plans, as well as an inadequate legal framework and unclear procedures for establishing and sustaining public-private partnerships. In the absence of an

overall strategy, the Government is pursuing a piecemeal approach, proceeding with a management contract with a private operator in the city of Tripoli and considering other arrangements supported by the World Bank in Baalbeck. As these isolated efforts increase, different donors may encourage different or contradictory approaches. Efforts to foster private sector involvement increase, in part, out of recognition of the weak performance, inadequate staffing, and poor resources of the regional water authorities. These efforts are closely linked to a planned merger of authorities, but a clear and broadly accepted understanding of the operational partnership among the central, regional authorities, and the private operators has yet to emerge and is probably a premature step in the overall process.

COST RECOVERY & INFRASTRUCTURE DEVELOPMENT IN THE DAMOUR RIVER BASIN

In the Damour River Basin, the Damour Municipality attempts to recover costs of water supply through water subscription fees. However, due to the prevailing economic situation, the municipality is not charging at full cost. Especially for households under the poverty threshold, water is provided free of charge. Water services in other municipalities of the River Basin are provided by water authorities and subscribers pay the corresponding fees.

The significant delays in the development of planned hydraulic infrastructure imply that financing for new infrastructure is limited. However, the problem is not only of financial nature, as there is some controversy and conflict on the implementation of the project among local stakeholders.

CONCLUDING REMARKS

Table 6 summarizes water management challenges currently faced in the Damour River Basin, as analysed in the previous paragraphs. The intensity of problems faced, both in the Damour area and in Lebanon as a whole, has motivated several international and national efforts to pursue equitable and efficient water management at the national, river basin and local levels. For example, the CAMP project, financed by the United Nations Environment Program (UNEP) and the Mediterranean Action Plan (MAP), managed by the Priorities Action Program Regional Activity Center (PAP/RAC), was implemented in Lebanon by the Ministry of Environment from 2002 to 2004. It aimed at promoting integrated coastal zone management and has promoted specific interventions at three coastal cities, Damour, Sarafand and Naqoura. Although the project successfully mobilized local communities towards integration of water management operations and other sustainable practices, it has failed to ensure continuity of the activities undertaken. This was partly due to the fact that no follow-up activities were launched by the MEW.

Along the same line, the EC-financed IPP-MSD project, which was aimed at strengthening the institutional structure of the MEW and of water and wastewater establishments, can be considered a successful water management initiative. The project managed to build capacity in beneficiary institutions, developed a decision-support tool that would be used for planning, and provided training to the corresponding staff.

Infrastructure development both in the Damour River Basin and throughout Lebanon is still a key issue. Securing a minimum water supply requires development of hydraulic infrastructure and development and proper maintenance of distribution networks. Sewerage infrastructure (networks and wastewater treatment plants) is still in the process of being devel-

oped. In this context, issues arise as to how financial sustainability of water services can be ensured (even if capital costs are subsidized).

Table 6: Overview of water management challenges currently faced in the Damour River Basin

| Challenge | Description |
|-----------------|---|
| Sharing water | <ul style="list-style-type: none"> – Conflicts among water users – Peak demand for irrigation occurs during summer when water is least available – Geologic formations with fissured karstic bedrock and narrow steep valleys do not always favour construction of dams for storage of surface water – Old water supply infrastructure leading to excessive losses – Lack of wastewater management infrastructure – Seawater intrusion in coastal aquifers due to overexploitation |
| Valuing water | <ul style="list-style-type: none"> – Inadequate water pricing – Inadequate financing for water infrastructure – Lack of economic incentives for efficient water use and less polluting practices |
| Governing Water | <ul style="list-style-type: none"> – Conflicts among authorities regarding water allocation – Distribution of water establishments and offices by geopolitical boundaries rather than by river basin hydrographical boundaries – Lack of adequate monitoring data for proper assessment of water resources – Insufficient level of awareness and knowledge of best management practices in agriculture – Attraction of new investments could pose a stress to water resources if not properly planned – Sensitivity to geo-political context hinders economic development |

Furthermore, water saving practices and efficient allocation of water resources among sectors and users are issues that receive increasing attention both by policy makers and the citizens concerned. In this perspective, the development of policies aimed at public participation can further strengthen the institutional environment, facilitate the implementation of options through conflict resolution and ensure that the developed schemes are in line with the needs and interests of local societies.

PART II: THE INECO LEBANON CASE STUDY:
ENGAGING IN A PARTICIPATORY APPROACH FOR WATER STRESS MITIGATION
IN THE DAMOUR RIVER BASIN

BACKGROUND AND MOTIVATION

As illustrated in the previous section of this report, the Damour River basin is currently facing increasing water stress, manifested through the decrease in the total amount of surface and groundwater of adequate quality available to meet the needs of local domestic, agricultural and industrial users.

The problem is particularly acute in the irrigated coastal plains of Damour, where farmers complain about the lack of water during the summer season because river water is abstracted upstream; thus, the allocation of water is considered irrational, particularly from the perspective of downstream users. The groundwater resources of the area are also under stress due to significant abstractions, mainly for inter-basin transfer to the Beirut area. In addition, the Damour municipality has repeatedly expressed their concern about the increased salinity of groundwater.

The results of a SWOT analysis (Figure 7) undertaken in the area identify the strengths, weaknesses, opportunities and threats that the water resources management system is currently facing. Strengths and weaknesses refer to issues internal to the area and related to its inherent characteristics. Opportunities and threats originate from outside the Damour area boundaries.

| | |
|---|--|
| <p>Strengths</p> <ul style="list-style-type: none"> ➤ Availability of groundwater ➤ Presence of major surface water courses ➤ Presence of the Litani River Authority, which manages major irrigation projects ➤ Limited industrial activities ➤ Acceptable level of urbanisation ➤ Feasibility study for water supply in the area already prepared | <p>Weaknesses</p> <ul style="list-style-type: none"> ➤ Peak demand for irrigation occurs during summer when water is least available ➤ Geologic formations with fissured karstic bedrock and narrow steep valleys do not always favour the construction of dams for surface water storage ➤ Water establishments and offices are set up by geopolitical boundaries rather than by water basin limits ➤ Old water supply infrastructure leading to excessive losses ➤ Lack of wastewater management infrastructure ➤ Lack of adequate monitoring data for the proper assessment of water resources ➤ Seawater intrusion in coastal aquifers due to overexploitation ➤ Insufficient level of awareness and knowledge of best management practices in agriculture ➤ Inadequate water pricing and lack of economic incentives for efficient water use and less polluting practices |
| <p>Opportunities</p> <ul style="list-style-type: none"> ➤ Interest from international funding sources in the development of the new liberated south, leading to potential financial assistance that can be used in water resource management activities/projects | <p>Threats</p> <ul style="list-style-type: none"> ➤ Difficult climatic conditions with most rainfall occurring within a short period of time ➤ Attraction of new investments that could pose a stress to water resources if not properly planned ➤ Sensitivity to the geo-political context that hinders economic development |

Figure 7: SWOT Analysis for Water Resources Management in the Damour Area

The above analysis, combined with the fact that the problems faced in the Damour River Basin are representative of the water management issues faced in Lebanon today, have led to the selection of the local water stress issue as a Case Study for the INECO Project.

The overall Case Study goal was to initiate a process towards the engagement of citizens, water users, decision-makers, local water management authorities and policy makers in a dialogue aimed at exploring alternative water management solutions. Focus is given not only to infrastructure development, but also on soft responses, aimed at preventing pollution, rationalizing water use and ensuring the financial sustainability of water services. The overall process and its outcomes are outlined in the following paragraphs.

DISCUSSING WITH LOCAL STAKEHOLDERS – THE APPROACH

The INECO approach towards the development of a participatory process for discussing alternative institutional and economic instruments to address water management issues was based on the Objective Oriented Project Planning method.

The method, which is similar to the Logical Framework Approach, has been suggested as a tool to support urban participatory decision-making. In INECO, this method has been used to frame discussions with stakeholders, focusing on a water management problem that is commonly perceived as significant (focal) in the region of interest.

The followed approach was divided in three stages (Figure 8):

1. The first stage, **Problem Analysis**, involved the identification of stakeholders and the mapping of their key problems, constraints and opportunities, and the definition of the key water management issue in the region of interest. Furthermore, this stage included the identification and analysis of cause and effect relationships between threats and root causes of the issue at hand;
2. Next, the **Analysis of objectives** concerned the development of policy objectives from the identified problems, and the identification of means-to-end relationships;
3. The final stage, **Option analysis**, concerned the identification of different options that can contribute to the achievement of the agreed objectives. Options were subsequently evaluated by stakeholders to formulate the most suitable strategy for problem mitigation.

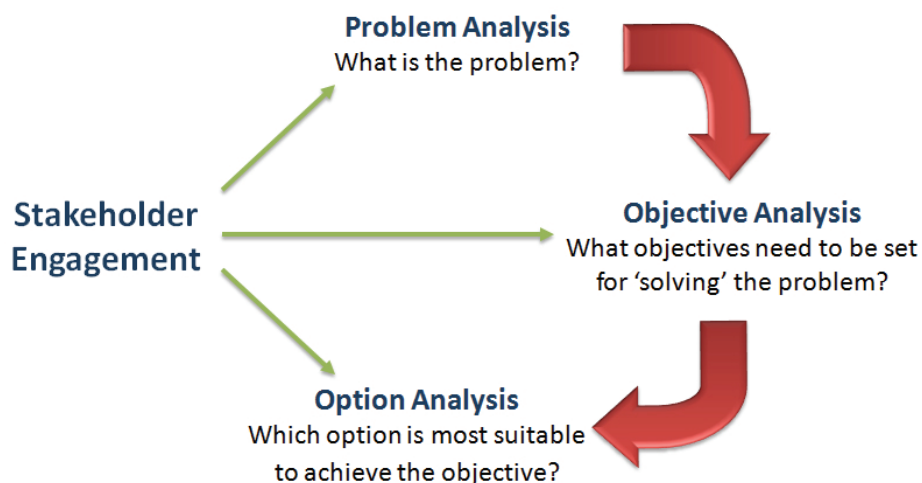


Figure 8: The framework for public participation and engagement in INECO

The overall process was articulated through individual (preparatory or consultation) meetings with key stakeholders (decision and policy makers, representatives of key water users), workshops and public meetings open to stakeholders and all citizens concerned, surveys, discussion fora, and dedicated questionnaires. Emphasis was given to the openness of the process; special care was given to inform stakeholders of all outcomes and replies of other parties, whereas all information collected was made accessible to the public through the distribution and web uploading of material.

The following paragraphs describe the overall implementation of this approach for deriving regional policy recommendations for the mitigation of water stress in the Damour River Basin.

PROBLEM ANALYSIS

The first stage of the developed process concerned the identification of key stakeholders, with a role or concern over the management of water resources and infrastructure development in the region, these being:

- The Beirut Water Authority (BWA), which exploits wells in the area in order to meet part of the increasing urban water demand of the Beirut Metropolitan area;
- The Damour Municipality, which is particularly concerned over the availability of water resources, and the quality of water provided both for drinking water supply and for irrigation purposes;
- Farmers of the area, who experience water shortage especially during the dry summer periods;
- Upstream users, whose practices are often cited as the main cause of water shortage and pollution downstream the Damour River.

The discussions held with different stakeholders revealed several conflicts over water use in the Damour area, between:

- The stakeholders and the policy makers, primarily between the local Municipalities and the Beirut Water Authority, since the former consider that the latter overexploits local groundwater resources.
- The stakeholders themselves, particularly between the Damour municipality and upstream water users.

On the one hand, the BWA is facing major problems in providing sufficient water to meet the constantly increasing water demand in Beirut, and needs to rely on external water supply sources (groundwater from Damour being one of these). On the other hand, the Municipality of Damour is concerned by the overall deterioration of groundwater quality, and particularly with the increased salinity of groundwater due to excessive pumping.

The concern of the Damour municipality is increased as the local authority does not have access to the records of BWA, to monitor the quantity of water being pumped and the quality of the water abstracted. Furthermore, the municipality complains about inappropriate allocation of the Damour river water upstream, and the excessive pollution of the river by upstream users. The coastal agricultural plain is at times suffering from lack of sufficient water due to upstream overexploitation of surface water resources. Nevertheless, upstream users are not willing to discuss the issue and reach consensus on the amounts of water to be used. Furthermore, with respect to water quality, there is no sufficient enforcement of dis-

charge standards, or infrastructure to ensure proper treatment of both domestic and industrial wastewater prior to disposal in the river. Main conflicts over water use, including those mentioned above, are summarized in Table 7, below.

Table 7: Summary of conflicts over water use in the Damour River Basin

| Stakeholder group | Variable of interest | Preference | Willingness to compromise |
|-------------------------------|----------------------------------|--|--|
| Beirut Water Authority | Groundwater from the Damour Area | Maximize groundwater mining | Limited willingness, given the rapid increase of water demand and limited alternative options for water supply |
| Damour municipality | Groundwater quantity and quality | Maintain the quality of groundwater; avoid sea water intrusion | Local aquifer can be exploited by the BWA, as long as groundwater quality is not affected |
| | Surface water quantity | Maintain minimum water flow for use in irrigation | Willingness to compromise with upstream users, as long as a minimum flow for irrigation is maintained downstream |
| | Surface water quality | Suitable standard of water | Not willing to compromise surface water quality |
| Farmers | Water for irrigation | More water | Willingness to compromise as long as enough water is available for irrigation |
| Upstream users | Surface water | More water | Limited willingness to compromise |

Following from the initial mapping of stakeholder views and perceptions, the first workshop, open to all parties, was held on September 12th 2007 in Meshref. The event was attended by 43 participants, including representatives from Ministries, delegates of local authorities, local farmers and owners of agricultural lands, representatives of the Beirut & Mount Lebanon Water Office, NGOs, and experts working in the field of water resource and environmental management. The workshop was primarily aimed at discussing the problem with the local stakeholders, through the development of a “Problem Tree” describing the causes and effects of the problem in a qualitative way. This event also offered the opportunity for a first exchange of view on policy objectives and potential options, which are further discussed in the following paragraph. Through a dedicated and simple (non-technical) questionnaire, stakeholders were also able to express their views on the significance of the problem, its effects and primary causes.



Photos from the INECO Lebanon Stakeholder Workshop “Building a common vision for mitigating water stress in the Damour River Basin”, Meshref, Damour, September 12th 2007

The developed “Problem Tree” is presented in Figure 10. According to the perceptions of local stakeholders, the focal water management problem faced in the Damour River Basin

can be best described as the **decrease in the total amount of surface and groundwater of adequate quality required for meeting the water needs of domestic, agricultural and industrial users (Water Stress)**. Contributing causes include the uncontrolled discharge of industrial and domestic wastewater in surface water, uncontrolled surface water allocation, and seawater intrusion in groundwater. These are in turn attributed to limited law enforcement and inadequate regulation, limited capacity of authorities, limited financial resources, lack of a clear planning framework, lack of participation and coordination and inefficient monitoring. The issue of groundwater inter-basin transfers is particularly regarded as the main cause of groundwater quality deterioration in the coastal area. It is perceived that the problem is further exacerbated by lack of awareness and technical capacity, by social and political pressure from user groups, and lack of integrated management of the water resources of the area. Future effects can comprise increased conflict among water users, and increased social costs due to health problems from the use of polluted water.

The dedicated questionnaire, completed during the workshop, was also a helpful tool in revealing the perceptions of stakeholders as to the significance of causes and effects to the problem. Answers as per the causes of the problem are presented in Figure 9. A key issue that is evident from the processing of stakeholder replies is that the majority believes that the main reason for both water quality deterioration and resource overexploitation is related to the enforcement of the pertinent legislation on water discharges and groundwater exploitation. Furthermore, participants underlined the need for reaching a joint agreement on the allocation of water resources of the Basin, both between upstream and downstream users and between local authorities and the Beirut Water Authority.

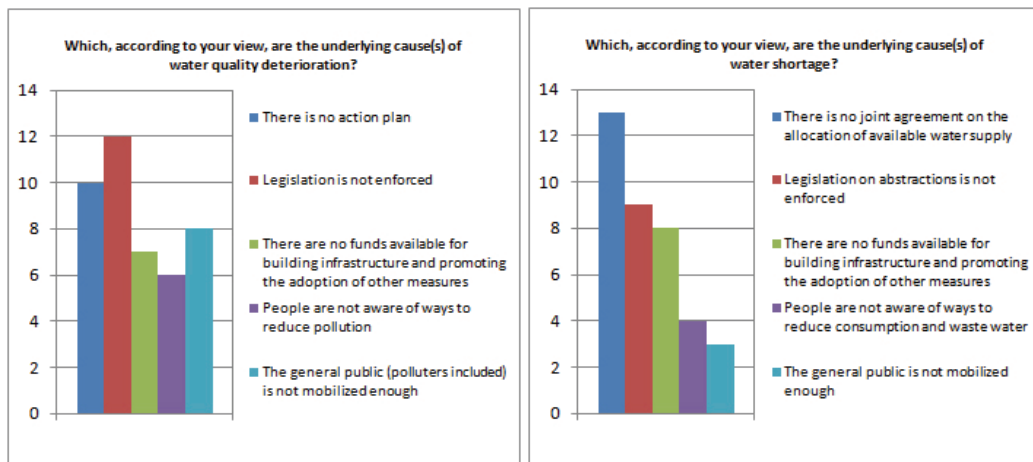


Figure 9: Stakeholder answers on the "underlying causes" of water quality deterioration and water shortage in the Damour River Basin

All participants stressed the need for new infrastructure for water supply enhancement (mostly river damming and water recycling projects). However, several groups also pointed out the need of adopting a global water management scheme that would address the technical, environmental and health, financial and institutional issues at all water management levels and operations.

Several participants converged to the requirement of closely monitoring water and environmental quality in the river basin. Medium and long-term solutions should seek to the long-term preservation of the natural capital and heritage and the development of a "water culture" among water users.

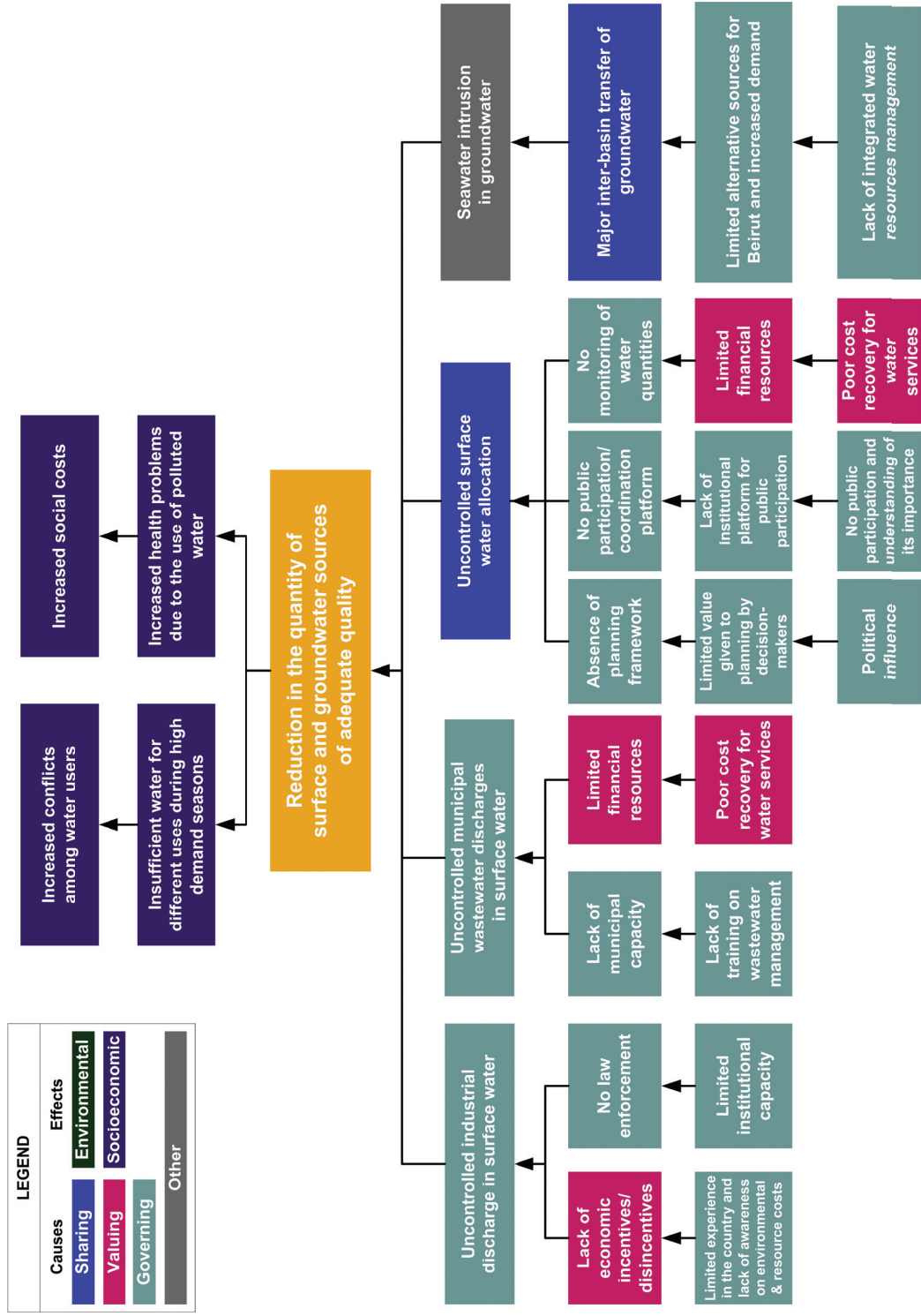


Figure 10: "Problem tree" analysis of causes and effects to water stress in the Damour River Basin

It was further pointed out that due to the political nature of water-related issues in the Basin and in Lebanon, sustainable solutions can only be achieved through strong political commitment and governmental support. In this regard, participants proposed that the outcomes of the INECO Case Study in Lebanon should be formulated as a comprehensive policy proposal, which should be then submitted to higher-level policy makers for appropriate action.

DEFINING POLICY OBJECTIVES

Subsequently, individual consultation and discussion sessions were held with all local stakeholders and actors that participated in the first event, as well as additional groups that expressed their interest to join the process. These meetings were aimed at: (a) consolidating the problem analysis of the previous workshop, and (b) identifying key policy objectives which should be pursued for problem mitigation. In this stage, the developed “Problem Tree” was used to identify and develop policy objectives for mitigating the issue at hand. The resulting “Objective Tree”, which maps the corresponding means-to-end relationships is depicted in Figure 11. This “tree” was further elaborated to define a set of key policy objectives, to achieve the main goal of “Water Stress Mitigation”, incorporating the views and goals of all stakeholders at the table.

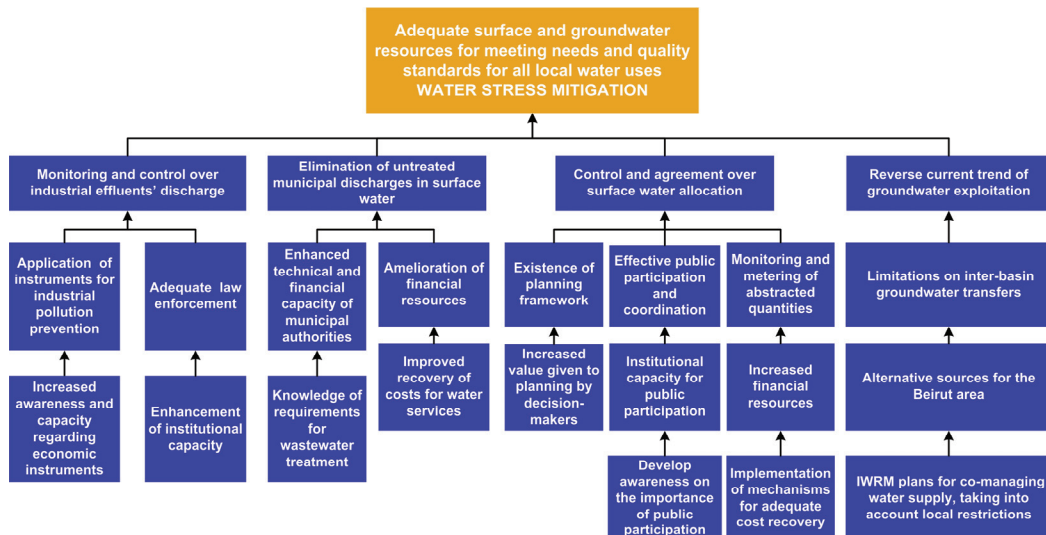


Figure 11: Proposal on objectives for mitigating water stress in the Damour River Basin

The key policy objectives, which according to the Objective Tree of Figure 11 need to be achieved are:

- **Objective A:** Monitoring and control of the discharge of industrial effluents;
- **Objective B:** Development of schemes for the collection and treatment of domestic effluents;
- **Objective C:** Agreement and control over surface water allocation;
- **Objective D:** Regulation and control of groundwater abstractions, in order to minimize overexploitation.

Furthermore, and through the individual consultation meetings with local stakeholders, these objectives were further articulated into four (4) main elements, as follows:

- Securing necessary quantity & adequate quality of surface and underground water, particularly during dry seasons;

- Rehabilitation of infrastructure and reinforcement of the monitoring and regulatory capacity of institutions dealing with water management issues;
- Water pollution prevention;
- Allocation of water resources, on the basis of a joint agreement and of a comprehensive socioeconomic survey and analysis of water use.

In the above context, the next section of this report outlines instruments that were suggested for achieving these objectives. Emphasis is placed on “soft” responses; the issue of additional infrastructure development is analysed as well, addressing also issues relating to the future financial sustainability and management of water services.

IDENTIFICATION AND ANALYSIS OF OPTIONS FOR WATER STRESS MITIGATION

The work towards deriving policy recommendations focused on the identification of alternative (institutional and economic) options to achieve the aforementioned objectives. These suggestions, subject to evaluation, were used to formulate a roadmap for the development of strategies for achieving the wider goal, i.e. the mitigation of water stress in the Damour River Basin. To facilitate discussions with local stakeholders, and in accordance with the objectives defined above, potential policy instruments were grouped to five (5) categories, as follows:

- (1) Options aimed at regulating/controlling groundwater abstractions;
- (2) Options aimed at preventing/controlling pollution from industrial and domestic water use;
- (3) Options aimed at fostering the reaching of a joint agreement for surface water allocation;
- (4) Options for improving efficiency in water use;
- (5) Options for strengthening the socio-economic and institutional environment in the River Basin. This category also groups suggestions for improving the knowledge base on water resources, as data availability and disclosure of information to stakeholders are prerequisites for raising awareness and achieving informed decision-making and public participation.

The following paragraphs present in more detail the suggested options. The analysis also outlines barriers that have inhibited the (effective) implementation of potential responses, as well as associated issues that need to be considered and evaluated to achieve sustainable solutions to the problem at hand. Identified issues pertain to the three main functions: (a) water service provision (Operational function); (b) River Basin /Aquifer management (Organizational function); (c) National water policy and law (Constitutional function).

REGULATION OF GROUNDWATER ABSTRACTIONS

The reduction of groundwater abstractions to sustainable levels is considered a key objective by all stakeholders and decision-makers consulted throughout the Case Study development process. Figure 12 outlines the relevant options that were suggested to stakeholders for further evaluation.

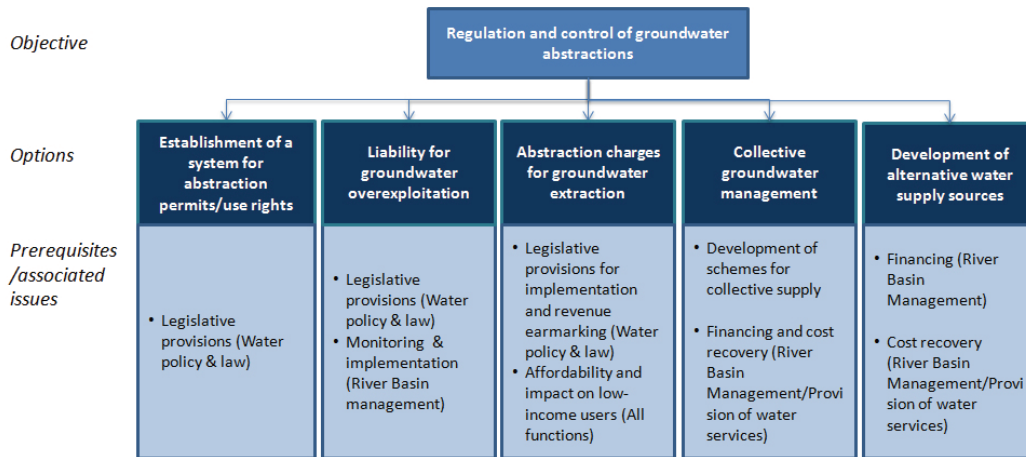


Figure 12: Suggested options – Regulation of groundwater abstractions

It is noteworthy that the relevant legislation in Lebanon foresees procedures for permit issuing for borehole drilling. In particular, extraction permits are subject to strict conditions and require Republican Order or Decree except for those under 150 meters depth and not exceeding 100 m³/day. Abstraction from public boreholes normally complies with permits issued. However, questions arise as to the effectiveness of the system in the case of private boreholes and wells, or when alternative sources of water supply are not available or costly to exploit. Furthermore, specific upstream zones of the Damour River Basin have been declared protected and borehole drilling is restricted in these areas.

Infrastructure development is also being strongly supported as a potential option. Stakeholders demand the construction of a dam in the Damour River, with the aim to secure water supply during the dry summer months, and compensate for the transfer of the region’s water resources to the Beirut Metropolitan Area. Additionally, it is believed that the expansion of the public water supply system to supply deprived areas (e.g. the Saadiyat area) and the development of collective schemes for irrigation can help to mitigate groundwater over-exploitation. Other solutions, such as the development of water reuse and recycling schemes are also gaining momentum and support by stakeholders.

Strict legislation enforcement, especially with regard to extractions from private boreholes and wells is also an option that is strongly advocated. It is however recognized that the current technical and financial resources are not adequate for monitoring all groundwater extraction points in the region. Abstraction metering is considered a first key step towards enforcement of stricter limitations in groundwater extraction from existing boreholes, both public and private.

MITIGATION OF INDUSTRIAL AND DOMESTIC POLLUTION

It should be noted that there is no “heavy” industrial activity in the Damour area. However, there is uncontrolled discharge of industrial wastewater from small manufactories and facilities, as confirmed by measured COD concentrations. In this perspective, Figure 13 summarizes options that were suggested for industrial pollution control. In accordance with the analysis outlined in the previous section, it is believed that:

- The implementation of effluent charge systems or the introduction of tradable emission permits (market-based instrument) are not considered applicable given the current institutional framework and the administrative situation;

- Legislation enforcement, through the establishment of a discharge permit system and the regular monitoring of industrial discharges, is strongly supported. The option can have the potential to achieve the suggested objective, provided that there is commitment from the part of the competent authorities;
- Voluntary agreements could provide the technical and financial resources necessary to implement water pollution mitigation measures.

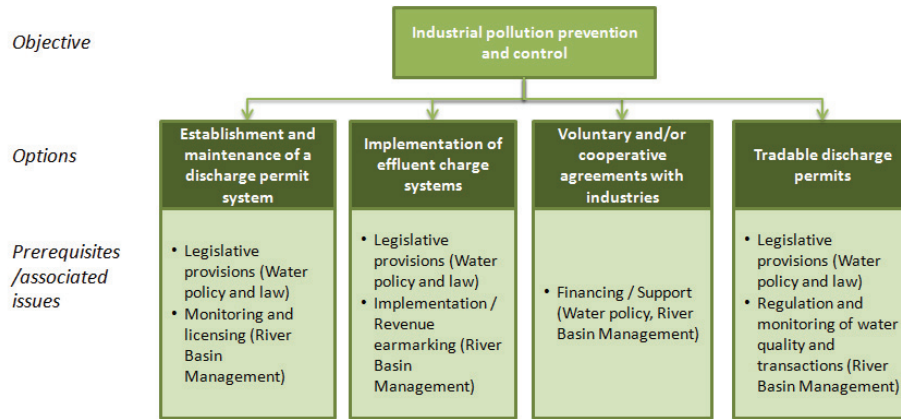


Figure 13: Suggested options – Industrial pollution prevention and control

Water pollution abatement in the River Basin would also require interventions in the management of domestic wastewater. To that end, suggestions mostly focus on the development of the pertinent infrastructure, through State or other funds, as it is estimated that the recovery of capital costs in this case can compromise the affordability of water service charges. However, it is also widely recognized that a reform of water tariffs should be implemented and that sewerage charges should be introduced in order to recover at least the operation and maintenance costs of the required schemes. This reform could be accepted by local stakeholders, provided that the increase is logical and charges are calculated in an open and transparent way.

REACHING AGREEMENT ON SURFACE WATER ALLOCATION

The allocation of the water of the Damour River is an issue of conflict among upstream and downstream users in the River Basin. Options that are suggested to that end involve (Figure 14):

- The introduction of tradable water use rights for surface water.
- The establishment of a surface water abstraction permit system. Although such a system is already in place, there is need to re-define water use rights, as the current framework is considered outdated and does not take into account the change of river flow patterns and the socio-economic developments experienced in the last decade.
- Cooperative agreements between upstream and downstream users, possibly also involving “informal” water trading. Such agreements can be the outcome of negotiations between users. Prerequisites for the implementation of this option would be the development of public participation processes at the River Basin level, to help reach consensus on water allocation and environmental protection.

Finally, it is noted that consensus or mitigation of conflict over surface water allocation could be effected through additional infrastructure development (i.e. the construction of the per-

inent dam in the Damour River Basin), provided that the reservoir’s operational rules are defined in accordance with the interests of both upstream and downstream users.

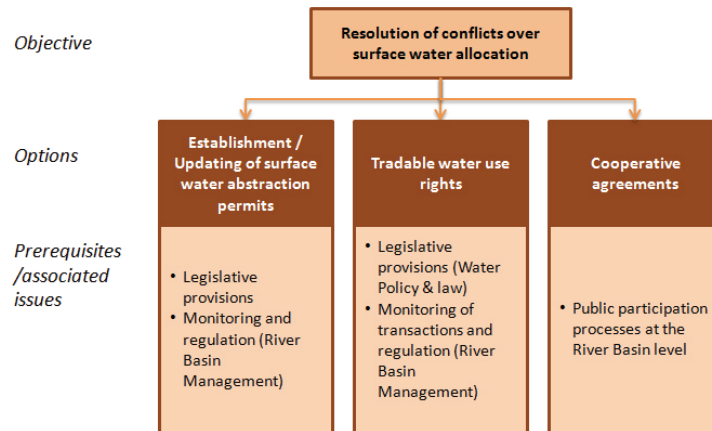


Figure 14: Suggested options – Reaching consensus on surface water allocation

IMPROVING EFFICIENCY IN WATER USE

Improving efficiency in water use is a key objective broadly recognized by all the parties that were consulted. The development of a water culture, through regular awareness and information campaigns and disclosure of information on water-related issues, is strongly supported. Individual efforts are undertaken both at the national and local level, but a more systematic and professional approach that would include the provision of advice on technical issues (irrigation methods, irrigation scheduling, water saving in the home) needs to be pursued. Additional incentives, requiring financial resources from the State or water management authorities and water service providers, include the provision of grants, subsidies, soft loans and/or tax rebates for the installation of water saving equipment.

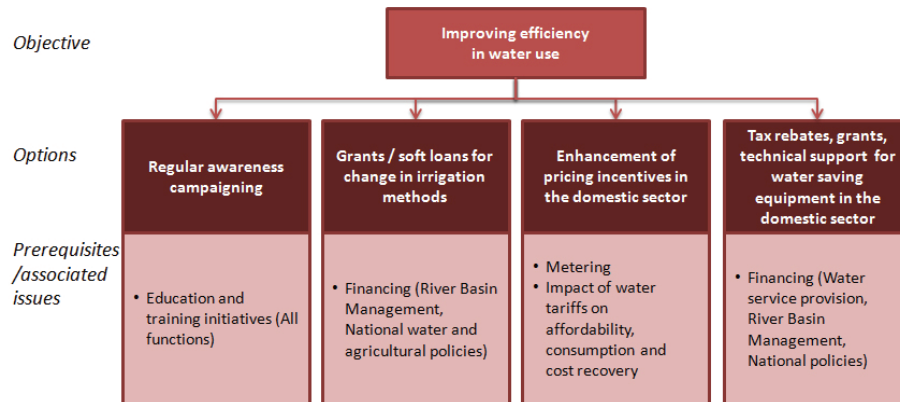


Figure 15: Suggested options – Improving efficiency in water use

Notably, reinforcing the incentives provided by water tariffs is an option that wins the acceptance of stakeholders, provided that the main objective in water pricing policy design and implementation is cost recovery and not penalization of water use. Currently, and due to the lack of an efficient water metering system, water pricing is based on a lump sum determined according to theoretical water consumption. Water pricing reforms can be oriented towards the introduction of a fixed charge, aimed at recovering maintenance cost, and a volumetric charge, provided that water meters are installed in households and that water metering is regularly practiced in all establishments.

STRENGTHENING THE SOCIO-ECONOMIC AND INSTITUTIONAL ENVIRONMENT

The strengthening of the overall socio-economic and institutional environment in the Damour River Basin is considered key to support the implementation of all other instruments.

Decentralization of water management at the River Basin Level is an option that needs to be pursued, as it can facilitate the management of locally shared surface and groundwater resources in an integrated and participative way. Similarly, public participation or at least public consultation at the local level is considered essential. Specific measures can comprise the establishment of local Advisory Committees, or a River Basin Agency, the implementation of Notice and Comment Procedures and the organization of public hearings and meetings.

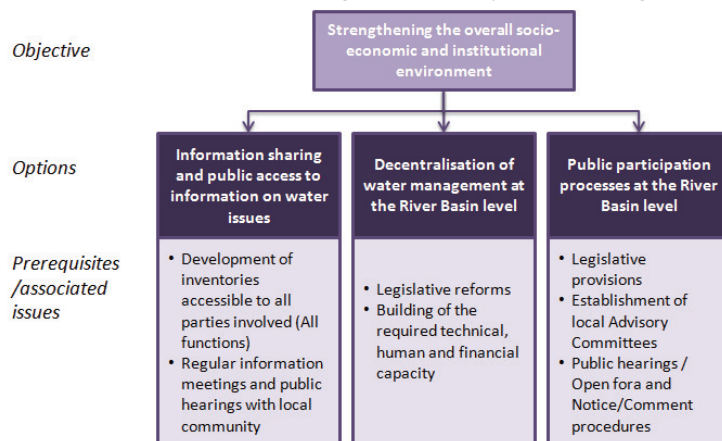


Figure 16: Suggested options – Strengthening the overall socio-economic and institutional environment

Furthermore, there is strong need to improve the knowledge base on water resources in the area, as data are often unavailable or hard to retrieve. Towards this end, inventories and databases, accessible to all users and citizens of the region, can contribute to enhancing awareness on significant water management problems and towards more informed water exploitation and use.

OPTION EVALUATION

PRIORITIZATION OF SUGGESTED INSTRUMENTS

The first step towards the evaluation of suggested responses was their prioritization by local stakeholders, on the basis of a set of predefined criteria common to all the INECO Case Studies. The step was implemented from February to June 2008, and included the:

- Distribution and completion of a survey for ranking ten (10) broad categories of instruments. The survey was aimed at evaluating the feasibility and applicability of economic and institutional instruments, taking into account the local and the national water management context, current conditions and priorities, and future challenges;
- Further consultation meetings and discussion sessions with key user groups and decision-makers to discuss the outcomes of the prioritisation “exercise” and elaborate on potential options.

In total, 80 questionnaires were distributed. A total of 32 responses were received, representing all key stakeholders and user groups. Prior to the distribution of the surveys,

several consultation meetings were held and continuous contact was pursued to answer potential queries and provide expert support. The outcomes are summarized in the spider chart of Figure 17.

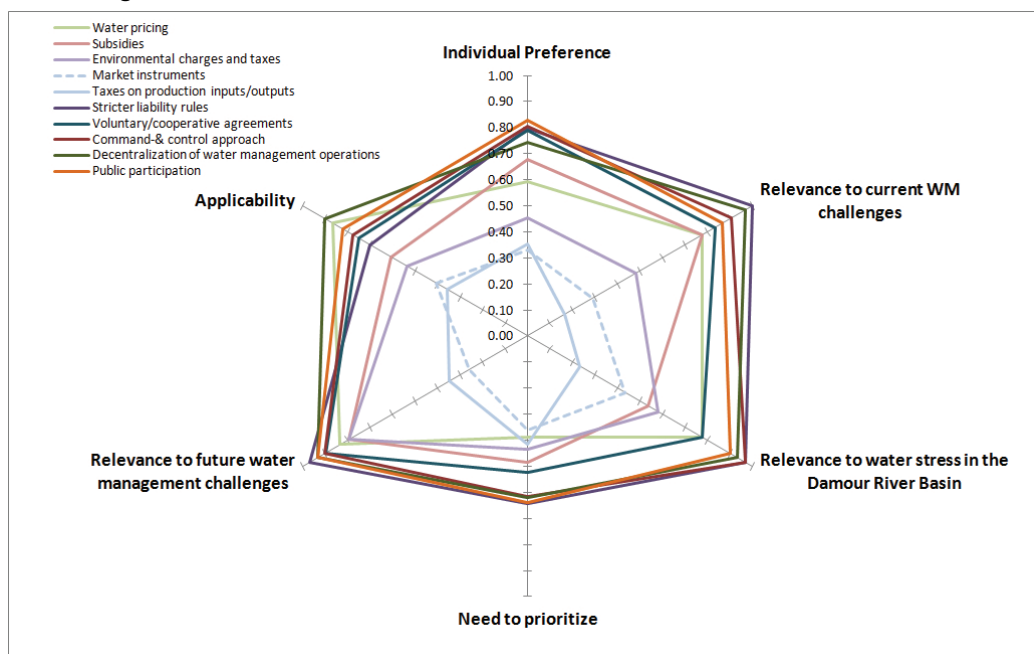


Figure 17: Prioritization of instruments for addressing current and future water management challenges

A key outcome was that answers from different stakeholder groups converged with regard to the solutions of the problem under discussion. Instruments and approaches that seemed to be most relevant and applicable comprise decentralization, public participation and increased liability of polluters. Instead of indirect taxes, there is preference for (financial) incentives, including voluntary agreements.

With regard to the currently applied (or potentially applicable) instruments, opinions and suggestions can be summarized in the following:

- Water pricing does not seem problematic. Consequently it can be argued that the installation of water meters will be accepted by the local community. Tariff structures could be revised, introducing different elements, provided that their increase does not impose excessive burden on water users. A possible differentiation among user groups could be envisaged by setting a low fixed charge and a volumetric charge. Professional categories, such as industries and tourist resorts would be subject to volumetric pricing, whereas in the case of households and farmers a fixed charge could be applied.
- Cost recovery would ameliorate substantially to achieve financial sustainability if water meters are installed and if the proposed differentiation of charges is also taken into consideration.
- A command-and-control approach which would imply the introduction of a discharge permit system, the definition of technology standards and the enforcement of the relevant penalties and sanctions, would be acceptable.

- Market-based instruments are neither a preferred nor an appreciated option. They are generally ignored by stakeholders, and are not presently considered applicable for different socio-economic reasons.
- Voluntary agreements, which have not yet been extensively applied, are clearly preferred.

Decentralization is regarded as prerequisite for enabling the effective implementation of all water management options and development policies. Public participation is also strongly supported, and all contacted parties wish to be further involved in the planning process.

FURTHER CONSIDERATIONS TOWARDS OPTION IMPLEMENTATION

The overall process of evaluating potential policies for mitigating water stress was complemented through a last step, aimed at mapping perceptions and sharing views on prerequisites and further considerations for the implementation of proposed approaches.

The process was articulated through individual interviews with Municipal Authorities, Water Authorities, water and environmental experts, industrialists, farmers and experts in agriculture, citizens and professionals from the target region. The outcomes of this step are presented in the following paragraphs, which elaborate on issues relating to: (a) cost recovery and cost sharing, (b) framework for water management, (c) means for regulating abstractions, preventing pollution and incentivizing water conservation, and (d) ways of enabling public participation and involvement in decision-making.

Cost recovery and cost sharing issues

Infrastructure development has often been advocated as one of the main requirements for achieving mitigation of water stress and improved provision of water services. Given however the high costs entailed not only for the construction, but also for the expansion and proper maintenance of current networks and the limited financial resources of municipal authorities, cost recovery and cost sharing mechanisms require thorough examination and analysis.

In this regard, different questions were set forth to user groups and decision-makers in order to map opinions on:

- Ways of distributing costs among different consumer categories (households, industry, tourist sector and agriculture);
- Transparency, fairness and equity of the current tariff system, and ways through which these can be improved;
- Water pricing as means to achieve recovery of costs for water service provision and the financing of the water system;
- Willingness to accept an increase of the applied water rates, provided that this would mean provision of improved water services;
- Potential differentiation of water tariffs according to the type of use, with the aim to generate cross-subsidies among different water user categories.

With regard to cost allocation issues, the majority of stakeholders considered that allocation based on quantities used by the different users would be the equitable way of allocating costs. However, and as pointed out by participants, there would be need for the installation of water meters, at least in households, and for taking appropriate provisions to ensure access to water services for poorer water users. Further to this, respondents argued that currently the administrative costs for the management of different public services are very

high; therefore, more efficient allocation of financial resources could ensure the funding of water systems, at least to a certain degree.

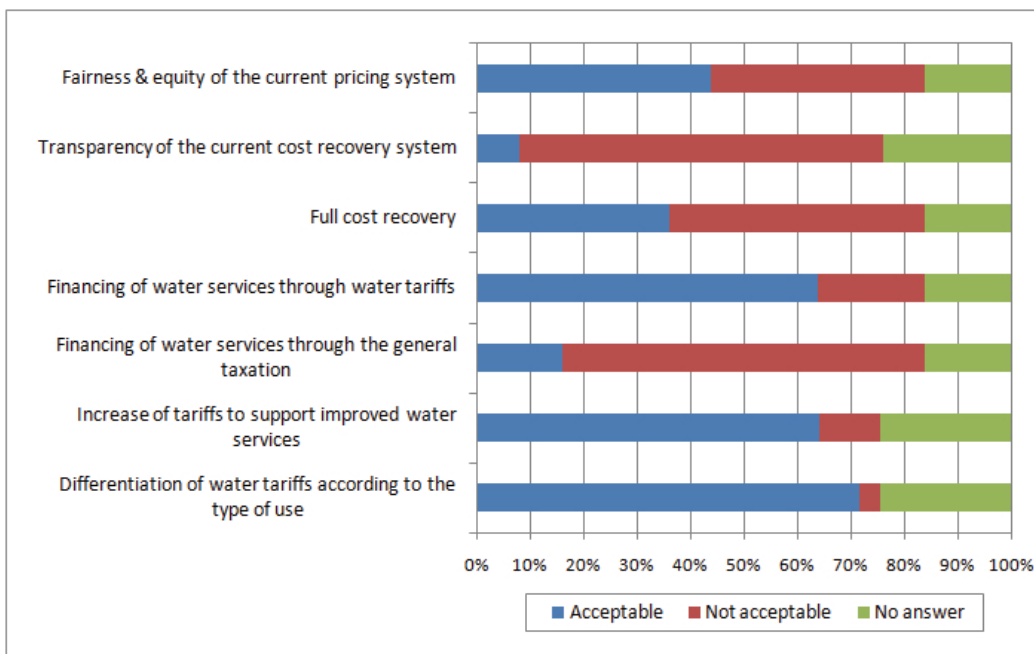


Figure 18: Stakeholder views on cost recovery and cost sharing issues

As presented in Figure 18, the majority (68%) of stakeholders believes that the current system for the recovery of costs and the definition of water tariffs is not transparent enough. Suggested ways for enhancing transparency and understandability of the water bill included:

- Enhanced cooperation between municipalities (public sector) and users (private sector);
- Detailed and understandable invoicing;
- Control of financial operations of water service providers;
- Information sharing on financial issues through media and municipal publications;
- Transparent and comprehensible studies on water service costs;
- Compulsory metering for all water users.

The fairness of the current cost recovery system is also an issue of debate, with 40% of respondents considering that currently water tariffs are high compared to the quality of water services provided (frequent water supply interruptions). However, the majority would be willing to pay higher water tariffs provided that there is clear improvement of water services and that the stress problem on the natural resource side is alleviated.

Full cost recovery through water tariffs was not considered appropriate by 48% of interviewees. This is probably due to the concern that full cost recovery would pose significant economic burden to water users (infrastructure development has not been completed in the area, and the current municipal and governmental policy is to subsidize water services, mostly due to socio-economic and political reasons). However, the majority (64%) would prefer paying for water directly, as customers of water services, than indirectly, through general taxation. The main arguments supporting this view were related to: (a) the fairness in the allocation of costs, as every consumer would pay according to the cost they incur to

the system, (b) the lower complexity and (c) the increased transparency and efficiency in the system.

Cross-subsidization between high and low income uses has been indicated by most respondents as a socioeconomically justified way of allocating costs. In particular, 76% of interviewees agree with the option to charge some users more than others; 60% believes that the tourism sector should pay more than households, or even be forced to develop its own water supply and sanitation (through desalination units and individual wastewater treatment plants). Furthermore, 72% believes that industry and commercial premises should pay more than households. When it comes to irrigation, farmers argue that crop production costs are very high, and that additional water charges would create significant economic burden to an already poorly supported sector.

Framework for water management

The outdated institutional framework for water management and the evident deficiencies in the development and provision of water services underline the need for a more professional water management system, able to implement required technologies and offering enhanced management skills and capital provision. Analysed issues pertained to:

- The evaluation of the existing water and sanitation undertakings, in relation to meeting current demands and securing environmental protection;
- Margins for improvement, without considering complex (and time consuming) organizational transformations;
- Potential contribution and involvement of the private sector;
- Acceptability of private sector involvement in the provision of water services.

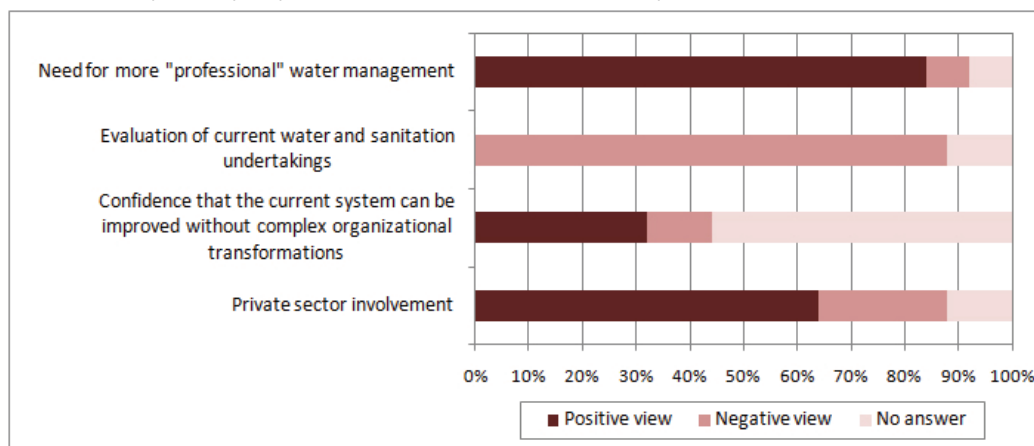


Figure 19: Stakeholder views concerning the framework for water management and provision of water services

The vast majority of respondents indicated that indeed there the current water supply and sanitation undertakings cannot adequately respond to their task and growing challenges (Figure 19). In light of this view, private sector involvement can be seen as alternative to the current framework of water service provision, considering also that the experience from other sectors (energy, telecommunications, transport) has been positive and supported by all governments after the civil war. However, respondents point out that there is need for transparent procedures, and strict control of all operations by the government or independent regulatory authorities. Potential tariff increases due to the (partial) privatization of wa-

ter services also raise opposition and concern among respondents, although the corresponding benefits are well acknowledged.

Regulation of abstractions and discharge of industrial effluents

The effective implementation of command-and-control regulatory approaches for individual groundwater abstractions and discharge into water streams or onto land is being advocated as a priority solution for mitigating different causes contributing to water stress in the Damour River Basin. Stricter enforcement of regulations was examined in light of the:

- Feasibility, applicability and effectiveness of bans on water abstractions and police control of discharges;
- Empowerment and political willingness of the Government to strictly enforce legislation on the above issues;
- Compensation for environmental damage through the setting of relevant environmental taxes and charges, and ways through which these could be defined;
- Development of collective schemes for wastewater treatment and water supply, so as to prevent individual abstractions and discharges, and ways through which the costs for the development of such systems should be recovered.

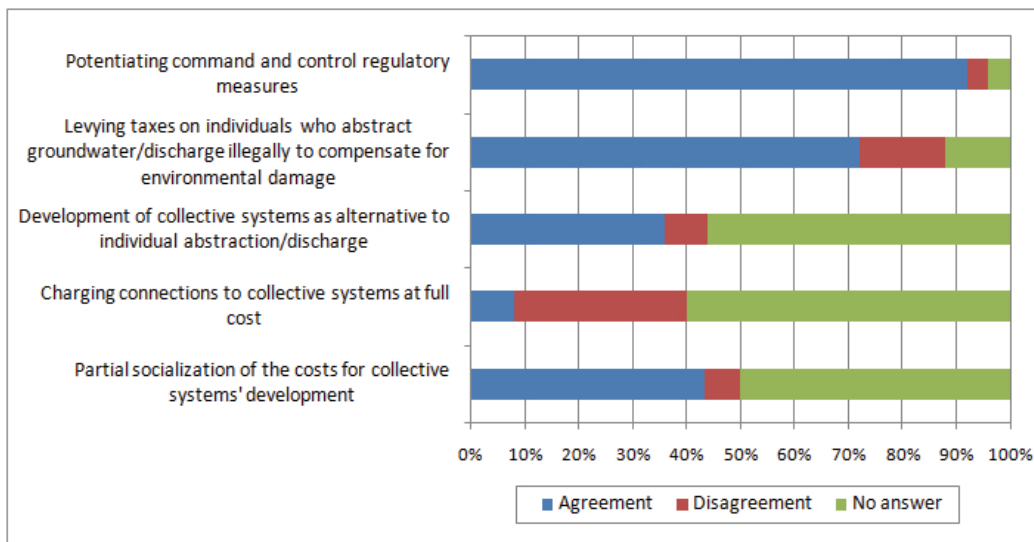


Figure 20: Stakeholder views on alternative approaches to regulating groundwater abstractions and discharge of effluents

While the great majority (92%) of stakeholders interviewed underlined the pertinence of potentiating command-and-control regulatory measures, 72% does not consider that the government is sufficiently empowered and has the political willingness to do so, because of lack in efficiency, transparency and trust in the overall operation of the system, which is also subject to political influence.

A similar 72% is favourable towards the introduction of taxes as means of “compensating” environmental damage and reinforcing civic responsibility. According to stakeholders’ perceptions, this would entail an in-depth assessment of the current situation, strict control and efficient monitoring by the government, improvement and enforcement of law and regulations, and ensuring that violators pay the corresponding fines.

The acceptability of developing collective schemes in order to provide alternatives to individual abstractions and discharges is high. Almost all respondents that consider the alternative acceptable, also agree that the cost of these connections should be partially socialized (e.g. funded through cross-subsidies or by the government), so as to maintain affordability, and provide additional incentives to individual users to connect to collective schemes.

Incentives towards water saving

Means employed to provide incentives for the adoption of improved water use practices could entail the enhanced application of volumetric charges, the development of financing mechanisms to provide aid to those who decide to invest in new technologies, and also the introduction and enforcement of mandatory technology standards for new buildings and irrigation schemes.

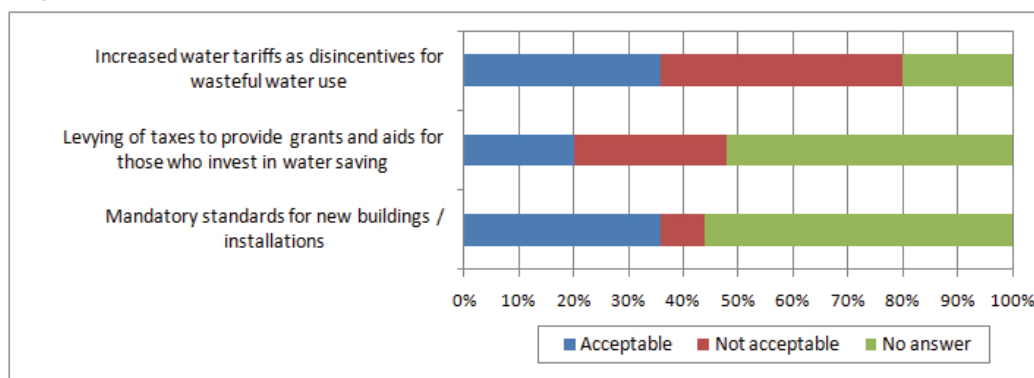


Figure 21: Stakeholder views on mechanisms to provide incentives towards water saving

As depicted from Figure 21, the incentive function of water tariffs is a controversial issue: 44% of respondents would not accept an increase of water tariffs justified solely by the need to provide disincentives for excessive water use. An important share (36%) however would support their implementation, provided that there are additional incentives for adopting new technologies, and that tariff changes are applied progressively. Levying of dedicated taxes, in order to secure funding to support those who invest in water saving, receives reluctant support. Finally, one third of respondents consider that water saving standards should be mandatory for new buildings and new irrigation projects; the latter however needs to be approached differently, requiring also technical assistance and training of farmers, as discussed below.

Industrial pollution prevention and control

Industry is not a primary use sector of the area. In this regard, issues relating to industrial pollution prevention and control were not prioritized, and also received less importance by local stakeholders. Consideration was given on the analysis of ways through which the industrial sector could be encouraged towards cleaner production practices, with the relevant responses being portrayed in Figure 22.

Twenty-eight percent (28%) considers that the industrial sector can afford compliance to tighter effluent standards; however the majority believes that the provision of subsidies, grants and other financial incentives would assist enhanced compliance and competitiveness and that the industrial sector should be supported in the transition phase.

Given the growing concern on pollution, and awareness efforts implemented by NGOs and civil organization in the last 10 years, citizens are becoming more and more aware of the issues at stake. In this context, the levying of dedicated taxes to polluters is widely accepted, and stakeholders are sensitized to award industries that undertake significant efforts to reduce pollution. Training, education and technology transfer are required for the modernization of the Lebanese industry. It is worth noting that most industrialists that were interviewed have requested participation in relevant EU and USAID assisted programs and insisted on raising societal awareness among consumers and users through dialogue, exhibitions, and advertising campaigns.

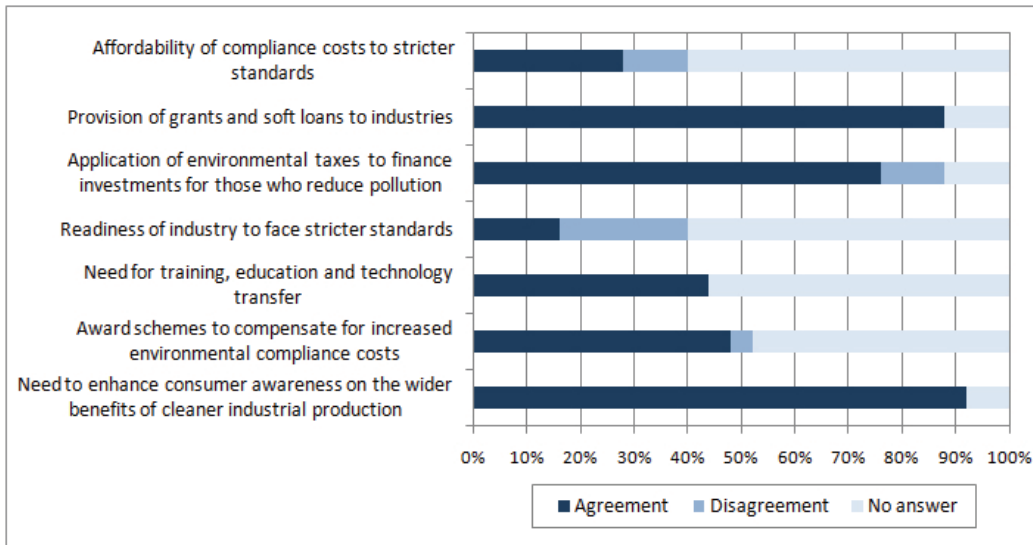


Figure 22: Stakeholder views on alternative approaches to industrial pollution prevention

Water conservation in irrigated agriculture

The main issues of concern with regard to irrigated agriculture comprise the needs to:

- Increase efficiency in water use;
- Adapt crop choices to water availability;
- Promote a more efficient way of sharing water among the different water users; and
- Guarantee that all adopted responses will remain socially equitable in order to not damage subsistence agriculture.

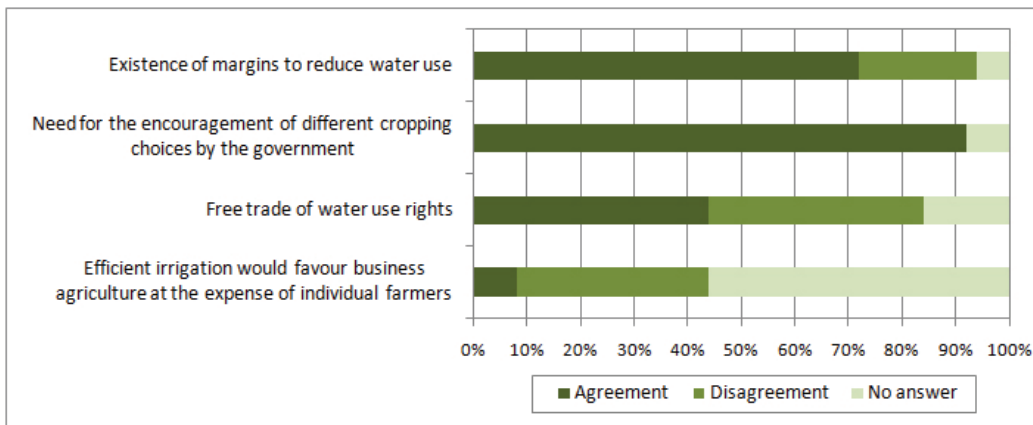


Figure 23: Stakeholder views on ways to conserve water in irrigated agriculture

As the Damour River Basin is mostly an agricultural and tourist area, issues related to irrigated agriculture are controversial, and receive significant attention by the majority of stakeholders. The majority (64%) believes that there are significant margins to reduce water use in the agricultural sector. At the same time governmental support is required for modernizing agriculture, improving water allocation, hydraulic infrastructure development, and encouraging the adoption of modern irrigation methods. Overall, 36% of respondents believe that efficiency improvements in irrigation will not threaten subsistence agriculture, whereas a significant number of respondents (44%) would also accept free trading of water use rights by farmers. Finally, opinions regarding change of cropping patterns are nearly unanimous; 92% believes that change should be encouraged, stressing at the same time the importance of securing markets for agricultural produce.

Public participation and stakeholder involvement

The need to strengthen the involvement of stakeholders and water users in decision-making had been perceived as of crucial importance from the early stages of case study definition and elaboration. Potential issues considered critical for further analysis included:

- Perceptions of users on public participation and joint decision-making;
- Ways through which water users could be further involved;
- Willingness of decision-makers to consider the outcomes of participatory planning processes;
- Actual accessibility to information on water management issues of common interest;
- Impartiality and objectivity of decisions taken, as water allocation issues are often subject to political pressure from specific user groups.

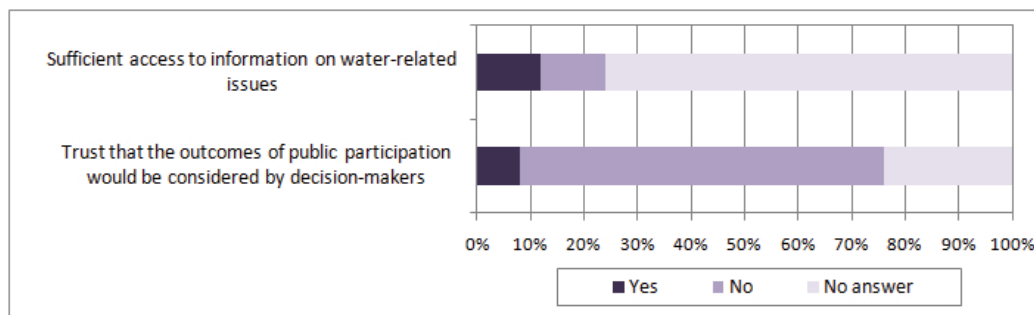


Figure 24: Stakeholder views on major inhibiting factors to public participation

A summary of responses received is depicted in Figure 24, from where it is evident that more than half of the respondents did not comment at all on public participation, although they originally perceived that it was an issue of utmost importance.

Thirty-six percent (36%) of interviewees, however, stressed the importance of participatory approaches in promoting democratic management and accountability, as well as cooperation between decision-makers and water users concerning the identification of significant water management issues, solutions and decision-taking. Furthermore, enhanced public participation and involvement would improve civic responsibility in matters of environmental protection and resource conservation. Local and national debates on water-related issues would be useful to allow people to express their views and develop the sense of “own responsibility”.

Manifesting commitment towards pursuing these initiatives, respondents stressed the need for: (a) training on different water management issues and alternative solutions, (b) organization of awareness campaigns, and (c) cooperation with public authorities to implement sustainable solutions, such as adaptation of the agricultural sector, demonstration projects for water recycling and reuse, development of infrastructure projects, etc. However, citizens remain doubtful of the willingness of decision-makers to seriously consider the outputs of participatory processes, and often support the view that some stakeholders are given more weight than others.

CONCLUDING REMARKS

Since the mid 1990s, a large number of EU funded research projects have been implemented in the Mediterranean Basin Countries. Several of these focus on water management problems, among other topics, in view of the need to address the main causes and mitigate impacts relating to increased water scarcity and water quality degradation, and foster capacity building for environmentally sustainable socio-economic development.

The INECO Project is also included among these efforts, seeking to “establish a Mediterranean network of research institutes, public authorities and stakeholders for coordinating research and to analyze decision making practices regarding the application of institutional instruments in the water sector”. The Project focused on institutional and economic instruments for addressing issues related to three key challenges in water management: sharing water equitably, valuing water and governing water wisely.

The selection of the Damour River Basin in Lebanon for the implementation of an INECO Case Study was based on the relevance of the problems faced in the region to the overall Project objectives and to the water management challenges faced throughout the country. The keen interest and willingness of local stakeholders representing several major and minor groups (farmers, tourist resorts, municipalities, water authorities, individuals) to participate in the Project activities highlighted the relevance of participatory approaches for promoting a common understanding of problems and developing shared goals and objectives.

The increasingly deteriorating state of water resources in Lebanon, in combination with the existing deficiencies in the water resources management framework, has prompted an in depth examination of the issues at hand by all participants. A number of solutions to the examined issues have been identified by the participating stakeholders throughout the INECO project implementation as pertinent, applicable and acceptable. Some stakeholders have expressed a preference for easy to implement measures, such as the installation of water meters, the invoicing according to water quantities used, and the strict control of water extraction. Others favour the introduction of new technologies, different cropping choices, and incentives, measures for which the government is responsible and requiring financing, to be sought from international donors or organizations. The construction of dams is a measure already supported by the government, and included in the “ten years plan” concerning the management of water resources in Lebanon, which however requires significant funding. As indicated from the results presented throughout this report, environmental taxation is supported in certain sectors (e.g. industry), but not well accepted in others (e.g. agriculture). Overall, stakeholders point out the need for transparency, good administrative organization, environmental stewardship and government responsibility.

Long term on-going awareness campaigns undertaken over the past decade by NGOs, municipal and ministerial authorities have contributed to the identification of potential solutions. Participating stakeholders exhibited sincere motivation for constructive engagement towards identifying applicable and relevant solutions. Despite factors inhibiting the development of civic responsibility in water management issues, the INECO experience indicates an overall shift, albeit slow, towards enhanced public mobilization and involvement.

KEY INDICATORS ON WATER STRESS IN THE DAMOUR RIVER BASIN

| | |
|-------------------------------------|--|
| General data (profile) | Basin area (km ²): 333 |
| | Annual precipitation (million m ³): 337 |
| | Annual river discharge (million m ³): 100 (average) and 55 (in dry years) |
| | Annual aquifer recharge (million m ³) : N/A |
| | Total population: 76,000 |
| | Total agricultural area (ha): 400 |
| | Total irrigated area (ha): 200 |
| | Main crops (%) 70% bananas – 10% citrus – 20% green vegetables & others |
| Access to water services | Access to piped water network (% of population): 80 |
| | Wastewater treatment coverage: 0 |
| Water quality and protection | Water quality and pollution in surface (rivers, lakes), underground, transitional and coastal waters: see text |
| | Contaminant load from industrial activities: NA |
| | Manufacturing units with own wastewater treatment plant (%): 0 |
| Sharing water | Total water demand: Domestic (%): 30 Irrigation (%): 60 Industry (%): 5 Tourism (%): 5 |
| | Total volume of water supplied to other regions (Beirut): 80% (from Damour) |
| | Total volume of surface water abstraction: NA |
| | Total volume of groundwater extraction: NA (only from Damour vil- lage) |
| | Total volume of regulated surface water supply: NA |
| | Water exploitation index: 10-20 (Damour village only) |
| | % water deficit per use during the summer season : ar.60 (estimated) |
| | Existence of formal policies on prioritization of water use: N |
| Governing water | Abstraction Monitoring: None |
| | Discharge permit issuing: None |
| | Participation in decision-making: None |
| | Planning Framework – Existence of river basin management plans: None |

REFERENCES

Dar Al-Handasah (1996), Feasibility study for water supply of the area between Damour River and the Southern International Boundary up to elevation 600m, Master Plan Report.

MoE/ELARD (2003), Integrated Water Resources Management in CAMP area with demonstrations in Damour, Sarafand and Naqoura Municipalities, submitted to Regional Activity Center, Priorities Action Programme.

MoE, UNEP, PAP/RAC, (2004), Coastal Area Management Programme (CAMP) in Lebanon, Consolidated Report.