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Lebanon

Water as a human right: Assessment of water resources and water sector in Lebanon

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Summary

Lebanon is the richest country in the Middle Eastern region in its water resources. The country receives about 9 billion cubic metres of rainfall more than half of which is lost as runoff and evapotranspiration as a result of the topography and the length of the dry season. Despite this, Lebanon suffers from a shortage of water for irrigation, domestic and industrial uses. This deficit is mainly due to a historical negligence on the part of the government before the 1975 conflict and the lack of planning in the rehabilitation after 1991.

Although Lebanon has accessed the Convent on Economic Social and Cultural Rights as early as 1976, and has signed and ratified most other related conventions, the tenyear master plan for the water resources management was only launched in the year 2000. Until date, the works were initiated on only one dam of the more than 30 planned dams and hill lakes. The lack of financial resources in a heavily indebted country and conflicting interests of politicians are the major barriers facing the implementation of the plan.

In terms of demand, the irrigation water needs account for more than 60% of the total while the domestic and potable water requirements account to about 30%. The irrigation sector depends highly on the ground water supply from artesian wells that were dug during the last 2 decades. Since 1995, many irrigation canals were rehabilitated by the government using international loans and a few US-based NGOs with funding from USAID. These NGOs have supported also installing some major lines for domestic water in deprived villages of Northern and Southern Lebanon and the Bekaa.

The domestic water supply and quality, though improving as compared to the previous periods, is still inadequate. The major reason is that the domestic water network is in an increasingly deteriorating situation at the distribution level. Only the primary supply lines and partly secondary ones were rehabilitated. This leads to significant losses in water quantities, infiltration of pollutants and impurities into the corroded pipes from the sewage lines and the surroundings. As a result of these problems, as much as 20% of the total households have no access to water through the public network. More than 80% of the households have a low to intermediate satisfaction of water needs in terms of quality and quantity. A report by UNICEF (2000) indicates that more than 70% of the water resources in Lebanon are polluted. This is an alarming figure that signals to long-term effects.

Despite these problems, the public discussion on the right to water and its human right context is very weak and reaction of people to these problems is absent.

Within the public sector, the policy and capacity building of water issues was intensified during the last 2 years through support from the US and EU.

Numerous actions need to be taken to alleviate the constraints facing a sound implementation of the integrated master plan for water resources in Lebanon. The major needed steps are awareness and capacity building at both the institutional and public level, in addition to intensive lobbying at the political level.

1 The national water sector

Lebanon is a small country situated at the eastern end of the Mediterranean Sea. Its area is about 10450 km2 with about 210 km of coastline and an average of 50 km depth. Lebanon is considered to be a mountainous country with narrow fertile plains on the coastline and between Mount Lebanon and Anti-Lebanon, the two chains running along the country from north to south. The total agricultural area is estimated at about 30% (360,000 ha) of the country and half of it is cultivated.

The total population is estimated at 4.4 million as the last census was conducted more than 40 years ago. The annual population growth is estimated at 1.4%.

Lebanon has suffered from a civil war from 1975-1991 that has devastated its infrastructure and its socio-economic constellation. In addition to the war related demographic changes and internal rural-urban migration, it is estimated that about half of the population has left the country during the war to destinations in Europe, North and South America and Australia.

As of 1991, intensive reconstruction efforts have been concentrated around Beirut and the major cities. Agriculture, being historically not as important as tourism and commerce for the overall economy, has not been given adequate attention in all its sectors. This has led to an increasingly deteriorating socio-economic situation in rural areas.

The worsening economic situation and the increasing debt reaching about US\$ 35 billion has practically frozen most development efforts in all sectors. The impact of this situation will be discussed later.

1.1 Background, geography and climate

Lebanon has a reputation among its neighbours for the abundance of its water resources. A relatively mountainous terrain consisting of two parallel mountain ranges that run north to south, and between them the Bekaa Valley, the country exhibits contrasting physiological features and well-differentiated geomorphologic regions. In this context, the country can be divided into four main regions from west to east:

- A relatively flat and narrow fertile coastal strip with an average width of 2 to 3 km running north to south, and reaching the shoreline on many occasions.
- The "Mount Lebanon" chain parallel to the coastline with mean elevations of 2,200 m and peaks upwards of 3,000 m above mean sea level (*amsl*).
- The Bekaa Plateau, a very fertile and rich land depression at an average altitude of 900 m *amsl*, with a length of 125 km and a width varying from 7 km in the south to nearly 20 km in the north.
- The "Anti Lebanon" mountain chain, bordering Syria and also running in a north-south direction east of the Bekaa Plateau and reaching elevations of 2,800 m *amsl* at Mount Hermon.



Figure 1: Physiography of Lebanon (El Fadel, 2001)

Lebanon's climate is generally Mediterranean, with abundant (>80%) rainfall during 4 – 5 months (November – March) in the winter and followed by hot dry summers. Its topographical features result in heavy precipitation along the coastal plains and much less in the interior, and this rain shadow explains the notable difference in vegetative cover between the greenery of the coastal areas and the dry landscape of the interior. Snow is frequently present in areas higher than 1,500 m above sea level. Precipitation varies spatially, as well as temporally. Precipitation in the highlands averages 1,500 mm/year, and the mountain peaks along the western ranges receive about 2,000 mm. Annual average precipitation in the northern Bekaa region, near Hirmil, is about 250 mm; in Ba'albeck, 550 mm; and in Karoun and Marje'youn, 700 mm. Yearly precipitation along the coast is 830 mm in the north, 800 mm around Beirut, and 700 mm in and around Sour (Tyre) in the south (Amery, 1998).

According to the national meteorological service, eight eco-climatic zones could be defined, with rainfall being the principle criterion. These zones are distributed as follows: (National Action Programme to Combat Desertification, 2003)

- The coastal strip including the three northern, central and southern coastal zones,
- The Mount Lebanon with two northern and central zones varying in precipitation,
- The inlands that are divided into three zones, the northern and central (semiarid) and the western Bekaa (more continental with higher precipitation).

Geologically, the country's fissured and fractured limestone formations have the ability of snowmelt and rainwater to percolate and infiltrate deep and feed into the underground aquifers. Ultimately, the water in these layers either

- remains stored and may be exploited through wells while others remain untapped in deep layers;
- reappears as surface waters, at lower elevations, in the form of seasonal fresh water springs (nearly 2,000) that feed into various streams (nearly 40);
- forms underground springs discharging near the coastline or the sea or is lost to deep layers and may reappear in the groundwater of neighbouring countries.

Strength and weakness

Lebanon's topographical features result in an unequal allotment of precipitation along the coastal plains and the interior of the country resulting in differences in vegetative cover of the green coastal areas and dry interior. In general average precipitation should be sufficient for human needs if adequately managed.

1.2 Water resources and water balance in Lebanon

A number of streams (14 to 17 depending on the source of information) are classified as perennial rivers, while the remaining ones are considered seasonal. These perennial rivers are distributed as follows (Figure 2):

- Thirteen rivers flow westwards from their source in the heights of Mount Lebanon towards the Mediterranean Sea. These rivers have an average length of less than 60 km;
- El Kabir is a coastal river that traces the northern border of Lebanon with Syria;
- The Litani river drains the southern Bekaa plateau, transverses the southern edge of the Mount Lebanon range and discharges into the Mediterranean towards the south;
- The Hasbani river originates from springs in the northern bases of Mount El Sheikh (Hermon) and flows through Hasbaya to join in winter the Wazzani.
- The Wazzani crosses the southern border and forms one of the tributaries of the River Jordan; and
- El Assi (Orontes) river flows northwards into Syria draining the northern Bekaa resources and flows to discharge in the Mediterranean towards Iskenderun in Turkey.

There are various reports regarding the water balance in Lebanon that are in agreement on some issues and contradict on others. Given its topographical situation, Lebanon does not receive any surface water from the neighbouring countries.

The country consists of two principal hydrological regions:

The Mediterranean (or coastal) watershed, with an area of about 5 500 km2, which gives rise to 12 perennial rivers from the western slopes of the mountain ranges, flowing from east to west and emptying into the sea;

The interior watershed, with an area of 4 700 km², which is the source of the Litani, Assi (Orontes), and Hasbani/Wazzani rivers (Amery, 1998).



Figure 2: Major river basins in Lebanon

(El Fadel, 2001, based on Directorate of Geographic Affairs maps)

Furthermore, the country could be divided into some 40 drainage basins of permanent or intermittent streams, whose flows depend on the topography of the watershed and the size of the mountain reservoirs that their sources feed (Fawaz 1967).



Figure 3: Mean annual precipitation in Lebanon (Directorate of Geographic Affairs)

Table 1 shows two estimates of the water budget in Lebanon. Both estimates show that about 50% of the average yearly precipitation is lost through evapotranspiration. Other losses include surface water flows to neighbouring countries (almost 8%) and groundwater seepage (12%) leaving around 2,600-3,300 MCM of surface and groundwater that is potentially available.

Factors	Water budget - Litani Water Authority (Comair 1998)	Water budget (Mallat 1982)
Total precipitation	+8,600	+9,700
Evapotranspiration	-4,300	-5,075(a)
Percolation to groundwater and flow into the sea	-880	-600(b)
Flow into Palestine		
Hasbani/Wazzani River	-160	-140
Groundwater flow to Hulah and northern Palestine	-150	n.a.
Flow into Syria		
Assi River	-415	-415
Kabir River	-95	-95
Net available surface water	+2,600	+3,375

Table 1: Hydrological budget of Lebanon: two perspectives (MCM/Year)

Source: Comair (1998) and Mallat (1982), a) Includes groundwater seepage in Lebanon and from South Lebanon into Palestine and the sea. , b) Excludes water flow into the sea.

Groundwater contributes a significant component of the total water presently demanded in Lebanon. Thousands of government and privately owned wells, distributed all over the country, provide about 30-40% of all the water being furnished for domestic and industrial use and for irrigation. Furthermore, additional amounts of water may be eventually developed through surface storage and are estimated at about 540 MCM per year, while those likely to be made available by proper management of the ground water aquifers is about 1,500 MCM (UNDP Groundwater Study, Mission of 1962-69 cited by Macksoud, 1998). This figure is close to that reported by FAO indicating that a total volume of 1,360MCM distributed in 8 major aquifers. (?)

Lebanon possesses an additional important water resource whose capacity and modes of exploitation are yet to be determined. Along the littoral zone, sub-marine springs discharge millions of cubic metres annually into the Mediterranean. The estimates of these quantities range from 250-1000 MCM (Jaber, 1995; Khawlie 2000 and Shaaban, 2001 as cited by Abdallah, 2001.

Strength and weakness

Theoretically and despite the climatic and geological factors, if well managed, the available water resources should be sufficient for fulfilling the basic needs of the Lebanese people, whether for irrigation or for domestic use. The seasonality of most rivers and the fact that significant quantities of water are shared with Syria and Palestine, are barriers facing the exploitation of those resources.

1.3 Water demand and supply

Many Lebanese politicians declare Lebanon as the worst country in the region with respect to the management of its water resources. Water has been historically mishandled as a resource in Lebanon. Currently, water resource use is approaching unsustainable levels because of a lack of effective management policies coupled with increased consumption resulting from the population growth, increasing needs for agricultural purposes, and industrial development that have led to an uncontrolled exploitation of groundwater and surface resources.

Despite the abundance of water resources, more than 50% of the Lebanese territories are desertification/land degradation prone areas and that for many reasons, the most important of which is unsustainable land and water resources management.

Agriculture is by far the largest consumer of water in Lebanon accounting for more than two-thirds of the total water demand, reaching upwards of 85 percent in certain predominantly agricultural regions. This may increase the cost of water resource management, and diverts valuable water resources from other potential uses especially the supply of potable water. Other activities that exert additional water demand are recreational activities (water parks, resorts and sports).

Table 2: Estimated (a) water consumption and projected water demand in Lebanon (MCM/Year).

Year	Domestic	Industrial	Irrigation	Total
1966	94	n.a.	400	494
1990(b)	310	130	740	n.a.
1996	185-368	35-70	669-900	889-1,338
2000 (c)	280	400	1,600	2,280
2015	900	240	1,700	2,840

Sources: Jaber (1997); Comair (1998a); Al Diyar Newspaper, 6 Jul 1995, 5 Dec 1996. (a) Water consumption data, with the possible exception of the 1966 data, are estimates. (b) An Nahar Newspaper, 25 Feb 1996. (c) Nasir Nasrallah, Director General of the Litani Water Authority (An Nahar, 25 May 1996).

In 1966, the domestic and industrial sectors consumed 94 MCM of water, and the agricultural sector consumed 400 MCM (Table 2). By the mid-1990s, Lebanon was estimated to consume at least 890 MCM/Year of water, close to 50% of which was drawn from aquifers. Other estimates indicated that, in 1994, water utilization was

1,293MCM for agricultural (67.7%), domestic (28.4%) and industrial (3.9%) usages (FAO, 2002).

1.3.1 Irrigation consumption

Of all the 360,000 ha arable land in Lebanon, 146,000 ha was rain fed in 1996, while the irrigation potential is estimated at 177,500 ha. The total irrigated area increased from about 23,000 ha in 1956 to 54,000 ha in 1966, decreased to 48,000 ha in the early 1970s, and then increased again to approximately 67,000 ha in 1983 and 87,500 ha in 1993.

According to studies conducted by the Food and Agriculture Organization of the Nations and by the United Nations Development Programme, the irrigated area of Lebanon is expected to rise to 170,000 ha by 2015, and this will require 1,700 MCM/year (Table 2). However, this projected demand could be reduced to 1,300 MCM/year with the implementation of water saving methods (Jaber 1997). According to a report by METAP (2002), the water allocated for irrigation will decrease from 85% to 61% of the available resources.

In the absence of real integrated irrigation schemes on other rivers such as the Assi, Kabir, Hasbani, Wazzani, El-Bared and others, the main source of irrigation is the Litani River and the Litani-Awali network. Estimates indicate that still about 45.7% of the irrigation water comes from springs, artesian and recharge wells.

There are plans to irrigate 6,000 and 4,000 ha, respectively, in the Hermel and Akkar regions of the northern Bekaa from the Assi and Yammouneh schemes. A total of 33,000 ha are included within the irrigation schemes in the regions of southern Lebanon. This includes 1,200 ha near Saida and the currently irrigated area of 6,000 ha in the Kassmieh region. In the coastal plain, rivers and aquifers can irrigate 58,000 ha.

1.3.2 Industrial consumption

Little data is available on the current or expected water needs of the industrial sector in Lebanon. The available data indicates that the Lebanese industry supplies 60 to 70 percent of its needs from groundwater. In 1996, an estimated 71.4% of all industrial water used in the country was drawn from underground sources, and the remainder was drawn from surface sources.

As shown in table 2 above, the industrial use of water, which was at 400 MCM in 2000, will decrease to 240 MCM in 2015. Hardly any water recycling facility exists in the industrial facility and this is mainly due to the low cost of water extraction as compared to recycling.

1.3.3 Domestic water consumption and quality

The daily domestic water consumption was estimated at 165-205 litres/day per capita in the mid-1990s. The Lebanon report for the millennium development goals states an estimated consumption of 60 litres/capita/day, as compared to a 160 litres theoretical daily average reported in other studies.

This figure is expected to reach 215 litres of which 30 MCM come from aquifers in the Damour region and 50 MCM comes from those of Jeita. The capital Beirut is

estimated to require 250 MCM/Year of water, but its fresh and wastewater infrastructure is inadequate, though it is better than other regions. This results in an irregular supply of fresh water, especially during the summer.

Additionally and during the years of conflict, more than 45,000 artesian wells were dug throughout the Lebanese territory for domestic use and were an additional cause of a sinking water table and the intrusion of seawater. The consumption of water from these sources is not accounted for and hence, the domestic water consumption figures might need some revision.

The domestic water network has suffered greatly during the war due to the lack of maintenance and the illegal tapping. The deterioration of the pipes, the increased leakages and the irresponsibility of many users through removing the flow regulators from or even installing pumps directly at the supply led to a distortion in the distribution of potable water.

During the post war period, rehabilitation efforts focused on the primary and secondary supply lines leaving the tertiary ones nearly untouched. This in turn is alone a potential threat to the water safety irrespective of the quality and quantity reaching the primary or secondary supply lines.

In addition, the faulty planning of the sewage network and its vicinity to the potable water network caused in many cases a contamination of potable water. This led in certain areas to outbreaks of waterborne illnesses when sewage water infringes into potable water network lines. A serious problem exists in new residential areas that were established during the war and in the absence of governmental service provision. These areas lying in the vicinity of the major cities have no domestic water or sewage networks.

During the construction, artesian wells were dug to provide households with potable water and at a close distance deeper wells or primitive septic tanks were made to receive the sewage. The areas are time bombs threatening the groundwater aquifers and exist mainly in the Aramoun-Bshamoun area south of Beirut and the areas east of Tripoli.

The latest general survey related to the domestic water supply dates back to 1996 (published in 1998) as part of the mapping of living conditions in Lebanon conducted by the UNDP and the Ministry of Social Affairs.

According to this study, 79% of the total households have access to water through the public network with significant disparities among regions ranging from 68% in the north to 88% in Beirut. Despite a significant improvement in supply as of 1991, especially in rural areas, still many villages in remote areas do not have home access to potable water and have to rely on buying water from underground sources.

The same report indicates that about 16% of the dwellings have access to a public and private network in addition to an artesian well, while about 5% have no access to any source of water and these usually purchase water from private suppliers. The access to the public network does by no means indicate that water is abundantly available. The same report indicates that about 10% of the dwellings have a very low degree of satisfaction of their basic water needs, while the needs of 74% are moderately satisfied.

A report by METAP (2000) indicates that Lebanon still does not have a water quality database, and quotes UNICEF that 60-70% of the Lebanese water resources are polluted.

Till date the number of sewage treatment facilities in Lebanon does not exceed more than 2 regional ones that provide primary treatment for less than 10% of the population. Village-level of secondary sewage treatment facilities were established with the help of the USAID. Still the problem is far from being solved and cases of contamination of potable water sources by sewage water are reported occasionally with no improvement in sight, as still about 35 MCM of industrial effluents are discharged in the Bekaa and the Mediterranean.

As for the access to potable water, the figures show a bigger problem as the data show that 60% of the households get non-sterilized water through the public network, while 13% receive sterilized water as compared to 10% using spring water and 5% consuming bottled or mineral water. Looking at the degree of satisfaction in terms of potable water supply, about 21% and 61% of the households in Lebanon are classified as very low and intermediate, respectively.

Currently, with respect to potable and domestic water, all the water authorities operate chlorination units. However, due to the absence of accredited and credible laboratories and the lack of knowledge regarding the degree of deterioration of the tertiary network, there is a tendency to over-chlorinate the water to insure that they get rid of microbial contaminants. This leads to unpleasant chlorine taste in the water and to increased corrosion of the already mostly corroded galvanised pipes of the tertiary supply lines.

As a result of all the above-mentioned problems, the country has witnessed a boom in suppliers of "drinking water". A study published by the Ministry of Health in 2002 indicated that more than 4000 such operational companies are not licensed and registered, while only seven are legally registered. Of the seven, two have shown varying degrees of contamination in their water. This report has created much controversy, however little action was taken to confront this problem.

The concern regarding the quality of potable water is growing among citizens, nongovernmental and civil society organizations that operate in the country, as is the concern regarding the quality of near-shore seawater. One of the critical areas is the industrial zone in the Litani watershed near the town of Zahle. The majority of plants located in the Litani watershed (except for cattle and poultry farms) are grouped in seven clusters, most in the vicinity of Zahle, an area, according to a 1996 survey of industries (N'khaal et al. 1998), that contains a total of 36 factories, including 15 plants for processing food and beverages and 6 plants for manufacturing non-metallic products (glass, ceramics, etc.). The Lebanese Ministry of the Environment is monitoring the industrial waste of about 100 factories, with the choice of factories based on the size and type of activity and operation they are engaged in. Of these, only four are located in the Litani River watershed.

1.3.4 Water pricing

The water pricing system in Lebanon is based on a yearly subscription for the flow in the supply line and not on the consumption. A line capable of supplying one cubic metre of water per day is subscribed currently ranging between 130-150 USD per

year. This is controlled via a gauge at the household supply lines. Normally, people tend to remove or change the setting of the gauge personally or through bribing the control officers.

There are no reports on the impact of the pricing system for the accessibility to water. The prevailing conditions in Lebanon do not allow deprived households water if they do not cover their subscription. Although in many cases people are fined, there is no real enforcement as this might lead to tensions between the authorities.

Recently, the city of Saida introduced a new tariff system based on consumption. This model shall be copied into other areas.

As for the cistern supply of domestic water, the prices range from 4 to 10 USD per 4000 litres depending on the area and season. This is not affordable to all households and many people tend to carry water from public sources using gallon containers.

Regarding bottled water, the price ranges from 0.67 USD to 4 USD per 20 litres. Surely, smaller containers are more expensive at retail shops.

Irrespective of the quality of supplied water, the price of water does not allow for adequate accessibility to water for all income groups. Normally, this would lead to a problem at the social level, however, the dependency of many households on more than one source of income and the fact that many people access water illegally from the network reduce the problem and its consequences.

Strength and weakness

National water management is in a poor state. Agriculture is by far the largest consumer of water in Lebanon accounting for more than two-thirds of the total water demand. Household water consumption accounts for an average amount in comparison with other developing countries. Reliable data for industrial water consumption are not available. Water quality is very poor due to resource overuse in the coastal areas causing salination of wells and poor supply network conditions. Water prices are in general affordable, but need to be improved due to the fact the tariff system doesn't differentiate between users and uses.

1.4 Legal and regulatory framework

The legal framework in Lebanon is generally outdated. Nearly all laws and regulations for water quality and water resources protection date back to the time of French colonialism in 1925. A few complementary application decrees have been issued. In addition to those are also a few laws covering wastewater disposal, solid waste discharge, industrial wastewater discharge, and other water pollutants. The main legal texts covering water are:

- Order No. 144, 1925: Protection of Surface Water and Groundwater Resources
- Order No. 320, 1926: Protection of Catchment Areas
- Decree No. 639, 1942: Protection of Nabaa Al Assal Spring, Faraya
- Decree No. 10276, 1962: Protection Zones for Water Sources and Recharge Areas
- Decree No. 14438, 1970: Restrictions on the Depth of Unlicensed Boreholes

- Decree No 14522, 1970: allocation of water resources for areas south of Beirut River to the southern Border
- Decree No. 8735, 1974: Pollution from Solid and Liquid Waste
- Law No. 64, 1988: Pollution from Hazardous Waste
- Decision No. 2528/C, 1996: Protection of Groundwater at El Kneisse Mountain
- Decree No. 680, 1998: The Preservation and Protection of Boreholes

One of the troublesome and urgent hydrological issues in Lebanon pertains to groundwater management. Order in Council 144 (10 June 1925) states that public property is any that may, by its very nature, be used by many people or for the benefit of the general public. Regardless of how much time may have passed in ownership or use of a certain land resource, such properties may not be sold or profited from, and they include surface and groundwater, lakes, rivers, and lake and riverbanks. However, in the late 1960s, the legislation was amended to exclude wells drilled on private lands with an output of less than 100 m3/sec. Such wells must not pump water that possibly belongs to someone else or feeds into a river. Innumerable wells are found throughout Lebanon, especially in the Litani watershed, and for various reasons enforcement of existing laws is very lax to nonexistent.

Some wells were dug during the civil war to meet the water needs of nearby rural communities. Until the government water infrastructure is rebuilt, it would be difficult to imagine the state enforcing the law on such wells. In addition, the average age of the poorly paid staff at the Ministry of Electrical and Water Resources is 55, and this figure is increasing yearly because of the current employment freeze. The Ministry also suffers from a shortage of technical and managerial skills.

As for the standards, the Ministerial Decision No. 1/52, July1996, issued standards for water quality and wastewater discharge. The implementation of the standards proved difficult; hence, they were revised and amended under decision No. 8/1, January 2001.

Despite the texts dealing with surface and ground waters, catchments and declaring them as common goods (144/1925 and 320/26), still there is no mention of the accessibility and the right to water within the Lebanese legislation. The absence of such texts renders activities in this context more difficult and complicated.

Strength and weakness

The legal water framework in Lebanon is generally outdated and needs to be adjusted.

1.5 Institutional setting

The Ministry of Energy and Water (MEW) is the major authority dealing with water. It is responsible for water management and developed a 2000-2009 water strategy in coordination with the other bodies. The strategy addresses: dams and aquifer recharge; potable water projects; irrigation projects; wastewater treatment plant construction; and prevention of river flooding and inundation. The *MEW* supervises four autonomous water authorities that were established by law No. 221 of May 2000 namely: Greater Beirut and Mount Lebanon, Northern Lebanon, Southern Lebanon, the Bekaa. These authorities were formed as a result of merging the nineteen water authorities into the above-mentioned four.

The Ministry of Environment is responsible for the protection of the environment in general, through providing studies on wastewater treatment, environmental impact assessment and natural resources management and conservation. This Ministry is also responsible for proposing legislation that ensures the implementation of relevant measures.

The Ministry of Public Health established a Department of Sanitary Engineering to monitor water quality. The ministry also sets standards for drinking water; proposes specifications for wastewater and drinking water networks; recommends action for pollution prevention; and operates water quality equipment such as chlorinators.

The Ministry of Municipalities and Rural Affairs is responsible for monitoring municipal works including sewage and drainage infrastructure.

The Council for Development and Reconstruction, which has the role of a Ministry of Planning, is responsible for the implementation of the major infrastructure projects in the country, including irrigation, water networks, wastewater and solid waste facilities.

The National Council and Scientific Research conducts and coordinates scientific research and contains an environmental division responsible for pollution, marine biology, waste, wildlife, and nature reserves.

Personal communications with experts working in the water and infrastructure sectors indicate that the four water authorities are still relatively inactive with respect to their mandates and responsibilities towards the regional suppliers and the Ministry of Energy and water. Despite the legal and theoretical distribution between the different authorities, this does not seem to be applied on the ground and there is no central source of information where documentation about the domestic and potable water distribution network is collected. After 1991, the parties involved in the rehabilitation of the network were the CDR, *MEW*, the water authorities, some municipalities and the central fund for the displaced. It is not confirmed whether there was proper coordination among those parties to avoid duplication of work that was reported on a few occasions.

Strength and weakness

Water authorities are defined, but without clear definition of their roles, competences, mandate, and responsibilities towards the regional suppliers and national ministries.

1.6 Political and administrative aspects

Though Lebanon is in a favourable position with respect to water availability, still the national demands are not yet met. The civil war and the following severe economic crisis have left their marks on many sectors including water. The water resources are only partially developed with attempts from the various institutions to improve them. Widespread public and political concerns about water reflects the country's insecurity about perceived and real threats to its sovereignty over water resources, and affects the quality of water data collected, analysed, and published.

In light of the growing regional discussions about the distribution of water resources and the need to have an "equitable" sharing of water, there was a tendency within the Lebanese administration to strictly control any issues related to the water sector. The major concerns are related to the claims of Israel in Lebanese waters that are based on the misconception that Lebanon has excessive water resources exceeding its future demands. As a result, discussions on issues related to the water resources, especially those of the southern part of Lebanon, are strictly monitored by the Ministry of Energy and Water. This makes it difficult to manage water resources adequately in the present and to make meaningful projections into the future about potential use and availability of water.

Both the political and institutional aspects of the water sector do not support an enabling environment for achieving the right to water and assuring it. On the other hand, the regional political context regarding water makes the national handling of the water problem more difficult. As mentioned, the government considers public discussions on water as negative to its image and to a certain extent a taboo subject. The impact of this attitude affects mainly the free accessibility to information and data.

Strength and weakness

Public awareness of water issues is concerned about the country's insecurity about perceived and real threats to its sovereignty over water resources. National water policy, law and institutional setting does not contribute to change that perception. Water data quality is often poor and data itself are not easy to get with negative impetus on data collection, analysis, and publishing.

2 Meeting the UN concept: The Lebanese understanding of water

2.1 The national water policy versus the human right to water

Politically, the government of Lebanon has historically been committed to the principle of the "Right to Water" that is one of the commitments of the Convent on Economic, Social and Cultural rights that Lebanon accessed in 1976. In practice, till 1975, a big part of Lebanon had no direct access to domestic and potable water at the household level. During the war between 1975-1991, the existing infrastructure was torn apart either accidentally or on purpose by the different parties.

After the war, the reconstruction of the network with all its components started without a clear plan, taking into consideration the different political interests.

It is worth noting here, that the extremely complex social matrix creates, to a certain extent, a different view of human rights. Many politicians see the rights as only those of the people from their own confession or their voters. In a review about "the transformation and implementation in the water sector in Lebanon, the role of politics", Kunigk (1999) indicates that the religious groups are reflected within the water sector through the distribution of leadership within the water authorities among persons representing the different confessions.

In 1999, the Ministry of Energy and Water completed its 10-year strategy mentioned above that was adopted by the council of ministers in 2000. In a presentation during a UNDP workshop held in Beirut 2001, the director general of water and energy points out "the increasing need of the citizen to water" as one of the driving forces behind the adoption of this plan. Additionally, the plan guidelines indicate "alleviating the thirst of the Lebanese and their suffering could not be achieved except through a policy of water harvesting through lakes, dams and groundwater replenishment".

The director general indicates further that the balanced policy targets six main components, namely:

- securing additional water resources through the establishment of 30 dams and lakes and the ground water replenishment,
- potable water supply projects through the establishment of water treatment and pumping stations,
- irrigation schemes through designing and installing irrigation networks,
- wastewater projects, including the networks and collection facilities,
- alignment and maintenance of rivers through Inundation and flooding, and
- electrical facilities projects that include the establishment of electricity networks in deprived areas and initiating hydro-electrical, solar and wind energy projects.

The implementation of the water policy is hindered mainly by political and financial difficulties that will be discussed later. The problems, which are similar to other sectors, did not trigger a public discussion about the privatisation possibilities for the sector, though there are rumours that there are already potential buyers for the water sector and the negotiations are taking place behind the scenes.

2.2 Community approach to water

Despite the positive changes in the communities' approach to environmental issues, there is still a gap in the approach to water access from a human right concept. Very few national non-governmental or community-based organisations dealt with the water issues from an integrated human-rights-based perspective. Discussions dealing with the quality of potable and irrigation water are occasional and usually lack sustainability, momentum and commitment.

One such activity was done by the young volunteers with the *Social Movement* who did a survey about water accessibility and needs in one of the suburbs. The study, though published, is indicated at as lacking professionalism in terms of data collection.

On the other hand, Environmental NGOs focused more on other priorities such as solid and sewage waste management, privatisation and public access.

As for privatisation, public discussion on the issue has not reached the water sector and it is still focused on other sectors, namely the electricity and telecommunications

The projects executed by US-based NGOs have a political dimension serving mostly an agenda of the agency and for a specific period. Despite still being a priority for the people, the water management projects, domestic and sewage, funded by the USAID have been downgraded and the NGOs that were executing these projects removed them from their priority setting. For example, the same NGOs were advised to downsize their projects within their clusters and move towards the liberated zone right upon the end of occupation.

National NGOs working on water issues mostly tend to be service providers ensuring water supply to deprived areas or households.

Universities and research centres are until now focusing on the needs for irrigation when dealing with water demand management. This is demonstrated in terms of workshops and a couple of projects dealing with water harvesting and sound irrigation practices.

2.3 Constraints facing the water sector

The water sector is facing several constraints and problems, which need to be addressed through an integrated approach that combines practical technology with political and social support to avoid water shortages in the future (figure 4). The major challenges include:

- increasing water scarcity,
- continuing water quality deterioration,
- inter-sectoral water allocation conflicts,
- unsystematic and disordered cost recovery and wasteful operational performance,
- inadequate government involvement and bureaucratic restraint, and
- the inefficient institutional arrangements.

The constraints facing the water sector in Lebanon affect the quantity and quality of supplied water. These constraints can be divided into 5 categories namely: political, technical, financial, legal and institutional, and natural.

2.3.1 Political constraints

The master plan was approved in 2000, still however a broad assessment of the achievements to date reveal that very little has been done towards reaching its aims. Of course, the mentioning in the master plan of the need of people to water rather than being a legitimate right, clarifies the approach of the authorities and hence, could explain the low-level commitment among the decision makers and their handling of the issue.

The major obstacle facing the realization of the plan is the lack of political will and the presence of political interest behind every step that is being discussed. An example of this is the discussion that delayed the launch of the establishment of a dam in the Kesrouan area north of Beirut for more than a year. Other projects are still pending for similar reasons.

2.3.2 Technical constraints

Technical aspects include the staff capacity, distribution network design and status including the purification equipment and techniques, physical assaults against the network, contamination of water sources and the outdated water management and saving techniques.

2.3.3 Financial constraints

The poor management and embezzlement has affected the water sector just as any other sector. In many cases, the infrastructure rehabilitation works were not completed or not compliant with the standards.

On the other hand, the pricing system needs revision to promote water saving, while many people tend to refrain from payment, linking the issue to inadequate supply.

On the institutional and administrative level, the distribution of authorities between the *MEW*, CDR, and the water authorities with the relevant restrictions and bureaucratic barriers significantly affects the planning and implementation of plans. The lack of cooperation and coordination between the various water authorities poses an additional limitation on the improvement of the services.

The nature conditions in Lebanon reduce the possibilities for an efficient utilization of water resources. The topography (fissured carstic rock and steep slopes) and the concentration of precipitation in less than 100 days, increases the difficulty of water harvesting. This is augmented by the hot dry summer, which causes high levels of evapotranspiration.

2.3.4 Water supply

The current water supply in terms of network coverage and accessibility to water is by far better than 1975 with respect to most rural areas. This has been achieved during the post 1991 period. However, with the bulk of the population living in the urban areas, minimal achievements have been noted regarding securing additional water

resources to enhance supply. For example, after more than 7 relatively dry years, the year 2003 was an exceptional year in terms of precipitation, which reached in some areas double the 50-years average. The enormous amounts of water resulted in many problems that unveiled the poor infrastructure quality. The fact the works have started on only one dam of the 30 mentioned in plan, and that after intensive political discussions, is one indicator of the problem. Data from the Litani water authority indicated that 10 million cubic metres were released daily from the full Qaraoun Lake over a period of two months, more than two times the capacity of that lake. Estimates of the quantity lost from springs after the Qaraoun Dam, reveal that a similar quantity of water was lost. Still, during the summer of 2003, water shortages and rationing were noted in many areas of the country though at a lower extent than in previous years. The lake, which was completely full at the same time last year, is still not even half full in the same month of 2004, where rainfall has exceeded the average. Similar rationing was observed in other areas of the country.

Another challenge is the integrity of the supply system, which is still disturbed by heavy rains, and supplies in too many areas are disrupted due to the intrusion of runoff water into the water pumping and purification stations.

2.3.5 Water quality

Water quality is as important as its quantity since quality affects usage and vice-versa. In Lebanon, the discharge of raw sewage into surface and ground waters, especially in the mountainous rural areas where this water is later used for irrigation or as a potable source of water, presents serious health problems as evidenced by microbial contamination of rivers, springs and ground water.

As mentioned earlier, water used for irrigation purposes accounts for more than twothirds of the water demand in Lebanon. Seasonal disparities between the winter precipitation period and the maximum irrigation water demand period (dry summer) has consistently led to excessive and uncontrolled groundwater withdrawal to meet these demands. Such patterns of water withdrawal have led to severe lowering of the water table and caused saltwater intrusion along the coast. This intrusion poses a serious threat to the quality of fresh water in coastal areas, particularly in some locations where seawater has actually intruded several kilometres inland and contaminated coastal aquifers. Other agricultural practices have also contributed to a diminishing water quality. Excessive fertilizer utilization and unregulated application of pesticides in some areas has led to contamination of surface and subterranean waters by these substances or their by-products, particularly in shallow aquifers.

The lack of sewage treatment facilities and the presence of septic tanks or wells present an enormous threat to water quality and especially the underground aquifers. There seems to be a political ignorance regarding the gravity of this and other problems. The uncontrolled disposal of solid waste in watersheds has also led to the contamination of river basins by the leachates. The leachates might also infiltrate through fissured bedrock and pollute the groundwater downstream from a dumpsite, and thus widen the contaminated region. With respect to industrial pollution two main categories can be identified; the surface and subsurface disposal of liquid effluents laden with organic chemicals and heavy metals, which find their way through the highly pervious and fractured bedrock into the groundwater. The second and more widespread source of industrial pollution is from leaky underground gasoline storage tanks and the uncontrolled surface dumping of waste oils and petroleum by-products and residues.

2.4 Future needs

In general, there is a consensus within the reports that at the current rate of water consumption, Lebanon will be facing a serious shortage beyond the year 2010 (Figure 4). However, the traditional and future water demands vary widely because of different assumptions used in the estimation process, particularly in relation to available land for agriculture, average consumption per hectare, annual population growth, average per capita consumption, and future industrialization potential. While the numbers vary, the consensus is that there will be a deficit in the quantities of water required within the next ten to fifteen years as depicted in Figure 4. Using the water balance presented in Table 1, it is clear that the total quantity of fresh water available for exploitation will result in a water shortage in the near future; hence the need to address the issue of water management through proper policy setting (El-Fadel, 2001).



Figure 4: Lebanon's future water demand and deficit (EI-Fadel, 2001)

The web of social and political conditions and the water realities presented above require a comprehensive framework that can address these constraints and provide for more efficient allocation of water resources. In this context, management, institutional and policy options, as well as the feasibility of developing non-conventional water resources must be examined.

2.5 Management, institutional and policy options

Efficient water resources management is crucial when addressing the water imbalance in Lebanon. New management and planning policies are necessary to overcome the problems and constraints outlined above. The importance of proper water management has already been recognized in other countries that have initiated specific policies, legislation and steps to mitigate water-related problems. Fundamental issues emerging from cross-country studies relating to water management indicate that measures to enhance proper resource allocation and water quality are complementing and sometimes replacing actions targeting additional resource development and increasing water quantity. In addition, centralized decision-making, administrative regulation and bureaucratic characteristics are fading and paving the way towards decentralization, stakeholder participation and economic mechanisms.

As such, the current institutional reorganization drive in the country should be exploited as a platform to launch fundamental change in water laws, policies and administration in line with international trends.

Currently, these approaches are still lacking and in Lebanon and there is a high importance for targeting them. Despite some decentralization trials, the systems seem to be stationery blocked by the socio-political structure and the lameness of the public sector and public servants, including the water authorities.

2.6 Current activities in water resources management

Considering the projected water shortages that Lebanon will face within the next couple of decades, the Ministry of Energy and Water launched steps aimed at setting the general policy for the management of Lebanon's water resources through the formulation of the 10-year plan for water and wastewater management, to be completed by 2011. This is the first step towards proper, sustainable, and comprehensive water management.

Despite the various studies, projects and assessments of the infrastructure and needs, very little has been achieved towards the implementation of the master plan for water resource management and protection. The fact that prioritisation of activities is based on political and not on national interests, and the economic crisis, has been the major reason behind this inactivity and the stall.

On the other hand, infrastructure projects have been initiated through the assistance of loans and grants from major organizations and governments such as the World Bank, European Investment Bank, European Union, United States Agency for International Development (USAID), Saudi Fund for Development, Kuwait Fund for Arab Economic Development, Arab Fund for Economic and Social Development, French and Italian cooperation agencies, and the German and Japanese Governments through their specialized agencies. These projects include rehabilitation and maintenance works on water treatment plants, sewage treatment, pumping stations, groundwater wells and surface reservoirs, extension of existing and newly constructed potable water supply and distribution networks and technical support on sound irrigation practices. Institutional and administrative development of the water sector is also a focal area for a multi-million Euro project funded by the European Union MEDA programme.

The USAID is currently implementing a water policy programme within the MEW that focuses on three policy and implementation areas, namely private sector participation, water services pricing and local level participation. The objectives will be accomplished through training groups of the different water and wastewater authorities, local authorities and the MEW to build the strategies using a collaborative and participatory process.

On the other hand, the proposed EU project focuses on Institutional Programming and Planning within the Ministry of Energy and Water as well as the Water authorities. The programme that was signed recently focuses on three major aspects:

- The main rules of operation and the cooperation mechanisms between the water authorities
- The network losses, their detection methods and the policy for loss reduction, and
 - Development of models for optimum use of water resources

This programme includes under the priority areas the stakeholder consultation and trainings that would contribute to its success. Details related to this project are not available yet as the finalization of the contracts is ongoing.

3 Conclusions and recommendations

The information in this document confirms what has been stated by many reports and studies regarding the water supply and accessibility. Surely, the mismanagement of resources leads to this conclusion. The efforts that were made towards alleviating the war damage did not completely succeed due to the faulty planning, corruption and lack of expertise. An additional challenge was the lack of accurate data. The figures used currently are mostly estimates that are based on pre-war data. The fact that the existing system is not capable of satisfying the needs of the population in terms of irrigation and domestic water leads to the following recommendations of utmost priority:

- The rehabilitation of the water network and the broadening of its geographical coverage,
- Implement with available resources, without resorting to international debt, the Ten-year action plan in order to increase available water resources
- Capacity development of public sector personnel on management related issues
- Focus on managerial aspects to reduce/eliminate the water rationing such as stricter control on the networks and their losses,
- Make use of available water resources, especially the trans-boundary ones within the limitations of international law
- Conduct community training and awareness campaigns related to the right to water, accessibility and affordability, in addition to good practices in water management and saving practices
- Work on updating existing legislation or develop new legal texts that support a sound water management policy, and ensure the enforcement of these texts.

4 List of NGOs

As mentioned earlier, very few national NGOs handle the water issue from a human right perspective, rather it was always considered as a basic need and the water was provided as a service. On the other hand, a few US based NGOs were involved in installing primary and secondary domestic water networks and irrigation canals in some remote areas.

Caritas Lebanon

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Youssef Hajjar Street, Sin El-Fil, Kalaa, Beirut

Tel.+961 1 499767/8/9, 483305

Fax.: +961 1 494713

Email: executive@caritas.org.lb

Recently moved into service provision regarding irrigation water management

Jihad AI Binaa Association

P.O.Box 24-153

Rotex Building

Haret Hreik Main Street, Beirut

Tel.: +961 1 557151/2

Fax: +961 1 557603

Email: binaa@cyberia.net.lb

The association was mostly involved during the war in providing potable water to houses through cisterns and other basic services such as garbage collection. Later it became involved in agricultural and rural development including irrigation.

Social Movement

148 Alam street, Forest Building

Badaro Street, Beirut

Tel.: +961 1 381 279/381879/383718

Fax.: +961 1 387736

Email: mouvementsocial@mouvementsocial.org

The movement is involved in various social activities including preliminary water study in one of the suburbs of Beirut. The activity was part of a youth mobilization campaign that needs to be continued.

The below mentioned NGOs are US based that received funding from USAID to implement a project in domestic and irrigation water supply and sewage treatment. The project cycle was between three and five years. The project was closed or is currently being closed.

Cooperative Housing Foundation Bir Hassan, Adnan Al Hakim St., Mobarak Bldg., 3rd Floor, Beirut Tel.: +961 1 853263/780 Fax.: +961 1 853262 Email: cdi@cyberia.net.lb Mercy Corps International 5590 Beirut- Lebanon Bostani Bldg, 3rd Floor 35 El-Fors St., Beyond Olivetti Justice Palace Area. Tel.: +961 1 611586/7 Mobile: +961 3 701543 Fax.: +961 1 611585 Email: mc@lb.mercycorps.org YMCA Lebanon P.O.Box 11-5520 Beirut Centre Delta, 3rd floor Horsh Tabet - Sin El Fil, Beirut Tel.: +961 1 490640/685, 491740 Fax.: +961 1 (01) 491740, 490640 Email: ymca@ymca_leb.org.lb Pontifical Mission P.O.Box 70790 Antelias Jal El Dib - Mar Abda Bldg. Tel.: +961 4 714901-4 Fax.: +961 4 714905 Email: pontim@inco.com.lb

In addition to the above-mentioned NGOs, the following universities and research institution are involved in water management issues, with a special focus on irrigation and quality.

American University of Beirut

http://www.aub.edu.lb

Faculty of Agricultural and Food Sciences

Faculty of Health Sciences

Faculty of Engineering and Architecture

This university operates interfaculty programmes that handle environment and water related issues

Notre Dame University

http://www.ndu.edu.lb

Water, Energy and Environment Research Centre deals mainly with water demand management at the agricultural level

National Council for Scientific Research

http://www.cnrs.edu.lb

The largest governmental research body supports the researcher in various fields including water quality of rivers, ground water assessment and irrigation management

Lebanese Agricultural Research Institute

http://www.larileb.com

Once a major actor in water management and irrigation research, the institute currently works on irrigation water management in the northern Bekaa region, maintains a laboratory that conducts routine water analysis for the public and conducts pesticide and fertilizer residue analysis for ground water

5 List of donor activities of governmental and non-governmental organizations

United States Agency for International Development

Supported grants worth about 53 million USD for US based NGOs to work in the Field of water supply, sewage treatment and solid waste management. The agency is currently supporting the Water Policy Programme at the MEW with a budget of about 1.3 million USD.

European Commission

Currently finalising the agreements with the MEW with a budget of about €15 million.

Italian Ministry of Foreign affairs/Trust funds

The project of about €2 million supports water demand management activites within a rural development context in the northern Bekaa in cooperation with LARI, CARITAS and the Italian Institute of University Cooperation

The World Bank

The bank gave loans of about \$120 (supposedly 'million', please verify figure!) to rehabilitate the irrigation and domestic water sectors.

6 References

Abdallah, C., 2002. Lebanon National Report, Gateway to Land and water information. Food and Agriculture Organisation of the United Nations

Akl, G. 2004. Development Alternatives Inc. Lebanon Water policy programme, personal communication

Amery, H. 1998. Assessing Lebanon's water balance. Workshop on Freshwater in the Eastern Mediterranean, IDRC/Carlton University

Comair, F. 1998. Sources and uses of water from the Litani Basin and Karoun Lake. Paper presented at the Workshop on Pollution in the Litani Basin and Lake Karoun, and Environmental Problems in the Western Bekaa and Rashaya, 9–10 May 1998

Fawaz, M. 1967. International Conference on Water for Peace, Beirut, Lebanon. Vol. I. Government Press, Washington, DC, USA. pp. 293–299.

Jaber, B. 1997. Water in Lebanon: problems and solutions. Public lecture given in the Department of Hydrology, Purdue University, Lafayette, IN, USA, Apr 1997.

Karoun, and Environmental Problems in the Western Bekaa and Rashaya, 9–10 May 1998.

Comair, F., 2002, Ten year action plan of the Ministry of Energy and Water. Workshop on Water Issues in Lebanon, Lebanese Parliament

El Fadel, M. 2002. Water Resources in Lebanon, Current Situation and Future needs.

Kunigk, E., 1999, Policy transformation and implementation in the water sector in Lebanon: The role of politics. Water Issues Study Group, School of Oriental and African Studies, University of London.

Macksoud, 1998. Towards a sustainable groundwater development in Lebanon. International Conference "Water and Sustainable Development, Paris, 19-21 March 1998

Mallat, H. 1982. Water of Lebanon–Petroleum of Lebanon. No. 6. Department of Law, Politic and Management, Lebanese University, Beirut, Lebanon. [In Arabic]

Ministry of Agriculture, Lebanon, 2003. National Action Programme to Combat Desertification

N'khaal, Saad al Deen; Ali, N.; Smaha, E. 1998. The role of wastewater in polluting the Litani water and Lake Karoun. Paper presented at the Workshop on Pollution in the Litani River and Lake Karoun, and Environmental Problems in the Western Bekaa and Rashaya, 9–10 May 1998.

Srour, S.; Sleiman, B. 1998. Water management plan for the Litani River and Karoun reservoir. Paper presented at the Workshop on Pollution in the Litani River and Lake and Environmental Problems in the Western Bekaa and Rashaya, 9–10 May 1998

United Nations Development Programme, Lebanon and Ministry of Social Affairs, 1998. Mapping of Living Conditions in Lebanon. UNDP, Beirut, Lebanon

United Nations Development Programme, 2003. Millennium Development Goals, Lebanon Report. UNDP, Beirut, Lebanon