8406

HYDROLOGY OF LEBANON

Preliminary Technical Report

September 1986

Associates for Middle East Research
2400 Chestnut Street
Philadelphia, PA 19103

PART ONE

Hydrology of Lebanon

Summary

Table of Contents

PART TWO continued

1. Hydrology of Lebanon

The general hydrological profile of Lebanon can be summarized as follows. Total annual rainfall (gross) is 9,200 million cubic meters (Mcm) of water; loss due to real natural evaporation is 4,400 Mcm (45% of total rainfall); net amount of rainfall is 4,500 Mcm (52% of total rainfall); surface water production is 3,900 Mcm; and underground water production is 750 Mcm.

1.1. Surface water

The eighteen rivers of Lebanon carry an estimated 3,900 Mcm/yr to the delta. The distribution follows (Table 1):

Table 1: Annual Flows

River Name	Contribution in Mcm	
Nahr el-Kabir	129	(Lebanese part)
Nahr Escourne	56	
Nahr Arqa	43	
Nahr el-Bared	254	
Nahr Abu Ali	248	
Nahr el-Asfour	8	
Nahr el-Jaouz	65	
Subtotal (North Lebanon)	803	
Nahr Ibrahim	385	
Nahr el-Kalb	370	
Nahr Beirut	173	
Subtotal (Mount Lebanon)	924	
Nahr Damour	242	
Nahr Awali	243	
Nahr Saitaniq	17	
Nahr Zahrani	38	
Nahr Litani	987	
Nahr Ezzye	6	
Subtotal (South Lebanon and Bekaa)	1533	
Nahr Hasbani	145	
Nahr Orontes	490	
Total	3895	

The total water flowing from Lebanon to other countries is 650 Mcm/year. Of this total Syria receives: water of the Orontes - 415 Mcm; and water of Nahr el-Kabir - 95 Mcm. Israel receives 140 Mcm from the Hasbani and the Wazzani. The total annual amount of surface water flowing within Lebanon is thus:

3900 - 650 = 3250 Mcm.

1.2. Underground water

The total annual volume of underground water (see map) is estimated as 750 Mcm, distributed as follows: flowing to the sea - 150 Mcm; available underground water - 600 Mcm, of which 450 Mcm is used and 150 Mcm is difficult to exploit.

2. **Rainfall**

Rainfall varies annually from region to region. In the western part the average rainfall on the coastal mountain is: 700 mm in Tyre (south); 900 mm in Beirut (central coastal area); and 1000 mm in Tripoli (north). On the high plateau rainfall reaches 2000 mm in Conet as Sawda (3000 meters of altitude). On Mount Lebanon (central region) rainfall varies from 1300 mm to 1500 mm. On the eastern part of the mountain and in the Bekaa the yearly averages of rainfall can vary as follows: north of Bekaa: 200-400 mm (Baalbek-Hermel); central Bekaa: 600-700 mm; and southern Bekaa: 900-1000 mm.

In Table 2 the yearly averages of rainfall observed in 50 stations that cover the total Lebanese territory for a period of 32 years are presented. See the annex for tables presenting detailed data on rainfall (monthly and annual averages) in Lebanon.

Table 2: Yearly Rainfall in Lebanon (Averages)

Station Name	Altitude (m)	Years of Observation	Yearly Avg. (mm)	Avg. for 1939-40 to 1970-71 (mm)
1-North Batroun	20	30	1024	1035
2-Ghazir	390	22	1085	1108
3-Suq Mikayel	70	28	901	901
4- Arbaniya	510	12	1299	1256
5-A.U.B.	34	95	899	926
6-St. Joseph University	45	20	885	887
7-Beirut Airport	15	18	740	757
8-Suq el-Gharb	790	23	1184	1192
9-Jisr el-Qadi	260	22	1108	1132
10-Keter-Maya	380	6	796	788
11-Sidon	5	6	690	678
12-Sfaray pilot section	570	10	1016	940
13-Deir Zahrani	450	6	1089	994
14-Arab Salim	580	6	1020	1010
15-Qasmieh (Litani mouth)	30	24	676	660
16-Ain Ebel	766	12	802	775
17-Aitaroun	680	32	787	787
18-Insariya	160	7	730	656
19-Duweir	380	10	931	860
20-Nabatiya	410	7	928	834
21-Tyre	5	6	704	627
22-Jouaya	300	6	726	719
23-Qana	300	4	631	618
24-Jarmaq	400	6	978	969
25-Qlaya	1050	28	1210	1211
26-Bikfaya	900	22	1308	1336
27-Dahr el-Baydar	1510	19	1361	1381
28-Beit Eddine	880	31	1138	1138
29-Jezzine	945	30	1380	1352
30-Rihan	1090	4	1194	938
31-Hermel Bekaa	700	32	239	239
32-Jamouneh	1370	31	982	995
33-Baalbek	1150	31	406	407
34-Qaa el-Rim	1320	32	1294	1294
35-Tel Amara (agr. research)	905	18	618	632
36-Ksara	920	50	634	650
37-Chtaura	920	19	833	845
38-Taanayel	880	5	879	?
39-Anjar	925	31	531	527

Table 2 (continued)

Station Name	Altitude (m)	Years of Observation	Yearly Avg. (mm)	Avg. for 1939-40 to 1970-71 (mm)
40-Mansura South Bekaa	860	33	632	637
41-Joub Jannin	920	25	720	720
42-Qirawn village	950	16	675	680
43-Mashghara	1070	28	1462	1396
44-Terbol	890	3	804	604
45-Qirawn Dam	950	9	1151	1066
46-Markabeh	670	5	1256	1040
47-Hasbaya	750	27	1030	1037
48-Marjayoun	760	25	894	885
49-Deir el-Ashayeb	1280	5	754	649
50-Rashaya	1235	25	847	847

Source: UNDP, *Annuaire des precipitations mensuelles et annuelles du Liban* (Beirut, 1973).

3. Water Utilization in Lebanon

The total annual volume of water (surface and underground water) consumed in Lebanon just before the civil war (1975) reached approximately 854 Mcm, that is 23% of the available reserves in the country. (See table 3.) The sources of this consumption were: 62.8% from surface water; and 37.2% from underground water.

Table 3: Distribution of Consumed Water (1975)

Utilization	Surface Water Volume in Mcm	%	Underground Water Volume in Mcm	%	Total Consumed Volume in Mcm	%
Irrigation water	422	79	247	78.3	669	78.4
Domestic water	105	20	40	12.3	145	16.9
Industrial water	10	1	30	9.4	40	4.7
Total (Lebanon)	537	100	317	100	854	100

3.1. Irrigation by surface water

The surface water used for irrigation comes from the 18 main rivers that flow permanently in Lebanon and the perennial springs scattered throughout the country. The water is pumped directly from the rivers or by gravity from the pipes leading to them. The most popular system of irrigation practiced in Lebanon

is the traditional method of submersion. The quantity consumed per hectare can vary from 7000 cu m (Bekaa) to 20,000 cu m (in Qasmieh and coastal flat areas). The distribution network is generally not well maintained and losses can reach 50%. The only areas that are collectively irrigated are the perimeter of Qasmieh - Ras el-Ain (approx. 5000 hectares); and the pilot perimeter of Sidon - Jezzine (Lebaa) (approx. 300 ha).

3.2. Irrigation by underground water

Underground water is exploited by drillings scattered throughout the region, which allow profitable water extraction, especially in the coastal areas and in the Bekaa. The number of these drillings was estimated in 1985 at some 3500. 55% of them are located in the Bekaa, and 1050 are in the coastal area south toward the Awali River, from Sidon to the Israeli border (altitude 0-240 m). The depth of these drillings varies from 50 m to 300 m, according to the aquifer, with an average of 150 m. The size of the fields irrigated by these drilling systems varies between 10 ha and 20 ha.

These artesian wells are complemented by some 1500 to 1800 ordinary wells that are mainly used to irrigate citrus around the main cities in Lebanon (Tyre, Sidon, Beirut, Tripoli) and in the Bekaa.

The total area irrigated by underground water in 1975 reached 27,000 ha. The execution of the five big irrigation projects that were studied in the period of 1970-76 was postponed because of the civil war that started in 1975.

Table 4: Distribution of Irrigation by Area (1975)

Region	Irrigated Area in ha Surface Water	Underground Water	Total
North Lebanon	11,500	3400	14,900
Mount Lebanon	7400	200	7600
Southern Lebanon	8100	7800	15,900
Central Bekaa	10,600	7500	18,100
Southern Bekaa	4600	5800	10,400
Total Bekaa	15,200	13,300	28,500
Total Lebanon	42,200	27,700	66,900
Volume of water consumed	422 Mcm	247 Mcm	669 Mcm

Source: *Liban: Etude de reconstruction et de developpement l'agriculture - Annexe technique 10* (Beirut, 1980), p. 10.

3.3. Irrigation as of 1985

During the ten years of civil war irrigation using surface water has increased on the average at the rate of 1% per year, and irrigation using underground water has increased at an annual rate of 2%. In this period 930 ha/yr were newly irrigated. The areas currently irrigated represent 7.6% of the total land in the country and almost 25% of the agricultural areas. The most important expansion of the irrigation system was in the Bekaa (internal zone) and along the coastal area of southern Lebanon. (See Table 5.) The expansion of irrigation developed outside of the collective perimeter and without any governmental intervention.

Table 5: Irrigation Distribution (1985)

Region	Irrigated Area in Ha Surface Water	Underground Water	Total
North Lebanon	12,600	4100	16,700
Mount Lebanon	8100	240	8340
Southern Lebanon	8900	9300	18,200
Bekaa (central and South)	17,600	15,360	32,960
Total Lebanon	47,200	29,000	76,200
Volume of water consumed	464 Mcm	319 Mcm	783 Mcm

3.4. Power production

There are 12 power stations established on six rivers in Lebanon. Their total power is estimated to be 275 MW. Table 6 gives the distribution of stations by river, their starting date, and the power of each.

Table 6: Hydroelectric Power Plants

River	Power Plant	Starting Date	Power (in MW)	Volume of Turbine Water (in Mcm)
Nahr Jaouz	Kaftoun	1954	5.00	46
Nahr Abu Ali	Kadisha	1929	1.60	11
Nahr Kadisha	Mar-Lisha	1958	3.10	20
Nahr Abu Ali	Blaouza	1961	8.40	48
Nahr Abu Ali	Kousba	1972	7.40	44
Nahr el-Bared	Bared I	1954	13.50	148
Nahr el-Bared	Bared II	1961	3.70	52
Total North Lebanon	7		43.00	369
Nahr Ibrahim	1		32.48	
Nahr Essafa	1		13.12	
Total Mount Lebanon	2		45.60	
Nahr Litani	Markabeh Plant	1962	34.00	317
Nahr Litani	Awali Plant	1965	105.00	282
Nahr Litani	Joun Plant	1968	48.00	377
Total Litani	3		187.00	300 (avg.)
Total Lebanon	12		275.00	

The proportion of hydroelectric power to total power consumption has decreased from 40% in 1975 to 17% currently (see Table 7).

Table 7: Power Production in Lebanon

Year	Power Source: Thermal Stations (kWh)	Hydroelectric Stations (kWh)	Bought by Syria (kWh)	Total (kWh)
1982	1792	576	125	2493
1983	1812	919	94	2845
1984	1686	984	46	2716
1985	2599	547	39	3185

Source: *Journal en Nahar*, 06/07/86, p. 7.

3.5. Drinking water, domestic water, industrial water

The total quantity of water needed for urban and rural consumption, as well as industrial consumption, was estimated just before the civil war in 1975 to be 185 Mcm, that is, 21.6% of the total quantity of water consumed in Lebanon (see Table 8). The average consumption (domestic water) was close to 147 liters per person per day, varying from between 90 liters/person/day in the rural areas to 170 liters/person/day in the big cities (Beirut, Tripoli, Zahleh, and Sidon). These figures include the loss in the pipe that is estimated to be 18 to 30% of the total quantity of water carried.

Table 8: Water Consumption in Lebanon (1975)

Utilization (1975)	Origin of Water: Surface Water Vol. in Mcm	%	Underground Water Vol. in Mcm	%	Total Mcm
Domestic water	105	70	40	30	145
Industrial water	10	25	30	75	40
Total	115	80	70	20	185

If one takes into consideration population increase (up to about 3 million in 1985) the average water consumption is 160 liters/person/day. Thus the water consumption for domestic purposes would be:

3 million p x 160 Mcm/p/d x 365 d = 175.25 Mcm

Industrial water consumption will be in the neighborhood of 35 Mcm because many plants have closed their doors (20 to 30%), and there has been very limited development of the remaining industries. Therefore, the total consumption of domestic and industrial water reached 210 Mcm in 1985.

4. Water Utilization Planning

In the long run the objective is to double the irrigated areas (currently 76,200 ha). This can be done through the execution of big irrigation projects and through starting projected small and medium hydroelectric power units.

The execution and development of the hydroelectric program is to proceed in two steps. The first is execution of the big irrigation projects that had been studied before the civil war (see Table 9).

Table 9: Execution of Big Irrigation Projects

Project Location	Area to be Irrigated (in ha) Water Origin: Surface Water	Underground Water	Total
Akkar Plain	5600	3400	9000
Koura-Zgharta Plain	7000		7000
Kaa-Hermel	6000		6000
South Bekaa	16,200	5800	22,000
South Lebanon	30,000		30,000
Total	64,800	9200	74,000

Source: *Liban - Annexe technique* 10, p. 11.

The second step is realization of the small and medium size hydroelectric power units, especially those in the Bekaa, in the east of the country (see Table 10).

Table 10: Realization of the Small and Medium Size Hydroelectric Power Units

Project Location	Area to be Irrigated (in ha) Water Origin: Surface Water	Underground Water	Total
Central Bekaa		2000	2000
Yammouneh (Lake)	4500		4500
Banqaya	1300	700	2000
Small dams in the Bekaa	2500		2500
Total	8300	2700	11,000

Source: *Liban - Annexe technique* 10, p. 12

It is useful to recall that the private sector has played the initiating role in the expansion of irrigation by underground water. The irrigated areas using this water will increase from 29,000 ha in 1955 to 34,000 ha in the year 2000 (see Table 11); a long term perspective is given in Table 12.

Table 11: Utilization of Underground Water by the Private Sector

	Area Irrigated (in ha)		
	1985	1990-2000	year 2000
North Lebanon	4400	300	4700
Mount Lebanon	240	500	740
South Lebanon	9300	1300	10,600
Bekaa (central and south)	15,360	2700	18,060
Total Lebanon	29,000	4800	33,800

Table 12: Long-term Perspectives

Project Location	Area to be Irrigated (in ha) Water Origin		
	Surface Water	Underground Water	Total
Small hydroelectric units	50,000	- - -	50,000
Underground water	- - -	28,100	28,100
Big projects	64,800	9200	74,000
Medium projects	8300	2700	11,000
Total Lebanon	123,000	40,000	163,100

Source: *Liban - Annexe technique 10*, p. 12

5. Planning for Water Utilization

The expansion of irrigated areas by the execution of new irrigation projects and by more intensive drilling for underground water, the increasing population, and the increasing needs of industry all require the use of supplemental quantities of water.

The total annual quantity of water needed for the year 2000 is estimated to be 1980 Mcm, 49% of the total available water reserve in the country.

This total volume can be distributed by its use in the following manner (see Table 13).

Table 13: Estimated Quantities of Water Needed

Use of Water	Current Need Volume	%	Projected Need Volume	%	Supplementary Volume	%
Irrigation water	783	79.0	1600	80.0	817	82.7
Domestic water	175	17.8	310	15.6	135	13.7
Industrial water	35	3.2	70	4.4	35	3.6
Total Lebanon	993	100.0	1980	100.0	987	100.0

The quantity of supplementary water needed for the year 2000 is nearly equal to that currently consumed. However, these projections are based on the realization of the planned irrigation projects that were mentioned previously.

6. Water Quality in Lebanon

This section is limited to physical and clinical analyses of the water of certain available sources.

6.1. Greater Beirut area

The following table summarizes the clinical analysis of the surface water of some rivers, as well as that of some artesian wells that provide the city of Beirut with drinking water.

Table 14: Clinical Analysis of Water

Chemical Element	Nahr Ibrahim	Litani (Awali)	Nahr Beirut	Spring of Jeita	Well of Hadeth
Ca	48.00	54.00	50.00	31.00	111-116
Mg	15.81	8.50	6.00	22.00	32-43
Na	5.20	7.20	8.30	2.70	40-130
K	0.70	1.40	1.00	0.80	2-4
Cl	7.08	7.08	17.00	16.00	92-276
SO4	11.35	17.45	18.30	15.00	65-100
HCO3	207.40	189.00	149.45	140.60	336-403
Res 180	211.00	198.00	193.00	166.00	531-944
Cond.	330.00	330.00	300.00	235.00	810-1450
Dh	18.20	17.00	15.00	16.00	41-56
pH	7.10	7.20	7.50	7.80	7.5-7.8

Source: *Approvisionnement en eau potable de la ville de Beyrouth* (Beirut 1969), p. 90.

6.2. Sidon (South Lebanon)

The origin of the area's drinking water is an artesian well located at Ain el-Helorie. A physical examination yields the following:

- color: none; taste: none; smell: none
- turbidity: clear
- conductivity (25%) micron: 595
- elements in suspension: none.

Results of chemical examination are detailed in Table 15.

Table 15: Chemical Examination of the Water of Sidon
(in parts/million - milligrams/1000 liters)

pH	7.2	total alkalinity	230.0
residuals	426.0	total acidity	30.0
chlorine	50.0	hardness hydro-Francais	
sulphate	53.5	total hardness	30.0
nitrate		permanent	
oxygen		hardness	10.8
calcium	78.4	temporary	
magnesium	23.4	hardness	19.2
total iron		total hardness	300.0
metals		alkaline hardness	230.0
sodium	24.3	non-alkaline	
potassium	1.7	hardness	70.0

Source: *Service eau potable de Saida* (Examination made 8/4/86).

7. General Distribution Network of Water in Lebanon: Greater Beirut Area

The collection and distribution network for water in Beirut and its suburbs provides drinking water for almost 50% of the Lebanese population residing in that city.

7.1. Beirut's drinking water

Beirut's network for collection and distribution of water has a total length of about 300 km. The main pipe consists of three parts. The first line of 600 mm diameter connects Dbaye treatment station to the lower reservoirs of Ashrafieh. This line provides for the suburbs of northeast Beirut. A second line of 1000 mm diameter connects Dbaye to Ashrafieh. This line provides Beirut city with water, as well as its southern suburban areas. A third line of 450 mm diameter is used to take water from Atelias to the treatment station of Dbaye.

7.2. Ain Delbe

The water of Ain Delbe provides for the southern suburbs of Beirut. The distribution network consists of a principal pipe (diameter = 225 mm) and a mixture of pipes made of steel, cast iron, and cement. The total length of the network is 200 km.

PART TWO

Hydrology of Lebanon

Detailed Study

1. Rainfalls: Monthly and annual averages

The bed of the Litani, which has an area of 2186 sq km, receives each year a quantity of rain that varies from 400 mm in Baalbek (at its source) to 650 mm in the central Bekaa, to 680 mm in Qirawn, to almost 660 mm when it reaches the sea in Qasmieh. Table 16 summarizes the yearly averages recorded in 10 stations that cover almost the total bed of the Litani River.

Table 16: Average Annual Rainfall at Litani Stations

Station Name	Altitude (m)	Years of Observation	Yearly Avg. (mm)	Avg. for 1939-40 to 1970-71 (mm)
1. Baalbek	1150	31	406	407
2. Qaa el-Rim	1320	32	1294	1294
3. Tel Amara	905	18	618	632
4. Ksara	920	50	634	650
5. Mansura	860	33	632	637
6. Joub-Jannin	920	25	720	720
7. Qirawn Dam	950	9	1151	1066
8. Markabeh	670	5	1256	
9. Jarmaq				
10. Qasmieh delta	30	24	676	660

The following tables summarize the monthly and yearly averages of rainfall recorded in 9 stations evenly distributed along the bed of the Litani River, from its starting point near the city of Baalbek to the point where it reaches the ocean, that is, the Qasmieh Dam in the south.

Table 17: Monthly and Yearly Average Rainfall at Litani Stations (in mm)

(1) Baalbek Station, Bekaa - altitude 1150 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
38-39	0	2	113	53	56	86	158	57	0	0	0	0	525
39-40	0	1	79	30	149	26	34	14	0	0	0	0	333
40-41	0	28	66	146	109	34	54	9	0	0	0	0	446
41-42	-	-	-	-	-	-	-	-	-	-	-	-	-
42-43	-	-	-	-	-	-	-	-	-	-	-	-	-
43-44	0	0	2	28	228	121	121	25	33	0	0	0	558
44-45	0	0	133	141	108	84	15	23	23	0	0	0	527
45-46	0	0	21	29	35	136	73	23	35	0	0	0	352
46-47	0	11	4	43	143	67	18	7	9	0	0	0	303
47-48	0	2	26	27	106	232	89	51	9	0	0	0	541
48-49	0	3	64	57	104	133	97	65	0	0	0	0	523
49-50	0	0	1	113	129	32	52	33	34	0	0	0	394
50-51	0	19	43	89	54	73	18	63	0	0	0	0	360
51-52	0	15	33	174	30	134	61	25	0	0	0	0	473
52-53	0	10	27	58	88	135	153	30	0	0	0	0	502
53-54	0	0	98	74	187	141	32	61	6	0	0	0	609
54-55	9	6	47	48	11	51	85	31	17	0	0	0	305
55-56	0	2	78	51	117	95	44	5	20	0	0	0	412
56-57	0	0	17	83	87	38	41	23	34	5	0	0	327
57-58	0	9	26	95	113	20	18	5	5	0	0	0	291
58-59	0	3	9	44	91	82	32	10	8	0	0	0	279
59-60	8	5	22	10	34	8	74	8	12	0	0	0	181
60-61	0	2	35	32	70	41	29	8	2	0	0	0	218
61-62	1	12	22	128	64	136	6	36	12	0	0	0	416
62-63	0	55	1	105	126	49	60	59	11	0	0	0	465
63-64	2	35	29	54	34	150	26	15	17	0	0	0	362
64-65	0	0	150	10	84	94	55	45	2	0	0	0	441
65-66	0	41	16	94	35	57	77	1	3	0	0	0	324
66-67	4	15	10	152	100	61	164	12	43	0	0	0	560
67-68	1	66	53	75	162	33	28	6	34	0	0	0	457
68-69	0	8	61	179	212	26	67	21	23	0	0	0	462
69-70	0	52	37	39	74	24	59	31	4	0	0	0	320
70-71	0	4	27	63	40	92	54	99	5	0	0	0	384

(2) Ksara station, central Bekaa - altitude 905 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
21-22	0	9	36	209	195	159	33	15	8	0	0	0	662
22-23	0	1	112	116	149	116	81	83	23	1	0	0	681
23-24	4	9	17	124	164	205	55	11	5	3	0	0	596
24-25	0	35	126	93	82	49	5	45	1	12	0	0	448
25-26	1	31	23	118	311	181	101	79	18	0	3	0	866
26-27	0	1	5	167	122	193	47	109	7	0	0	0	650
27-28	0	21	14	59	99	308	20	3	3	0	0	0	527
28-29	0	11	88	146	174	421	59	41	16	4	0	0	960
29-30	0	1	47	90	72	147	10	19	2	0	0	9	397
30-31	3	1	55	175	156	212	73	33	2	6	0	0	717
31-32	2	1	26	157	73	94	34	39	1	0	0	0	426
32-33	0	4	73	2	74	64	67	46	1	0	0	0	330
33-34	6	15	18	133	117	210	28	13	13	0	0	0	553
34-35	0	32	3	222	231	161	26	100	0	0	0	0	775
35-36	4	34	112	59	37	155	53	9	23	0	0	2	488
36-37	0	7	184	102	89	33	11	62	10	1	0	0	498
37-38	0	73	64	38	227	189	60	28	58	0	0	0	739
38-39	3	1	121	97	105	111	95	59	1	5	0	0	597
39-40	0	18	99	90	238	99	86	27	0	0	0	0	657
40-41	0	19	118	252	194	42	95	13	0	0	0	0	734
41-42	1	20	23	214	240	72	133	8	10	1	0	0	720
42-43	0	67	106	33	270	80	117	78	6	0	0	0	757
43-44	0	6	4	68	283	124	78	29	26	0	0	0	619
44-45	0	8	183	156	164	126	33	15	31	0	0	0	715
45-46	0	0	72	78	29	180	97	7	92	0	0	0	554
46-47	0	28	13	61	299	73	29	9	24	0	0	0	535
47-48	0	1	50	53	134	242	131	47	19	0	0	0	678
48-49	0	7	86	129	163	189	121	87	7	0	0	0	790
49-50	5	0	2	184	181	66	77	36	26	0	0	0	577
50-51	1	58	42	71	86	77	28	76	4	0	0	0	443
51-52	0	43	58	209	79	167	99	23	0	0	0	0	678
52-53	0	28	42	124	199	184	202	19	1	0	0	0	800
53-54	0	2	142	128	179	206	49	59	4	0	0	0	770
54-55	3	4	69	85	26	80	140	40	14	0	0	0	461
55-56	0	17	132	132	125	132	89	4	32	0	0	0	665
56-57	0	0	52	160	187	87	96	16	40	7	0	0	645
57-58	0	11	52	183	209	16	36	14	13	0	0	0	634
58-59	1	19	11	71	167	100	62	24	13	1	0	0	466
59-60	10	8	40	42	92	31	85	30	2	0	0	0	340
60-61	0	12	76	45	126	97	68	8	4	0	0	0	436
61-62	14	7	61	183	117	141	34	23	4	0	0	0	583
62-63	0	36	0	223	161	117	93	82	4	1	0	0	716
63-64	7	58	38	102	88	217	82	50	24	0	0	0	666
64-65	0	0	165	41	157	135	51	74	7	2	0	0	631
65-66	0	86	30	227	99	88	109	0	4	0	0	0	643
66-67	0	54	10	234	161	136	205	24	40	0	0	0	864
67-68	0	91	71	138	261	55	33	6	16	0	0	0	672
68-69	0	24	132	373	403	62	126	41	14	0	0	0	1174
69-70	0	58	62	81	153	75	115	45	3	0	0	0	590
70-71	0	17	39	115	72	175	69	195	0	0	0	0	682

(3) Tel Amara station, central Bekaa - 905 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
53-54	0	1	163	133	204	205	42	65	5	0	0	0	817
54-55	0	0	66	82	18	81	125	27	12	0	0	0	411
55-56	0	11	105	126	155	131	86	6	35	0	0	0	653
56-57	0	0	27	141	181	80	72	16	54	2	0	0	572
57-58	0	17	56	174	191	23	43	14	7	0	0	0	524
58-59	0	17	4	95	175	88	62	17	27	0	0	0	486
59-60	4	8	31	45	98	38	81	39	2	0	0	0	346
60-61	0	10	71	57	125	86	72	17	2	0	0	0	440
61-62	7	16	50	182	112	136	35	27	3	0	0	0	567
62-63	0	24	0	200	152	142	103	80	4	4	0	0	708
63-64	0	54	38	72	91	207	81	35	23	0	0	0	602
64-65	0	0	182	38	138	152	64	71	6	2	0	0	652
65-66	0	54	29	237	99	75	111	0	4	0	0	0	609
66-67	0	33	10	213	162	126	208	32	40	0	0	0	824
67-68	0	92	74	123	220	61	27	2	46	0	0	0	645
68-69	0	21	120	315	345	59	133	39	14	0	0	0	1046
69-70	0	49	63	75	164	74	117	45	4	0	0	0	591
70-71	0	9	36	109	60	165	46	200	0	0	0	0	625

(4) Qirawn dam - altitude 950 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
61-62	5	10	173	355	142	281	37	32	13	0	0	0	1048
62-63	0	25	0	349	308	256	243	79	49	0	0	0	1309
63-64	3	53	53	171	177	363	227	39	48	0	0	0	1134
64-65	0	0	346	72	227	279	84	100	1	2	0	0	1110
65-66	0	79	72	261	177	124	174	6	1	0	0	0	894
66-67	5	32	5	296	246	219	330	53	29	0	0	0	1215
67-68	0	62	107	247	414	92	57	10	35	0	0	0	1024
68-69	0	38	144	540	608	95	255	34	4	0	0	0	1718
69-70	0	93	87	185	171	101	205	66	0	0	0	0	908
70-71	-	-	-	-	-	-	-	-	-	-	-	-	-

(5) Taanayel station, Bekaa - altitude 880 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	0	0	161	37	164	195	54	54	5	1	0	0	670
65-66	0	88	37	206	103	109	109	1	4	0	0	0	659
66-67	0	52	12	235	204	182	234	27	44	0	0	0	990
67-68	0	75	73	182	351	58	34	4	45	0	0	0	820
68-69	0	17	129	402	412	68	143	65	20	0	0	0	1255
69-70	-	-	-	-	-	-	-	-	-	-	-	-	-
70-71	-	-	-	-	-	0	100	229	1	0	0	0	-

(6) Terbol station - altitude 890 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
66-67	0	39	11	186	152	121	198	26	74	0	0	0	807
67-68	0	144	58	130	168	52	41	9	40	0	0	0	641
68-69	0	19	117	277	329	48	132	34	8	0	0	0	964
69-70	-	-	-	66	167	71	111	50	4	0	0	0	-
70-71	0	11	-	-	88	250	75	158	-	0	0	0	-

(7) Qirawn village station

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
52-53	0	4	30	105	230	165	201	22	2	0	0	0	759
53-54	0	0	141	128	220	195	37	65	0	0	0	0	786
54-55	0	0	34	92	22	72	121	37	10	0	0	0	388
55-56	0	4	94	80	98	105	50	10	22	0	0	0	463
56-57	0	0	53	132	143	80	79	21	32	5	0	0	545
57-58	0	14	31	158	158	14	32	6	10	0	0	0	423
58-59	0	30	20	80	142	87	48	3	8	0	0	0	418
59-60	2	0	26	10	83	12	79	31	0	0	0	0	243
60-61	0	4	122	28	87	143	28	2	3	0	0	0	417
61-62	2	10	80	192	81	120	9	8	3	0	0	0	503
62-63	0	26	0	262	215	79	76	49	4	0	0	0	711
63-64	-	-	-	-	-	-	-	-	-	-	-	-	-
64-65	-	-	-	-	-	-	-	-	-	-	-	-	-
65-66	0	-	-	241	175	137	145	3	0	0	0	0	-
66-67	0	45	32	300	237	197	231	28	39	0	0	0	1109
67-68	0	70	77	191	402	59	39	9	12	0	0	0	859
68-69	0	23	110	515	558	73	184	25	1	0	0	0	489
69-70	0	78	61	141	171	88	161	46	4	0	0	0	750
70-71	0	59	33	126	72	227	135	285	0	0	0	0	937

(8) Jarmaq station - altitude 400 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	0	0	282	103	239	169	56	115	2	0	0	0	966
65-66	0	70	51	168	244	155	146	14	0	0	0	0	848
66-67	20	50	24	304	239	207	312	42	7	0	0	0	1205
67-68	0	28	84	215	403	82	17	88	40	0	0	0	957
68-69	0	-	136	-	563	41	-	-	-	0	0	0	-
69-70	0	57	81	121	196	88	293	32	6	0	0	0	874
70-71	0	11	81	150	94	291	86	299	0	0	0	0	1021

(9) Qasmieh station, coastal area - altitude 30 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
44-45	0	30	142	96	128	170	49	19	16	0	0	0	650
45-46	0	8	115	160	84	156	49	0	60	0	0	0	592
46-47	0	3	0	133	279	30	22	19	40	0	0	0	526
47-48	3	41	68	68	154	228	118	45	30	0	0	0	755
48-49	0	10	79	370	89	212	102	126	0	0	0	0	988
49-50	12	0	10	275	97	-	-	-	-	0	0	0	-
50-51	7	29	122	59	118	64	13	75	0	0	0	0	487
51-52	0	71	93	209	74	151	10	20	0	0	0	0	708
52-53	0	42	108	130	328	144	163	39	0	0	0	0	953
53-54	0	0	121	17	194	178	58	105	0	0	0	0	673
54-55	0	5	84	210	58	78	84	41	25	0	0	0	572
55-56	1	40	162	284	165	-	-	-	-	0	0	0	-
56-57	0	0	12	125	-	-	-	-	-	-	-	-	-
57-58	-	25	65	240	310	10	35	20	-	0	0	0	705
58-59	38	12	6	93	195	113	54	34	25	3	0	0	573
59-60	20	32	70	54	156	13	136	20	4	0	0	0	524
60-61	0	0	120	24	97	209	68	34	6	0	0	0	557
61-62	2	7	57	236	168	129	7	19	0	1	0	0	626
62-63	0	40	0	353	189	133	59	38	13	0	0	0	825
63-64	0	100	58	114	59	225	162	7	25	0	0	0	750
64-65	0	0	255	94	138	72	67	60	0	0	0	0	686
65-66	0	52	19	134	193	102	53	0	0	0	0	0	553
66-67	4	57	32	219	176	133	125	17	6	0	0	0	769
67-68	0	11	79	210	243	44	31	22	0	0	0	0	640
68-69	0	82	227	304	567	25	91	20	6	0	0	0	1321
69-70	0	61	89	79	109	88	100	41	0	0	0	0	567
70-71	0	20	92	90	92	233	63	189	0	0	0	0	784

2. Contribution of the Litani river and its tributaries

The Litani river, with a bed area of 2186 sq km, has an annual average flow of 987 Mcm. It is supplied by 12 permanent springs that contributes an annual volume of water equal to 206 Mcm/yr; 4 permanent rivers that provide a supplementary quantity of water per year equal to 119 Mcm; and 10 other rivers that add an average volume of water of 88 Mcm. The contribution per month and year of water flowing in the bed of the Litani and the other tributary rivers that supply its water is summarized in the following tables.

Table 18: Average Measures of the Water Contributed by the Litani River and its Tributary Rivers

Average Monthly and Yearly Volume of Water Flow in Mcm

(1) river: Source Ras el-Ain
sampling station: near Terbol

Time period	67/68-72/73	63/64-72/73
Sep	0.1	0.079
Oct	0.3	0.157
Nov	0.4	0.229
Dec	0.5	0.350
Jan	0.8	0.577
Feb	1.1	0.971
Mar	1.3	1.369
Apr	1.2	1.387
May	0.7	0.817
Jun	0.3	0.321
Jul	0.2	0.234
Aug	0.1	0.145
Total	7.0	6.636

(2) river: Source Faour
sampling station: near Kfar-Zabad

Time period	67/68-72/73	63/64-72/73
Sep	0.1	0.047
Oct	0.1	0.107
Nov	0.2	0.155
Dec	0.3	0.234
Jan	0.3	0.334
Feb	0.6	0.507
Mar	0.6	0.629
Apr	0.5	0.544
May	0.2	0.354
Jun	0.1	0.162
Jul	0.1	0.090
Aug	0.1	0.068
Total	3.0	3.231

(3) river: Nahr Sghir
sampling station: downstream of Faour

Time period	67/68-72/73	64/65-72/73
Sep	0.2	0.114
Oct	0.3	0.256
Nov	0.5	0.385
Dec	0.8	0.627
Jan	1.4	1.145
Feb	1.6	1.473
Mar	1.7	1.786
Apr	1.5	1.653
May	0.9	0.969
Jun	0.3	0.414
Jul	0.2	0.267
Aug	0.2	0.191
Total	10.0	9.280

(4) river: S. Ain el-Baida
sampling station: near Kfar-Zabad

Time period	67/68-72/73	63/64-72/73
Sep	0.5	0.358
Oct	0.8	0.603
Nov	0.7	0.556
Dec	0.8	0.649
Jan	1.0	0.783
Feb	1.3	1.056
Mar	1.2	1.076
Apr	0.9	0.937
May	0.7	0.802
Jun	0.6	0.582
Jul	0.5	0.477
Aug	0.4	0.381
Total	9.0	8.260

(5) river: S. Hamsine
sampling station: downstream of source

Time period	67/68-72/73	62/63-72/73
Sep	0.9	0.938
Oct	0.9	0.914
Nov	0.8	0.836
Dec	1.0	0.918
Jan	1.2	1.124
Feb	1.3	1.308
Mar	1.3	1.423
Apr	1.2	1.348
May	1.1	1.211
Jun	1.0	1.057
Jul	0.9	1.007
Aug	0.8	0.912
Total	12.0	12.966

(6) river: Ghzayel
sampling station: Anjar

Time period	67/68-72/73	61/62-72/73
Sep	2.6	2.113
Oct	3.1	2.506
Nov	3.1	2.544
Dec	4.9	3.856
Jan	8.0	6.026
Feb	9.9	10.424
Mar	10.5	10.594
Apr	8.4	8.219
May	5.5	5.319
Jun	3.2	2.873
Jul	2.7	2.387
Aug	2.1	1.950
Total	64.0	58.811

(7) river: Anjar canal
sampling station: beginning of canal

Time period	67/68-72/73	62/63-72/73
Sep	0.9	0.862
Oct	0.4	0.359
Nov	0.2	0.179
Dec	0.1	0.087
Jan	0.1	0.053
Feb	0.1	0.054
Mar	0.1	0.096
Apr	0.2	0.175
May	0.9	0.712
Jun	1.4	1.346
Jul	1.5	1.449
Aug	1.5	1.473
Total	7.4	6.845

(8) river: Ghzayel
sampling station: Damascus road

Time period	67/68-72/73	52/53-72/73
Sep	6.5	5.800
Oct	7.9	6.351
Nov	8.0	6.362
Dec	11.1	8.041
Jan	16.5	11.842
Feb	16.9	15.867
Mar	18.9	17.880
Apr	15.3	14.183
May	10.9	9.439
Jun	6.6	6.146
Jul	5.8	5.502
Aug	5.2	5.265
Total	130.0	112.696

(9) river: Litani
sampling station: Damascus road

Time period	67/68-72/73	52/53-72/73
Sep	0.4	0.233
Oct	1.4	0.802
Nov	2.2	1.476
Dec	6.0	3.910
Jan	11.9	8.304
Feb	12.3	12.379
Mar	14.0	12.851
Apr	10.6	8.724
May	4.1	3.157
Jun	1.2	0.820
Jul	0.4	0.306
Aug	0.0	0.110
Total	65.0	53.072

(10) river: Bardaouni
sampling station: Damascus road

Time period	67/68-72/73	52/53-72/73
Sep	0.0	0.025
Oct	0.2	0.171
Nov	0.6	0.566
Dec	3.9	2.668
Jan	6.6	5.013
Feb	6.0	5.561
Mar	8.4	8.249
Apr	9.1	8.125
May	5.9	5.424
Jun	2.0	2.063
Jul	0.3	0.420
Aug	0.0	0.046
Total	43.0	39.331

(11) river: Jalala
sampling station: Damascus road

Time period	67/68-72/73	63/64-72/73
Sep	0.0	0.000
Oct	0.0	0.006
Nov	0.1	0.149
Dec	1.0	0.860
Jan	1.1	1.010
Feb	1.4	1.507
Mar	2.0	2.082
Apr	1.2	1.214
May	0.2	0.247
Jun	0.0	0.008
Jul	0.0	0.000
Aug	0.0	0.000
Total	7.0	7.083

(12) river: Source Chtaura
sampling station: downstream of source

Time period	67/68-72/73	61/62-72/73
Sep	0.6	0.598
Oct	0.5	0.535
Nov	0.5	0.462
Dec	0.9	0.800
Jan	1.5	1.438
Feb	1.7	1.865
Mar	2.1	2.204
Apr	1.8	1.841
May	1.5	1.529
Jun	1.1	1.115
Jul	0.9	0.906
Aug	0.7	0.709
Total	14.0	14.010

(13) river: Chtaura wadi
sampling station: Damascus road

Time period	67/68-72/73	63/64-72/73
Sep	0.5	0.430
Oct	0.4	0.366
Nov	0.4	0.347
Dec	0.9	0.778
Jan	1.5	1.398
Feb	1.6	1.735
Mar	2.0	2.060
Apr	1.8	1.796
May	1.3	1.324
Jun	0.9	0.858
Jul	0.7	0.655
Aug	0.5	0.527
Total	12.0	12.274

(14) river: Delem wadi
sampling station: Kob Elias

Time period	67/68-72/73	61/62-72/73
Sep	0.7	0.708
Oct	0.8	0.763
Nov	1.0	0.999
Dec	2.8	2.294
Jan	3.4	2.947
Feb	3.4	3.423
Mar	4.0	3.888
Apr	2.8	2.578
May	1.4	1.432
Jun	0.9	0.882
Jul	0.8	0.787
Aug	0.7	0.720
Total	23.0	21.421

(15) river: S. Amiq
sampling station: downstream of source

Time period	67/68-72/73	62/63-72/73
Sep	0.2	0.164
Oct	0.3	0.317
Nov	0.5	0.530
Dec	0.9	0.973
Jan	2.4	2.062
Feb	3.0	3.418
Mar	3.7	4.194
Apr	3.5	3.876
May	2.7	2.700
Jun	1.1	1.315
Jul	0.7	0.763
Aug	0.3	0.310
Total	19.0	20.622

(16) river: Litani
sampling station: Mansura

Time period	67/68-72/73	31/32-72/73	31/32-53/54
Sep	4.1	6.752	9.515
Oct	10.4	9.462	11.035
Nov	13.4	12.601	14.218
Dec	33.2	23.069	22.291
Jan	50.5	41.740	45.785
Feb	55.2	56.088	59.926
Mar	63.3	56.708	53.312
Apr	48.2	42.470	45.188
May	25.7	25.299	22.655
Jun	7.7	10.752	14.785
Jul	2.8	6.867	10.625
Aug	1.4	5.692	9.329
Total	316.0	297.800	329.664

(17) river: S. Khraizat
sampling station: downstream of source

Time period	67/68-72/73	61/62-72/73
Sep	0.4	0.392
Oct	0.4	0.365
Nov	0.3	0.332
Dec	0.5	0.461
Jan	0.8	0.719
Feb	1.0	1.009
Mar	1.2	1.325
Apr	1.3	1.321
May	1.2	1.194
Jun	0.9	0.879
Jul	0.7	0.701
Aug	0.5	0.528
Total	9.0	9.226

(18) river: Nahr esh. Shita
sampling station: Qirawn dam

Time period	67/68-72/73	65/66-71/72
Sep	0.0	0.000
Oct	0.2	0.185
Nov	0.5	0.413
Dec	1.9	1.868
Jan	2.5	2.341
Feb	2.3	2.147
Mar	2.0	2.125
Apr	1.6	1.626
May	0.7	0.741
Jun	0.0	0.002
Jul	0.0	0.000
Aug	0.0	0.000
Total	12.0	11.450

(19) river: Litani
sampling station: Qirawn

Time period	67/68-72/73	39/40-53/54	39/40-72/73
Sep	5.6	12.260	8.202
Oct	11.9	15.389	12.060
Nov	15.4	18.750	15.492
Dec	52.1	30.280	31.722
Jan	87.6	76.480	63.193
Feb	75.6	94.248	78.900
Mar	74.1	90.338	77.033
Apr	62.7	65.723	55.398
May	31.0	41.077	32.104
Jun	7.7	21.913	14.003
Jul	3.3	14.875	8.665
Aug	2.4	11.878	6.621
Total	430.0	493.215	403.393

(20) river: S. Ain-Zarqa
sampling station: downstream of source

Time period	67/68-72/73	62/63-72/73
Sep	5.2	4.299
Oct	5.3	4.388
Nov	5.3	4.249
Dec	5.8	4.863
Jan	8.7	7.327
Feb	9.4	9.145
Mar	11.9	12.016
Apr	11.5	11.302
May	9.0	8.535
Jun	6.5	6.154
Jul	6.0	5.758
Aug	5.7	5.146
Total	90.0	83.182

(21) river: Markabeh tunnel
sampling station: Jezzine-Markabeh window

Time period	67/68-72/73
Sep	1.7
Oct	1.8
Nov	2.2
Dec	2.8
Jan	3.0
Feb	3.0
Mar	3.0
Apr	3.0
May	2.0
Jun	2.0
Jul	1.9
Aug	1.7
Total	28.0

(22) river: Litani
sampling station: Qlaya

Time period	67/68-72/73	49/50-60/61
Sep	10.1	14.658
Oct	9.9	17.072
Nov	16.8	20.116
Dec	23.7	32.166
Jan	40.3	62.830
Feb	44.3	85.916
Mar	38.2	87.503
Apr	40.8	61.695
May	32.3	37.155
Jun	12.0	20.589
Jul	10.9	15.630
Aug	8.7	13.055
Total	288.0	468.387

(23) river: es-Safa wadi
sampling station: Khallet Khazem

Time period	67/68-72/73	64/65-72/73
Sep	0.0	0.000
Oct	0.0	0.005
Nov	0.1	0.323
Dec	1.0	1.029
Jan	1.8	1.837
Feb	1.1	1.328
Mar	1.0	1.040
Apr	0.7	0.602
May	0.0	0.057
Jun	0.0	0.002
Jul	0.0	0.000
Aug	0.0	0.000
Total	6.0	6.223

(24) river: Aajis wadi
sampling station: near Khallet Khazem

Time period	67/68-72/73	64/65-72/73
Sep	0.0	0.007
Oct	0.0	0.014
Nov	0.1	0.243
Dec	0.9	0.858
Jan	1.3	1.314
Feb	0.9	1.023
Mar	0.9	0.986
Apr	0.5	0.492
May	0.1	0.106
Jun	0.0	0.031
Jul	0.0	0.012
Aug	0.0	0.005
Total	5.0	5.091

(25) river: Naqouziya wadi
sampling station: near Jarmaq

Time period	67/68-72/73	64/65-72/73
Sep	0.0	0.000
Oct	0.0	0.000
Nov	0.0	0.032
Dec	0.2	0.164
Jan	0.6	0.481
Feb	0.3	0.355
Mar	0.3	0.314
Apr	0.1	0.137
May	0.0	0.002
Jun	0.0	0.000
Jul	0.0	0.000
Aug	0.0	0.000
Total	2.0	1.485

(26) river: el-Aishiya wadi
sampling station: Jarmaq

Time period	67/68-72/73	64/65-72/73
Sep	0.0	0.000
Oct	0.0	0.000
Nov	0.0	0.034
Dec	0.2	0.155
Jan	0.4	0.359
Feb	0.2	0.230
Mar	0.1	0.159
Apr	0.2	0.155
May	0.0	0.000
Jun	0.0	0.000
Jul	0.0	0.000
Aug	0.0	0.000
Total	1.0	1.092

(27) river: Zaghrin wadi
sampling station: Jarmaq

Time period	67/68-72/73	64/65-72/73
Sep	0.0	0.011
Oct	0.0	0.010
Nov	0.0	0.087
Dec	0.5	0.416
Jan	1.3	1.067
Feb	0.8	0.908
Mar	0.7	0.783
Apr	0.6	0.587
May	0.2	0.217
Jun	0.1	0.076
Jul	0.0	0.043
Aug	0.0	0.026
Total	4.0	4.231

(28) river: Source Maidane
sampling station: near the source

Time period	67/68-72/73	63/64-72/73
Sep	0.1	0.118
Oct	0.1	0.140
Nov	0.2	0.142
Dec	0.3	0.265
Jan	0.7	0.534
Feb	0.4	0.571
Mar	0.5	0.497
Apr	0.3	0.344
May	0.2	0.186
Jun	0.2	0.162
Jul	0.2	0.151
Aug	0.2	0.136
Total	3.0	3.256

(29) river: Source Guelle
sampling station: near the source

Time period	67/68-72/73
Sep	1.1
Oct	1.1
Nov	1.5
Dec	2.0
Jan	3.0
Feb	4.5
Mar	5.5
Apr	4.5
May	3.5
Jun	2.5
Jul	1.6
Aug	1.4
Total	31.0

(30) river: Litani
sampling station: Khardale

Time period	67/68-72/73	39/40-53/54	39/40-72/73
Sep	12.1	22.229	17.649
Oct	11.9	25.495	19.861
Nov	22.2	29.268	24.294
Dec	37.9	43.299	39.811
Jan	73.6	110.071	80.413
Feb	73.7	136.881	102.882
Mar	63.4	131.160	105.728
Apr	58.7	97.928	79.175
May	43.4	65.627	53.038
Jun	17.7	37.408	28.830
Jul	15.0	26.897	21.765
Aug	12.1	22.227	17.499
Total	442.0	748.491	590.945

(31) river: Litani
sampling station: downstream of Gandouriye wadi

Time period	67/68-72/73
Sep	12.7
Oct	12.4
Nov	22.6
Dec	41.1
Jan	79.3
Feb	81.6
Mar	71.0
Apr	66.2
May	44.2
Jun	17.9
Jul	15.5
Aug	12.3
Total	477.0

(32) river: Gandouriye wadi
sampling station: upstream Litani

Time period	67/68-72/73
Sep	0.2
Oct	0.2
Nov	0.2
Dec	0.2
Jan	0.8
Feb	1.4
Mar	1.2
Apr	1.1
May	1.0
Jun	0.6
Jul	0.5
Aug	0.3
Total	8.0

(33) river: near Qasmieh canal
sampling station: Qasmieh canal

Time period	67/68-72/73
Sep	9.8
Oct	9.5
Nov	6.2
Dec	3.8
Jan	2.9
Feb	2.3
Mar	2.7
Apr	2.7
May	8.7
Jun	9.9
Jul	9.9
Aug	9.3
Total	78.0*

* including 2.4 Mcm pumped into the Litani near its delta

(34) river: Litani - Qasmieh
sampling station: near the delta

Time period	67/68-72/73
Sep	6.1
Oct	6.9
Nov	20.9
Dec	46.0
Jan	91.0
Feb	103.1
Mar	82.8
Apr	74.4
May	47.2
Jun	14.5
Jul	10.2
Aug	6.2
Total	509.0

(35) river: Kfar Dajjal wadi
sampling station: Maifadoun Dam

Time period	67/68-72/73
Sep	0.000
Oct	0.000
Nov	0.000
Dec	0.047
Jan	0.165
Feb	0.087
Mar	0.035
Apr	0.027
May	0.000
Jun	0.000
Jul	0.000
Aug	0.000
Total	0.356

The monthly and yearly quantities of water flow in the Litani's bed and its tributaries are detailed in the following tables:

Table 19: Quantity of Flowing Water per Month and per Year (in Mcm)

(1) river: Source Ras el-Ain
sampling station: near Terbol

Year	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
Sep	0.000	0.000	0.000	0.000	0.000	0.336	0.039	0.415
Oct	0.000	0.000	0.000	0.000	0.000	0.683	0.167	0.782
Nov	0.000	0.013	0.005	0.143	0.000	0.855	0.402	0.874
Dec	0.000	0.080	0.071	0.233	0.000	0.830	1.044	0.857
Jan	0.000	0.187	0.190	0.388	0.265	1.286	2.089	0.795
Feb	0.314	0.400	0.653	0.520	0.871	2.080	3.005	0.791
Mar	0.723	1.106	1.130	0.710	2.427	2.116	3.027	1.184
Apr	0.764	1.115	1.135	0.679	3.045	1.348	2.851	1.102
May	0.920	0.241	0.530	0.005	2.478	1.018	1.902	0.121
Jun	0.013	0.000	0.005	0.000	1.464	0.492	1.231	0.000
Jul	0.000	0.000	0.000	0.000	1.058	0.200	1.085	0.000
Aug	0.000	0.000	0.000	0.000	0.603	0.013	0.830	0.000
Total	2.734	3.142	3.715	2.678	12.214	11.257	17.612	6.921

Source Ras el-Ain continued

Year	70-71	71-72	72-73
Sep	0.000	0.000	0.000
Oct	0.000	0.000	0.000
Nov	0.000	0.000	0.000
Dec	0.000	0.388	0.000
Jan	0.067	0.496	0.000
Feb	0.327	0.745	0.000
Mar	0.544	0.723	0.125
Apr	1.039	0.791	0.060
May	0.798	0.161	0.000
Jun	0.005	0.000	0.000
Jul	0.000	0.000	0.000
Aug	0.000	0.000	0.000
Total	2.780	3.304	0.185

(2) river: Source Faour
sampling station: near Kfar-Zabad

Year	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
Sep	0.000	0.000	0.013	0.000	0.130	0.104	0.220	0.000
Oct	0.000	0.013	0.000	0.134	0.000	0.343	0.254	0.327
Nov	0.000	0.207	0.020	0.306	0.000	0.384	0.319	0.207
Dec	0.000	0.334	0.107	0.228	0.040	0.295	0.530	0.482
Jan	0.000	0.429	0.308	0.294	0.222	0.723	0.522	0.375
Feb	0.423	0.472	0.448	0.462	0.363	1.161	1.137	0.435
Mar	1.272	0.645	0.562	0.493	0.919	0.835	1.339	0.579
Apr	0.946	0.898	0.557	0.389	0.765	0.272	1.244	0.700
May	0.643	0.755	0.241	0.067	1.125	0.174	0.616	0.230
Jun	0.104	0.130	0.078	0.000	0.528	0.124	0.544	0.031
Jul	0.000	0.005	0.000	0.000	0.249	0.085	0.562	0.000
Aug	0.000	0.000	0.013	0.000	0.168	0.013	0.490	0.000
Total	3.416	3.888	2.348	2.386	4.389	4.539	7.661	3.586

Source Faour continued

Year	70-71	71-72	72-73
Sep	0.000	0.000	0.000
Oct	0.000	0.003	0.000
Nov	0.000	0.104	0.000
Dec	0.124	0.179	0.013
Jan	0.206	0.220	0.040
Feb	0.290	0.242	0.060
Mar	0.407	0.346	0.167
Apr	0.285	0.259	0.075
May	0.222	0.107	0.008
Jun	0.078	0.000	0.000
Jul	0.000	0.000	0.000
Aug	0.000	0.000	0.000
Total	1.617	1.460	0.363

(3) river: Nahr Sghir
sampling station: downstream of Faour

Year	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72
Sep	0.000	0.039	0.000	0.461	0.054	0.472	0.000	0.000
Oct	0.000	0.150	0.000	0.978	0.343	0.814	0.000	0.019
Nov	0.111	0.389	0.000	1.166	0.604	1.055	0.021	0.119
Dec	0.324	0.624	0.088	1.203	1.701	1.082	0.099	0.525
Jan	0.616	0.603	0.485	2.250	4.304	1.211	0.222	0.611
Feb	1.304	0.798	1.447	2.714	4.393	1.173	0.523	0.839
Mar	1.762	1.187	2.804	2.309	3.980	1.637	1.061	1.066
Apr	1.633	0.902	3.173	1.646	3.548	1.426	1.490	0.972
May	0.624	0.053	2.844	1.176	2.386	0.364	1.029	0.252
Jun	0.047	0.000	1.791	0.500	1.278	0.096	0.078	0.000
Jul	0.000	0.000	1.053	0.161	1.189	0.000	0.000	0.000
Aug	0.021	0.000	0.787	0.013	0.905	0.000	0.000	0.000
Total	6.442	4.745	14.472	14.577	24.685	9.270	4.523	4.403

Nahr Sghir continued

Year	72-73
Sep	0.000
Oct	0.000
Nov	0.000
Dec	0.000
Jan	0.008
Feb	0.070
Mar	0.271
Apr	0.091
May	0.000
Jun	0.000
Jul	0.000
Aug	0.000
Total	0.440

(4) river: S. Ain el-Baida
sampling station: near Kfar-Zabad

Year	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
Sep	0.000	0.186	0.168	0.078	0.026	0.518	1.321	0.700
Oct	0.000	0.134	0.375	0.723	0.000	1.232	1.647	0.549
Nov	0.000	0.168	0.376	0.739	0.026	0.829	1.140	0.669
Dec	0.000	0.147	0.434	0.857	0.054	0.723	1.500	1.125
Jan	0.000	0.246	0.375	1.339	0.187	1.446	2.000	0.603
Feb	0.230	0.319	1.113	0.825	0.363	2.177	3.500	0.835
Mar	0.562	0.509	0.763	0.683	1.594	1.808	2.500	1.312
Apr	0.617	0.803	0.881	0.829	1.400	0.881	1.192	1.281
May	0.482	0.790	0.710	0.643	1.500	0.750	1.178	0.924
Jun	0.143	0.316	0.492	0.065	1.426	0.933	1.192	0.648
Jul	0.129	0.241	0.321	0.054	1.178	1.152	0.991	0.576
Aug	0.147	0.169	0.155	0.027	1.018	0.777	1.004	0.522
Total	2.310	4.028	6.163	6.862	8.772	13.226	19.165	9.694

S. Ain el-Baida continued

Year	70-71	71-72	72-73
Sep	0.446	0.143	0.000
Oct	0.549	0.817	0.003
Nov	0.778	0.713	0.117
Dec	0.777	0.621	0.225
Jan	0.608	0.716	0.308
Feb	0.435	0.823	0.170
Mar	0.656	0.496	0.435
Apr	1.166	0.842	0.145
May	0.937	0.584	0.008
Jun	0.467	0.285	0.000
Jul	0.086	0.174	0.000
Aug	0.067	0.067	0.000
Total	6.972	1.444	1.411

(5) river: S. Hamsine
sampling station: downstream from source

Year	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
Sep	1.389	0.928	0.951	1.019	0.804	1.234	1.055	0.920
Oct	0.900	0.879	1.010	0.994	0.828	1.219	1.192	0.948
Nov	0.717	0.837	0.982	0.889	0.684	1.146	1.164	0.894
Dec	0.785	0.862	0.916	0.920	0.809	1.184	1.738	0.916
Jan	0.879	0.921	1.085	1.050	1.082	1.733	2.716	0.940
Feb	1.335	1.508	1.369	1.110	1.430	1.989	2.666	0.856
Mar	1.420	1.567	1.428	1.353	2.033	1.902	2.194	1.114
Apr	1.340	1.306	1.529	1.151	2.019	1.418	1.926	1.001
May	1.312	1.377	1.334	1.085	1.720	1.315	1.677	0.865
Jun	1.068	1.267	1.104	1.104	1.348	1.260	1.402	0.907
Jul	1.154	1.085	1.130	0.988	1.350	1.200	1.245	0.895
Aug	1.031	1.026	1.045	0.892	1.272	1.098	1.010	0.747
Total	13.330	13.563	13.883	12.555	15.379	16.698	19.985	11.003

S. Hamsine continued

Year	70-71	71-72	72-73
Sep	0.664	0.801	0.552
Oct	0.675	0.817	0.595
Nov	0.661	0.692	0.533
Dec	0.624	0.782	0.565
Jan	0.613	0.895	0.450
Feb	0.740	0.962	0.423
Mar	1.034	0.900	0.712
Apr	1.558	0.827	0.759
May	1.178	0.804	0.654
Jun	0.899	0.677	0.596
Jul	0.854	0.702	0.479
Aug	0.838	0.656	0.418
Total	10.338	9.515	6.736

(6) river: Ghzayel
sampling station: Anjar

Year	61-62	62-63	63-64	64-65	65-66	66-67	67-68	68-69
Sep	1.283	1.019	1.040	2.048	2.074	1.265	3.292	2.880
Oct	1.390	1.339	2.212	2.330	2.558	1.829	3.985	3.056
Nov	1.205	1.449	2.164	2.921	2.481	1.628	3.618	3.590
Dec	3.383	2.095	2.267	2.981	2.525	3.254	5.515	11.311
Jan	2.954	4.497	5.434	5.858	5.924	5.953	13.242	13.293
Feb	9.641	11.513	14.802	11.989	5.821	12.531	16.998	19.627
Mar	7.877	9.859	12.575	8.236	7.541	18.462	14.412	16.298
Apr	3.206	7.740	7.666	7.890	5.892	15.586	7.657	12.569
May	2.732	6.859	5.177	4.783	2.515	8.844	6.683	8.491
Jun	1.545	2.281	2.514	2.198	2.037	4.697	4.463	5.658
Jul	1.197	1.977	2.113	1.842	4.462	4.042	3.503	4.449
Aug	0.983	1.495	1.800	1.566	1.310	3.383	2.836	3.892
Total	37.199	52.125	58.084	54.642	79.949	79.504	86.207	110.814

Ghzayel continued

Year	69-70	70-71	71-72	72-73
Sep	4.132	1.817	2.164	1.550
Oct	4.476	2.349	2.678	1.867
Nov	4.723	2.245	2.727	1.978
Dec	3.715	2.279	4.845	2.041
Jan	5.475	2.301	6.101	1.690
Feb	5.857	5.559	9.554	1.701
Mar	10.422	10.245	6.900	4.505
Apr	7.172	14.280	6.109	2.921
May	3.873	7.941	4.441	1.495
Jun	2.385	3.872	1.918	1.156
Jul	2.055	2.986	1.698	1.004
Aug	1.580	2.086	1.607	0.865
Total	55.825	57.910	50.740	22.773

(7) river: Anjar canal
sampling station: beginning of the canal

Year	55-56	56-57	57-58	58-59	59-60	60-61	61-62	62-63
Sep	0.588	0.752	0.653	-	0.731	-	-	0.601
Oct	0.305	0.581	0.372	-	0.479	0.078	-	0.324
Nov	0.091	0.143	0.093	0.153	0.145	0.000	-	0.215
Dec	0.000	0.070	0.019	0.035	0.027	0.000	-	0.094
Jan	0.000	0.013	0.000	0.040	0.005	0.000	-	0.011
Feb	0.000	0.000	0.036	0.056	0.018	0.034	-	0.007
Mar	0.000	0.027	0.067	0.104	0.062	0.080	-	0.013
Apr	-	0.137	-	0.210	-	-	0.295	0.047
May	0.747	0.619	-	1.138	-	-	0.651	0.359
Jun	1.078	1.024	-	1.255	-	-	1.229	1.213
Jul	1.173	1.213	-	-	1.216	-	-	1.379
Aug	1.181	0.991	-	1.262	-	-	1.187	1.511
Total	-	5.570	-	-	-	-	-	5.651

Anjar canal continued

Year	63-64	64-65	65-66	66-67	67-68	68-69	69-70	70-71
Sep	0.658	0.682	0.829	1.055	0.956	0.780	0.972	0.990
Oct	0.321	0.346	0.273	0.335	0.204	0.367	0.348	0.469
Nov	0.109	0.210	0.161	0.308	0.078	0.098	0.047	0.270
Dec	0.027	0.150	0.129	0.027	0.054	0.040	0.104	0.096
Jan	0.032	0.096	0.013	0.000	0.027	0.077	0.107	0.088
Feb	0.025	0.090	0.039	0.092	0.025	0.039	0.099	0.065
Mar	0.032	0.123	0.166	0.257	0.027	0.051	0.104	0.104
Apr	0.114	0.184	0.384	0.060	0.334	0.031	0.233	0.171
May	0.276	0.509	1.323	0.185	1.093	0.530	0.892	0.889
Jun	1.309	1.700	1.242	1.166	1.325	1.392	1.532	1.382
Jul	1.256	1.481	1.578	1.337	1.369	1.575	1.607	1.658
Aug	1.387	1.564	1.251	1.570	1.511	1.757	1.690	1.663
Total	5.771	7.232	7.147	6.424	7.209	6.719	7.788	7.730

Anjar canal continued

Year	71-72	72-73
Sep	1.001	0.959
Oct	0.496	0.461
Nov	0.176	0.298
Dec	0.054	0.177
Jan	0.035	0.145
Feb	0.028	0.090
Mar	0.040	0.142
Apr	0.140	0.232
May	0.825	0.956
Jun	1.625	0.925
Jul	1.543	1.395
Aug	1.243	1.055
Total	7.056	6.581

(8) river: Ghzayel
sampling station: Damascus road

Year	52-53	53-54	54-55	55-56	56-57	57-58	58-59	59-60
Sep	8.289	10.137	9.593	5.246	5.850	5.822	4.264	5.329
Oct	8.771	9.645	9.083	5.448	5.946	5.694	4.960	4.853
Nov	8.727	11.070	8.374	5.565	6.262	5.936	4.435	4.305
Dec	10.186	13.384	8.330	6.717	7.173	7.007	4.832	3.999
Jan	14.145	31.860	7.582	9.763	7.583	13.654	5.185	4.880
Feb	25.630	53.407	8.719	17.193	17.839	13.973	6.232	4.342
Mar	41.094	28.276	11.359	16.464	17.134	11.204	19.097	4.184
Apr	30.645	25.762	8.354	12.302	12.719	9.152	10.646	4.196
May	16.668	14.902	7.127	8.748	8.825	8.241	6.174	2.255
Jun	12.794	10.433	4.502	8.389	6.117	5.124	3.903	2.154
Jul	11.386	9.350	4.470	5.713	6.093	4.018	4.283	2.274
Aug	11.543	10.049	5.030	6.085	6.401	4.018	4.087	1.880
Total	194.311	210.275	92.523	107.633	107.942	93.843	78.098	44.551

Ghzayel continued

Year	60-61	61-62	62-63	63-64	64-65	65-66	66-67	67-68
Sep	1.926	2.683	4.044	4.399	4.722	6.280	4.051	8.121
Oct	2.411	2.906	4.676	4.998	5.255	6.942	4.604	10.213
Nov	2.494	2.690	3.883	5.238	6.104	6.871	3.810	10.135
Dec	2.850	4.985	5.011	5.791	7.358	7.607	6.996	11.991
Jan	3.704	7.159	7.524	7.071	10.987	8.847	9.557	23.537
Feb	4.536	12.065	16.676	20.575	19.628	10.136	19.550	25.672
Mar	5.394	12.755	15.741	20.329	15.615	13.049	30.153	23.725
Apr	5.767	7.144	13.351	13.577	15.630	11.547	25.446	14.546
May	3.790	4.502	10.475	8.871	9.289	5.183	17.961	13.612
Jun	2.250	3.877	5.352	4.622	5.347	3.839	11.381	8.131
Jul	2.274	3.827	3.707	4.650	5.250	4.218	9.407	7.194
Aug	2.678	2.890	3.557	4.221	4.762	3.653	8.223	6.763
Total	110.074	67.483	93.917	104.345	109.947	88.172	151.139	163.641

Ghzayel continued

Year	68-69	69-70	70-71	71-72	72-73
Sep	7.312	9.510	4.795	5.544	3.885
Oct	8.608	11.413	5.426	6.578	4.942
Nov	8.753	11.612	5.456	6.770	5.101
Dec	23.393	10.250	5.943	10.140	4.936
Jan	39.801	13.657	5.697	11.105	5.381
Feb	34.118	12.299	10.470	12.863	4.938
Mar	31.428	19.982	17.969	12.157	8.632
Apr	24.074	13.948	21.021	11.921	6.291
May	17.324	8.536	14.750	7.743	3.236
Jun	11.314	5.886	7.610	3.981	2.436
Jul	10.285	5.710	5.903	3.696	1.824
Aug	9.128	5.461	5.335	3.351	1.457
Total	225.538	127.814	110.375	96.859	53.059

(9) river: Litani
sampling station: Damascus road

Year	52-53	53-54	54-55	55-56	56-57	57-58	58-59	59-60
Sep	0.303	1.050	0.712	0.065	0.060	0.024	0.000	0.091
Oct	1.748	1.516	1.347	0.109	0.196	0.387	0.174	0.265
Nov	1.983	4.103	2.309	1.075	0.412	0.918	0.443	0.464
Dec	3.332	6.385	3.402	4.331	3.102	3.822	1.460	0.975
Jan	7.984	28.506	4.110	6.779	4.068	8.517	2.676	1.564
Feb	18.599	39.342	4.250	14.445	9.788	8.189	4.449	1.240
Mar	29.237	23.468	6.316	12.370	8.341	4.494	7.869	1.312
Apr	22.089	20.738	3.222	4.243	3.232	1.350	2.716	1.192
May	3.777	3.723	0.442	1.100	1.926	0.225	0.512	0.511
Jun	1.664	0.892	0.028	0.215	0.718	0.000	0.145	0.103
Jul	1.120	0.501	0.000	0.035	0.003	0.000	0.000	0.000
Aug	0.662	0.284	0.034	0.005	0.144	0.000	0.000	0.000
Total	92.498	130.505	26.172	44.881	31.990	27.927	20.444	7.717

Litani continued

Year	60-61	61-62	62-63	63-64	64-65	65-66	66-67	67-68
Sep	0.003	0.000	0.000	0.070	0.008	0.122	0.000	0.918
Oct	0.062	0.070	0.348	0.672	0.394	1.138	0.303	2.609
Nov	0.116	0.130	0.443	1.172	2.423	1.376	0.454	3.818
Dec	0.292	3.806	3.608	2.006	2.598	4.636	2.614	6.913
Jan	1.406	7.033	7.583	2.936	6.670	6.072	7.063	22.946
Feb	2.342	15.350	16.821	13.149	16.700	5.538	15.884	22.488
Mar	1.237	13.140	16.239	14.932	10.941	8.568	27.020	19.220
Apr	1.410	3.243	10.259	7.232	10.850	4.680	23.128	7.841
May	0.533	1.275	5.777	2.303	2.560	1.165	15.961	4.947
Jun	0.095	0.472	0.876	0.622	0.927	0.086	3.123	1.752
Jul	0.000	0.048	0.447	0.129	0.144	0.000	1.682	0.147
Aug	0.000	0.000	0.032	0.000	0.000	0.000	0.873	0.000
Total	7.496	44.567	62.393	45.223	54.145	33.387	98.105	93.599

Litani continued

Year	68-69	69-70	70-71	71-72	72-73
Sep	0.485	0.990	0.000	0.000	0.000
Oct	1.575	3.401	0.303	0.300	0.000
Nov	2.755	3.878	1.034	1.366	0.316
Dec	18.098	3.894	2.263	3.977	0.683
Jan	31.586	7.936	2.502	5.373	1.061
Feb	28.513	7.618	5.816	7.685	1.759
Mar	29.610	12.905	10.941	6.854	4.652
Apr	22.677	5.783	18.735	5.356	3.186
May	9.377	2.116	4.567	2.267	0.707
Jun	3.650	0.311	1.164	0.236	0.132
Jul	2.041	0.000	0.124	0.000	0.000
Aug	0.293	0.000	0.000	0.000	0.000
Total	150.640	48.838	47.454	32.454	12.566

(10) river: Bardaouni
sampling station: Damascus road

Year	52-53	53-54	54-55	55-56	56-57	57-58	58-59	59-60
Sep	0.000	0.142	0.023	0.062	0.036	0.021	0.000	0.049
Oct	0.051	0.182	0.171	0.204	0.075	0.142	0.104	0.185
Nov	0.308	1.242	0.550	1.607	0.353	0.324	0.236	0.280
Dec	1.290	2.094	1.136	4.014	2.523	2.598	0.595	0.340
Jan	4.630	12.176	1.307	4.687	3.702	6.942	1.484	1.120
Feb	10.559	12.750	2.172	8.835	6.960	5.741	2.185	0.937
Mar	15.510	10.260	4.400	8.872	7.291	7.513	6.557	2.233
Apr	14.349	11.076	4.898	5.721	6.343	7.167	5.365	3.765
May	8.903	7.355	2.751	4.567	5.469	2.360	2.927	1.313
Jun	3.895	3.883	0.510	2.252	1.402	0.207	0.371	0.230
Jul	1.162	1.093	0.010	0.758	0.088	0.000	0.000	0.000
Aug	0.273	0.201	0.002	0.051	0.008	0.000	0.000	0.000
Total	60.930	62.454	17.930	41.830	34.250	33.015	19.894	10.462

Bardaouni continued

Year	60-61	61-62	62-63	63-64	64-65	65-66	66-67	67-68
Sep	0.000	0.000	0.000	0.111	0.007	0.016	0.000	0.052
Oct	0.000	0.024	0.112	0.297	0.072	0.549	0.078	0.694
Nov	0.080	0.334	0.143	0.524	1.830	0.454	0.073	1.117
Dec	0.214	4.031	2.751	2.078	1.813	3.814	3.005	5.153
Jan	1.778	5.721	4.926	2.561	4.478	5.464	4.626	11.102
Feb	2.557	9.362	9.379	7.943	9.442	4.693	8.322	8.659
Mar	2.715	10.063	9.605	11.260	7.580	7.068	12.238	8.886
Apr	6.298	5.531	9.666	7.561	8.743	6.236	13.237	7.195
May	3.206	3.099	7.422	5.844	5.925	2.700	11.710	6.841
Jun	0.254	0.108	3.167	3.082	2.805	0.285	8.123	2.292
Jul	0.000	0.029	0.664	0.300	0.212	0.000	2.716	0.177
Aug	0.000	0.000	0.037	0.005	0.000	0.000	0.247	0.000
Total	17.105	38.902	47.872	41.566	42.910	31.284	67.425	52.173

Bardaouni continued

Year	68-69	69-70	70-71	71-72	72-73
Sep	0.000	0.000	0.000	0.000	0.000
Oct	0.005	0.587	0.059	0.005	0.000
Nov	0.578	1.221	0.189	0.425	0.031
Dec	11.324	1.575	1.628	3.217	0.238
Jan	17.811	4.502	2.049	3.439	0.745
Feb	11.977	4.505	4.950	3.653	2.206
Mar	15.835	9.096	8.231	3.948	4.960
Apr	11.633	6.568	12.332	6.804	3.753
May	11.110	3.086	3.659	2.828	2.793
Jun	6.379	0.384	2.252	0.293	0.049
Jul	1.286	0.008	0.516	0.000	0.000
Aug	0.083	0.000	0.021	0.000	0.000
Total	88.021	31.532	47.026	24.617	14.717

(11) river: Jalala
sampling station: Damascus road

Year	63-64	64-65	65-66	66-67	67-68	68-69	69-70	70-71
Sep	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oct	0.000	0.000	0.021	0.005	0.019	0.000	0.016	0.000
Nov	0.220	0.650	0.119	0.023	0.155	0.083	0.200	0.000
Dec	0.329	0.152	1.047	0.916	1.746	2.472	0.512	0.450
Jan	0.573	0.800	1.031	0.828	1.867	2.877	0.712	0.469
Feb	2.405	1.407	1.043	2.056	1.496	2.535	1.350	1.297
Mar	3.983	1.331	1.055	2.317	1.843	3.712	1.974	1.998
Apr	0.647	0.660	0.410	3.450	0.912	1.415	0.601	2.849
May	0.104	0.083	0.029	1.160	0.056	0.182	0.102	0.228
Jun	0.000	0.000	0.005	0.070	0.000	0.000	0.000	0.000
Jul	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aug	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	8.311	5.143	4.760	10.825	8.094	13.276	5.467	7.291

Jalala continued

Year	71-72	72-73
Sep	0.000	0.000
Oct	0.000	0.000
Nov	0.026	0.010
Dec	0.972	0.000
Jan	0.870	0.010
Feb	0.834	0.651
Mar	1.505	1.106
Apr	0.511	0.630
May	0.445	0.080
Jun	0.003	0.000
Jul	0.000	0.000
Aug	0.000	0.000
Total	5.166	2.487

(12) river: Source Chtaura
sampling station: downstream from the source

Year	61-62	62-63	63-64	64-65	65-66	66-67	67-68	68-69
Sep	1.024	0.428	0.609	0.480	0.580	0.470	0.726	0.531
Oct	0.723	0.442	0.562	0.522	0.501	0.397	0.603	0.501
Nov	0.389	0.363	0.480	0.661	0.439	0.384	0.493	0.454
Dec	0.616	0.670	0.670	0.830	0.921	0.491	0.804	1.982
Jan	2.411	0.857	1.112	0.790	1.728	1.127	2.678	2.772
Feb	2.685	1.597	1.839	2.468	1.438	1.911	2.649	2.903
Mar	1.821	2.611	2.491	2.277	1.541	3.117	2.652	2.544
Apr	1.387	1.737	1.892	1.918	1.610	2.758	2.009	2.234
May	1.326	1.527	1.312	1.553	1.254	2.233	1.438	2.076
Jun	0.933	1.128	1.037	1.218	0.964	1.541	1.089	1.490
Jul	0.777	0.991	0.830	0.964	0.719	1.213	0.937	1.205
Aug	0.616	0.763	0.629	0.723	0.612	0.985	0.704	0.903
Total	14.708	13.114	13.463	14.404	12.307	16.627	16.728	19.595

Source Chtaura continued

Year	69-70	70-71	71-72	72-73
Sep	0.609	0.454	0.752	0.530
Oct	0.616	0.469	0.624	0.455
Nov	0.531	0.368	0.505	0.450
Dec	0.576	0.616	0.844	0.560
Jan	1.125	0.696	1.433	0.415
Feb	1.430	1.258	1.476	0.615
Mar	1.995	2.317	1.634	1.420
Apr	1.788	2.216	1.244	1.270
May	1.232	2.210	1.085	1.950
Jun	0.881	1.464	0.881	0.725
Jul	0.633	1.705	0.790	0.535
Aug	0.576	0.870	0.643	0.455
Total	12.042	14.143	11.911	8.595

(13) river: Chtaura wadi
sampling station: Damascus road

Year	63-64	64-65	65-66	66-67	67-68	68-69	69-70	70-71
Sep	0.334	0.435	0.389	0.334	0.526	0.378	0.495	0.446
Oct	0.238	0.359	0.359	0.308	0.445	0.354	0.415	0.391
Nov	0.257	0.391	0.270	0.275	0.381	0.371	0.410	0.342
Dec	0.635	0.629	0.742	0.637	0.911	1.993	0.426	0.541
Jan	0.900	1.018	1.414	1.208	2.694	3.276	0.986	0.632
Feb	2.115	2.080	1.241	2.032	2.325	2.939	1.280	1.231
Mar	2.518	1.870	1.414	2.807	2.258	2.721	1.904	2.266
Apr	1.965	1.730	1.317	2.338	1.654	2.343	1.563	2.613
May	1.300	1.180	0.905	1.770	1.165	1.658	1.010	2.076
Jun	0.814	0.810	0.588	1.148	0.788	1.063	0.710	1.325
Jul	0.672	0.660	0.407	0.852	0.662	0.787	0.544	0.978
Aug	0.477	0.500	0.426	0.678	0.597	0.611	0.530	0.670
Total	12.225	11.824	9.472	14.387	14.406	18.489	10.273	13.511

Chtaura wadi continued

Year	71-72	72-73
Sep	0.583	0.386
Oct	0.458	0.348
Nov	0.441	0.340
Dec	0.913	0.364
Jan	1.398	0.303
Feb	1.551	0.564
Mar	1.497	1.353
Apr	1.260	1.172
May	0.964	0.849
Jun	0.757	0.586
Jul	0.576	0.407
Aug	0.431	0.346
Total	10.829	7.013

(14) river: Delem wadi
sampling station: Kob Elias

Year	61-62	62-63	63-64	64-65	65-66	66-67	67-68	68-69
Sep	0.894	0.570	0.684	0.562	0.570	0.718	0.933	0.816
Oct	0.951	0.562	0.686	0.608	0.726	0.844	1.034	0.726
Nov	0.933	0.583	0.816	2.058	0.923	0.796	1.262	0.871
Dec	1.272	1.500	1.460	1.039	2.571	2.936	3.706	6.075
Jan	2.277	1.312	2.394	3.618	2.563	2.911	4.722	7.291
Feb	3.048	1.984	3.550	4.156	2.441	5.421	4.570	5.315
Mar	2.879	2.839	4.465	3.495	2.759	6.417	5.134	6.059
Apr	0.907	2.372	1.776	5.592	1.301	4.982	2.408	3.507
May	0.911	2.210	1.095	1.543	0.640	2.518	1.403	2.271
Jun	0.752	1.063	0.791	0.788	0.718	1.296	0.990	1.288
Jul	0.844	0.951	0.715	0.672	0.632	1.112	0.865	1.117
Aug	0.737	0.870	0.562	0.688	0.619	0.897	0.712	1.004
Total	16.405	16.816	18.994	21.819	16.463	30.848	27.739	36.340

Delem wadi continued

Year	69-70	70-71	71-72	72-73
Sep	0.446	0.627	0.645	0.531
Oct	1.015	0.704	0.763	0.544
Nov	1.140	1.039	0.723	0.848
Dec	1.591	2.194	2.421	0.763
Jan	2.877	1.819	2.328	1.251
Feb	2.748	4.057	2.137	1.638
Mar	4.184	3.940	2.095	2.394
Apr	1.812	5.757	1.708	1.814
May	1.125	1.642	1.122	0.715
Jun	0.758	0.804	0.643	0.653
Jul	0.774	0.643	0.656	0.562
Aug	0.804	0.645	0.648	0.461
Total	19.814	23.871	15.889	12.174

(15) river: Source Amiq
sampling station: downstream of the source

Year	61-62	62-63	63-64	64-65	65-66	66-67	67-68	68-69
Sep	-	0.156	0.194	0.130	0.001	0.000	0.531	0.233
Oct	-	0.258	0.469	0.335	0.392	0.000	0.804	0.509
Nov	-	0.363	0.661	0.842	0.642	0.204	1.037	0.583
Dec	-	0.536	0.750	1.232	1.230	1.258	1.406	2.009
Jan	-	0.777	0.911	2.170	2.120	2.399	4.821	5.892
Feb	-	3.871	3.387	5.927	2.310	3.772	5.201	6.774
Mar	-	4.928	4.982	4.285	2.988	6.831	4.982	6.294
Apr	-	4.212	4.471	4.277	2.405	6.027	3.953	6.674
May	1.446	2.745	1.942	2.678	1.446	4.809	2.812	5.022
Jun	0.583	1.750	1.037	1.361	0.478	3.072	1.426	2.398
Jul	0.241	0.911	0.777	0.670	0.201	1.768	0.951	1.473
Aug	0.241	0.335	0.241	0.201	0.000	0.921	0.335	1.004
Total	-	10.852	19.822	24.108	14.213	31.061	28.259	38.865

Source Amiq continued

Year	69-70	70-71	71-72	72-73
Sep	0.518	0.000	0.039	0.000
Oct	0.603	0.005	0.107	0.000
Nov	0.726	0.324	0.454	0.000
Dec	0.670	1.004	0.536	0.000
Jan	1.272	0.670	1.446	0.200
Feb	2.117	1.960	1.742	0.289
Mar	3.455	3.817	2.344	1.228
Apr	3.227	5.036	1.244	1.115
May	2.143	4.821	0.857	0.425
Jun	0.778	2.074	0.065	0.026
Jul	0.455	1.138	0.000	0.000
Aug	0.054	0.335	0.000	0.000
Total	16.018	21.184	8.834	3.283

(16) river: Litani
sampling station: Mansura

Year	31-32	32-33	33-34	34-35	35-36	36-37	37-38	38-39
Sep	8.294	7.293	5.731	6.682	8.839	6.506	7.633	11.910
Oct	8.571	7.765	5.986	6.755	9.830	6.988	9.163	13.360
Nov	8.872	8.012	5.783	6.747	14.909	15.923	10.964	21.231
Dec	14.359	8.258	9.857	15.985	17.578	25.667	13.148	20.329
Jan	22.697	9.998	16.411	47.322	12.610	48.766	38.989	43.098
Feb	42.500	14.431	41.861	74.032	41.994	47.300	58.426	45.599
Mar	29.050	12.200	37.899	47.949	29.685	32.813	66.146	65.814
Apr	20.998	14.313	20.881	45.521	16.915	26.716	54.663	51.739
May	15.698	9.819	12.524	24.298	11.164	17.211	39.581	25.964
Jun	10.560	7.144	8.416	14.642	8.385	9.492	20.593	15.495
Jul	8.338	6.246	7.242	11.833	7.226	8.606	15.556	11.306
Aug	7.398	5.834	6.838	9.623	6.830	8.067	12.026	10.349
Total	202.355	111.043	179.435	311.389	185.965	254.055	346.888	339.194

Litani continued

Year	39-40	40-41	41-42	42-43	43-44	44-45	45-46	46-47
Sep	11.050	10.466	9.632	10.663	10.412	11.625	14.261	11.687
Oct	11.627	12.519	12.077	15.707	12.945	15.077	15.658	13.258
Nov	15.264	13.401	11.809	25.583	12.377	27.250	16.446	12.701
Dec	23.462	54.248	33.933	19.815	13.245	31.927	21.135	13.783
Jan	43.452	75.416	87.075	56.495	54.050	77.907	22.070	53.038
Feb	70.405	64.629	70.958	73.832	66.531	75.810	50.085	73.846
Mar	60.050	60.526	82.138	70.362	64.271	72.052	74.894	38.373
Apr	45.158	35.233	59.678	76.255	58.553	48.408	43.175	22.758
May	25.030	21.084	32.015	47.282	35.516	36.651	43.106	17.525
Jun	18.364	12.934	18.486	22.343	17.068	20.176	15.264	9.181
Jul	11.509	9.621	11.777	13.930	14.102	15.128	11.451	7.307
Aug	9.819	8.863	10.044	10.430	13.140	14.613	11.255	5.713
Total	345.370	378.935	439.312	442.723	372.210	446.627	338.895	279.169

Litani continued

Year	47-48	48-49	49-50	50-51	51-52	52-53	53-54	54-55
Sep	6.469	8.872	16.205	8.535	6.166	8.323	11.882	10.674
Oct	7.885	11.113	16.504	11.450	7.741	10.288	14.838	14.102
Nov	9.979	15.902	16.503	12.011	8.276	12.348	24.704	17.460
Dec	10.947	31.059	27.823	13.767	35.840	19.314	32.050	21.663
Jan	23.447	43.149	73.286	31.418	40.899	47.043	84.423	20.367
Feb	64.214	78.776	58.015	28.960	82.472	69.407	81.174	22.423
Mar	73.008	91.130	59.115	20.975	85.586	90.573	76.575	40.645
Apr	54.678	88.975	47.527	19.997	43.898	72.685	70.580	27.063
May	42.675	62.109	28.190	12.621	26.583	36.557	35.872	11.785
Jun	16.905	26.075	11.078	5.824	13.683	20.324	17.626	2.009
Jul	9.998	18.004	7.837	4.901	9.125	12.990	10.363	1.856
Aug	7.435	16.956	7.751	5.121	7.869	10.116	8.697	1.878
Total	327.658	491.923	370.398	175.580	368.138	409.968	468.784	192.925

Litani continued

Year	55-56	56-57	57-58	58-59	59-60	60-61	61-62	62-63
Sep	3.087	2.626	2.709	1.382	1.200	0.083	0.285	2.354
Oct	5.986	5.485	6.798	4.430	3.849	1.711	1.733	4.880
Nov	16.234	10.003	10.438	5.949	6.638	4.204	2.356	4.349
Dec	33.035	23.136	24.689	8.764	7.561	4.926	18.138	18.077
Jan	37.096	30.397	52.491	14.498	12.396	12.139	30.665	34.811
Feb	66.837	51.640	38.840	23.178	10.496	18.633	65.014	76.369
Mar	60.727	51.690	33.234	45.651	17.227	17.560	48.648	70.152
Apr	36.296	36.248	23.966	23.447	18.849	21.573	19.634	49.502
May	23.867	22.940	10.550	9.527	2.879	9.099	9.803	27.703
Jun	6.345	5.080	3.087	1.729	0.000	0.692	2.229	6.594
Jul	2.427	2.052	0.683	1.264	0.000	0.000	0.868	2.411
Aug	1.069	1.706	1.340	1.511	0.000	0.018	0.747	0.715
Total	293.006	43.003	208.519	141.835	81.095	90.474	200.120	297.917

Litani continued

Year	63-64	64-65	65-66	66-67	67-68	68-69	69-70	70-71
Sep	2.273	2.680	3.896	1.830	6.521	4.230	7.693	2.475
Oct	5.836	5.611	11.689	5.876	15.061	11.557	17.053	6.401
Nov	8.852	18.061	11.394	5.907	17.753	15.381	20.174	9.119
Dec	15.848	18.476	31.661	31.302	42.161	73.819	22.338	19.587
Jan	24.079	43.037	40.487	44.421	93.926	99.339	44.352	19.212
Feb	78.801	81.488	35.948	76.205	91.977	92.914	43.021	42.752
Mar	80.124	45.058	44.070	105.427	78.790	97.716	10.466	68.755
Apr	46.446	49.536	30.295	92.210	39.813	81.327	36.493	79.507
May	24.722	22.857	7.979	65.862	30.186	49.333	14.804	39.220
Jun	6.988	5.389	0.982	24.165	11.244	20.985	3.450	9.712
Jul	1.307	1.190	0.324	12.661	2.820	10.553	0.919	2.732
Aug	0.493	0.838	0.265	5.822	2.210	4.955	0.455	0.771
Total	295.771	294.201	215.858	471.658	432.460	552.109	281.213	300.243

Litani continued

Year	71-72	72-73
Sep	3.045	0.630
Oct	8.134	4.425
Nov	12.247	5.700
Dec	34.683	6.482
Jan	36.659	9.787
Feb	44.317	15.996
Mar	33.684	30.654
Apr	31.825	19.984
May	16.159	4.980
Jun	0.882	0.000
Jul	0.019	0.000
Aug	0.037	0.000
Total	221.681	98.088

(17) river: Source Khraizat
sampling station: downstream of the source

Year	61-62	62-63	63-64	64-65	65-66	66-67	67-68	68-69
Sep	0.311	0.272	0.415	0.363	0.389	0.324	0.518	0.441
Oct	0.281	0.308	0.375	0.335	0.321	0.268	0.485	0.367
Nov	0.324	0.272	0.298	0.433	0.363	0.233	0.363	0.290
Dec	0.643	0.348	0.335	0.469	0.552	0.402	0.367	0.804
Jan	0.710	0.442	0.402	0.769	0.670	0.836	1.339	1.580
Feb	0.895	0.932	1.165	1.198	0.877	1.178	1.644	1.669
Mar	1.259	1.580	1.420	1.406	1.037	1.923	1.556	1.741
Apr	1.076	1.516	1.439	1.231	1.083	1.944	1.361	1.970
May	0.763	1.420	1.205	1.303	0.830	1.607	1.272	1.594
Jun	0.486	1.140	0.829	0.938	0.664	1.192	0.907	1.198
Jul	0.375	0.763	0.562	0.769	0.501	1.018	0.723	1.100
Aug	0.308	0.576	0.496	0.509	0.375	0.804	0.589	0.804
Total	7.431	9.569	8.441	9.723	7.662	11.729	11.124	13.589

Source Khraizat continued

Year	69-70	70-71	71-72	72-73
Sep	0.555	0.332	0.454	0.337
Oct	0.509	0.343	0.412	0.343
Nov	0.428	0.332	0.324	0.337
Dec	0.367	0.351	0.557	0.308
Jan	0.442	0.375	0.702	0.300
Feb	0.738	0.702	0.832	0.280
Mar	1.104	1.307	0.991	0.555
Apr	1.270	1.426	0.876	0.640
May	1.037	1.741	0.870	0.660
Jun	0.752	1.330	0.679	0.435
Jul	0.643	0.970	0.562	0.365
Aug	0.415	0.702	0.418	0.338
Total	8.260	9.911	7.672	4.903

(18) river: Nahr esh Shita
sampling station: Qirawn dam

Year	61-62	62-63	63-64	64-65	65-66	66-67	67-68	68-69
Sep	-	-	-	-	0.000	0.000	0.000	0.000
Oct	-	-	-	-	0.426	0.086	0.000	0.000
Nov	-	-	-	-	0.446	0.665	0.638	0.518
Dec	-	-	-	-	1.406	2.300	2.989	5.847
Jan	-	-	-	-	1.521	1.947	4.060	7.047
Feb	-	-	-	-	1.565	2.110	3.971	0.948
Mar	-	-	-	1.484	1.535	3.509	1.353	4.733
Apr	-	-	-	1.788	0.941	2.214	0.531	2.600
May	-	-	-	0.667	0.000	1.529	0.595	0.820
Jun	-	-	-	0.000	0.000	0.000	0.000	0.000
Jul	-	-	-	0.000	0.000	0.000	0.000	0.000
Aug	-	-	-	0.000	0.000	0.000	0.000	0.000
Total	-	-	-	-	7.840	13.760	14.137	26.546

Nahr esh Shita continued

Year	69-70	70-71	71-72	72-73	73-74
Sep	0.000	0.000	0.000	0.000	0.002
Oct	0.327	0.335	0.281	0.028	0.201
Nov	0.181	0.524	0.564	0.388	0.363
Dec	0.742	0.536	0.643	0.482	0.500
Jan	1.473	0.737	1.098	0.844	-
Feb	2.056	0.919	0.629	4.981	-
Mar	2.419	1.607	1.098	0.750	-
Apr	1.654	3.683	0.923	0.467	-
May	0.656	1.393	0.508	0.428	-
Jun	0.000	0.013	0.000	0.000	-
Jul	0.000	0.000	0.000	0.000	-
Aug	0.000	0.000	0.000	0.000	-
Total	8.743	10.541	6.014	4.016	-

(19) river: Litani
sampling station: Qirawn Dam

Year	38-39	39-40	40-41	41-42	42-43	43-44	44-45	45-46
Sep	-	12.390	11.265	12.162	13.349	14.103	12.563	14.868
Oct	-	14.670	14.351	16.070	18.393	18.926	16.692	16.670
Nov	-	18.948	14.510	16.039	30.039	18.681	31.726	18.725
Dec	-	28.587	65.066	40.779	26.256	20.369	36.737	25.241
Jan	-	71.195	132.442	147.355	69.435	72.400	115.613	28.528
Feb	-	92.715	87.244	91.668	101.352	87.195	93.947	68.064
Mar	85.626	68.915	79.176	120.874	94.583	77.722	86.609	86.344
Apr	65.912	53.359	46.560	72.208	101.114	71.814	58.919	50.852
May	33.635	37.787	27.020	41.065	57.132	42.710	43.481	51.482
Jun	20.202	23.579	15.840	27.294	30.715	20.964	25.508	22.226
Jul	14.335	14.027	12.026	17.195	20.208	15.487	17.029	14.295
Aug	12.436	10.824	11.477	13.132	15.095	12.990	14.442	9.380
Total	-	446.996	516.977	615.841	582.691	473.393	553.266	407.175

Litani continued

Year	46-47	47-48	48-49	49-50	50-51	51-52	52-53	53-54
Sep	11.379	8.478	10.617	18.001	10.257	6.356	10.975	17.131
Oct	15.280	10.328	13.649	18.693	13.949	10.081	13.084	19.994
Nov	14.691	12.118	16.949	18.271	14.992	11.327	16.068	28.165
Dec	16.887	13.802	32.998	29.449	17.195	43.969	22.817	34.050
Jan	66.315	28.544	50.124	91.502	37.069	42.986	62.570	131.121
Feb	102.146	83.572	118.294	67.775	37.669	118.785	100.365	163.372
Mar	49.359	86.333	114.389	61.967	28.115	109.276	174.217	112.204
Apr	30.604	66.327	103.317	51.669	29.303	51.112	107.392	96.790
May	24.205	48.131	68.382	33.105	16.443	32.184	46.682	45.825
Jun	13.315	21.607	32.128	14.956	8.261	18.749	28.147	25.407
Jul	9.707	12.773	22.632	11.541	5.692	12.765	20.093	17.694
Aug	7.725	9.037	18.018	10.261	4.612	10.641	16.062	14.496
Total	361.613	401.050	601.502	426.790	218.557	468.115	618.477	705.712

Litani continued

Year	54-55	55-56	56-57	57-58	58-59	59-60	60-61	61-62
Sep	17.278	5.555	4.186	3.872	2.683	2.496	1.304	1.000
Oct	19.815	8.399	7.810	7.457	5.769	5.188	2.628	3.000
Nov	21.713	20.586	11.358	10.127	7.478	8.214	5.605	6.100
Dec	28.035	39.844	24.928	29.291	10.505	9.940	6.498	22.600
Jan	27.421	50.852	32.494	69.909	18.366	15.631	16.970	37.800
Feb	28.619	96.598	70.933	54.546	33.351	13.433	28.164	48.000
Mar	53.871	80.446	61.842	40.746	65.990	21.296	23.224	61.600
Apr	34.632	44.388	40.471	25.401	28.209	20.386	26.262	24.500
May	19.290	27.496	26.208	11.565	12.698	5.582	10.746	12.900
Jun	5.811	10.638	7.286	5.161	3.966	2.164	2.666	3.600
Jul	4.205	4.492	3.710	2.826	2.236	1.891	1.811	2.000
Aug	3.814	2.756	2.649	2.373	2.052	1.241	1.379	1.900
Total	264.504	392.050	93.875	263.334	194.303	107.462	127.257	261.000

Litani continued

Year	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
Sep	3.800	6.822	4.588	4.194	3.845	6.455	5.363	9.331
Oct	7.000	9.707	10.714	12.428	7.875	14.650	11.200	19.552
Nov	6.600	12.701	22.186	12.571	7.607	19.040	16.848	20.736
Dec	22.500	20.624	22.874	37.498	36.426	47.000	163.320	24.105
Jan	38.435	28.820	45.131	41.649	52.497	151.380	246.647	50.354
Feb	71.100	87.420	95.994	41.224	99.455	125.280	163.700	44.271
Mar	72.595	94.735	48.134	47.408	147.086	87.200	127.022	78.745
Apr	44.098	47.434	51.840	27.423	106.350	46.800	98.350	39.398
May	31.918	26.784	22.364	7.017	74.800	30.832	58.420	15.392
Jun	15.049	8.683	5.184	0.239	30.900	8.767	22.000	2.592
Jul	8.196	2.927	0.487	2.850	9.818	2.727	11.000	1.875
Aug	5.598	1.982	0.881	2.932	3.214	3.468	5.892	1.175
Total	326.869	348.639	330.374	237.437	579.873	543.599	929.762	307.526

Litani continued

Year	70-71	71-72	72-73	73-74
Sep	3.369	5.035	3.790	2.152
Oct	7.232	10.603	8.175	3.375
Nov	11.664	13.900	10.447	8.502
Dec	23.570	43.650	11.114	15.803
Jan	21.159	42.240	13.600	-
Feb	49.554	51.430	19.455	-
Mar	77.406	37.104	37.352	-
Apr	136.357	34.100	20.724	-
May	54.372	21.975	5.000	-
Jun	11.405	1.398	0.000	-
Jul	2.411	1.839	0.000	-
Aug	2.143	1.500	0.000	-
Total	401.142	264.769	129.657	-

(20) river: Source Ain Zarqa
sampling station: downstream of the source

Year	61-62	62-63	63-64	64-65	65-66	66-67	67-68	68-69
Sep	2.618	3.421	4.212	2.799	2.981	4.795	5.184	6.765
Oct	-	2.949	3.616	3.817	2.893	3.080	4.687	5.424
Nov	-	2.825	3.344	3.499	3.188	2.592	4.400	6.480
Dec	-	4.018	3.375	4.821	3.348	3.150	5.022	8.000
Jan	-	4.955	4.312	7.767	5.759	5.357	12.338	15.450
Feb	-	8.709	8.951	9.919	7.306	9.314	14.515	14.500
Mar	-	14.999	15.534	8.491	7.553	14.062	14.062	18.500
Apr	-	10.109	15.811	8.813	6.221	15.163	10.498	17.150
May	5.625	6.428	10.714	7.165	4.982	10.579	6.294	14.600
Jun	4.018	5.638	6.091	5.378	3.681	7.646	4.536	7.776
Jul	3.080	5.464	5.598	5.491	4.232	6.294	5.223	7.861
Aug	3.616	4.607	4.848	3.904	3.562	5.491	5.759	7.098
Total	-	73.319	85.615	73.337	55.524	85.709	92.185	128.023

Source Ain Zarqa continued

Year	69-70	70-71	71-72	72-73	73-74
Sep	4.795	6.610	3.110	3.758	-
Oct	6.910	4.553	6.535	3.810	3.803
Nov	5.651	3.655	6.247	4.790	4.018
Dec	5.330	3.696	7.513	5.150	5.089
Jan	5.892	5.356	5.678	4.550	-
Feb	7.258	7.250	8.467	4.350	-
Mar	10.044	11.785	9.642	7.500	-
Apr	15.552	11.665	8.709	5.440	-
May	9.508	10.310	7.419	5.620	-
Jun	6.558	8.424	6.402	5.500	-
Jul	6.750	5.350	5.732	5.080	-
Aug	5.402	6.720	4.821	4.612	-
Total	91.620	83.561	86.775	59.512	-

(21) river: Markabeh tunnel
sampling station: Jezzine - Markabeh window

Year	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
Sep	1.555	1.853	1.762	-	-	-	2.073	2.592
Oct	1.567	1.955	1.826	-	-	-	2.400	2.678
Nov	1.459	1.776	1.776	-	-	-	2.592	2.592
Dec	1.687	1.888	1.942	-	-	-	2.764	2.678
Jan	2.009	1.955	2.089	-	-	-	5.050	2.678
Feb	1.972	2.032	1.947	-	-	-	3.600	1.814
Mar	2.196	2.491	1.942	-	-	-	3.135	2.900
Apr	1.853	2.268	1.801	-	-	-	2.592	2.720
May	1.870	2.062	2.022	-	-	-	2.680	2.678
Jun	1.776	1.905	2.255	-	-	-	2.592	2.592
Jul	1.754	1.888	1.982	-	-	-	2.678	2.008
Aug	1.848	1.942	1.366	-	-	-	2.678	2.142
Total	21.546	24.015	22.705	-	-	-	34.834	30.072

Markabeh tunnel continued

Year	70-71	71-72	72-73
Sep	2.075	2.300	1.348
Oct	2.678	1.070	1.098
Nov	2.592	1.070	1.037
Dec	3.450	2.140	1.205
Jan	2.945	2.410	1.339
Feb	2.900	2.505	1.216
Mar	3.482	2.678	1.902
Apr	3.370	2.333	1.607
May	2.940	2.300	1.607
Jun	2.592	1.944	1.296
Jul	2.140	1.875	1.098
Aug	2.140	1.607	1.071
Total	33.304	24.232	15.818

(22) river: Litani
sampling station: Qlaya

Year	48-49	49-50	50-51	51-52	52-53	53-54	54-55	55-56
Sep	-	25.205	16.817	9.984	17.320	22.937	22.557	10.800
Oct	-	26.409	19.834	13.105	18.446	25.198	26.406	13.456
Nov	-	24.292	19.952	14.456	20.018	33.621	27.812	24.818
Dec	-	36.474	22.828	54.797	26.910	42.723	33.793	47.381
Jan	-	109.174	49.074	59.179	73.112	161.853	36.054	61.309
Feb	-	86.266	49.071	135.282	130.174	215.142	37.311	107.668
Mar	-	84.431	39.691	127.503	187.247	141.162	69.041	104.918
Apr	-	71.270	33.439	69.056	125.170	114.017	46.710	62.384
May	98.562	48.310	24.312	46.028	68.420	67.873	27.079	41.936
Jun	51.244	23.463	12.455	27.154	43.385	39.886	12.877	20.124
Jul	36.518	18.181	10.202	19.330	29.925	28.688	10.574	14.825
Aug	27.724	16.341	9.168	16.721	23.538	22.825	9.286	10.933
Total	-	569.816	306.823	592.595	763.668	915.925	359.600	520.552

Litani continued

Year	56-57	57-58	58-59	59-60	60-61	61-62	62-63	63-64
Sep	10.495	12.053	11.387	9.772	6.475	6.555	8.268	16.544
Oct	12.575	14.512	14.584	12.634	7.406	8.791	12.680	17.254
Nov	17.978	17.499	15.954	14.088	10.930	12.234	7.781	19.330
Dec	34.640	43.832	18.668	13.044	10.901	42.233	28.150	27.582
Jan	42.212	87.728	28.024	23.693	22.560	47.732	44.357	33.491
Feb	84.875	77.567	47.073	21.040	39.535	78.259	77.487	59.693
Mar	80.550	62.892	84.627	30.577	37.393	75.429	79.956	95.739
Apr	59.295	42.392	48.001	30.526	38.079	48.463	59.199	48.063
May	40.045	24.092	24.957	14.098	18.762	35.149	57.023	40.883
Jun	20.005	15.998	14.653	9.606	10.469	16.825	36.280	20.039
Jul	13.266	13.116	12.005	9.058	8.391	9.160	25.772	19.228
Aug	12.015	11.785	10.210	7.550	6.286	10.869	18.036	21.240
Total	427.951	423.466	330.143	195.636	217.187	391.699	454.989	419.086

Litani continued

Year	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72
Sep	25.850	13.128	9.756	11.013	11.677	8.582	9.725	9.253
Oct	36.595	5.836	7.708	11.271	12.639	7.725	9.273	8.450
Nov	27.000	9.235	7.841	9.552	67.205	2.525	6.765	6.353
Dec	42.793	27.092	6.792	4.915	121.776	3.469	6.608	2.708
Jan	32.570	1.958	4.556	139.121	88.711	4.018	4.079	3.977
Feb	46.860	4.144	14.043	121.020	125.177	6.175	4.841	7.121
Mar	62.840	5.439	59.076	82.591	123.309	7.620	8.667	5.461
Apr	44.761	14.419	98.882	49.401	104.792	16.135	68.543	3.896
May	33.175	7.858	76.750	35.933	85.334	8.895	44.247	14.214
Jun	22.353	8.901	38.139	14.699	32.498	5.886	4.266	7.690
Jul	35.092	9.428	4.885	9.811	27.258	8.054	4.419	8.782
Aug	12.181	10.315	8.375	9.787	10.084	9.891	6.075	9.723
Total	422.070	117.753	36.203	499.174	810.454	88.925	177.508	87.658

Litani continued

Year	72-73
Sep	10.310
Oct	10.207
Nov	7.932
Dec	2.885
Jan	1.639
Feb	1.427
Mar	1.907
Apr	2.123
May	4.942
Jun	7.087
Jul	7.143
Aug	6.434
Total	64.040

(23) river: Safa wadi
sampling station: near Khallet Khazem

Year	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72
Sep	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oct	0.000	0.000	0.000	0.000	0.000	0.048	0.000	0.000
Nov	2.328	0.016	0.000	0.119	0.298	0.130	0.000	0.013
Dec	1.409	0.723	1.082	0.790	3.402	0.362	0.670	0.814
Jan	2.751	0.983	1.912	3.029	5.566	0.728	0.643	0.522
Feb	2.146	0.997	2.351	1.012	1.229	0.719	0.439	0.742
Mar	0.297	0.795	2.362	0.383	1.441	1.888	1.087	0.388
Apr	0.829	0.106	0.513	0.036	0.114	0.166	3.269	0.334
May	0.142	0.000	0.099	0.013	0.000	0.032	0.185	0.040
Jun	0.000	0.000	0.002	0.000	0.000	0.000	0.013	0.000
Jul	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aug	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	9.902	3.621	8.321	5.382	12.050	4.071	8.306	2.853

Safa wadi continued

Year	72-73
Sep	0.000
Oct	0.000
Nov	0.000
Dec	0.004
Jan	0.404
Feb	0.322
Mar	0.718
Apr	0.049
May	0.000
Jun	0.000
Jul	0.000
Aug	0.000
Total	1.497

(24) river: Aajis wadi
sampling station: near Khallet Khazem

Year	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72
Sep	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.016
Oct	0.000	0.019	0.000	0.016	0.000	0.000	0.048	0.016
Nov	1.530	0.075	0.000	0.052	0.130	0.249	0.089	0.039
Dec	0.541	1.023	0.809	0.739	2.941	0.147	0.611	0.868
Jan	1.532	1.104	1.267	2.196	3.744	0.629	0.185	0.868
Feb	1.504	0.965	1.689	1.007	0.830	0.472	0.876	1.275
Mar	0.485	0.766	1.998	0.536	1.283	1.731	0.986	0.319
Apr	0.798	0.228	0.635	0.181	0.355	0.259	1.446	0.264
May	0.147	0.059	0.169	0.056	0.145	0.080	0.088	0.083
Jun	0.010	0.007	0.041	0.010	0.018	0.023	0.047	0.041
Jul	0.005	0.000	0.010	0.000	0.000	0.000	0.032	0.032
Aug	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.032
Total	6.554	4.246	6.618	4.793	9.446	3.640	4.436	3.873

Aajis wadi continued

Year	72-73
Sep	0.031
Oct	0.035
Nov	0.031
Dec	0.040
Jan	0.295
Feb	0.571
Mar	0.723
Apr	0.262
May	0.131
Jun	0.083
Jul	0.029
Aug	0.000
Total	2.231

(25) river: Naqouziya wadi
sampling station: near Jarmaq

Year	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72
Sep	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oct	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000
Nov	0.264	0.010	0.000	0.003	0.005	0.003	0.000	0.000
Dec	0.037	0.051	0.131	0.107	0.986	0.054	0.019	0.094
Jan	0.246	0.155	0.378	1.516	1.529	0.276	0.027	0.158
Feb	0.426	0.232	0.523	0.649	0.312	0.174	0.510	0.281
Mar	0.147	0.115	0.862	0.027	0.300	0.627	0.404	0.056
Apr	0.534	0.007	0.104	0.008	0.044	0.023	0.492	0.031
May	0.008	0.000	0.000	0.000	0.000	0.000	0.013	0.000
Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jul	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aug	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	1.662	0.570	2.001	2.310	3.176	1.157	1.465	0.620

Naqouziya wadi continued

Year	72-73
Sep	0.000
Oct	0.000
Nov	0.000
Dec	0.000
Jan	0.048
Feb	0.097
Mar	0.287
Apr	0.000
May	0.000
Jun	0.000
Jul	0.000
Aug	0.000
Total	0.432

(26) river: Aishiya wadi
sampling station: near Jarmaq

Year	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72
Sep	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oct	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000
Nov	0.290	0.003	0.000	0.000	0.003	0.010	0.000	0.000
Dec	0.024	0.064	0.153	0.067	0.712	0.046	0.019	0.303
Jan	0.230	0.169	0.246	0.793	1.342	0.220	0.051	0.126
Feb	0.368	0.114	0.276	0.559	0.261	0.109	0.157	0.220
Mar	0.142	0.134	0.399	0.013	0.206	0.343	0.099	0.043
Apr	0.295	0.000	0.080	0.000	0.010	0.003	0.975	0.026
May	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jul	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aug	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	1.349	0.487	1.154	1.432	2.534	0.731	1.301	0.718

Aishiya wadi continued

Year	72-73
Sep	0.000
Oct	0.000
Nov	0.000
Dec	0.000
Jan	0.051
Feb	0.010
Mar	0.056
Apr	0.000
May	0.000
Jun	0.000
Jul	0.000
Aug	0.000
Total	0.117

(27) river: Zaghria wadi
sampling station: near Jarmaq

Year	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72
Sep	0.000	0.000	0.000	0.021	0.000	0.047	0.000	0.031
Oct	0.000	0.000	0.000	0.005	0.000	0.048	0.000	0.032
Nov	0.726	0.000	0.000	0.000	0.000	0.023	0.000	0.031
Dec	0.337	0.179	0.179	0.185	2.397	0.020	0.150	0.279
Jan	0.870	0.461	0.616	1.915	4.976	0.257	0.126	0.319
Feb	1.502	0.823	1.290	0.980	2.076	0.225	0.610	0.581
Mar	0.485	0.541	1.674	0.522	0.943	1.461	0.616	0.348
Apr	0.705	0.264	0.880	0.241	0.446	0.420	2.017	0.347
May	0.308	0.118	0.305	0.126	0.193	0.153	0.426	0.257
Jun	0.122	0.020	0.096	0.052	0.090	0.080	0.117	0.109
Jul	0.056	0.000	0.048	0.019	0.099	0.013	0.067	0.078
Aug	0.032	0.000	0.046	0.008	0.062	0.000	0.046	0.035
Total	5.143	2.406	5.143	4.074	11.282	2.806	4.175	2.447

Zaghria wadi continued

Year	72-73
Sep	0.000
Oct	0.000
Nov	0.000
Dec	0.000
Jan	0.037
Feb	0.080
Mar	0.439
Apr	0.049
May	0.000
Jun	0.000
Jul	0.000
Aug	0.000
Total	0.605

(28) river: Source Maidane
sampling station: near the source

Year	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
Sep	-	0.130	0.130	0.135	0.085	0.104	0.150	0.148
Oct	-	0.147	0.131	0.120	0.112	0.134	0.160	0.134
Nov	-	0.156	0.143	0.119	0.104	0.122	0.150	0.140
Dec	-	0.161	0.348	0.241	0.187	0.228	0.696	0.174
Jan	-	0.321	0.375	0.388	0.362	0.884	2.116	0.268
Feb	-	1.173	0.895	0.351	0.569	0.544	0.847	0.206
Mar	-	0.884	0.267	0.201	0.736	0.321	0.643	0.868
Apr	0.285	0.311	0.415	0.194	0.414	0.194	0.428	0.181
May	0.214	0.147	0.187	0.142	0.193	0.174	0.241	0.155
Jun	0.168	0.130	0.176	0.137	0.181	0.163	0.168	0.137
Jul	0.169	0.107	0.169	0.120	0.147	0.147	0.155	0.142
Aug	0.086	0.121	0.134	0.102	0.107	0.155	0.155	0.112
Total	-	3.778	3.370	2.250	3.197	3.170	5.909	2.665

Source Maidane continued

Year	70-71	71-72	72-73
Sep	0.106	0.168	0.132
Oct	0.139	0.171	0.147
Nov	0.143	0.181	0.143
Dec	0.280	0.295	0.147
Jan	0.228	0.335	0.187
Feb	0.605	0.319	0.174
Mar	0.562	0.228	0.295
Apr	0.804	0.259	0.185
May	0.254	0.220	0.147
Jun	0.197	0.176	0.150
Jul	0.204	0.174	0.145
Aug	0.174	0.166	0.139
Total	3.636	2.692	1.991

(29) river: Source Guelle
sampling station: near the source

Year	65-66	66-67	67-68	68-69	69-70	70-71	71-72	72-73
Sep	1.361	1.102	1.426	1.452	1.555	1.231	1.607	1.192
Oct	1.071	1.071	1.205	1.232	1.553	1.406	1.286	1.138
Nov	0.842	0.778	0.881	-	1.192	0.897	1.037	0.972
Dec	1.540	1.330	1.674	-	0.870	1.205	1.607	0.870
Jan	3.019	1.942	-	-	1.942	1.138	3.884	1.004
Feb	4.161	4.444	-	-	2.722	3.498	4.476	1.452
Mar	4.678	5.973	-	-	4.339	6.503	4.285	4.220
Apr	4.277	5.314	-	-	5.054	6.428	4.406	2.840
May	3.611	4.955	-	-	4.352	6.602	4.152	2.480
Jun	2.177	4.303	3.577	3.888	2.877	4.342	2.981	2.070
Jul	1.540	3.013	2.464	3.214	2.210	2.812	2.116	1.945
Aug	1.232	2.076	1.808	2.384	1.821	1.982	1.406	1.745
Total	28.512	36.756	-	-	30.482	38.344	33.243	21.868

(30) river: Litani
sampling station: Khardale

Year	38-39	39-40	40-41	41-42	42-43	43-44	44-45	45-46
Sep	-	21.838	15.378	21.851	38.647	23.315	22.963	23.554
Oct	-	22.973	17.064	27.389	57.216	26.133	25.281	24.588
Nov	-	27.065	18.279	27.146	73.820	24.958	47.802	25.373
Dec	-	40.029	85.184	61.236	39.260	27.229	52.333	36.448
Jan	-	96.012	166.063	207.386	126.699	104.837	168.769	39.769
Feb	89.922	137.009	127.143	130.593	142.946	124.240	144.227	95.737
Mar	128.461	111.604	114.255	170.507	134.673	112.129	135.377	128.415
Apr	103.040	84.704	69.095	104.178	137.510	105.479	90.717	79.611
May	57.554	40.468	42.284	61.651	89.595	71.069	68.755	80.207
Jun	37.447	27.175	26.931	42.644	50.425	40.619	41.441	37.078
Jul	27.654	19.509	21.903	28.943	35.087	27.874	28.458	27.754
Aug	23.878	16.116	20.891	23.444	25.806	23.878	24.272	23.840
Total	-	650.502	724.530	906.968	951.684	711.760	850.395	622.379

Litani continued

Year	46-47	47-48	48-49	49-50	50-51	51-52	52-53	53-54
Sep	21.825	17.840	19.450	27.727	18.590	15.485	19.712	25.215
Oct	24.644	18.918	21.561	28.458	21.588	17.552	21.371	27.595
Nov	22.333	21.164	24.839	25.580	22.156	17.128	22.843	38.540
Dec	24.119	22.657	48.715	42.246	24.505	55.376	29.580	49.569
Jan	103.547	42.927	88.222	115.867	55.866	66.772	86.590	185.782
Feb	151.870	122.689	174.724	98.546	56.239	154.599	140.488	255.163
Mar	81.849	127.805	162.305	97.858	47.330	147.901	205.771	189.564
Apr	52.107	91.837	151.557	81.829	38.094	83.519	140.873	157.804
May	39.718	70.281	108.063	55.917	29.031	57.800	78.442	85.117
Jun	25.150	37.219	57.032	26.493	16.918	83.585	50.733	47.672
Jul	20.913	26.256	39.755	21.253	16.336	24.467	33.166	31.723
Aug	18.438	21.068	30.852	18.575	15.706	20.851	24.440	25.231
Total	586.513	620.721	923.135	640.349	362.359	702.985	854.009	1119.075

Litani continued

Year	54-55	55-56	56-57	57-58	58-59	59-60	60-61	61-62
Sep	23.779	11.939	15.170	13.841	13.123	13.476	9.406	7.763
Oct	26.658	12.953	17.782	16.981	15.205	15.205	11.552	9.577
Nov	28.198	26.423	21.311	18.844	16.293	16.599	15.570	16.140
Dec	33.576	58.097	38.371	53.343	19.935	17.525	16.509	63.794
Jan	35.684	76.117	54.018	121.752	32.468	35.433	34.251	62.088
Feb	43.134	142.351	114.730	104.746	56.672	29.508	65.451	106.034
Mar	79.883	128.450	103.630	73.964	106.962	45.669	54.096	103.978
Apr	57.051	74.862	72.174	47.467	58.336	44.240	59.352	63.672
May	29.286	47.686	43.312	26.433	29.085	20.369	30.475	44.065
Jun	20.492	23.182	20.360	17.040	16.796	13.563	17.441	21.384
Jul	13.898	17.640	16.137	13.641	14.453	12.813	13.184	11.413
Aug	12.294	14.945	14.067	12.755	13.620	10.671	10.081	13.057
Total	398.538	634.645	531.062	520.807	392.948	275.071	337.368	522.965

Litani continued

Year	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
Sep	10.025	20.482	28.950	14.030	11.926	13.266	13.393	11.620
Oct	13.622	22.970	39.975	8.177	10.213	12.540	13.818	11.244
Nov	10.648	23.525	38.146	11.260	10.788	11.389	88.776	5.552
Dec	32.696	31.723	56.854	40.064	13.563	10.446	183.355	6.198
Jan	53.150	42.434	63.181	16.681	17.675	187.887	206.218	17.780
Feb	105.767	95.090	80.279	23.732	35.003	164.573	210.513	15.357
Mar	113.369	137.348	89.946	22.464	187.070	112.643	176.059	34.203
Apr	81.697	63.613	75.194	21.848	154.032	63.094	136.469	29.637
May	74.484	49.044	49.248	16.017	98.096	41.253	107.685	16.480
Jun	43.216	25.474	33.665	10.759	49.256	20.129	37.434	10.656
Jul	38.644	23.506	50.330	11.972	9.848	13.397	31.629	10.917
Aug	22.576	25.180	15.345	11.662	11.348	12.623	14.599	11.721
Total	599.894	560.387	621.113	208.666	608.818	663.240	1220.148	177.365

Litani continued

Year	70-71	71-72	72-73
Sep	10.905	11.882	11.628
Oct	11.670	11.016	11.667
Nov	8.458	9.321	9.749
Dec	10.266	12.653	5.137
Jan	8.126	16.823	5.231
Feb	23.193	23.377	5.199
Mar	26.473	18.650	12.505
Apr	99.997	15.850	7.320
May	63.122	24.331	8.445
Jun	13.642	14.487	10.106
Jul	9.752	14.021	10.344
Aug	11.115	14.217	8.568
Total	296.719	186.628	105.899

(31) river: Litani
sampling station: Ghandouriye wadi

Year	66-67	67-68	68-69	69-70	70-71	71-72	72-73
Sep	11.148	12.592	14.476	10.964	11.656	14.673	11.900
Oct	9.508	12.476	13.786	10.531	11.544	14.075	12.000
Nov	8.932	11.483	88.550	5.661	8.377	11.291	10.000
Dec	13.274	9.875	201.453	5.351	10.676	13.510	5.700
Jan	19.218	200.269	285.621	15.510	9.417	17.841	7.300
Feb	39.929	176.790	237.115	16.143	26.797	25.089	7.800
Mar	197.130	120.300	198.244	40.117	31.576	21.114	14.100
Apr	167.210	70.777	145.875	32.918	121.033	17.885	8.400
May	97.754	41.159	110.018	18.039	64.424	22.531	9.200
Jun	49.603	19.393	37.346	9.691	15.479	14.933	10.500
Jul	9.964	13.890	31.659	10.114	11.311	15.280	10.700
Aug	10.316	13.234	15.288	10.839	11.539	14.324	8.900
Total	633.986	702.238	1319.471	185.878	333.824	202.546	116.500

(32) river: Ghandouriye wadi
sampling station: Litani

Year	66-67	67-68	68-69	69-70	70-71	71-72	72-73
Sep	0.000	0.075	0.114	0.495	0.124	0.145	0.008
Oct	0.000	0.099	0.070	0.568	0.037	0.343	0.005
Nov	0.000	0.246	0.122	0.334	0.000	0.422	0.008
Dec	0.000	0.153	0.426	0.123	0.000	0.429	0.003
Jan	0.001	1.069	2.518	0.442	0.008	0.662	0.021
Feb	0.387	1.939	4.691	0.385	0.128	1.070	0.002
Mar	1.328	1.446	3.800	0.544	0.378	0.991	0.005
Apr	1.591	0.835	3.092	0.645	1.633	0.570	0.003
May	0.975	0.579	2.577	0.509	1.720	0.654	0.000
Jun	0.495	0.433	1.949	0.358	0.739	0.477	0.000
Jul	0.356	0.241	1.414	0.445	0.536	0.265	0.000
Aug	0.236	0.198	1.007	0.281	0.311	0.147	0.000
Total	5.369	7.313	21.780	5.129	5.614	6.175	0.055

(33) river: Qasmieh canal
sampling station: connecting point of the canal

Year	65-66	66-67	67-68	68-69	69-70	70-71	71-72	72-73
Sep	10.723	9.355	10.210	9.754	9.111	9.541	10.158	9.865
Oct	6.653	8.158	9.353	9.701	7.786	9.230	10.609	10.325
Nov	6.706	6.807	8.551	4.979	3.048	6.063	7.620	7.136
Dec	5.815	4.942	1.987	4.516	5.378	3.568	3.477	7.782
Jan	0.924	3.377	0.000	5.611	4.039	3.675	1.248	2.764
Feb	0.510	1.522	0.000	0.118	3.247	5.138	2.333	3.065
Mar	0.000	0.696	1.037	0.000	3.857	5.793	1.192	4.468
Apr	1.867	3.525	6.610	1.322	3.491	0.472	1.431	2.696
May	9.437	9.449	11.139	10.403	9.283	5.901	8.199	7.382
Jun	9.189	10.552	10.918	10.109	9.090	10.272	10.034	9.168
Jul	9.878	8.306	10.660	10.427	9.519	9.728	10.075	9.029
Aug	10.041	8.386	10.633	9.131	9.966	9.870	9.457	8.900
Total	71.743	75.075	81.098	77.815	79.251	75.834	76.071	78.600

(34) river: Litani Qasmieh
sampling station: at the delta

Year	65-66	66-67	67-68	68-69	69-70	70-71	71-72	72-73
Sep	5.270	3.333	5.184	5.363	8.040	5.938	7.260	4.606
Oct	4.200	3.552	5.919	6.998	9.575	6.953	6.626	5.432
Nov	3.326	3.955	7.195	91.765	7.797	6.864	7.162	4.619
Dec	37.854	13.049	11.206	226.416	8.536	12.286	13.692	3.941
Jan	14.016	21.068	230.771	263.196	18.473	8.699	19.378	5.700
Feb	24.971	46.262	236.306	300.665	17.142	29.783	29.641	4.858
Mar	25.793	223.606	157.423	222.647	43.837	36.892	24.122	12.122
Apr	23.439	207.391	77.102	177.993	33.045	131.062	20.262	7.009
May	9.618	104.056	41.096	119.446	13.502	82.034	22.531	3.549
Jun	3.616	41.695	15.790	44.655	5.819	10.767	7.061	3.186
Jul	4.358	5.306	7.202	31.458	5.729	7.374	6.634	2.828
Aug	3.956	5.025	5.812	10.976	5.855	6.924	6.120	1.398
Total	160.417	678.798	801.816	1501.578	177.350	345.586	170.489	59.298

(35) river: Kfar dajjal wadi
sampling station: Maifadoun dam

Year	64-65	65-66	66-67	67-68	68-69	69-70	70-71	71-72
Sep	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Oct	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nov	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dec	0.000	0.000	0.064	0.000	0.252	0.000	0.000	0.000
Jan	0.005	0.000	0.171	0.252	0.686	0.054	0.000	0.000
Feb	0.031	0.010	0.102	0.035	0.370	0.000	0.119	0.000
Mar	0.000	0.000	0.128	0.000	0.051	0.155	0.003	0.000
Apr	0.000	0.000	0.000	0.000	0.000	0.000	0.163	0.000
May	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jun	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jul	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aug	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	0.036	0.010	0.465	0.287	1.359	0.209	0.285	0.000

Kfar dajjal wadi continued

Year	72-73
Sep	0.000
Oct	0.000
Nov	0.000
Dec	0.000
Jan	0.000
Feb	0.000
Mar	0.000
Apr	0.000
May	0.000
Jun	0.000
Jul	0.000
Aug	0.000
Total	0.000

3. General balance of the Litani (without the dams)

The available contribution of water in the Litani River during an average year is summarized as in Table 20.

Table 20: Balance of the Litani

River	Natural annual contrib. (Mcm)	1974 Influence of sampling (Mcm)	1974 Available contrib. (Mcm)	1985 Influence of sampling (Mcm)	1985 Available contrib. (Mcm)
		For an average year			
Upstream of Qirawn	572	122	405	122	405
Downstream of Qirawn	432	101	331	118	314
Total	959	223	736	240	719
		For summer of an average year			
Upstream of Qirawn	159	122	37	122	37
Downstream of Qirawn	145	87	58	98	47
Total	304	209	95	220	84

Source: FAO, *Developpement hydro-agricole du sud du Liban - Troisieme Partie. Les ressources en eaux*, (Rome 1977), p. 90.

4. Sedimentation

Upstream of Qirawn the bed of the Litani is almost flat. The natural sediments carried by the water of the river can contain a variety of minerals. Clay and sand usually stay in suspension up to Lake Qirawn. The total volume of sediment carried annually by the flood and the draining network is estimated to be 23,000 cu m over 100 years. Part of the sediments deposited in the dam are regularly evacuated through draining operations that take place at the bottom of the dam.

It is important to note that since 1962, when Lake Qirawn filled up, the Office of the Litani did not undertake any investigation on the sediments that are deposited at the bottom of the dam. The only trial that was attempted was in October 1979 (very dry year) when maintenance services were required. The lake was emptied to effect necessary repairs.

The building of the Qirawn dam has reduced drastically the deposit of sediments downstream of Qirawn. The amount of sediment is currently limited to the natural sediments carried from the bed of the river between Lake Qirawn and the delta at Qasmieh. The volume of sediments in this part is estimated to be 980 tons/sq km/yr (steep slope).

5. Underground water

The water tables of the Litani river are:

- the Neogene - Quaternary water table in the Bekaa - the Jurassic water table at Amiq;
- the Jurassic at Barouq - NIHA (average annual recharge of 155 Mcm, (not yet used in drilling);
- the Cretaceous at Jezzine (average annual recharge of 78 Mcm, (no current use by well);
- the Eocene of Nabatiya - Ghandouriye (average annual recharge of 780 Mcm, no current or future possibility of use);
- the middle Cretaceous of the western cliff, the most important water table of the area (average annual recharge of 250 Mcm, 58 Mcm used as of 1980);
- the Eocene of the coastal area (average annual recharge of 28 Mcm, can be used only in the area of Awali - Litani and the coast);
- the Quaternary of the coastal zone (average annual recharge of 46 Mcm);

The total volume of water tables of the Litani bed and its region (southern part of the country) is 633 Mcm.

6. Underground water extraction from the Litani

6.1. Volume of water extracted through drilling into the water table

Drilling methods started during the 1950's and have developed rapidly since 1959. The average volume of water drilled from the water tables, computed over a 6-year period of time, is about 63 Mcm. Just before the civil war this volume reached 80 Mcm, which represents twice the total volume taken from surface water (upstream of Qirawn).

Table 21: Volume of Drilled Water (Upstream of Qirawn)

Year	Volume of drilled water (in Mcm)	
1959	26 Mcm	(dry year)
1960	56 Mcm	(dry year)
1961	87 Mcm	(very dry year)
1962	62 Mcm	
1963	62 Mcm	
1964	62 Mcm	
1965	62 Mcm	
1966	62 Mcm	
1967	34 Mcm	(humid year)
1968	34 Mcm	(humid year)
1969	34 Mcm	(humid year)
1970	64 Mcm	
1971	69 Mcm	
1972	79 Mcm	(dry year)
1973	79 Mcm	(very dry year)

During the first three years of the civil war the number of drillings was about 1200 to 1300. The volume of drilled water varied between 125 Mcm and 133 Mcm. The number of drillings in the Litani bed is currently estimated to be 1925, and the annual volume of drilled water in a normal year is some 173 Mcm. The average flow of water drilling varies between 35,000 and 112,000 cu m/s. A detailed study of the current situation of extracted underground water requires an exhaustive survey in the field, which is a very difficult operation to be realized now, for two reasons: lack of financial and technical means; and a political situation that causes lack of safety.

6.2. Extraction from the springs of the Litani's bed

The quantity of water taken from the Litani and its tributary springs in 1974 reached 137 Mcm: 107 taken from the Litani itself (upstream and downstream of Qirawn) and 30 Mcm from the other sources.

Table 22 shows the total quantities of water taken from the tributary springs of the Litani in the year 1974.

Table 22: Water Extracted from Tributary Springs of the Litani

Source	Location relative to the Litani	Average annual contribution in (Mcm)	Quantity used for irrigation in (Mcm)
Anjar and Hamsine	Left of the Litani	71	9
Ras el-Ain and Faour	Left of the Litani	11	-
Ain el-Baida	Left of the Litani	10	-
Kob Elias and Amiq	Right of the Litani	41	9
Bardaouni	Right of the Litani	39	12
Chtaura	Right of the Litani	11	-
Total		183	30

Source: FAO, *Developpement hydro-agricole du sud du Liban* - Troisieme Partie. *Les ressources en eaux*, p. 82

7. Utilization of the Litani's water for irrigation

7.1. Irrigation from the Litani: 1972

The total area that was irrigated from the Litani River was about 20,210 ha, distributed as follows: 15,800 ha located upstream of Qirawn (Bekaa plain); and 4410 ha located downstream of Qirawn, especially in the coastal area. The irrigated areas are distributed by origin of water as shown in Table 23.

Table 23: Irrigation from Litani and Tributaries: 1972

	Area (ha)	Volume (Mcm)
Irrigation upstream of Qirawn		
Irrigation using surface water	6300	43
Irrigation using underground water	9500	79
Total Litani - upstream Qirawn	15,800	122
Irrigation downstream of Qirawn		
Surface irrigation		
Qasmieh perimeter	3270	59
Other scattered perimeters	1140	12
Total Litani - downstream Qirawn	4410	71
Total irrigation (Litani river)	20,210	193
Irrigation from Litani tributaries	4700	30
Total irrigation	24,410	223

7.2. Irrigation from the Litani: 1985

The total surface currently irrigated from the Litani and its tributary rivers is estimated in 1985 to be 39,760 ha, distributed as indicated in Table 24.

Table 24: Irrigation from Litani and Tributaries: 1985

	Area Irrigated (in ha) By surface water	By underground water	Total
Irrigation upstream of Qirawn	17,600	15,360	32,960
Irrigation downstream of Qirawn			
Qasmieh sector	3200	-	3200
model sector	300	-	300
other scattered sectors	1140	160	1300
Total	22,240	15,520	37,760

The total volume of water consumed varies from 240 to 260 Mcm.

The only two sectors that are irrigated collectively are: Qasmieh sector (60 Mcm); and the model sector of Sidon Jezzine (2 Mcm). Among the 60 Mcm assigned to Qasmieh sector, 50 Mcm come directly from the Litani, sent from Markabeh connecting

point, and 10 Mcm are pumped from sources located near the delta of the Litani (Ain Abou Abdallah), from a drilling station composed of 5 units with a total capacity of 1900 liter/sec (l/s) that was built in 1974. The station pumps the water from a dam-reservoir built at the beginning of the irrigation season. This pumped water is then sent through a canal South of Qasmieh to irrigate some 1000 to 1200 ha in the flat are of Tyre.

8. Utilization of the Litani's water for drinking purposes: 1972

The water of the Litani is used to provide drinking water for all of the southern region of the country, between the river itself and the border with Israel. Its management is insured by the Water Office of Jebel Amel. The sources of this water are shown in Table 25.

Table 25: Sources of Drinking Water

Source	Drinking water in Mcm		
	Winter	Summer	Total/year
Litani border	1.6	2.4	4.0
Ras el-Ain	0.5	1.1	1.6
Litani	0.5	0.7	1.2
Nabaa Chebaa	0.4	0.4	0.8
Marjayoun (wells)	0.2	0.2	0.4
Tyre city	0.5	0.6	1.1
Rashidia (Palestinian refugee camp)	0.5	0.6	1.1
Total			6.2

From this total volume of water only 1.2 Mcm came from the Litani. Two drilling stations located on the Litani at Jisr el-Qaaqaret transmit the water to the treating station located at Taibeh (650 m). The number of villages using this water is 65, while the number of subscribers to the water network is 20,000. The per capita consumption varies from 50 liters/day/person in the rural areas to 140 liters/day/person in Tyre and Rashidia. The water of the Litani is complemented by a certain number of lakes scattered in the bordering villages, and this water is used for domestic purposes.

Some 67 holding points with a capacity of about 350,000 cubic meters were recorded. A detailed list of these points will be presented as addendum.

9. Utilization of the Litani to produce hydroelectric power

The water of the Litani River that is stored in the Qirawn Dam has been used since the beginning of the 1960's to work the turbines of three electrical plants installed downstream of the dam. The volume of processed water varies from 266 Mcm/yr at Markabeh to 311 Mcm/yr at the Joun plant. The equivalent energy produced in the 3 plants is:

- at Markabeh plant: 1 kWh = 2.58 cu m of water
- at Awali plant: 1 kWh = 1.09 cu m
- at Joun plant: 1 kWh = 2.44 cu m

The total electricity produced by the three plants since they were built is recorded as in Table 26.

Table 26: Energy Production

Year	Energy Produced in 1000 mWh	Notes
1965	212	
1966	301	
1967	293	
1968	390	
1969	526	
1970	617	
1971	536	
1972	570	
1973	275	Dry Year
1974	575	
1975	540	
1976	450	
1977	640	
1978	740	
1979	300	Dry Year
1980	750	
1981	860	
1982	403	Israeli invasion
1983	751	
1984	727	
1985	198	until the end of March
1986	112	until the end of April

10. Planning the use of the Litani's water: Allocating water in the long run

10.1. Execution of the irrigation project of South Bekaa

The irrigation perimeter covers the area from Rayak in the North down to the Qirawn Dam in the south, on both sides of the Litani. The total irrigated area will reach 23,000 ha. This The perimeter is divided into three sections: left side of the Litani (8200 ha); right side of the Litani (9200 ha); and northern area (5600 ha). The total area of the perimeter is 23,000 ha.

On the left side of the river is Canal 900. At a length of 200 km, it carries 44 Mcm of water/yr. Its flow is 6 cu m/s. It receives 30 Mcm/yr from a drilling station located at the foot of Qirawn Dam; 12 Mcm/yr from other drilling plants in the area; and 2 Mcm/yr from the water surplus of Anjar-Hamsine sources.

On the right side the canal has 3 parts, with diameters varying between 700 and 900 mm. The flow rates vary between 380 l/s and 930 l/s. The total length of the canal is 14 km.

The sub-sector is supplied by water coming from: drilling batteries into the water tables (49 drilling points will be functioning between Tel Zroub and Kob Elias); and water from Anjar and Hamsine.

The northern sub-sector will be provided with water from a canal that will have 4 parts, with a diameter varying between 700 and 1100 mm and flow rates of 290 - 1500 l/s. Its total length will be 10 km. The canal will receive water from 12 drilling points into the water tables of Terbol and Barr-Elias and the sources of Anjar and Hamsine. Sixteen km of the canal have already been built, and part of the network of distribution (800 ha) was done in 1976. The project was stopped because of the troubles and unrest in the area (Israeli occupation, civil war).

10.2. Irrigation project of southern Lebanon

The project is intended to irrigate 30,000 ha of land in its final stage of realization, in the southern part of Lebanon. Priority has been given to the land located at 800 m of altitude, in the area of Nabatiya - Marjayoun and all the bordering area located south of the Litani. The volume of water needed is estimated to be 100 Mcm; it will be taken from Qirawn Dam (860 m altitude). During the first step of project execution 3 perimeters will be irrigated:

- Marjayoun sector: 2600 ha / 18 Mcm of water
- Nabatiya sector: 1600 ha / 11 Mcm
- sector South of Litani: 10,900 ha / 71 Mcm

The principal collecting canal will be 56 km long; the secondary will be 56 km. The distribution network will be put under "mechanical" pressure to allow irrigation by the sprinkling system. The project will be executed in a 10-year period of time according to the following schedule (Table 27).

Table 27: Schedule of Execution (Projected)

Year	Equipped Areas in ha	Irrigated Areas in ha
1980	1700	0
1984	8500	5100
1988	15,085	11,850
1992	15,085	15,085

10.3. Projects related to the hydrological development of the south

The dam of Khardale is expected to store the natural water contribution of the Litani, downstream of Lake Qirawn. Its storage capacity is 128 Mcm; the area of the basin is 4.2 sq km. This stored water should irrigate lands located between 300 and 500 meters of altitude (Nabatiya plateau) and the Qasmieh perimeter (coastal plain).

The dam at Bisri is to have a capacity of 53 Mcm. The stored water will be used to provide drinking water to the city of Beirut and to the area located north of Awali (Eqlim el-Kharraul).

11. History of the water distribution network in the bed of the Litani

11.1. Area of Bekaa (upstream of Qirawn)

A chronology of the water distribution network of this area includes the following events.

- 1930-1932: Sheikh Yaakoub and his group are given permission from the administration to use the water of the Anjar source to irrigate 200 to 300 ha. The total volume of this water taken through the Anjar canal reaches 45 Mcm during the 1931-39 period.

- 1939: Arrival of the Armenian refugees in the area of Anjar.

- 1940-42: Realization of an irrigation project of 800 ha for the Armenian refugees residing in Anjar.

- 1954-55: Beginning of pumping water from the Litani. Annual volume about 10 Mcm/year.

- 1958-59: Beginning of pumping water from the water tables of South Bekaa. Total volume: 50 Mcm/year.

- 1958-61: Qirawn dam is built.

- 1970-73: Large increase in the pumping of the water tables (year of weak rainfall). Volume pumped reached: 79 Mcm/year.

- 1975-1985: More increase in the pumping of the water tables. Volume reached 173 Mcm/year.

- 1975-1985: Relative slowdown and even stagnation in the quantities of water taken from the Litani and its tributaries. Average volume reached: 137 Mcm/year of which 107 Mcm is from the Litani and 30 Mcm is from its tributaries.

11.2. Litani downstream of Qirawn

- 1945-1956: Perimeter of Qasmieh enters into service. The total volume of water taken from the Litani before the building of the Qirawn Dam reaches 80 Mcm/yr.

- 1961-1975: Development of the pumping system on the water tables just before the delta of the river. (500 ha are irrigated).

12. **Water distribution and collection network**

12.1. The Qasmieh - Ras el-Ain perimeter

This system consists of a main canal and several branches. From the main point of water storage at Zrarye (29 m altitude) water is transmitted into the canal by gravity. The collection canal is an outdoor canal (surface canal), rectangular and trapezoidal, with a flow of 4.5 cu m/s. The dead head is 9 km long, ending in a partition into a north branch toward Sidon and a south branch toward Tyre. The north branch has a total length of 30 km, a total flow of 3.250 cu m/s, and irrigates an area of 2300 ha. The siphons have a length of 650 m, and the tunnels have a length of 2200 m. There are 290 collection points for water. The south branch has a total length of 9 km, a total flow of 1.250 cu m/s, and irrigates an area of 1000 ha. The siphons have a length of 40 m and the tunnels have a length of 600 m.

The southern branch of the canal of Ras el-Ain (source of Ras el-Ain) has a total length of 7 km, a total flow of 350 l/s, and irrigates a total area of 847 ha.

Hence, the total length of the two main perimeters is: 30 + 9 + 9 + 6 + 7 = 61 km.

12.2. Distribution network

The secondary distribution canals are built half on little stone walls and half directly on the ground. The tertiary canals are built in concrete slabs on which a small stone wall is built, often covered with cement.

According to results from a test sector in Itanye (25 ha), the distribution network density is 200 m/ha. That gives to the northern branch (Sidon) 460 km of distribution canals and 506 km of draining canals. For the south branch there are 200 km of distribution canals and 220 km of draining. At Ras el-Ain, the length of distribution canals is 170 km, and the length of draining canals is 181 km. Each secondary canal is provided, at its connecting point with the principal canal, with a certain proportion of the water flow. Over the diverse canals water is distributed to the beneficiaries on an individual turn system. One turn lasts 8 to 10 days at Ras el-Ain, 12 to 15 days at Tyre, and 18 to 20 days at Sidon (northern sector).

The individual turn for the water is given by an "irrigation command" to the users (called also right to water) to irrigate vegetables and bananas. It could be also given to those individuals who were not able to irrigate the totality of their land when the water was passing by (Addane). Agents of the government (water policemen) check the water sharing process along the canal. The cost of the water is calculated according to the number of duncem (1000 sq m) irrigated. The costs have changed over time as in Table 28.

Table 28: Water Costs (in Lebanese Pounds per Duncem)

Year	Cost level
1975	15
1977	25
1979	50
1981	100
1986	200

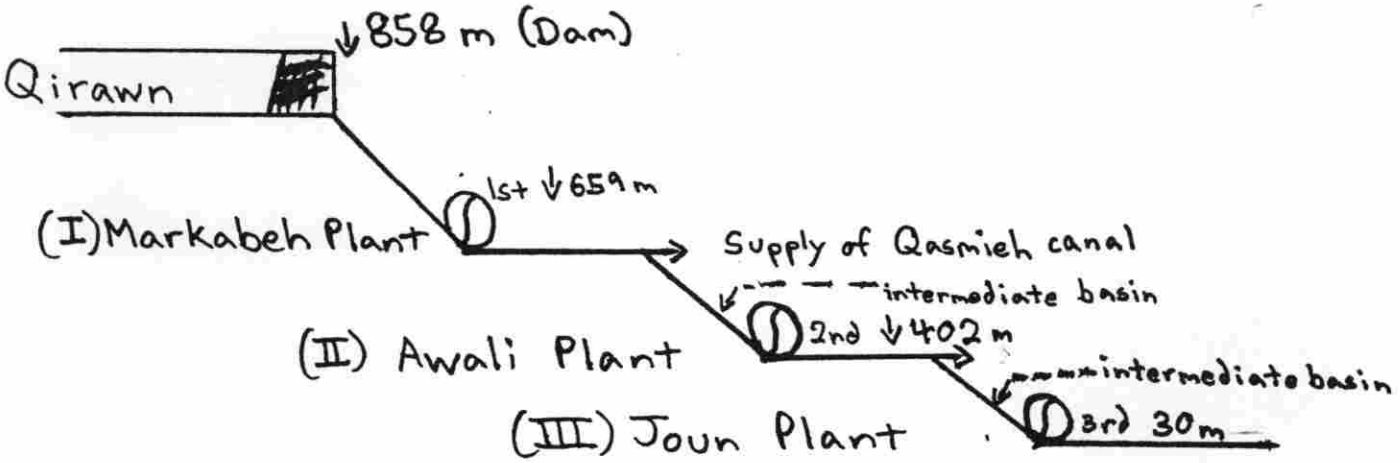
12.3. Condition of the canal network

It is generally believed to be bad; everywhere, one can see cracks that cause losses of water estimated to be 15-20% of the whole network. Usually, the management office of the perimeter doesn't intervene unless it is for the repair of the principal works.

13. History of the hydroelectric network

Three hydroelectric power stations have been built on the Litani. The first station, the Markabeh plant (Abdel-Aal) began operating in February 1962. Its capacity is 42,500 kWh, and the transformation coefficient is 0.42 kWh/cu m of water. The second station, Awali station (Paul Arcache plant) began operating in July 1965. Its capacity is 91,250 kWh, and the transformation coefficient is 0.92 kWh/cu m. The third station, Joun station (Charle Helou plant) began operating in October 1968. Its capacity is 60 kWh, and the transformation coefficient is 0.41 kWh/cu m.

In 1974 the total power produced in the three plants of the Litani represented 95% of the total quantity of energy produced in the country. Electricity of Lebanon is responsible for the management of the distribution network for the power produced by the plants of the Litani river. Other characteristics of the 3 plants (see diagram).



Currently, almost all the Qirawn water is used for the production of hydroelectricity, about 300 Mcm/yr on average.

The line for energy transport (71 KV) is composed of two major lines. The first, Markabeh - Awali, consists of 1 terne on horizontal layer: 17,581. The Awali - Beirut line 2 ternes on horizontal layer: 36,826.

- conducting sections: 366 square mm
- two control cables: 63 square mm in steel

14. Drinking water distribution network Jebel Amel source

This network provides drinking water for about 65 villages located between the Litani River and the southern border with Israel. Two pumping stations located on the Litani near Jisr Qaaqaiet pump water from the river to a main reservoir located at Taibeh (650 m of altitude). Their pumping capacity is 150-170 cu m/hr. The main tube has a diameter of 250 mm. The distribution network is comprised of 4 lines:

- Taibeh - Kfar - Kela - Deir Mimas;
- Taibeh - Markabeh - Meis el-Jebel - Blida;
- Taibeh - Shakra - Bint Jbeil; and
- Taibeh - Joya.

Since 1976 UNICEF has taken part in maintaining the network and fixing physical damage caused by the Israeli invasion. The following projects have been financed by this organization:

- installation of a new 10-inch diameter pipe connecting the pumping station to the main reservoir at Taibeh;
- construction of an electro-mechanical treatment station;
- drilling of another artesian well in the Marjayoun plain;
- building of water reservoirs at Qlaya - Bint - Jbeil - Markabeh;
- and repair of the reservoir and the network at Khiyam which were heavily damaged by the Israeli invasion of March 1978.

The predicted needs in drinking water for the area, for the year 2000, are estimated to be 20,000 cu m/day. That is almost 3.5 times the current consumption.

15. Physical damage due to the Israeli invasion and occupation of the region

There have been three invasions of the southern part of Lebanon since 1978, the most recent being in June 1982. The physical damages to the pumping equipment and the distribution network was substantial. There was total destruction of a part

(300 m) of the Zahrani siphon that carries water from Qasmieh toward Ghazieh sector (200 ha) near Sidon (July 1981). The result was that the irrigation process totally stopped for two months. Since then, this sector has received underground water from certain artesian wells, from which the Office of the Litani has signed contracts to buy water. The direct and indirect losses due to such a situation can be estimated at tens of millions of Lebanese pounds. There was almost total destruction of the pumping station of Qasmieh in July 1981, including the blowing up of the temporary dam, the destruction of three electrical transformers (250 KVA each), the partial destruction (65 m) of the siphon of Tyre carrying water by gravity from the dispatcher to the collecting canal (southern branch), and the destruction of three pumps at the station. The results were a general cutoff of electrical power for 45 days. The direct and indirect cost of such a loss reaches tens of millions of Lebanese pounds. The main collecting network was heavily damaged at several points, particularly at Adloun near the siphon of Abon el-Asouad at Ras el-Ain (Qana circle) and within 1 km of the South branch of Ras el-Ain.

The invasion of the region in 1982 caused human and material damage that is difficult to estimate. The installations of the Qasmieh perimeter were the most affected Damages to collective installations included: destruction of the new pumping station of Qasmieh (dam, transformers, and pumps); the bursting of one of the three water reservoirs of the Ras el-Ain source as well as a part of the collecting canal (dead head); bursting of a part of the main pipe that provides water to the distribution network of the model perimeter of Sidon - Jezzine; general cutoff of electrical power from 7 June to 25 July 1982, stopping all irrigation in the area; occupation of the buildings of the Litani in Sidon, Tyre, Qirawn, and Lebaa, during which important documents were stolen; and destruction of the station for pumping drinking water at Jebel Amel, which provides drinking water to all the area south of the Litani.

With respect to private installations, damages included: total destruction of some 30 pumping stations along the Qasmieh canal - Ras el-Ain; destruction of dozens of hectares of citrus and bananas located along the national road between Sidon and the south border in an effort to minimize the daily military operations carried out by the National Lebanese Resistance against the Israeli forces who were using this road; reduction of the total agricultural production of 1982 to one-half of its normal volume; and the loss of one-third of the total agricultural production during the three years of occupation. This last effect was essentially due to disturbances in the distribution market for goods, since the south was cut off from the northern part of the country, and also to the military operations.

Finally, a number of government buildings were occupied. It is recorded that many geological and hydrological maps were lost or stolen, as well as important reports and basic documents on the hydrology of southern Lebanon. However, the most important loss was related to the plunder of Qirawn warehouse in February 1984. The Israelis, occupying the South Bekaa, took all the pumping installations that had been stored at Qirawn since 1964. This equipment was provided by the League of Arab States to help pump water from Hasbani to the Lebanese territory in accordance with the decision of the Arab League concerning the diversion of the tributaries of the Jordan River.

The Israeli invasion and the civil war provoked a change in the structure of the private property system in the Qasmieh perimeter. Indeed, almost 50% of the land in that region used to belong to nonresident Christians in that sector. They have since sold their land to Muslim residents or immigrants. Another change of significance was the total halt of irrigation in the model sector of Sidon - Jezzine. Following the unrest that took place east of Sidon in May 1985, a large number of the Christian population left the area.

APPENDIX

1. **Tables**

Table 1: Management of the Stored Water of Qirawn (Capacity = 220 Mcm)

Year	Annual Rainfall (in Mcm)	Natural Cont. of Qirawn	Volume used downstream of Qirawn	Stored volume in Qirawn	Volume to be used	Allocated for drinking purposes for Beirut and South	Flowing from the dam of Qirawn
1939-40	646	480	122	220	242	20	166
40-41	856	550	122	220	263	15	239
41-42	633	649	122	220	293	20	359
42-43	706	616	122	220	283	15	336
43-44	618	506	122	220	250	20	264
44-45	756	586	122	220	274	15	272
45-46	516	440	122	220	252	21	192
46-47	547	395	130	220	228	21	105
47-48	729	434	122	220	228	15	131
48-49	783	635	102	220	309	15	299
49-50	561	460	125	220	256	21	245
50-51	554	252	135	220	220	31	2
51-52	712	501	122	220	248	15	129
52-53	804	651	102	220	295	15	349
53-54	811	739	102	220	295	15	499
54-55	464	308	130	220	220	23	122
55-56	657	435	122	220	229	31	93
56-57	518	337	122	220	220	30	60
57-58	426	306	130	216	216	31	0
58-59	456	262	135	161	161	31	0
59-60	300	206	142	94	94	31	0
60-61	408	257	142	94	94	31	0
61-62	532	366	125	199	202	21	0
62-63	702	432	122	220	228	15	100
63-64	611	454	122	220	257	20	150
64-65	620	440	122	220	248	20	159
65-66	632	332	122	220	220	20	92
66-67	805	657	92	220	295	15	300

Year	Annual rainfall (in Mcm)	Natural cont. of Qirawn	Volume used downstream of Qirawn	Stored volume in Qirawn	Volume to be used	Allocated for drinking purposes for Beirut and South	Flowing from the dam of Qirawn
67-68	626	621	122	220	284	20	372
68-69	1035	1006	92	220	295	15	735
69-70	650	414	122	220	222	20	234
70-71	568	513	122	220	278	21	167
71-72	486	388	130	220	245	21	112
72-73	388	218	142	191	191	31	0
Ave. 1939-70	633	476	121	209	240	21	193
Ave. 67/68-72/73	625	527	122	215	252	21	270

Source: UNDP/FAO, *Liban - Plan regional de developpement hydro-agricole*: Troisieme Partie: *Les ressources en eaux*. Developpement Hydro-agricole du Sud du Liban (Rome, 1977), p. 99.

Table 2: Distribution of Drinking Water in Southern Lebanon

Region	Litani-Border	Awali-Litani	Nahr Beirut Awali	City of Tyre	City of Sidon	Totals
Population	195,000	145,000	win. 323,000 sum. 442,000	13,000	58,000	win. 734,000 sum. 853,000
Distribution (in Mcm)						
Summer (7 mo.)	2.7	3.8	7.5	0.6	2.1	16.7
Winter (5 mo.)	1.3	1.6	5.4	0.5	1.1	9.9
Total	4.0	5.4	12.9	1.1	3.1	26.6
Losses	40-50%	35%	25%	35%	30%	35%
Losses l/pers./day	65	130	80	220	170	100
Sources	Ras el-Ain Litani Nabaa Chebaa Marjayoun well	Nabaa Tasse	Nabaa Safa Nabaa Barouq small springs and underground water	Nabaa Rashidia	Nabaa Kfaroua underground water well near Sidon	

Source: Office National du Litani - UNDP/FAO, *Alimentation en eau potable de Beyrouth et du Liban sud: Note d'information*, Projet de Developpement Hydro-agricole du Sud du Liban (n.p., January 1974), p. 16.

Table 3: Future Needs in Drinking Water for Southern Lebanon

Region	Needs in Mcm Summer	Winter	Total	Population by the Year 2000
Litani-Border	14.0	7.0	21.0	390,000
Awali-Litani	10.4	5.2	15.6	290,000
Nahr Beirut-Awali	26.3	9.8	36.1	Win. 550,000 Sum. 730,000
City of Tyre	1.1	0.6	1.7	26,000
City of Sidon	4.2	2.1	6.3	116,000
Totals	56.0	24.7	80.7	Win. 1,400,000 Sum. 1,600,000

Source: Office National du Litani - UNDP/FAO, *Alimentation en eau potable de Beyrouth et du Liban sud: Note d'information*, Projet de Developpement Hydro-agricole du Sud du Liban (n.p., January 1974).

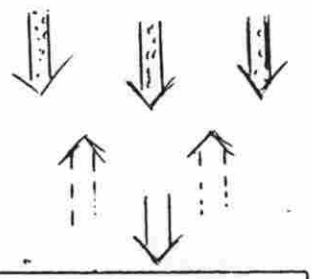
Table 4: Changes in Needs for Drinking Water in Greater Beirut

	Situation in 1970	Situation in 1980	Future Situation in the Year 2000
Population	900,000	1,130,000	1,800,000
Individual need	140 l/pers./day	180 l/pers./day	245 l/pers./day
Losses	35%	18%	18%
Needs with losses	190,000 cub. m/day	248,600 cub. m/day	540,000 cub. m/day
(in Mcm)	68 Mcm/year	90 Mcm/year	195 Mcm/year

Source: Office National du Litani - UNDP/FAO, *Alimentation en eau potable de Beyrouth et du Liban sud: Note d'information*, Projet de Developpement Hydro-agricole du Sud du Liban (n.p., January 1974).

FIGURE-I-

BILAN HYDROLOGIQUE General du LIBAN



Pluies BRUTE 9 200 Mm³

Evapo-TranspIRation reelle du Terrain 4400 Mm³

(Chiffres en millions de m³. d'eau)

Pluie nette = 4800
52 % (pluie brute

63 %

37 %

Ecoulement souterrain 3800

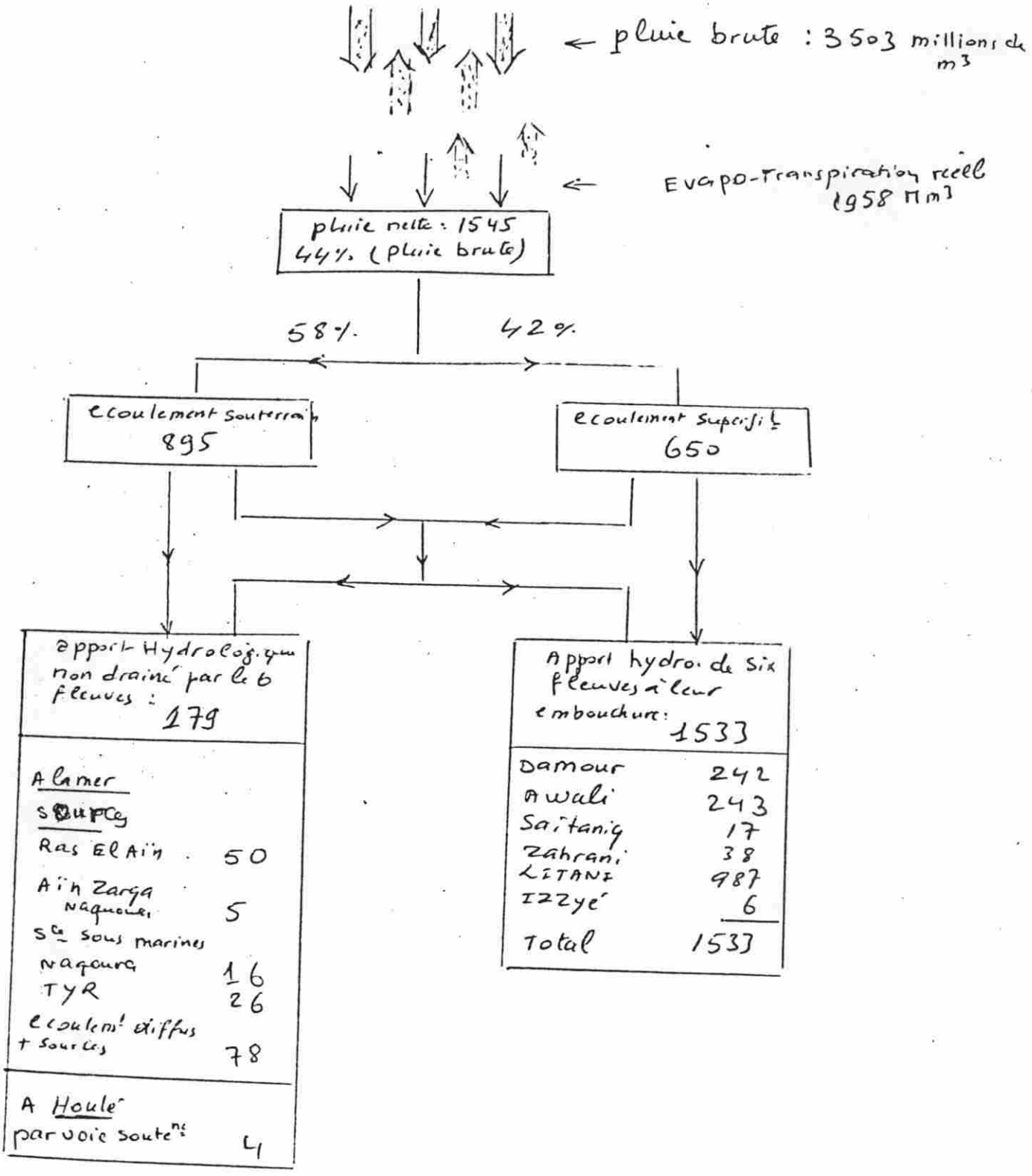
Ecoulement superf.le 1800

Apport Hydrolo. non drainé par les 18 fleuves : 800	
A la mer :	
Source Hab	35
Ras El Ain	50
Ain Zarqa (Nagoura)	5
Sces sous-marines	~~15~~
Chekka	75
Nagoura	16
TYR	26
Ecoulement diffus	178
Vers Houlé par voie souterraine	175
Vers la SYRIE (superficielle + souterraine)	140

Apport hydrolog. des 18 fleuves à leur embouchure : 3900	
Fleuves	Apport Naturel
Kebir	129 (partie Liban ss)
Estouène	56
Azrqa	43
Bared	254
Abou Ali	248
Assfour	8
Jaouz	65
Ibrahim	381
Kelb	370
Beyrouth	173
Damour	242
Awali	243
Saidany	17
Zahrani	38
Litani	987
Izzye	6
Hasbani	145
ORonte	490

FIGURE II.

BILAN HYDROLOGIQUE DU SUD DU LIBAN



3. Rainfall statistics by month and by year in Lebanon.
32 recording stations, period covering 7 to 95 years.

Monthly and Yearly Rainfall in mm

(1) Sampling station: Batroun, North Lebanon
Altitude: 20 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
39-40	0	0	120	309	313	205	76	62	14	0	0	0	1099
40-41	0	79	205	347	84	78	150	17	0	0	0	0	960
41-42	10	63	60	335	288	138	175	12	1	2	1	0	1085
42-43	0	201	164	83	497	115	166	84	4	0	0	0	1314
43-44	2	89	62	158	266	139	156	36	19	0	0	0	927
44-45	0	12	270	192	272	207	108	13	4	0	0	0	1078
45-46	0	4	173	155	82	327	99	6	123	0	0	0	969
46-47	11	64	0	179	522	79	31	18	48	0	0	0	952
47-48	11	47	129	29	215	326	148	112	29	0	0	0	1051
48-49	15	14	243	359	306	305	177	241	0	0	0	0	1660
49-50	6	9	26	217	144	117	108	22	84	0	0	0	733
50-51	20	61	96	199	205	78	63	72	1	0	0	0	796
51-52	0	146	170	398	101	205	105	21	1	0	0	0	1154
52-53	0	28	76	141	294	267	229	54	2	0	0	0	1091
53-54	0	9	278	117	351	249	41	67	16	0	0	0	1127
54-55	5	14	208	188	108	63	158	49	34	0	0	0	828
55-56	0	48	200	220	272	259	82	5	70	0	0	0	1057
56-57	0	19	40	219	147	138	126	38	19	11	7	0	760
57-58	2	28	142	332	458	48	105	6	2	0	0	0	1123
58-59	41	48	14	187	392	123	60	34	8	0	0	0	908
59-60	34	34	167	107	176	72	138	43	3	0	0	0	774
60-61	132	13	244	81	194	316	164	240	40	0	0	0	1424
61-62	10	-	-	-	176	184	9	98	79	0	0	0	-
62-63	0	44	3	375	205	126	84	54	26	0	0	0	917
63-64	28	162	171	105	81	291	174	19	37	0	0	0	1067
64-65	7	1	293	51	197	114	78	112	16	2	0	7	878
65-66	6	197	78	188	173	118	103	4	3	0	0	0	864
66-67	20	58	56	240	220	188	232	23	30	0	0	0	1071
67-68	9	94	92	164	282	63	80	27	4	0	0	0	815
68-69	6	60	234	301	509	46	214	50	15	0	0	0	1428
69-70	0	38	87	159	190	97	171	38	21	0	0	0	810
70-71	0	-	-	210	134	247	71	197	0	0	0	0	-

(2) Sampling station: Ghazir
Altitude: 390 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
49-50	40	2	30	227	235	119	125	34	62	0	0.3	0	874
50-51	14	110	109	192	129	152	88	80	5	0	0	0	877
51-52	6	115	135	297	140	274	150	91	2	0	0	7	1216
52-53	0	29	148	147	233	290	226	29	2	0	0	0	1104
53-54	2	6	269	113	326	236	68	125	13	0	0	0	1157
54-55	0	9	235	201	44	81	159	73	22	0	0	0	824
55-56	10	27	285	204	257	107	168	39	81	0	0	0	1158
56-57	1	17	54	190	203	102	182	58	30	7	1	0	845
57-58	3	73	124	231	371	47	91	42	1	0	0	0	983
58-59	49	47	5	145	294	134	77	27	24	6	0	0	807
59-60	79	48	71	49	231	67	180	75	17	0	0	0	802
60-61	11	19	80	69	240	280	161	4	18	0	0	0	882
61-62	23	5	114	312	137	183	23	133	2	0	0	0	931
62-63	6	78	6	357	358	230	129	83	6	3	0	0	1249
63-64	6	76	130	176	124	333	183	16	54	5	0	0	1096
64-65	16	0	288	73	229	174	140	107	12	1	0	0	1039
65-66	0	171	104	293	250	135	185	4	5	0	0	0	1148
66-67	49	89	12	337	322	288	382	29	33	0	0	0	1541
67-68	0	91	151	321	482	187	127	20	12	0	0	0	1390
68-69	0	47	151	528	584	64	292	57	17	0	0	0	1739
69-70	0	61	159	158	198	152	222	66	47	0	0	0	1063
70-71	7	137	92	218	138	324	167	355	3	0	0	0	1141

(3) Sampling station: Suq Mikayel
Altitude: 70 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
43-44	0	50	50	102	312	156	155	36	12	0	0	0	872
44-45	1	22	232	183	266	137	107	41	14	12	0	0	1015
45-46	2	10	134	196	67	322	173	22	123	0	0	0	1049
46-47	1	44	3	132	429	96	52	39	83	1	0	0	878
47-48	18	22	185	79	170	294	193	68	48	0	0	11	1086
48-49	13	16	201	213	242	269	173	140	1	0	0	0	1266
49-50	21	5	10	196	232	116	115	24	66	0	0	0	784
50-51	12	74	61	202	157	130	63	66	5	0	0	0	774
51-52	12	146	150	291	137	245	128	30	1	0	0	0	1140
52-53	0	23	127	150	218	275	220	33	3	0	0	0	1049
53-54	1	3	264	104	248	205	55	91	9	0	0	0	986
54-55	0	13	140	230	21	74	139	79	29	0	0	0	725
55-56	0	19	254	178	256	98	124	10	71	0	0	0	1010
56-57	0	2	22	151	121	101	126	19	17	3	0	0	563
57-58	1	8	103	175	304	29	54	25	0	0	0	0	699
58-59	21	32	9	70	250	76	50	18	24	1	1	0	552
59-60	74	23	38	41	132	32	113	49	3	0	0	0	505
60-61	4	22	79	95	176	229	123	4	5	0	0	0	738
61-62	17	2	114	269	143	149	15	91	3	0	0	0	802
62-63	6	82	1	236	306	169	76	60	4	8	0	0	942
63-64	18	110	96	105	138	248	103	10	41	0	0	0	869
64-65	18	0	269	58	136	84	93	91	11	1	0	0	761
65-66	0	153	53	249	174	81	127	1	4	0	0	0	841
66-67	20	36	6	222	248	187	285	35	25	0	0	0	1064
67-68	3	76	135	213	406	63	70	11	1	0	0	0	978
68-69	0	58	141	350	509	65	203	21	16	0	0	0	1365
69-70	0	66	138	127	171	90	207	44	22	0	0	0	864
70-71	2	86	97	153	110	262	107	220	1	0	0	2	1040

(4) Sampling station: Barbange
Altitude: 510 m

Year	59-60	60-61	61-62	62-63	63-64	64-65	65-66	66-67	67-68
Sep	29.9	0.8	16.7	0.0	0.3	0.2	0.0	25.0	6.1
Oct	22.7	31.3	12.0	67.6	123.3	0.0	161.9	99.5	112.2
Nov	72.7	107.4	82.6	0.3	129.7	351.3	148.2	37.9	144.7
Dec	68.2	107.7	301.0	258.6	159.7	60.3	291.4	403.4	314.4
Jan	177.0	232.3	213.6	313.7	132.1	231.8	220.2	392.9	612.3
Feb	86.5	203.9	252.7	253.1	454.2	245.2	178.1	326.0	175.0
Mar	188.3	199.3	50.6	232.7	235.8	116.4	197.6	454.4	59.0
Apr	123.3	16.9	102.1	107.6	36.4	141.9	8.1	73.2	11.4
May	6.5	17.9	13.2	15.7	61.8	16.7	12.5	57.2	34.1
Jun	0.0	0.0	0.0	0.3	0.0	1.0	0.0	0.0	0.4
Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aug	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5
Total	794.5	917.5	1044.5	1282.8	1321.3	1164.8	1218.0	1874.5	1478.1

(4) Continued

Year	68-69	69-70	70-71
Sep	0.0	0.3	3.0
Oct	51.6	134.9	68.0
Nov	196.6	180.1	57.0
Dec	472.3	194.1	260.0
Jan	605.7	197.9	107.0
Feb	78.3	144.9	313.0
Mar	290.2	313.5	224.0
Apr	47.1	93.7	40.7
May	19.3	23.6	5.0
Jun	0.0	0.0	1.0
Jul	0.0	0.0	0.0
Aug	0.0	0.4	0.0
Total	1761.1	1283.0	1445.0

(5) Sampling station: American University of Beirut (A.U.B.)
Altitude: 34 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
1876-77	6	63	274	111	163	400	124	65	3	0	0	6	1215
77-78	6	100	161	271	279	182	103	43	15	69	0	0	1230
78-79	21	17	0	111	79	59	171	14	20	0	0	0	490
79-80	3	86	116	340	237	107	91	54	12	0	0	0	1055
80-81	26	13	27	246	34	240	136	75	0	3	0	0	798
81-82	19	35	141	146	125	259	34	159	65	2	0	0	983
82-83	0	80	79	161	324	235	84	23	9	0	0	7	1001
83-84	0	54	389	164	270	154	93	42	14	0	0	1	1180
84-85	26	49	111	6	263	106	42	87	1	10	0	1	701
85-86	18	2	99	176	148	250	210	15	11	0	0	0	928
86-87	13	56	98	138	226	65	43	9	10	0	0	0	658
87-88	4	0	78	258	154	169	70	131	4	23	0	0	891
88-89	1	34	183	200	176	73	66	21	3	7	0	0	764
89-90	0	1	119	126	188	103	38	42	0	0	0	0	616
90-91	5	11	295	326	184	221	74	34	25	0	0	0	1176
91-92	62	22	91	204	201	111	102	58	46	0	0	0	896
92-93	0	68	211	100	379	140	215	47	0	0	0	0	1161
93-94	1	97	70	223	177	122	117	82	20	22	0	0	931
94-95	0	8	174	264	26	35	102	85	8	1	0	0	703
95-96	4	187	48	157	269	183	81	60	8	0	0	0	999
96-97	7	52	174	248	277	172	122	34	15	0	0	0	1100
97-98	0	76	137	256	80	109	86	3	46	0	0	0	792
98-99	0	4	121	154	190	172	82	51	14	2	0	0	789
1899-1900	0	39	106	225	192	245	121	7	26	1	0	0	962
1900-1901	2	71	37	226	218	3	30	32	65	0	0	0	681
01-02	0	18	92	167	298	60	86	6	0	0	0	0	782
02-03	21	53	254	322	176	226	85	6	0	0	0	0	1144
03-04	0	6	126	156	162	113	100	44	19	0	0	0	728
04-05	0	144	195	239	160	127	123	53	49	1	0	0	1090
05-06	5	63	53	241	165	49	90	103	61	4	0	0	834
06-07	0	34	125	126	195	211	218	37	7	0	0	0	953
07-08	8	25	42	151	136	145	98	38	17	9	0	0	669
08-09	0	2	199	262	149	113	44	40	1	0	0	0	810
09-10	9	207	179	173	197	49	241	30	13	0	0	0	1098
10-11	9	115	119	147	163	181	163	126	33	0	0	0	1057
11-12	7	137	80	277	214	116	53	23	30	0	12	0	949
12-13	0	161	180	242	179	124	59	45	2	1	0	0	992
13-14	4	46	93	248	258	49	124	108	13	2	0	0	949
14-15	0	27	317	130	73	154	99	75	1	0	0	0	877
15-16	0	20	187	59	183	126	109	175	0	0	0	0	869
16-17	12	12	30	185	284	180	117	9	9	0	0	0	838
17-18	6	24	53	215	263	158	144	14	36	1	0	0	921
18-19	38	108	131	304	152	251	56	25	21	1	0	0	1087
19-20	0	0	118	244	279	176	92	39	3	0	0	2	952
20-21	2	33	103	82	99	155	54	35	4	10	0	1	575
21-22	4	3	54	333	266	163	52	18	7	0	0	0	900
22-23	0	1	177	174	187	132	128	74	28	0	0	0	922
23-24	11	24	27	140	232	215	32	0	3	19	0	0	701
24-25	0	84	202	152	187	43	38	48	2	24	0	0	780
25-26	7	44	27	215	276	207	116	103	34	0	3	0	1031

A. U. B. continued

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
26-27	0	1	21	288	130	196	47	109	4	0	0	0	789
27-28	0	150	32	57	112	355	41	51	5	0	0	0	757
28-29	0	11	145	208	229	381	30	61	4	7	0	0	1080
29-30	4	29	100	213	118	158	15	51	1	0	0	0	689
30-31	6	6	125	188	183	251	72	37	5	3	0	0	876
31-32	9	14	53	172	102	125	30	11	0	0	0	0	515
32-33	0	3	89	12	98	76	73	35	8	0	0	0	393
33-34	12	70	14	105	113	231	33	26	9	2	0	0	614
34-35	0	14	19	303	213	223	82	421	0	0	0	0	976
35-36	6	72	251	111	88	194	53	73	26	0	0	0	873
36-37	8	17	279	182	160	72	35	30	37	0	0	0	821
37-38	0	202	170	123	338	192	97	36	37	6	0	0	1193
38-39	25	1	280	114	173	195	170	58	1	4	0	1	1021
39-40	0	0	181	196	266	147	98	21	15	0	0	0	924
40-41	10	41	240	184	99	74	117	17	0	1	0	0	783
41-42	17	38	52	260	245	76	173	6	18	2	0	1	887
42-43	0	143	124	70	416	110	136	116	11	0	0	0	1126
43-44	2	33	39	195	222	155	116	32	22	0	0	0	814
44-45	1	36	330	179	190	181	104	39	14	3	0	0	1077
45-46	0	4	90	191	115	250	143	14	88	0	0	0	895
46-47	20	42	8	176	405	95	42	20	22	3	0	0	832
47-48	2	58	254	55	192	284	200	58	48	0	0	1	1150
48-49	26	9	178	234	288	231	100	132	0	0	0	0	1200
49-50	22	10	17	240	169	139	105	8	71	0	0	0	780
50-51	3	91	45	201	154	78	59	55	4	0	0	0	691
51-52	18	86	272	280	120	202	120	37	0	0	0	0	1133
52-53	1	23	137	170	234	202	242	43	10	0	0	0	1061
53-54	2	8	224	129	248	184	49	116	9	0	0	0	968
54-55	0	22	181	145	81	74	106	88	42	0	0	0	739
55-56	0	26	154	219	210	125	112	4	51	0	0	0	900
56-57	4	11	29	121	116	123	175	45	43	6	8	0	681
57-58	4	43	144	227	354	24	39	18	2	3	0	0	858
58-59	15	48	22	64	310	81	50	36	17	5	2	0	649
59-60	23	56	116	95	154	29	118	36	2	0	0	0	630
60-61	20	29	205	51	163	268	93	3	16	0	0	0	848
61-62	7	6	77	227	178	192	13	58	7	0	0	0	766
62-63	0	138	5	286	260	153	70	100	70	0	0	0	1082
63-64	22	95	126	135	97	320	91	21	54	0	0	0	960
64-65	2	0	232	101	152	111	103	84	19	4	0	2	809
65-66	0	152	37	246	186	121	107	1	30	0	0	0	878
66-67	14	34	81	254	229	192	274	27	15	0	0	0	1121
67-68	24	113	202	189	321	71	42	12	4	1	0	0	978
68-69	2	60	221	418	689	41	142	11	19	0	0	0	1600
69-70	2	40	135	121	145	91	209	44	19	0	0	0	805
70-71	1	57	93	169	191	225	77	207	0	1	0	0	1021

(6) Sampling station: Beirut Airport

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
53-54	1	0	137	82	134	128	33	57	2	0	0	0	571
54-55	5	14	95	116	39	50	72	45	15	0	0	0	446
55-56	0	19	97	131	99	55	80	4	42	0	0	0	527
56-57	0	1	21	121	91	72	155	27	21	10	5	0	519
57-58	1	43	74	125	127	14	19	7	0	0	0	0	410
58-59	7	41	12	71	188	63	37	12	9	0	0	0	440
59-60	34	16	53	63	126	34	124	28	4	0	0	0	482
60-61	18	12	101	31	171	210	82	16	7	0	0	0	648
61-62	3	4	66	135	219	88	7	47	4	0	0	0	573
62-63	0	93	0	168	174	125	106	42	82	0	0	0	810
63-64	5	83	114	120	75	248	144	14	38	0	0	0	841
64-65	2	0	315	77	190	116	92	90	2	0	5	0	896
65-66	0	98	37	275	165	143	87	8	18	0	0	0	831
66-67	9	43	56	249	252	173	263	42	82	0	0	0	1115
67-68	2	38	114	218	259	71	48	30	7	3	0	9	798
68-69	2	40	196	324	641	55	164	19	19	0	0	0	1460
69-70	3	43	108	105	229	114	236	65	25	0	0	0	928
70-71	0	53	104	170	120	246	93	230	21	1	0	2	1021

(7) Sampling station: Ketermaya Eqlim el-Kharrub
Altitude: 380 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	0	0	304	78	143	84	108	75	0	0	0	0	792
65-66	0	137	24	244	150	104	73	0	0	0	0	0	732
66-67	8	21	32	213	174	179	250	24	40	0	0	0	941
67-68	0	39	78	171	224	42	30	50	38	0	0	0	672
68-69	0	46	-	-	548	45	142	23	10	0	0	0	-
69-70	1	63	77	111	185	101	159	86	8	0	0	0	791
70-71	0	39	88	119	118	200	60	225	0	0	0	0	849

(8) Sampling station: Sidon
Altitude: 5 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
62-63	0	37	5	225	127	132	67	37	22	0	0	0	652
63-64	0	44	72	115	122	205	109	13	27	0	0	0	707
64-65	0	0	268	72	155	80	82	42	0	0	0	0	699
65-66	0	67	12	224	122	87	59	1	0	0	0	0	572
66-67	4	30	27	183	156	180	171	11	12	0	0	0	774
67-68	0	55	60	-	-	-	-	-	-	-	-	-	-
68-69	0	-	-	287	581	34	135	13	16	0	0	0	-
69-70	1	108	82	112	140	111	147	16	8	0	0	0	735
70-71	0	80	100	96	121	222	-	-	-	0	0	0	-

(9) Sampling station: Sfaray, Pilot sector
Altitude: 570 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
61-62	0	8	140	263	144	205	19	33	0	0	0	0	732
62-63	0	47	0	349	262	191	138	93	18	0	0	0	1098
63-64	0	98	64	105	160	396	190	11	54	0	0	0	1078
64-65	0	0	250	85	150	102	102	92	0	0	0	0	781
65-66	0	79	50	254	175	120	112	7	0	0	0	0	798
66-67	0	56	44	272	304	249	270	37	37	0	0	0	1270
67-68	0	69	80	223	338	85	72	52	12	0	0	0	931
68-69	0	67	118	418	576	47	265	43	3	0	0	0	1537
69-70	0	84	166	128	143	112	224	64	0	0	0	0	921
70-71	0	24	24	135	108	248	95	387	0	0	0	0	1021

(10) Sampling station: Deir Zahrani
Altitude: 450 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	0	0	357	93	232	162	65	88	2	0	0	0	1000
65-66	0	65	43	192	209	121	75	12	0	0	0	0	717
66-67	27	-	-	-	271	-	287	-	-	0	0	0	-
67-68	0	15	100	244	348	81	23	9	8	0	0	0	828
68-69	0	3	167	436	518	100	286	66	27	0	0	0	1603
69-70	0	83	143	201	439	109	268	86	0	0	0	0	1329
70-71	0	22	94	143	101	298	94	309	0	0	0	0	1061

(11) Sampling station: Ain-Ebel, Southern frontier

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
59-60	20	22	45	28	200	35	162	40	0	0	0	0	552
60-61	0	0	122	65	127	221	61	34	5	0	0	0	635
61-62	2	8	58	286	200	172	16	28	5	0	0	0	775
62-63	0	40	0	262	220	122	97	82	10	0	0	0	833
63-64	0	63	95	148	102	270	140	8	26	0	0	0	852
64-65	3	0	232	79	172	142	75	76	3	0	0	0	780
65-66	0	41	35	104	161	90	112	5	1	0	0	0	547
66-67	10	38	37	234	183	134	185	10	32	0	0	0	861
67-68	0	21	88	172	381	57	23	32	17	0	0	0	789
68-69	0	39	177	345	446	27	242	35	0	0	0	0	1310
69-70	0	71	133	106	175	85	193	37	4	0	0	0	804
70-71	6	12	47	103	95	291	86	251	0	0	0	0	885

(12) Sampling station: Insariya, Southern coastal frontier
Altitude: 160 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	0	0	218	80	196	69	37	51	0	0	0	0	651
65-66	0	48	30	161	156	99	60	2	0	0	0	0	556
66-67	22	49	38	167	173	158	134	12	30	0	0	0	783
67-68	0	8	95	124	130	28	8	31	2	0	0	0	426
68-69	0	92	181	426	435	22	91	25	4	0	0	0	1276
69-70	4	59	71	90	112	56	157	15	0	0	0	0	564
70-71	0	67	117	112	94	227	78	157	0	0	0	0	852

(13) Sampling station: Duweir
Altitude: 380 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
61-62	0	20	60	285	122	196	22	13	5	0	0	0	723
62-63	0	61	8	365	275	159	109	72	24	0	0	0	1073
63-64	18	58	75	144	72	330	159	109	72	24	0	0	946
64-65	0	0	322	144	173	135	56	73	1	0	0	0	874
65-66	0	82	56	184	181	134	113	8	0	0	0	0	758
66-67	22	48	31	189	224	215	214	22	14	0	0	0	779
67-68	1	24	85	163	287	84	38	25	11	0	0	0	718
68-69	0	35	167	426	518	53	148	27	8	0	0	0	1382
69-70	1	87	84	110	193	97	278	24	5	0	0	0	879
70-71	0	38	97	130	98	239	87	283	0	0	0	0	977

(14) Sampling station: Nabatiya
Altitude: 410 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	0	0	253	103	200	166	55	105	3	0	0	0	884
65-66	0	92	48	177	200	117	111	20	0	0	0	0	765
66-67	39	35	57	251	198	176	230	31	12	0	0	0	1023
67-68	0	57	80	183	329	79	19	5	8	0	0	0	760
68-69	0	14	160	437	447	36	154	36	3	0	0	0	1287
69-70	0	39	67	125	192	100	214	28	9	0	0	0	774
70-71	4	23	86	121	91	239	77	308	0	1	0	0	1001

(15) Sampling station: Tyre
Altitude: 5 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	0	0	-	63	144	64	46	25	0	0	0	0	342
65-66	0	68	10	80	185	115	64	0	0	0	0	0	522
66-67	30	34	28	230	140	110	148	16	18	0	0	0	754
67-68	0	-	-	323	-	-	-	-	-	-	-	-	-
68-69	5	92	194	389	472	38	98	13	2	0	0	0	1304
69-70	0	66	135	64	119	96	101	7	7	0	0	0	595
70-71	4	22	94	110	152	196	42	185	0	0	0	0	705

(16) Sampling station: Kana
Altitude: 300 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	0	0	193	70	118	62	141	0	0	0	0	0	686
65-66	0	55	15	99	116	113	103	5	1	0	0	0	507
66-67	7	41	108	221	140	126	134	12	10	0	0	0	800
67-68	0	70	63	153	206	60	13	11	7	0	0	0	533
68-69	0	41	-	217	347	158	106	40	-	0	0	0	-
69-70	0	81	90	-	468	-	165	-	-	0	0	0	-
70-71	0	-	-	110	102	163	-	-	-	-	-	-	-

(17) Sampling station: Qlayat (Resrouan)
Altitude: 1050 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	7	0	407	58	273	231	162	169	49	5	0	0	1358
65-66	0	171	97	308	240	214	208	11	11	0	0	0	1259
66-67	32	127	27	432	396	308	410	84	34	0	0	0	1849
67-68	10	110	173	376	392	133	113	11	28	0	0	0	1344
68-69	0	87	189	487	716	99	390	90	22	0	0	0	2075
69-70	0	98	146	210	237	133	290	86	14	0	0	0	1211
70-71	1	69	78	290	140	336	214	451	11	0	0	0	1590

(18) Sampling station: Dahr el-Beidar
Altitude: 1510 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
52-53	0	13	150	3	249	476	440	60	10	0	0	0	1615
53-54	0	15	276	188	614	377	124	200	0	0	0	0	1794
54-55	0	3	124	191	50	169	310	125	31	0	0	0	1003
55-56	1	33	235	248	259	193	148	9	116	0	0	0	1242
56-57	0	40	93	236	231	88	131	51	63	19	0	0	952
57-58	15	39	100	224	259	40	135	51	30	0	0	0	893
58-59	10	25	9	158	246	170	120	46	42	10	0	0	836
59-60	20	28	66	92	226	68	236	85	10	1	0	0	832
60-61	0	25	139	101	227	158	160	24	8	0	0	0	842
61-62	0	11	178	391	154	370	73	54	2	0	0	0	1235
62-63	0	66	2	433	403	318	273	187	22	0	0	0	1704
63-64	21	124	117	149	191	424	298	57	71	0	0	0	1542
64-65	1	0	435	63	284	300	90	157	13	6	0	0	1348
65-66	0	189	178	426	241	192	197	9	17	-	0	0	1448
66-67	9	94	31	494	405	446	514	131	104	0	0	0	2229
67-68	1	140	175	427	566	146	97	22	25	0		3	1601
68-69	0	69	244	658	667	127	431	151	26	0	0	0	2374
69-70	1	74	121	197	279	147	303	105	14	0	0	0	1240
70-71	1	76	60	246	95	419	186	461	1	1	0	0	1125

(19) Sampling station: Beit Eddine Shouf
Altitude: 880 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
40-41	-	49	194	46	236	96	151	25	0	0	0	0	796
41-42	0	43	19	427	473	191	220	29	0	0	0	0	1402
42-43	0	136	237	5	509	168	247	213	0	0	0	0	1514
43-44	0	6	24	131	492	214	192	112	36	0	0	0	1207
44-45	0	30	297	174	364	270	170	36	28	0	0	0	1369
45-46	0	4	169	257	83	401	204	19	196	0	0	0	1333
46-47	0	93	2	139	529	91	48	52	62	0	0	0	1016
47-48	6	6	128	89	265	447	227	85	49	0	0	0	1302
48-49	0	7	253	214	259	269	196	166	0	0	0	0	1364
49-50	6	0	11	226	258	46	178	30	0	0	0	0	814
50-51	9	82	71	218	240	120	115	146	9	0	0	0	1007
51-52	0	158	115	395	126	275	186	37	0	0	0	0	1292
52-53	0	20	154	193	281	339	322	24	0	0	0	0	1332
53-54	0	0	266	160	362	343	86	197	7	0	0	0	1360
54-55	0	0	107	162	50	152	179	128	28	0	0	0	806
55-56	0	56	232	233	273	167	152	18	105	0	0	0	1237
56-57	0	6	79	188	287	113	163	27	69	6	2	0	940
57-58	0	36	93	296	395	27	90	32	12	0	0	0	981
58-59	10	50	12	165	219	153	73	24	29	24	1	0	761
59-60	13	44	82	79	204	87	195	81	6	0	0	0	784
60-61	0	10	156	81	190	260	181	74	14	0	0	0	965
61-62	0	9	100	236	162	218	31	17	5	0	0	0	778
62-63	0	99	3	355	286	232	192	144	16	0	0	0	1327
63-64	0	66	49	176	155	327	270	40	47	0	0	0	1129
64-65	0	0	318	61	213	211	104	112	7	15	0	0	1041
65-66	0	104	104	298	207	125	139	9	2	0	0	0	987
66-67	4	15	40	382	297	287	372	67	61	0	0	0	1525
67-68	1	47	110	257	350	117	74	27	5	0	0	0	987
68-69	0	62	141	493	568	75	283	58	0	0	0	0	1680
69-70	0	67	106	132	234	132	247	58	15	0	0	0	1042
70-71	20	28	73	208	103	322	137	371	0	0	0	0	1189

(20) Sampling station: Rihan
Altitude: 1090 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
66-67	1	20	15	276	256	239	209	49	81	0	0	0	1094
67-68	0	5	110	273	292	108	62	33	5	0	0	0	883
68-69	0	28	315	337	561	77	234	29	3	0	0	0	1584
69-70	0	-	-	-	219	-	-	21	4	0	0	0	-
70-71	0	29	33	159	136	343	97	420	0	1	0	0	1218

(21) Sampling station: Hermel, Bekaa
Altitude: 700 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
31-32	0	0	6	40	34	50	28	29	0	0	0	0	187
32-33	0	4	8	2	58	35	34	22	0	0	0	0	163
33-34	1	5	9	56	57	32	3	13	2	0	0	0	177
34-35	0	15	6	42	83	60	6	25	0	0	0	0	237
35-36	0	33	41	32	31	76	19	0	0	0	0	0	232
36-37	0	0	64	68	40	31	7	31	10	0	0	0	250
37-38	0	42	29	13	69	68	31	2	5	0	0	0	259
38-39	0	6	30	37	29	57	54	28	0	0	0	0	241
39-40	0	1	50	45	123	27	39	27	0	0	0	0	312
40-41	0	10	31	66	75	21	40	5	0	0	0	0	248
41-42	0	4	12	103	75	17	62	1	4	0	0	0	278
42-43	0	29	16	37	58	77	70	25	0	0	0	0	312
43-44	0	0	9	27	170	52	48	56	36	0	0	0	398
44-45	0	2	46	58	59	53	7	16	20	0	0	0	261
45-46	0	6	17	6	30	77	21	7	28	0	0	0	192
46-47	7	5	6	10	89	11	42	7	9	0	0	0	168
47-48	4	4	8	50	22	57	50	72	31	0	0	0	300
48-49	0	5	15	104	11	61	30	27	0	0	0	0	252
49-50	0	5	0	66	59	56	32	40	6	0	0	0	264
50-51	0	23	12	28	27	24	7	54	0	0	0	0	174
51-52	5	11	27	109	22	80	24	9	13	0	0	0	300
52-53	0	23	8	11	71	56	89	17	3	0	0	0	277
53-54	0	3	48	22	57	52	39	48	6	0	0	0	274
54-55	0	8	57	14	19	25	21	14	3	0	0	0	161
55-56	0	5	45	41	68	38	50	36	55	0	0	0	308
56-57	0	4	22	61	61	38	50	36	55	0	0	0	328
57-58	0	11	24	47	45	9	10	3	23	0	0	0	171
58-59	0	3	10	19	17	34	15	14	13	0	0	0	124
59-60	0	5	24	7	22	6	19	4	6	0	0	0	93
60-61	0	0	21	21	39	50	4	47	17	0	0	0	199
61-62	0	6	37	62	48	48	3	32	10	0	0	0	246
62-63	0	11	2	30	29	15	29	40	32	0	0	0	187
63-64	0	8	12	81	26	48	61	15	7	0	0	0	259
64-65	0	0	51	0	58	51	45	19	0	0	0	0	224
65-66	0	33	7	38	19	13	27	0	0	0	0	0	137
66-67	22	27	5	90	56	59	21	13	71	0	0	0	363
67-68	0	39	26	41	115	8	8	6	15	0	0	0	259
68-69	0	1	51	46	68	28	29	14	0	0	0	0	236
69-70	0	42	22	14	52	9	11	6	4	0	0	0	160
70-71	0	0	8	55	25	20	21	36	1	0	0	0	166

(22) Sampling station: Qirawn Village, South Bekaa
Altitude: 950 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
52-53	0	4	30	105	230	165	201	22	2	0	0	0	759
53-54	0	0	141	128	220	195	37	65	0	0	0	0	786
54-55	0	0	34	92	22	72	121	37	10	0	0	0	388
55-56	0	4	94	80	98	105	50	10	22	0	0	0	463
56-57	0	0	53	132	143	80	79	21	32	5	0	0	545
57-58	0	14	31	158	158	14	32	6	10	0	0	0	423
58-59	0	3	20	80	142	87	48	3	8	0	0	0	418
59-60	2	0	26	10	83	12	79	31	0	0	0	0	243
60-61	0	4	122	28	87	143	28	2	3	0	0	0	417
61-62	2	10	80	192	81	120	9	8	3	0	0	0	503
62-63	0	26	0	262	215	79	76	49	4	0	0	0	711
63-64	-	-	-	-	-	-	-	-	-	-	-	-	-
64-65	-	-	-	-	-	-	-	-	-	-	-	-	-
65-66	0	-	-	241	175	137	145	3	0	0	0	0	-
66-67	0	45	32	300	237	197	231	28	39	0	0	0	1109
67-68	0	70	77	191	402	59	39	9	12	0	0	0	859
68-69	0	23	110	515	558	73	184	25	1	0	0	0	1489
69-70	0	78	61	141	171	88	161	46	4	0	0	0	750
70-71	0	59	33	126	72	227	135	285	0	0	0	0	937

(23) sampling station: Marjayoun
altitude: 760 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
44-45	0	20	241	160	321	234	104	57	55	7	0	0	1199
45-46	-	-	-	-	-	-	-	-	-	-	-	-	-
46-47	-	-	-	-	219	46	51	34	3	0	0	0	-
47-48	0	9	85	44	136	287	180	74	39	0	0	0	854
48-49	0	8	123	204	237	235	211	150	2	0	0	0	1170
49-50	3	0	33	248	180	128	111	39	110	0	0	0	851
50-51	0	55	59	88	134	168	49	69	7	0	0	0	628
51-52	10	77	57	330	121	272	162	29	1	5	0	0	1063
52-53	0	20	103	104	287	239	273	42	8	0	0	0	1076
53-54	0	0	157	120	284	322	86	98	4	0	0	0	1072
54-55	0	1	56	192	59	110	169	63	35	0	0	0	685
55-56	0	42	199	211	246	103	131	10	57	0	0	0	1000
56-57	0	0	45	186	180	99	138	37	38	5	7	0	737
57-58	0	83	60	224	293	23	67	7	0	2	0	0	759
58-59	13	40	4	90	161	155	83	20	26	7	0	0	599
59-60	20	4	63	59	161	62	169	60	0	0	0	0	599
60-61	0	9	175	60	164	260	63	64	19	0	0	0	820
61-62	3	17	85	246	161	183	33	29	5	0	0	0	762
62-63	0	39	0	269	233	218	163	131	20	0	0	0	1073
63-64	2	52	102	97	94	310	213	10	31	0	0	0	910
64-65	0	0	214	65	174	146	65	82	2	0	0	0	748
65-66	0	96	42	162	147	133	112	10	1	0	0	0	708
66-67	11	32	21	255	187	198	242	39	22	0	0	0	1000
67-68	1	35	86	181	300	75	41	36	17	0	0	0	773
68-69	1	31	165	416	499	69	176	69	1	0	0	0	1425
69-70	0	62	84	113	176	86	266	49	9	0	0	0	845
70-71	1	23	43	157	107	332	81	244	1	0	0	0	989

(24) sampling station: Deir el-Ashayer
altitude: 1280 m

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
64-65	0	0	-	-	-	-	49	67	0	0	-	-	-
65-66	0	29	70	114	107	96	56	1	1	0	0	0	473
66-67	0	11	24	207	110	164	167	38	50	0	0	0	771
67-68	0	47	78	178	280	60	50	11	62	0	0	0	760
68-69	0	10	89	388	320	48	206	66	0	0	0	0	1127
69-70	0	32	66	117	124	74	184	37	0	0	0	0	634
70-71	0	7	15	83	37	108	-	-	-	0	0	0	-

Source: FAO, *Annuaire des precipitaions mensuelles at annuelles du Liban*, Beirut, March 1973.

4. Annual and Monthly Contribution of Rivers Other than the Litani in Southern Lebanon

Monthly and yearly water flow in Mcm

(1) river: Nahr Zahrani
sampling station: el-Akhdar wadi

Period	67/68-72/73
Sep	0.2
Oct	0.2
Nov	0.3
Dec	4.8
Jan	9.0
Feb	6.3
Mar	6.8
Apr	4.7
May	1.5
Jun	0.5
Jul	0.3
Aug	0.2
Total	35.0

(2) river: Nahr Zahrani
sampling station: Deir Zahrani

Period	67/68 72/73	63/64-72/73
Sep	0.0	0.000
Oct	0.0	0.005
Nov	0.0	0.433
Dec	3.8	2.995
Jan	7.9	6.340
Feb	5.4	6.938
Mar	5.8	6.122
Apr	4.0	3.582
May	0.7	0.616
Jun	0.1	0.060
Jul	0.0	0.000
Aug	0.0	0.000
Total	28.0	27.091

(3) river: Nahr Zahrani
sampling station: delta

Period	67/68-72/73
Sep	0.0
Oct	0.0
Nov	0.0
Dec	4.2
Jan	8.5
Feb	5.2
Mar	6.1
Apr	5.0
May	0.7
Jun	0.0
Jul	0.0
Aug	0.0
Total	30.00

(4) river: Nahr Saitaniq
sampling station: Limoun wadi

Period	67/68-72/73	63/64-72/73
Sep	0.0	0.029
Oct	0.0	0.035
Nov	0.1	0.095
Dec	1.1	0.801
Jan	2.3	1.848
Feb	1.5	1.893
Mar	1.5	1.924
Apr	1.2	1.075
May	0.4	0.401
Jun	0.2	0.158
Jul	0.1	0.075
Aug	0.0	0.040
Total	8.0	8.369

(5) river: Nahr Saitaniq
sampling station: delta

Period	67/68-72/73
Sep	0.0
Oct	0.0
Nov	0.1
Dec	2.2
Jan	4.1
Feb	2.8
Mar	2.7
Apr	2.0
May	0.2
Jun	0.0
Jul	0.0
Aug	0.0
Total	14.1

(6) river: Nahr Aaraya
sampling station: Jezzine window

Period	67/68-72/73
Sep	0.3
Oct	0.3
Nov	0.2
Dec	3.0
Jan	4.0
Feb	4.5
Mar	4.0
Apr	2.5
May	1.2
Jun	1.0
Jul	0.5
Aug	0.3
Total	22.0

(7) river: Nahr Bisri
sampling station: Marj Bisri

Period	67/68-72/73	52/53-64/65
Sep	1.4	1.377
Oct	1.8	1.593
Nov	2.8	4.289
Dec	22.5	10.875
Jan	36.0	23.415
Feb	28.6	33.444
Mar	25.8	26.768
Apr	20.6	14.681
May	8.5	6.841
Jun	3.9	3.104
Jul	2.3	1.095
Aug	1.5	1.518
Total	156.0	130.000

(8) river: Awali canal
sampling station: downstream

Period	67/68-72/73
Sep	1.5
Oct	1.5
Nov	1.1
Dec	0.0
Jan	0.0
Feb	0.0
Mar	0.0
Apr	0.0
May	0.5
Jun	1.5
Jul	1.6
Aug	1.6
Total	9.8

(9) river: Nahr Awali
sampling station: Sidon

Period	67/68-72/73	without deviated water	52/53-64/65
Sep	33.1	2.1	0.361
Oct	30.4	2.4	0.417
Nov	33.2	5.2	4.695
Dec	59.2	35.2	14.378
Jan	69.3	51.3	29.903
Feb	51.6	39.6	44.405
Mar	50.9	39.9	35.682
Apr	43.1	32.1	19.277
May	29.1	13.1	7.733
Jun	33.1	7.1	2.563
Jul	38.2	5.2	1.169
Aug	33.2	3.2	0.531
Total	504.0	236.0	161.000

(10) river: Nahr es-Safa
sampling station: es-Sitt wadi

Period	67/68-72/73
Sep	0.5
Oct	0.5
Nov	0.6
Dec	4.5
Jan	7.0
Feb	5.3
Mar	4.7
Apr	3.6
May	1.0
Jun	0.5
Jul	0.4
Aug	0.4
Total	29.0

(11) river: Nahr Bouzeble
sampling station: Rechmaya

Period	67/68-72/73
Sep	1.2
Oct	1.4
Nov	1.9
Dec	8.1
Jan	13.6
Feb	13.1
Mar	14.2
Apr	11.5
May	5.8
Jun	3.2
Jul	2.2
Aug	1.8
Total	78.0

(12) river: Damour
sampling station: Jisr el-Qadi

Period	67/68-72/73	48/49-72/73
Sep	1.5	1.516
Oct	2.0	2.013
Nov	2.8	4.451
Dec	26.3	18.279
Jan	45.7	33.700
Feb	30.3	34.569
Mar	30.1	31.092
Apr	22.4	18.112
May	7.9	7.633
Jun	3.3	3.571
Jul	2.2	2.371
Aug	1.5	1.696
Total	176.0	158.903

(13) river: Nahr el-Hammam
sampling station: downstream of Damour

Period	67/68-72/73
Sep	0.3
Oct	0.5
Nov	0.8
Dec	5.3
Jan	9.8
Feb	7.3
Mar	7.2
Apr	5.1
May	1.7
Jun	0.7
Jul	0.4
Aug	0.3
Total	39.4

(14) river: Nahr el-Ghadi
sampling station: near the river

Period	67/68-71/72
Sep	0.0
Oct	0.0
Nov	0.259
Dec	2.756
Jan	5.342
Feb	3.072
Mar	3.524
Apr	1.157
May	0.158
Jun	0.000
Jul	0.000
Aug	0.000
Total	16.260

(15) river: Nahr el-Jamani
sampling station: Ras el-Metn

Period	67/68-72/73
Sep	0.0
Oct	0.1
Nov	0.6
Dec	8.7
Jan	10.6
Feb	7.0
Mar	12.6
Apr	6.6
May	0.3
Jun	0.0
Jul	0.0
Aug	0.0
Total	47.0

(16) river: Nahr Beirut
sampling station: Jamani - Metn

Period	67/68-72/73
Sep	0.0
Oct	0.2
Nov	1.1
Dec	18.4
Jan	24.8
Feb	15.2
Mar	25.2
Apr	11.9
May	1.5
Jun	0.2
Jul	0.0
Aug	0.0
Total	99.0

(17) river: Nahr Beirut
sampling station: Dachounieh

Period	67/68-72/73
Sep	0.6
Oct	1.0
Nov	2.4
Dec	26.9
Jan	37.6
Feb	22.1
Mar	36.8
Apr	21.5
May	3.5
Jun	1.2
Jul	0.7
Aug	0.6
Total	155.0

(18) river: Nahr Beirut
sampling station: Sinn el-Fil

Period	67/68-72/73
Sep	0.0
Oct	0.4
Nov	2.2
Dec	30.9
Jan	39.8
Feb	23.2
Mar	40.6
Apr	22.7
May	2.9
Jun	0.5
Jul	0.1
Aug	0.0
Total	163.0

5. Stored Water in Border Villages

Village name	Storage capacity (cubic meters)	Storage location
1. Aalma Echaab	1. - 2200 2. - 2000 3. - 3000	in the perimeter of the village 2 km outside the village
2. Chamaa	1. - 3000 2. - 6000	in perimeter of village 1 km outside the village
3. Tair Harfa	1500	.5 km outside the village
4. Jebbain	1000	1 km South of the village
5. Aajdel Zoun	4000	4 km outside the village
6. Rmaiche	1. - 9000 2. - 10,000	in the perimeter of the village
7. Chihine	4000	in perimeter of village
8. Mazounine	1. - 1500 2. - 5000	in the perimeter of the village
9. Ramye	1. - 1300 2. - 18,000	Birket el-Baida el-Marj
10. Aita Echaab	1. - 6800 2. - 3000 3. - 5000	in perimeter of village 1 km outside the village 3 km outside the village
11. Yater	10,000	in perimeter of village
12. Beit Lif	1500	in perimeter of village
13. Rchef	3000	in perimeter of village
14. Debel	10,000	1 km outside the village
15. Siddikine	3000	in perimeter of village
16. Rechknanait	2000	in perimeter of village
17. Zebkine	1. - 2200 2. - 3000	in the perimeter of the village
18. Kafra	2500	North of the village
19. Yaroun	4000	in perimeter of village
20. Haddatha	7800	in perimeter of village

Village name	Storage capacity (cubic meters)	Storage location
21. Beit Yahoun	1. - 2800	in perimeter of village
	2. - 4000	North of the village
22. Kounine	1. - 2400	in perimeter of village
	2. - 15,000	.5 km outside the village
23. Tyre	1200	in perimeter of village
24. Ainata	1. - 11,000	in perimeter of village
	2. - 1500	.5 km outside the village
25. Hanine	1000	in perimeter of village
26. Bint Jbeil	1. - 20,000	in the perimeter of the
	2. - 3400	village
27. Aitaroun	12,000	in perimeter of village
28. Maron Ertas	6000	1.5 km outside the village
29. Blida	5000	.8 km outside the village
30. Bkatchifa	10,000	in perimeter of village
31. Shakra	1. - 14,000	in perimeter of village
	2. - 4000	2.5 km outside the village
	3. - 1500	2 km outside the village
	4. - 1000	2.2 km outside the village
	5. - 1000	4 km outside the village
	6. - 12,000	2 km West of the village
32. Majdel Selem	4400	in perimeter of village
33. Touline	2000	in perimeter of village
34. Meis Eljabel	16,000	in perimeter of village
35. Houla	1. - 6000	in the perimeter of the
	2. - 3500	village
36. Markabeh	7000	in perimeter of village
37. Rob Tlatine	3000	in perimeter of village
38. Khabrikha	1. - 2000	in the perimeter of the
	2. - 1500	village
39. Kantara	3000	in perimeter of village
40. Adchit el-Ksair	1. - 5000	northeast of the village
	2. - 15,000	10 km outside the village

Village name	Storage capacity (cubic meters)	Storage location
41. Almane	3000	1 km outside the village
42. Hamra	2000	.2 km outside the village
43. Taibeh	1. - 7000 2. - 10,000	in the perimeter of the village
44. Arnoun	6500	in perimeter of village
45. Yohmor	1500	in perimeter of village
TOTAL	350,000 cu m	

Source: *Etude preliminaire de la planification de micro-emmagasinage des eaux hivernales de la zone frontiere du sud*, Beirut, 1969, p. 16.

6. Sources of Information

Consultations
- Central office of the FAO (two week visit), Rome
- Central library of the FAO
- Consultations and interviews
  - Marc Bral FAO/World Bank
  - J.P. Villaret, hydraulics expert, chief of FAO team of experts in Lebanon
  - G. Panayote, economics expert
  - Vissert, division project expert, FAO
  - Chaploz, FAO expert, project analyst

In Lebanon
- National office of the Litani, UN, Bir Hassan, Beirut
- Ministry of Hydraulic and Electrical Resources, Beirut
- Water Office of Beirut (drinking water)
- Water Office of Sidon
- Water Office of Jebel Amel
- Water Office of Nabaa Tasse
- Water Office of Tyre
- Perimeter of Qasmieh - Ras el-Ain (Sidon and Tyre)
- Model Perimeter of Lebaa - Jezzine (Sidon)
- American University of Beirut (AUB), faculty of Agronomy: (precipitations)
- Direction of Civil Aviation (Beirut)

Bibliography

FAO. *Annuaire des apports mensuelles observe des fleuves du sud du Liban*. Beirut, September 1974.

___. *Annuaire des precipitations mensuelles et annuelles du Liban*. Beirut, 1973.

___. *Hydrologie de la region Litani - Awali*. Beirut, 1974.

___. *La planification hydraulique du sud du Liban*. Beirut, 1972.

___. *Potential des sols irrigables (Projet Liban Sud)*. Beirut, 1974.

___. *Projets existants sur l'orientation et plans*. Beirut, 1980.

___. *Reorganisation du perimetre de Qasmieh - Ras el-Ain*. Beirut, 1974.

Gersar Mission. *Irrigation de la Bekaa Sud: Etude de factibilite*. Beirut, 1973.

Khoury, Elie. *Projet pilote Saida: Note de sythese.* Projet de Developpement Hydro-agricole du Sud du Liban. N.p.: Office National du Litani - UNDP/FAO, June 1972

Ministry of Hydraulic and Electrical Resources. *Etude preliminaire de la planification de micro-emmagasinage des eaux hivernals de la zone frontiere-sud.* Beirut, 1969

Ministry of Hydraulic and Electrical Resources/FAO. *Projet d'irrigation de la plaine de Akkar.* Beirut, 1972.

Ministry of Hydraulic and Electrical Resources/UN. *Approvissionnement en eau potable de la ville de Beyrouth.* Beirut, 1969.

Moudallal, Saadeddine. *Rapport sur les irrigations du sud: Etude comparative des trois solutions.* N.p.: Office National du Litani, May 1971.

Office National du Litani - UNDP/FAO. *Alimentation en eau potable de Beyrouth et du Liban sud: Note d'information.* Projet de Developpement Hydro-agricole du Sud du Liban. N.p., January, 1974.

_____. *Climatologie de la Bekaa centrale.* Projet de Developpement Hydro-agricole de la Bekaa Centrale. (Document LEB 74/001/01). N.p., n.d.

_____. *Irrigation du versant ouest entre les cotes 300 et 800.* Projet de Developpement Hydro-agricole du Sud du Liban. Beirut, November 1972.

_____. *Liban - Projet d'irrigation Koure-Zghorta: Synthese de l'etude de factibilite.* Beirut, 1973.

_____. *Projets existants sur l'orientation et plans agricoles: Document provisoire.* Projet de Developpement Hydro-agricole du Sud du Liban. N.p., May 1973.

_____. *Proposition pour un plan d'amenagement hydraulique regional: Allocation des eaux.* Projet de Developpement Hydro-agricole du Sud du Liban. Rome, 1977.

_____. *Rapport d'economie rurale: Folio 5: Zone cotier.* Projet de Developpement Hydro-agricole du Sud du Liban. Beirut, 1973.

UN Direction of Studies. *Barrage de Khardale: Etudes preliminaires.* Beirut, 1975.

UNDP/FAO. *Enquiete pedologique et programmes d'irrigation connexes: Liban - Rapport final.* Vol. I. Rome, 1969.

_____. Vol. III: Irrigation. Rome, 1969.

_____. *Liban: Etude de reconstruction et de developppement de l'agriculture: Annexe technique 10*. Beirut, 1980.

_____. *Liban - Plan regional de developpement hydro-agricole*. Part One: *Le milieu physique*. Developpement Hydro-agricole du Sud du Liban. Rome, 1977.

_____. Part Three: *Les ressources en eaux*. Developpement Hydro-agricole du Sud du Liban. Rome, 1977.

_____. Part Four: *Les ressources en sol*. Developpement Hydro-agricole du Sud du Liban. Rome, 1977.

_____. Part Five: *Les ouvrages de mobilisation des eaux*. Developpement Hydro-agricole du Sud du Liban. Rome, 1977.

_____. *Liban: Planification de l'utilisation des eaux dans le nord du Liban*. Projet Developpement Hydro-agricole. Rome, 1976.