Annex 1

Water Use

Project Name	No. 201, Janneh Dam					
Phase Completed	1) Proposal for the US Trade and Development Agency for Financing of Feasibility with Detailed Conceptual Design Study, February 2000, MEW					
Location	Mohafaza	Mount Lebanon	Caza/Village, Town	Jbeil and Kesrouan Cazas		
Discharge	Water Resources	Nahr Ibrahim River (Roueiss spring in right tributary and Afqa spring in left tributary)				
	Annual Runoff of Dam Watershed (million m3)	250	Originated from	Afqa spring		
	Specific Discharge of Nahar Ibrahim (liter/sec/km2)	36.5		Roueiss spring		
Dam	Type	Rockfill Dam	Max. Dam Height (m)	75	Crest Length (m)	350
	Crest EL (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	825	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	30	Active storage (million m3)	NA		
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA		
	Cost (US$ million)	63.5	as of 2000	Construction Period (years)		NA
Purpose	Domestic	to Jbail Caza and Kesrouane Caza				
	Industrial	non				
	Irrigation	non				
	Hydro-Power	40 MW (US$ 40 million)				
Other Facilities for Project						
Conveyance Method: Line B, Tunnel A, pipeline to Madiq				Cost (US$ million)		25.3
Hydro-electric plant				Cost (US$ million)		40.0
2 x Water Treatment Plant (18,000 & 65,000 m3/day)				Cost (US$ million)		8.9
Total Project Cost (US$ million)		137.7		as of	2000	

Remarks

1) There are three hydro-power plants, Chouane, El Madiq and Khdaira, constructed in 1940s.

2) Line B to supply water to Jbeil Caza will be conducted by Italian fund, and Tunnel B, a part of Madiq project to supply water to Kesrouan coastal area, is conducted by Japanese fund.

3) In the downstream of third power plant, the river water is conveyed to an irrigation canal to north (Aamchit) & south (Tabarja), and pipeline for domestic water to Jbail.

4) In the most downstream, the river water is conveyed to Jbail for domestic water.

5) CDR has carried out several development and rehabilitation projects inclusive of projects financed by Japan and Italy (implementation in 2000). However, the most new resources will be groundwater susceptible to saline water intrusion.

6) The water deficit in summer is still 12,800 m3/day and is expected to reach 27,800 m3/day by the year of 2020.

7) Nahar Ibrahim is originated from Afqa and Roueiss springs and there are Khdaira and Madiq springs along the river.

8) Electric charge by EDL to users is US$ 0.125/kWh.

8) The Project secures 30 MCM of water for the dry season and produce 147 million kWh of electricity annually.

9) It is assumed that 4 million m3 will be used for domestic and 6 million for maintenance discharge. Therefore, 240 million m3 can be used for power generation. Annual energy production will be 147 million kWh.

Data Source: Proposal for the US Trade and Development Agency for Financing of Feasibility with Detailed Conceptual Design Study, February 2000, MEW

Project Name	No. 202, Chabrouh Dam					
Phase Completed	1) The detail study was completed.					
	2) under the construction, as of June 2003					
Location	Mohafaza	Mount Lebanon	Caza/Village, Town	Kesrouan		
Discharge	Water Resources	a tributary of El Kelb river + Allaban Spring				
Dam	Type	Rockfill Dam	Max. Dam Height (m)	63	Crest Length (m)	470
	Crest EL (m)	1618.0	Crest Width (m)	10	Max. Base Width (m)	200
	High Water Level (EL. m)	1615	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	8	Active storage (million m3)	NA		
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA		
	Cost (US$ million)	NA	as of	NA	Construction Period (years)	NA
Purpose	Domestic	to Kesrouan region (250,000 inhabitants), 60,000 m3/day during the summer				
	Industrial	non				
	Irrigation	non				
	Hydro-Power	non				
Other Facilities for Project						
Conveyance: pipes from the dam to Nabaa El Laban (D = 1m, L = 5.19km)					Cost (US$ million)	
Total Project Cost (US$ million)					as of	
Remarks						

Data Source: MEW

Project Name	No. 204, Boqaata Dam						
Phase Completed	1) Pre-feasibility Study, 1983, MEW 2) Proposal for the US Trade and Development Agency for Financing of Detailed Feasibility Study, December 1999, MEW						
Location	Mohafaza	Mount Lebanon	Caza/Village, Town	Metn			
Discharge	Water Resources	Boqaata river (Tributary of El Kelb River), boundary of Kesrouane and Metn cazas According to MEW dated March 27 2003, from springs					
	Annual Runoff of Dam Watershed (million m3)	7					
Dam	Type	Rockfill Dam	Max. Dam Height (m)	63	Crest Length (m)	275	
	Crest EL (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA	
	High Water Level (EL. m)	1004	Normal Water Level (EL. m)	NA			
	Storage Capacity (million m3)	7	Active storage (million m3)	NA			
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA			
	Cost (US$ million)	20.6	as of	1999	Construction Period (years)	NA	
Purpose	Domestic	toE1 hydraulic system of Caza Metn to overcome the deficit in summer					
	Industrial	non					
	Irrigation	non					
	Hydro-Power	non					
Other Facilities for Project							
Conveyance: pumping from EL 960m to 1,070m (treatment plant) through pipe line (D = 600mm, L = 0.8km)					Cost (US$ million)	0.7	
Water Treatment Plant (35,000 m3/day)					Cost (US$ million)	4	
Total Project Cost (US$ million)		25.30			as of	1999	

Remarks

1) Although NERP (National Emergency & Recovery Project) is conducted for rehabilitation of water supply by CDR, the future demand exceeds the supply.

2) The treatment plant (35,000 m3/day) is also proposed.

3) Demand Projection for E1 system (75 km2 in lower part of Metn Caza)

	Summer Population	Consumption Rate (l/day)	Water Demand (m3/day)	Water Deficit (m3/day)
2000	172,300	120	41,350	24,350
2010	218,900	150	56,900	39,900

4) Water deficit is anticipated during the summer due to dormitory town for Greater Beirut and vacation residents.

5) Present available water resources to Caza Metn is 17,000 m3/day from Jeita spring.

6) Loss anticipated is 35% in 2000 and 25% in 2010. Non residential water is 30% of domestic water.

7) Boqaata dam is an alternative to supply water in Metn caza, instead of using Fourar Antelias spring, showing the low cost of water produced.

8) Metn area is one of the areas having the highest living standard and tourists (gulf area) in summer is very high.

Data Source: Proposal for the US Trade and Development Agency for Financing of Detailed Feasibility Study, December 1999, MEW

Project Name	No. 206, Damour Dam					
Phase Completed	1) Preliminary Study, 1950s 2) Preliminary Project Review, November 1999 3) Damour River Water Supply Project, Hydrological Reconnaissance Study, May 2000, CDR					
Location	Mohafaza	Mount Lebanon	Caza/Village, Town			
Hydrology	Water Resources	Damour river (2 km upstream of confluence with Nahr El Mammam river)				
	Annual Runoff of Damour Watershed (million m3)	220				
	The area of Damour watershed is about 288 km2.					
Dam	Type	NA	Max. Dam Height (m)	120	Crest Length (m)	NA
	Crest EL. (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	NA	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	60	Dam Volume (million m3)	NA		
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA		
	Cost (US$ million)	NA	as of	NA	Construction Period (years)	NA
Purpose	Domestic	Greater Beirut				
	Industrial	non				
	Irrigation	non				
	Hydro-Power	non				
Other Facilities for Project						
not specified			Cost (US$ million)			
			Cost (US$ million)			
			Cost (US$ million)			
Total Project Cost (US$ million)		NA	as of	NA		
Remarks						

1) In the latest report (CDR), there is no technical specifications of dam available and no description of purposes.

2) Geology of the dam site is characterized with Jurassic & Cretaceous limestone and sandstone formations.

3) Due to the karstic nature of the Jurassic limestone, the water tightness of any proposed reservoir is questioned.

4) Without the further study for geologic and hydrogeologic study, the technical feasibility cannot be examined.

Data Source: Damour River Water Supply Project, Hydrological Reconnaissance Study, May 2000, CDR

Project Name	N0. 207, Bisri Dam									
Phase Completed	1) Study of Water Resources Development of Lebanon, 1951-54, USA									
	2) Additional Geologic Investigations, 1975, Litani River Authority (LRA)									
	3) Pre-feasible Study, 1984, LRA									
	4) Feasibility Study, April 1995, Council for Development and Reconstruction (CDR)									
Location	Mohafaza	Saida		Caza/Village, Town	Saida / Bisri					
Discharge	Water Resources	Bisri river (tributary of Awali river), 17km upstream from river mouth								
	Monthly Flow	Max. (m3/s)	12.6	in February	Min. (m3/s)	0.5	in September			
	Average annual flow (million m3)		142.05	Average Monthly Flow (m3/s)		4.5				
Dam	Type	Earthfill with RCC		Max. Dam Height (m)	74	Crest Length (m)		790		
	Crest EL (m)	469.0		Crest Width (m)	10	Max. Base Width (m)		380		
	High Water Level (EL. m)		467.5	Normal Water Level (EL. m)		461				
	Storage Capacity (million m3)		128	Active storage (million m3)		120				
	Catchment Area (km2)		215	Annual Sedimentation Yield (m3/km2/year)				755		
	Cost (US$ million)		131.1	as of	1995	Construction Period (years)		3		
Purpose	Domestic	to Beirut located 30km north form the dam, release rate = 6.7 m3/s for 6 months								
	Industrial	included in the above discharge								
	Irrigation	Excess water can be used.								
	Hydro-Power	1.4 MW plant to operate 12 months at a rate of 3 m3/s (assumption) = 1.1GWh								
Other Facilities										
Conveyance Method	refer to "Awali-Beirut Water Supply Feasibility Report", Montgomery Watson (1994)									
Total Project Cost (US$ million)			NA	as of	NA					
Remarks										

1) RCC: Roller Compacted Concrete

2) Contingency = Construction Cost x 20%, escalation rate = 4%

3) Engineering inclusive of Administration = (Construction Cost + Contingency) x 15%

4) Cost does not include neither land acquisition and environmental mitigation.

5) The land acquisition might be US$ 6 million.

6) The Study identified only available water but not allocation of each purpose of water use.

7) No seepage was assumed.

8) O/M cost is 1%. Loan interest is 9%. Repayment period is 30 years.

9) Water Supply considering shortage in % / annual cost inclusive of repayment and O/M = Unit Cost of Water

10) Constant Release Rate = 6.7 m3/s for 6 months, Total sediment load of First 50 years (million m3) = 8

Data Source: Feasibility Study, April 1995, Council for Development and Reconstruction (CDR)

Project Name	No. 208, Habach Reservoir (Hill Lake)					
Phase Completed	1) Habach Reservoir Study, 2000, CDR					
Location	Mohafaza	Mount Lebanon	Caza/Village, Town	Metn		
Hydrology	Water Resources	El Habach valley				
	Annual Runoff of Watershed (million m3)	0.6				
	The above discharge does not include the flow of El Habach spring					
Dam	Type	NA	Max. Dam Height (m)	30	Crest Length (m)	380
	Crest EL (m)	1625.0	Crest Width (m)	8	Max. Base Width (m)	NA
	High Water Level (EL. m)	1623.6	Normal Water Level (EL. m)	1623		
	Storage Capacity (million m3)	0.55	Active Storage (million m3)	0.5		
	Catchment Area (km2)	NA	Dam Volume (million m3)	0.33		
	Cost (US$ million)	6.3	as of 2000	Construction Period (years)		2
Purpose	Domestic	E2 system in Metn Water Authority				
	Industrial	non				
	Irrigation	non				
	Hydro-Power	non				
Other Facilities for Project						
not specified			Cost (US$ million)			
			Cost (US$ million)			
Total Project Cost (US$ million)	6.3	as of	2000			

Remarks

1) Metn Water Authority area has 200 km2 and a population of 200,000 in 1997.

2) The above area is located between El Kalb and Beirut rivers, divided by 4 systems.

E1	(Jeita System)	pumping from Jeita and Daichoumieh springs	43 villages
E2	(Mamboukh-Bqellaiaa)	gravity from Mamboukh & Assal springs + Ballout lake	27 villages
E3	(Jamajem)	gravity from Jamajem spring	10 villages
E4	(Jouaizat)	gravity from Jouaizat spring	9 villages

3) Population of E2 in 1999 is 46,000. Major water sources are the above for domestic and Sannine & Jaouz En Nemi springs for irrigation.

4) In addition to 3 boreholes construction in Qattine (6000 m3/day in summer and 9000 m3/day in winter), Habash reservoir is proposed to supply 3500 m3/day during the summer.

5) The detailed study is required to assess the permeability and propose the prevention of seepage.

6) US$ 8.5 million inclusive of dam construction and detailed design is proposed for Kuwait Fund

Data Source: Habach Reservoir Study, 2000, CDR

Project Name	No 301, Noura Et Tahta Dam					
Phase Completed	1) In the early 1970s, MEW conducted preliminary geological and hydrological investigation.					
	2) Preliminary study in the framework of "FAO's Hydro-Agricultural Development Project for North Lebanon", 1972					
	3) Project Summary Report, 2000, MEW					
Location	Mohafaza	North Lebanon	Caza/Village, Town	Akkar		
Discharge	Water Resources	El Kebir River, border with Syria				
	Annual Runoff of Dam Watershed (million m3)	180				
Dam	Type	Rockfill Dam	Max. Dam Height (m)	80	Crest Length (m)	498
	Crest EL (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	158	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	70	Active Storage (million m3)	NA		
	Catchment Area (km2)	552	Dam Volume (million m3)	4		
	Cost for Lebanon (US$ million)	34.3	as of	2000	Construction Period (years)	NA
Purpose	Domestic	a part of Akkar Caza (173 km2) and subscribers are 50,000 in 2000				
	Industrial	non				
	Irrigation	2,300 ha (reclaimed land) + 2,700 ha in the coastal area (Akkar Caza)				
	Hydro-Power	non				
Other Facilities for Project						
Domestic Water	Transmission Line				Cost (US$ million)	1.4
	2 Pumping Stations				Cost (US$ million)	0.5
	Water Treatment Plant (10,000 m3/day)				Cost (US$ million)	2.8
Irrigation	Pressurized Irrigation (4,959 ha)				Cost (US$ million)	25
	Land Reclamation (2,300 ha)				Cost (US$ million)	6.9
Total Project Cost for Lebanon (US$ million)		53.8			as of	2000

Remarks

1) Domestic water in Akkar plain relies on groundwater; however, the dam project can reduce or eliminate the use of groundwater.

2) The present population in the Project Area (173 km2) is 50,000 and expected growth rate is 2.2%/year.

3) The storage volume is split equally to Lebanon (50%) and Syria (50%).

4) Domestic water supply (10,000 m3/day = 3.65 MCM/year) is only 10% of allocated volume to Lebanon.

5) Net irrigation requirement is 9,730 m3/ha from April to October; however El Kebir river has enough discharge for irrigation during April, May and second half of October. Thus, Irrigation water requirement is estimated 6,000 m3/ha.

4) Assuming that 35 MCM is available for irrigation and pressurized irrigation is applied, 4,959 ha of land is irrigable, and the priority is given to new scheme (reclaimed area) extending 2,300 ha. The rest of water is supplied to coastal area where saline water intrusion limits the use of groundwater.

5) Revenue increase form the present system (groundwater) to pressurized irrigation is assumed to be US$ 500/ha.

6) A half of the dam cost (US$ 17.2 million) will be shared by Lebanon Government.

Data Source: Project Summary Report, 2000, MEW

Project Name	No. 303, Bared Dam					
Phase Completed	1) Pre-feasibility Study, 1982, MEW 2) Proposal for the US Trade and Development Agency for Financing of Detailed Feasibility Study, December 1999, MEW					
Location	Mohafaza	North Lebanon	Caza/Village, Town	Tripoli and Akkar Cazas		
Discharge	Water Resources	El Bared river, boundary of Sir El Denniye and Akkar Cazas				
	Runoff of Dam Watershed (million m3)	196.2	discharge of El Bared + Abou Moussa river			
Dam	Type	Rockfill Dam	Max. Dam Height (m)	80	Crest Length (m)	450
	Crest EL (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	180	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	40	Active storage (million m3)	NA		
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA		
	Cost (US$ million)	45.2	as of	1999	Construction Period (years)	NA
Purpose	Domestic	to Qalamoun, Tripoli, Minie and a part of Akkar Caza				
	Industrial	non				
	Irrigation	850 ha (annual demand 10 MCM): 748 ha irrigation + 102 ha marginal land				
	Hydro-Power	non				
Other Facilities for Project						
	Transmission Line				Cost (US$ million)	15.7
	3 Pumping Stations				Cost (US$ million)	1.9
	Water Treatment Plant (35,000 m3/day)				Cost (US$ million)	12.5
	Total Project Cost (US$ million)	75.3			as of	1999

Remarks

1) Although NERP (National Emergency & Recovery Project) is conducted for rehabilitation of water supply by CDR, most of new resources are groundwater that are susceptible to saline water intrusion.

2) 165,000 m3/day of water is pumped from dam to treatment plant (EL 115m to 160m).

3) Presently 47,000 m3/day of groundwater are being pumped; however, it requires to monitor saline water intrusion.

4) The current overall deficit of water supply is 24,700 m3/day and expected to reach 111,700 m3/day by 2025.

5) Unit consumption = 150 to 170 liter/day per capita, non residential water = 30%, Losses = 25%

6) Two hydro-power plants have been constructed. The dam project would reduce the discharge to station No. 1 located at EL 80m.

7) Approximately 850 ha of land is available for irrigation between the 150 m contour and upper limit of existing Akkar-Bared and Minieh irrigation schemes.

8) The net water requirement is 9,730 m3/ha between April and October. Efficiency of open channel is 60% and pressurized drip system is 85%. Irrigation application is not determined yet.

9) The cost of irrigation ranges from US$ 2.5 million to US$ 4 million and not included in the project.

Data Source: Proposal for the US Trade and Development Agency for Financing of Detailed Feasibility Study, December 1999, MEW

Project Name	No. 304, Iaal Dam					
Phase Completed	1) Pre-feasibility Study, 1981, MEW 2) Proposal for the US Trade and Development Agency for Financing of Feasibility with Detailed Conceptual Design Study, December 1999, MEW					
Location	Mohafaza	North Lebanon	Caza/Village, Town	Zgharta		
Discharge	Water Resources	Jouit river in the Caza of Zgharta				
	Annual Discharge in Average Year (million m3)	12	Originated from Jouit Spring			
Dam	Type	Rockfill Dam	Max. Dam Height (m)	58	Crest Length (m)	644
	Crest EL (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	257.5	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	10	Active storage (million m3)	NA		
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA		
	Cost (US$ million)	19	as of	1999	Construction Period (years)	NA
Purpose	Domestic	to Zgharta, Kfaryachit, Enfe and Chekka				
	Industrial	non				
	Irrigation	non				
	Hydro-Power	non				
Other Facilities for Project						
	Transmission Lines				Cost (US$ million)	5.7
	2 Pumping Stations				Cost (US$ million)	0.2
	Water Treatment Plant (35,000 m3/day)				Cost (US$ million)	4.0
	Total Project Cost (US$ million)	28.9			as of	1999

Remarks

1) CDR has carried out several development and rehabilitation projects inclusive of projects. However, the most new resources will be groundwater susceptible to saline water intrusion.

2) The current water supply deficit in the project area is 12,000 m3/day and expected to reach 26,000 m3/day.

3) Water for the dam is supplied from Jouit river by gravity through the transmission line.

4) Presently 4,000 m3/day of groundwater are being pumped in Enfe and Chekka; however, groundwater is susceptible to saline water intrusion.

5) The present overall deficit of water supply is 12,000 m3/day and expected to reach 26,000 m3/day by the year of 2025.

6) Demand projection: unit consumption rate = 150 l/day, non residential = 10%, losses = 25%

7) 27,400 m3/day of water is Pumped to the treatment plant (from EL 215 to 230m).

Data Source: Proposal for the US Trade and Development Agency for Financing of Feasibility with Detailed Conceptual Design Study, December 1999, MEW

Project Name	No. 306, Dar Beachtar Dam						
Phase Completed	1) Dams of Jinsnaya-Azzibeh-Dar Beachtar (Italian Cooperation Mission), March 2001, CDR						
Location	Mohafaza	North Lebanon	Caza/Village, Town	Batroun			
Discharge	Water Resources	El Asfour river and Conveyance from Abou Ali River					
	Annual runoff from El Asfour river whose Dam Catchment Area is 56 km2 (million m3)				6 - 8		
	Expected Annual Discharge from Abou Ali River (million m3)				95		
Dam	Type	NA	Max. Dam Height (m)	75	Crest Length (m)	NA	
	Crest EL (m)	330.0	Crest Width (m)	NA	Max. Base Width (m)	NA	
	High Water Level (EL. m)	NA	Normal Water Level (EL. m)	NA			
	Storage Capacity (million m3)	55.00	Active Storage (million m3)	NA			
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA			
	Cost (US$ million)	NA	as of	NA	Construction Period (years)	NA	
Purpose	Domestic	not determined (potential site: littoral to EL. 250m between Batroun and Chekka)					
	Industrial	NA					
	Irrigation	not determined (potential site: plateau of Koura-Zghorta)					
	Hydro-Power	NA					
Other Facilities for Project							
Dike in El Asfour river	40m height for water storage				Cost (US$ million)	30	
Conveyance form Abou Ali	8m height weir, tunnel, canal				Cost (US$ million)	NA	
Irrigation	pipelines, regulation ponds, pumping stations etc.				Cost (US$ million)	NA	
Total Project Cost (US$ million)		90			as of	2001	

Remarks

1) There are 2 phases. 1st phase is to construct 40m height dike to store the discharge only from El Asfour river and 2nd phase is to complete 75m height dam with conveyance system from Abou Ali river.

2) CDR has proposed the study (geology, technical and economical feasibility) to Italian government but the result is unknown.

3) Dam and conveyance works from Abou Ali river inclusive of seepage treatment cost US$ 60 million.

4) Domestic water demand of North Lebanon in 1999 is 150,000 m3/day, while available water is 70,000 m3/day. The deficit (29.2 million m3/year) will be 60 million m3 in 2020.

5) Water will be supplied to areas expanding until EL. 250m by gravity and plateau of Koura-Zghorta by pumping.

6) Existing irrigation schemes in North Lebanon is 15,000 ha and potentially irrigable land is 16,000 ha (Akkar plain: 9,000 ha, plateau of Koura-Zghorta: 7,000 ha)

Data Source: Dams of Jinsnaya-Azzibeh-Dar Beachtar (Italian Cooperation Mission), March 2001, CDR

Project Name	No. 311, Brissa Reservoir (Hill Lake)					
Phase Completed	1) Brissa Spring Lake, 1994?, MEW (D/D)					
Location	Mohafaza	North Lebanon	Caza/Village, Town	Sir ed Danniye		
Discharge	Water Resources	Brissa and small springs scattered				
Dam	Type	NA	Max. Dam Height (m)	NA	Crest Length (m)	NA
	Crest EL (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	NA	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	1.00	Active Storage (million m3)	NA		
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA		
	Cost (US$ million)	NA	as of	NA	Construction Period (years)	NA
Purpose	Domestic	planned but not specified				
	Industrial	NA				
	Irrigation	NA				
	Hydro-Power	NA				
Other Facilities for Project						
					Cost (US$ million)	
					Cost (US$ million)	
Total Project Cost (US$ million)		NA	as of	NA		
Remarks						

1) Water sources are discharge of basin (1.65 km2), Brissa spring through existing irrigation canal and small springs.

2) Discharge of Brissa spring was estimated by only two measurements in 1994.

3) There is no data regarding lake specifications and purpose.

4) The above storage capacity is extracted from MEW 10 Year Work Plan.

5) The lake is filled by the drainage basin discharge (0.5 million m3/year) and Brissa spring (2 million m3/year); however, the figures are very rough estimate.

Data Source: Brissa Spring Lake, 1994, MEW

Project Name	No. 401, Lebaa Hill Lake					
Phase Completed	1) Dams of Jinsnaya-Azzibeh-Dar Beachtar (Italian Cooperation Mission), March 2001, CDR					
Location	Mohafaza	South Lebanon	Caza/Village, Town	Saida		
Hydrology	Water Resources	NA				
	Annual discharge from the basin (million m3)	1.25				
Dam	Type	NA	Max. Dam Height (m)	38	Crest Length (m)	135
	Crest EL (m)	188.0	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	NA	Normal Water Level (EL. m)		185	
	Storage Capacity (million m3)	0.96	Active Storage (million m3)		NA	
	Catchment Area (km2)	4.61	Dam Volume (million m3)		0.136	
	Cost (US$ million)	8	as of	2001	Construction Period (years)	NA
Purpose	Domestic	to Saida and its adjacent areas				
	Industrial	none				
	Irrigation	none				
	Hydro-Power	none				
Other Facilities for Project						
Treatment Plant					Cost (US$ million)	0.8
Study					Cost (US$ million)	0.7
					Cost (US$ million)	-
Total Project Cost (US$ million)		9.5			as of	2001

Remarks

1) A treatment plant will be located at the hill lake (distance of 130m).

2) The hill lake aims to supply domestic water during the dry season (May to October).

3) The demand in 1991 was 23,000 m3/day, while available supply was 19,000 m3/day.

4) Water deficit in 1991 was 4,500 m3/day and it is projected to increase to 26,000 m3/day in 2020.

Data Source: Dams of Jinsnaya-Azzibeh-Dar Beachtar (Italian Cooperation Mission), March 2001, CDR

Project Name	No. 402, Azzibe Hill Lake					
Phase Completed	1) Dams of Jinsnaya-Azzibeh-Dar Beachtar (Italian Cooperation Mission), March 2001, CDR					
Location	Mohafaza	South Lebanon	Caza/Village, Town	Nabatiyeh		
Discharge	Water Resources	NA				
Dam	Type	NA	Max. Dam Height (m)	37	Crest Length (m)	NA
	Crest EL (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	NA	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	0.70	Active Storage (million m3)	NA		
	Catchment Area (km2)	8.6	Dam Volume (million m3)	NA		
	Cost (US$ million)	5	as of	2001	Construction Period (years)	NA
Purpose	Domestic	to Jezzine and its surrounding areas				
	Industrial	none				
	Irrigation	none				
	Hydro-Power	none				

Other Facilities for Project			
Seepage works	excluded from dam works	Cost (US$ million)	1.2
Treatment Plant	8,000 m3/day	Cost (US$ million)	0.8
Study		Cost (US$ million)	0.5
Total Project Cost for Lebanon (US$ million)	9.5	as of	2001

Remarks

1) Population of Jezzine during the summer increases causing water deficit.

2) Discharge from existing springs (Nabeh Azzibeh and Ain El Malayki) is very low during the summer.

3) 4 wells (Es-Souq, Midane 1, Midane 2 and Es-Souhoum) supply water of 4,000 m3/day.

4) Cost for pumping is a burden to the Water Authority.

5) Water deficit in Jezzine and surrounding areas is 4,000 m3/day in 1991 and will be 12,000 m3/day in 2020.

Data Source: Dams of Jinsnaya-Azzibeh-Dar Beachtar (Italian Cooperation Mission), March 2001, CDR

Project Name	No. 502, Younine Dam									
Phase Completed	1) A preliminary summary study, 1997 2) Proposal for the US Trade and Development Agency for Financing of Detailed Feasibility Study, March 2000, MEW									
Location	Mohafaza	Bekka	Caza/Village, Town	Baalbeck/Younine						
Discharge	Water Resources	Surplus water form Yammouneh Spring + runoff of dam watershed + Wadi Nahle								
	Annual Runoff of Dam Watershed (million m3)	0.35								
	Available Volume from Yammouneh subtracting present uses from discharge (million m3)	Oct	Nov	Dec	Jan	Feb	Mar	Total		
		1.59	1.50	2.33	2.62	2.76	9.21	20.01		
Dam	Type	Earthfill Dam	Max. Dam Height (m)	55	Crest Length (m)	800				
	Crest EL (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA				
	High Water Level (EL. m)	1255	Bottom Water Level (EL. m)	1200						
	Storage Capacity (million m3)	20	Active storage (million m3)	NA						
	Catchment Area (km2)	9	Dam Volume (million m3)	NA						
	Cost (US$ million)	14.6	as of	2000	Construction Period (years)	NA				
Purpose	Domestic	non								
	Industrial	non								
	Irrigation	1,545 ha of pressurized irrigation by gravity								
	Hydro-Power	non								
Other Facilities for Project										
Conveyance: pipes (adduction) by gravity from Yammouneh to Dam (D = 1,000mm, L = 22km)					Cost (US$ million)	11.0				
Pressurized Irrigation Scheme					Cost (US$ million)	4.5				
Total Project Cost (US$ million)	30.1				as of	2000				

Remarks

1) The pipeline for conveyance will be used as a main pressurized irrigation line during the summer.

2) Rehabilitation and upgrade of domestic water supply in Younine has been conducted by the World Bank Loan. Therefore, domestic water supply is not included. Main sources for domestic water are wells.

3) The net water requirement at field is 11,000 m3/ha for April - October.

4) Efficiency is 60% for an open channel and 85% for a pressurized system of drip irrigation.

5) Pressurized irrigation can be applied by gravity using the elevation difference of dam bottom (1,200m) and agricultural land (1,000m).

6) Land reclamation: US$ 3,000/ha. Net revenue from irrigation is US$ 3,500 - 4,500/ha.

7) The land used to be cultivated by opium and cannabis but the government banned the cultivation in 1991.

8) Winter discharge from Yammouneh spring will be stored in the dam.

9) According to MEW's remarks on the Interim Report (Study on Water Resources Management Master Plan) dated March 27 2003, the storage capacity is reduced to 7 MCM. Thus, all information in this table has been changed.

Data Source: Proposal for the US Trade and Development Agency for Financing of Detailed Feasibility Study, March 2000, MEW

Project Name	No. 503, Massa Dam					
Phase Completed	1) Massa Dam on Yahfoufa-Janta River, Technical Pre-feasibility Study, March 1999, LRA					
Location	Mohafaza	Bekka	Caza/Village, Town	Zahle		
Hydrology	Water Resources	Wadi Yahfoufa (tributary of Litani river)				
	Data Availability	spot measurement during 1967 - 1983, significant data gaps				
Dam	Type	Earth Dam	Max. Dam Height (m)	35	Crest Length (m)	NA
	Crest EL (m)	1030.0	Crest Width (m)	7	Max. Base Width (m)	NA
	High Water Level (EL. m)	1026.5	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	7	Active Storage (million m3)	NA		
	Catchment Area (km2)	152.4	Dam Volume (million m3)	NA		
	Catchment Area in Lebanon (km2)	89.5	Reservoir Area (km2)	0.6		
	Cost (US$ million)	16.89	as of	1999	Construction Period (years)	2
Purpose	Domestic	nearby villages				
	Industrial	Non				
	Irrigation	in downstream				
	Hydro-Power	Non				
Other Facilities for Project						
not specified					Cost (US$ million)	
					Cost (US$ million)	
					Cost (US$ million)	
Total Project Cost (US$ million)					as of	

Remarks

1) There are two axis sites as alternatives but the upstream axis is recommended due to the large karst cavities.

2) 4 crest elevation were proposed for cost estimate but the selection was not discussed yet.

3) The use of water is not studied yet.

4) At the dam site, significant portion of river flow is lost by infiltration.

5) Flow measurements at dam site were conducted twice on February 10 and 13, 1999 (0.2 - 0.4 m3/sec).

6) The cost includes contingency of 15%, engineering cost of 8.5% and land acquisition.

7) Unit cost of storage ranges from 2.10 to 3.46 US$/m3. The lower the storage is, the higher the cost is.

Data Source: Massa Dam on Yahfoufa-Janta River, Technical Pre-feasibility Study, March 1999, LRA

Project Name	No. 601, Kfarsir Dam					
Phase Completed	1) Identification of potential dam site					
Location	Mohafaza	Saida	Caza/Village, Town			
Hydrology	Water Resources	Litani river (5 km upstream from diversion weir located in the upstream)				
Dam	Type	NA	Max. Dam Height (m)	NA	Crest Length (m)	NA
	Crest EL (m)	NA	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	NA	Normal Water Level (EL. m)	NA		
	Storage Capacity (million m3)	10.00	Active Storage (million m3)	NA		
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA		
	Cost (US$ million)	NA	as of		Construction Period (years)	NA
Purpose	Domestic	Non				
	Industrial	Non				
	Irrigation	Supplement to Qasmieh irrigation project				
	Hydro-Power	Non				
Other Facilities for Project						
40m height Dike					Cost (US$ million)	
Conveyance					Cost (US$ million)	
Irrigation					Cost (US$ million)	
Total Project Cost for Lebanon (US$ million)					as of	

Remarks

1) Main objective is to mitigate the irrigation water deficit during summer in Qasmieh project.

Data Source: LRA

Project Name	No. 602, Khardale Dam					
Phase Completed	1) During 1967 - 1974, the studies, such as geology, topography, etc., are conducted.					
Location	Mohafaza	Nabatiyeh	Caza/Village, Town			
Hydrology	Water Resources	Litani river (middle stream)				
Dam	Type	Rockfill Dam	Max. Dam Height (m)	77	Crest Length (m)	NA
	Crest EL (m)	310.0	Crest Width (m)	NA	Max. Base Width (m)	NA
	High Water Level (EL. m)	308	Normal Water Level (EL. m)	305		
	Storage Capacity (million m3)	128.00	Available Storage (million m3)	85	dry year	
	Catchment Area (km2)	NA	Dam Volume (million m3)	NA		
	Cost (US$ million)		as of		Construction Period (years)	NA
Purpose	Domestic	rural water supply in the irrigation project below				
	Industrial	NA				
	Irrigation	6,600 ha between Sainiq river and southern boarder expanding E.L. 200 to 500m and supplement to Qasmieh				
	Hydro-Power	NA				
Other Facilities for Project						
					Cost (US$ million)	
					Cost (US$ million)	
					Cost (US$ million)	
Total Project Cost for Lebanon (US$ million)					as of	

Remarks

1) New irrigation project (38 million m3), domestic water (7 million m3) and Qasmieh (40 million m3)

2) The above figures are based on UNDP/FAO but the figures obtained from Mr. Geadah is different.

3) There are three alternatives to locate a new irrigation project.

Data Source: LRA

Annex 2

Population

ANNEX 2: Population

Annex 2.1 Projected Population of Lebanon by Caza (in thousands)

Region		2002	2010	2020	2030	Average Annual Growth (%) '30/'02	Density (Person /km^2)
Mohafaza	Caza						
Beirut		440	483	542	608	1.16	30,632
Mount Lebanon	Aaley	167	194	233	282	1.88	1,049
	Baabda	589	697	862	1,065	2.14	5,677
	Chouf	162	186	220	262	1.73	550
	Jbeil	55	60	68	77	1.24	179
	Kesrwan	127	143	168	196	1.58	494
	Metn	545	641	785	962	2.05	3,535
	Total	1,645	1,921	2,336	2,844	1.98	1,398
North Lebanon	Akkar	148	158	173	190	0.90	234
	Batroun	94	102	113	125	1.02	432
	Bcharri	64	71	81	93	1.33	619
	Koura	86	95	107	121	1.23	660
	Minieh-Dinnieh	42	45	49	54	0.88	134
	Tripoli	340	405	505	629	2.22	18,365
	Zgharta	106	117	132	150	1.23	806
	Total	881	993	1,160	1,362	1.57	662
South Lebanon	Jezzine	86	92	101	112	0.96	426
	Saida	230	268	325	395	1.95	1,463
	Sour	199	218	246	278	1.20	663
	Total	515	579	673	785	1.52	825
Nabatieh	Bent Jbeil	74	81	91	102	1.16	372
	Hasbaya	42	46	52	58	1.16	229
	Marjaayoun	69	77	87	99	1.30	350
	Nabatieh	115	129	149	173	1.46	548
	Total	300	332	378	432	1.31	383
Bekka	Baalbek	191	210	237	269	1.22	118
	El Hermel	30	33	37	43	1.21	79
	Rachaiya	41	43	45	47	0.50	92
	West Bekka	86	94	106	120	1.18	256
	Zahle	241	280	339	410	1.92	855
	Total	588	659	763	889	1.47	208
Total		4,369	4,968	5,852	6,920	1.66	662

Annex 2. 1 (Breakdown of Population: 1/4)

- Projected Population of Beirut Suburbs by Caza (in thousands)

Caza	2002	2010	2020	2030	Average Annual Growth (%) '30/'02
Aaley	76	91	114	142	2.23
Baabda	492	587	732	912	2.23
Chouf	28	33	41	51	2.23
Metn	385	460	573	715	2.23
Total	982	1,171	1,460	1,820	2.23

Annex 2. 2 (Breakdown of Population: 2/4)

- Projected Population of Mohafaza Center Cities (in thousands)

Mohafaza	Center City	2002	2010	2020	2030	Average Annual Growth (%) '30/'02
North Lebanon	Tripoli	336	401	500	624	2.23
South Lebanon	Saida	146	174	217	270	2.23
Nabatieh	Nabatieh	22	26	33	41	2.23
Bekaa	Zahle	135	161	201	251	2.23
Total		639	762	951	1,185	2.23

Note: Baabda is included in Beirut Suburbs.

Annex 2. 3 (Breakdown of Population: 3/4)

- Projected Population of Urban Areas by Caza (in thousands)

Region		2002	2010	2020	2030	Average Annual Growth (%) '30/'02
Mohafaza	Caza					
Beirut		-	-	-	-	-
Mount Lebanon	Aaley	82	94	111	131	1.66
	Baabda	95	108	127	150	1.66
	Chouf	129	147	173	204	1.66
	Jbeil	33	38	45	53	1.66
	Kesrwan	116	133	156	184	1.66
	Metn	145	166	195	230	1.66
	Total	601	685	808	952	1.66
North Lebanon	Akkar	46	52	62	73	1.66
	Batroun	39	44	52	62	1.66
	Bcharri	44	50	59	69	1.66
	Koura	51	58	68	81	1.66
	Minieh-Dinnieh	13	14	17	20	1.66
	Tripoli	4	4	5	6	1.66
	Zgharta	63	72	84	100	1.66
	Total	258	295	347	410	1.66
South Lebanon	Jezzine	31	35	41	49	1.66
	Saida	64	73	86	101	1.66
	Sour	113	129	153	180	1.66
	Total	208	237	279	329	1.66
Nabatieh	Bent Jbeil	39	45	53	62	1.66
	Hasbaya	22	26	30	36	1.66
	Marjaayoun	46	52	61	72	1.66
	Nabatieh	57	65	77	90	1.66
	Total	164	187	221	260	1.66
Bekka	Baalbek	111	127	149	176	1.66
	El Hermel	17	19	23	27	1.66
	Rachaiya	0	0	0	0	1.66
	West Bekka	47	54	64	75	1.66
	Zahle	87	100	118	139	1.66
	Total	263	300	354	417	1.66
Total		1,494	1,704	2,009	2,368	1.66

Annex 2.. 4 (Breakdown of Population: 4/4)

- Projected Population of Rural Areas by Caza (in thousands)

Region		2002	2010	2020	2030	Rural Ratio (%)	
Mohafaza	Caza					2002	2030
Beirut		0	0	0	0	0.0	0.0
Mount Lebanon	Aaley	8	9	9	9	9.1	3.4
	Baabda	2	2	2	2	2.2	0.2
	Chouf	15	15	16	17	9.2	2.5
	Jbeil	22	22	24	25	39.3	32.0
	Kesrwan	10	11	11	12	8.2	6.1
	Metn	6	6	6	6	4.2	1.7
	Total	62	65	68	72	3.8	2.5
North Lebanon	Akkar	102	106	111	117	69.0	61.7
	Batroun	55	58	61	64	58.7	50.7
	Bcharri	20	21	22	23	31.5	25.0
	Koura	35	37	38	40	40.9	33.4
	Minieh-Dinnieh	30	31	32	34	70.2	63.1
	Tripoli	0	0	0	0	0.0	0.0
	Zgharta	44	45	48	50	41.0	33.5
	Total	286	297	313	329	32.4	24.1
South Lebanon	Jezzine	55	57	60	63	64.2	56.6
	Saida	21	22	23	24	24.8	6.1
	Sour	86	89	94	98	43.0	35.4
	Total	162	168	177	186	31.4	23.7
Nabatieh	Bent Jbeil	35	36	38	40	47.1	39.3
	Hasbaya	20	21	22	23	46.9	39.1
	Marjaayoun	24	24	26	27	34.0	27.2
	Nabatieh	36	38	40	42	38.9	24.2
	Total	114	119	125	132	38.1	30.4
Bekka	Baalbek	80	83	87	92	41.8	34.1
	El Hermel	13	13	14	14	42.5	33.3
	Rachaiya	41	43	45	47	100.0	100.0
	West Bekka	39	40	42	45	44.9	37.2
	Zahle	18	19	20	21	17.3	5.1
	Total	190	198	208	219	32.4	24.6
Total		815	848	891	937	18.6	13.5

Note: 1) Population growth of rural areas was estimated at 0.5% per annum.
2) Rural ratio represents ratio of rural population to total population of Caza.