

PH-AAA-043

931176/62

11/20/82

931176/62

11/20/82

**WATER AND SANITATION
FOR HEALTH PROJECT**



**COORDINATION AND
INFORMATION CENTER**

Operated by The CDM
Associates
Sponsored by the U. S. Agency
for International Development

1611 N. Kent Street, Room 1002
Arlington, Virginia 22209 USA

Telephone: (703) 243-8200
Telex No. WUI 64552
Cable Address WASHAID

WATER AND WASTE NEEDS OF METROPOLITAN BEIRUT AND SURROUNDING AREAS

WASH FIELD REPORT NO. 66

DECEMBER 1982

The WASH Project is managed by Camp Dresser & McKee Incorporated. Principal Cooperating Institutions and subcontractors are: International Science and Technology Institute; Research Triangle Institute; University of North Carolina at Chapel Hill; Georgia Institute of Technology—Engineering Experiment Station.

Prepared for:
USAID Mission to the Republic of Lebanon
Order of Technical Direction No. 124

WATER AND SANITATION
FOR HEALTH PROJECT



COORDINATION AND
INFORMATION CENTER

Operated by The CDM
Associates
Sponsored by the U. S. Agency
for International Development

1611 N. Kent Street, Room 1002
Arlington, Virginia 22209 USA

Telephone: (703) 243-8200
Telex No. WUI 64552
Cable Address WASHAID

The WASH Project is managed
by Camp Dresser & McKee
Incorporated. Principal
Cooperating Institutions and
subcontractors are: Interna-
tional Science and Technology
Institute; Research Triangle
Institute; University of North
Carolina at Chapel Hill;
Georgia Institute of Tech-
nology—Engineering Experi-
ment Station.

December 22, 1982

Ms. Barbara Turner
AID NE/TECH
Room 4731 NS

Attention: Mr. Joseph Haratani

Dear Ms. Turner:

On behalf of the WASH Project I am pleased to provide you with 25 copies of a report on Water and Waste Needs of Metropolitan Beirut and Surrounding Areas.

This is the final report by Robert H. Thomas, Robert J. Kachinsky and Max S. Clark and is based on their trip to Lebanon from November 3 to November 19, 1982.

This assistance is the result of a request by the Mission on October 21, 1982. The work was undertaken by the WASH Project on October 21, 1982 by means of Order of Technical Direction No. 124, authorized by the USAID Office of Health in Washington.

If you have any questions or comments regarding the findings or recommendations contained in this report we will be happy to discuss them.

Sincerely,

Dennis B. Warner, Ph.D., P.E.
Director
WASH Project

cc. Mr. Victor W.R. Wehman, Jr.
S&T/H/WS

DBW:cdej



WASH FIELD REPORT NO. 66

LEBANON

WATER AND WASTE NEEDS OF METROPOLITAN BEIRUT
AND SURROUNDING AREAS

Prepared for the USAID Mission to the Republic of Lebanon
under Order of Technical Direction No. 124

Prepared by:

Robert H. Thomas, P.E.
Robert J. Kachinsky, P.E.
Max S. Clark, III, P.E.

December 1982

Water and Sanitation for Health Project
Contract No. AID/DSPE-C-0080, Project No. 931-1176
Is sponsored by the Office of Health, Bureau for Science and Technology
U.S. Agency for International Development
Washington, DC 20523

TABLE OF CONTENTS

Chaper	Page
EXECUTIVE SUMMARY.....	iii
PREFACE.....	1
1. INTRODUCTION.....	2
1.1 Background of Study.....	2
1.2 Scope of Work and Methodology.....	4
2. CONDITIONS AND NEEDS.....	5
2.1 General Conditions.....	5
2.2 Water Supply Organizations.....	5
2.3 Water Supply Conditions and Needs.....	8
2.3.1 General.....	8
2.3.2 Beirut Water Office.....	9
2.3.3 Ain Ed-Delbeh Water Authority.....	11
2.3.4 Other Water Authorities.....	12
2.4 Solid Waste Organizations.....	13
2.5 Solid Waste Conditions and Needs.....	14
2.5.1 Greater Beirut.....	14
2.5.2 Other Municipalities.....	19
2.6 Sewerage and Drainage Organizations.....	21
2.7 Sewerage and Drainage Conditions and Needs.....	24
2.7.1 Beirut Municipality.....	24
2.7.2 North Metn Union of Municipalities.....	25
2.7.3 Saida Municipality.....	25
2.7.4 South Beirut Suburbs.....	25
2.8 Overall Administrative Needs.....	26
3. RESPONSES TO THE NEEDS.....	28
3.1 Responses to Date.....	28
3.1.1 Water Supply.....	28
3.1.2 Solid Wastes.....	30
3.1.3 Sewerage and Drainage.....	31

Chapter	Page
3.2 Other Needed Responses.....	31
3.2.1 Water Supply.....	31
3.2.2 Solid Wastes.....	33
3.2.3 Sewerage and Drainage.....	35
4. OPPORTUNITIES FOR SHORT-TERM FOREIGN ASSISTANCE.....	37
4.1 Opportunities and Costs.....	37
4.1.1 General.....	37
4.1.2 Water Supply.....	38
4.1.3 Solid Wastes.....	50
4.1.4 Sewerage and Drainage.....	52
4.2 Priorities.....	57
 APPENDICES	
A. ORDER OF TECHNICAL DIRECTION AND ADDITIONAL MATERIALS.....	61
B. STUDY TEAM ITINERARIES.....	73
C. PERSONS INTERVIEWED.....	74
D. ILLUSTRATIONS.....	77
E. NEEDS IDENTIFIED BY MUNICIPALITIES AND WATER AUTHORITIES.....	90
F. SCOPES OF WORK FOR TECHNICAL ASSISTANCE AND CONSULTING SERVICES.....	101
G. REFERENCES.....	114

EXECUTIVE SUMMARY

A three-man WASH Project team spent approximately three weeks in Lebanon in November, 1982 to evaluate urgent needs for assistance in the water and wastes subsectors in the Beirut area and in southern Lebanon. This is the report on their mission.

Water supplies in Lebanon are provided by 15 water authorities, of which seven are located in the area under study. The largest of these authorities is the Beirut Water Office, which serves approximately one million persons. Most of the almost 4 million people in Lebanon are provided with piped water, but the quantities and reliability are generally inadequate. The public supplies are supplemented by private well systems, many of which, especially in the vicinity of Beirut, are polluted and brackish.

There was general deterioration of water supply systems during the civil war and extensive damage to some systems during the Israeli invasion. Because of both war damage and corrosion of galvanized-iron service connections, there has been extensive leakage and disruption of service. The distribution system in part of southwest Beirut was effectively destroyed. Parts of the source, treatment and transmission facilities in Saida and Jabal Amel (Taibe) were made unusable. Grid power outages continue to interrupt to service in all systems, including Beirut. The problems of leakage detection and repair are aggravated by the lack of qualified staff and equipment to undertake necessary rehabilitation, although a watermain repair team under West German sponsorship did provide temporary assistance until mid-November 1982.

The national government agency responsible for water supply is the Ministry of Hydraulic and Electric Resources. Since 1975, in coordination with the Ministry, the United Nations through UNICEF has provided system rehabilitation services, including studies, design, construction and some staff training, for water authorities in Lebanon. This work, which continues, is funded partly out of UNICEF's own budget partly from other international sources (including USAID), and partly by Lebanon's national Council for Development and Reconstruction (CDR). Most of the rehabilitation needs of water supply systems outside of Beirut are intended to be addressed under UNICEF direction.

Sewerage systems, which are in many instances combined with stormwater drainage systems, exist in the large coastal population centers. There was severe war damage to the systems in Saida and Beirut. The Beirut trunk sewers are very old and deteriorated, with numerous collapses and severe blockage problems. Adequate maps of the sewer systems do not exist. During heavy storms, local flooding occurs in the streets in parts of Beirut.

Sewerage and drainage are municipal responsibilities. For this reason, the responsible administrative agency at the national level is the Ministry of the Interior. Various ministries and other central agencies have been involved on sewerage system design and implementation. The Ministry of Hydraulic and Electric Resources is responsible for river flood control. Some urgent sewer and drain repair in southwest Beirut was done by the contracting firm OGER Liban with the assistance of the German watermain repair team. Beirut, Tripoli, and Saida have very limited sewer cleaning capability, while other sewer municipalities are understood to have none.

Solid wastes are collected and disposed of by municipalities and, in some cases, unions of municipalities. In general they are disposed of by open dumping, but there is one functioning compost/incineration plant at Qarantina in east Beirut.

There is a shore dump site at Normandie in north Beirut and another at Dawra in the northern suburbs. Both of these, and a shore dump site at Saida, have been greatly enlarged by disposal of building debris since the invasion. The Normandie and Dawra dumps have created enormous rafts of floating material in the Mediterranean Sea, and that at Saida will now do so. All three can be protected against the sea by suitable earthworks, and the dump at Normandie can now be closed, since solid waste from the west can now be transported to east Beirut.

After the Israeli siege of west Beirut, the Lebanese contracting firm OGER Liban, with funding from Saudi Arabia, undertook a very effective crash program of rubble and trash removal, but the firm will soon stop this work. During the invasion, many municipal compactor and other trucks were damaged or destroyed both in Beirut and elsewhere. Truck maintenance facilities are lacking as are basic office equipment and furniture.

Several opportunities have been identified for possible foreign assistance without duplicating known efforts by others. These are as follows:

HIGH PRIORITY PROJECTS (IN PRIORITY ORDER)	ESTIMATED DOLLAR COMPONENT
1. Beirut Municipality: provide 40 solid waste packer vehicles	\$ 2,500,000
2. Beirut Municipality; sewer cleaning, inspection, mapping, training ¹⁾	1,900,000
3. CDR: consultant advisory services to waste management technical group ^{1) 2)}	1,000,000
4. Beirut Water Office: repair damaged water mains, provide stand pipe supplies in poor areas ¹⁾	2,400,000
5. Ministry of Hydraulic and Electric Resources (for Saida Water Authority): provide equipment to augment well capacity ³⁾	350,000
6. CDR or Grand Projects of Beirut: Greater Beirut Area solid waste feasibility study ¹⁾	750,000
7. Ministry of the Interior (for other communities): provide solid waste packer and other vehicles	1,000,000
8. Ministry of Hydraulic and Electric Resources: provide laboratory, well testing and survey equipment ³⁾	600,000

9. Ministry of Hydraulic and Electric Resources (for the Ain Ed-Delbeh, Barouk, Saida, Nabaa Et-Tasseh, Sour and Environs, and Jabal Amel Water Authorities): repair watermains, provide training and equipment ³⁾	3,700,000
10. Beirut Water Office: provide standby pumping capacity at Ashrafiyeh ¹⁾	100,000
11. Ministry of Hydraulic and Electric Resources: prepare water resources and water supply development master plan ^{1) 3)}	3,000,000
Subtotal	\$ <u>17,300,000</u>

OTHER PROJECTS

	ESTIMATED DOLLAR COMPONENT
o Beirut Municipality: provide 10 dump trucks and 2 front-end loaders	\$ 1,000,000
o Ministry of the Interior (for Saida Municipality): sewer cleaning, inspection, mapping, training ¹⁾	600,000
o Ministry of the Interior (for North Metn Union of Municipalities): sewer cleaning inspection, mapping, training ¹⁾	1,000,000
o Beirut Water Office: replace damaged mains ¹⁾	3,700,000
o Beirut Water Office: provide standby generator sets at water treatment plant and main pump station ¹⁾	2,000,000
o Ministry of Hydraulic and Electric Resources (for the Jabal Amel Water Authority): provide additional raw water pumping and mains capacity ¹⁾	600,000
o Ministry of Interior: replace damaged solid-waste vehicles (compactors, bulldozers, dump trucks, street sweepers, jeeps, and dumpsters) requested by 60 municipalities ⁴⁾	<u>10,000,000</u>
Subtotal	\$ 18,900,000
TOTAL	\$ 36,200,000

- 1) Requires consulting engineering services (cost included)
2) It is understood that the Italian Government is considering funding this work.
3) Requires preparatory technical assistance (cost included)
4) This item is divisible, according to available funds.

PREFACE

This report was prepared by a team consisting of R. H. Thomas (team leader), R. J. Kachinsky and M. S. Clark III, all of Camp Dresser & McKee Inc. (CDM). Technical and logistic support for the team was provided by the Lebanese consulting engineering firm Dar Al-Handasah (Shair & Partners). Specialist technical inputs and graphics assistance were provided by staff of CDM headquarters offices in Boston, Massachusetts.

Grateful acknowledgement is made of the help of the persons interviewed during the study. They are listed in an appendix to this report.

Because of the current volatility of the Lebanese pound exchange rate, all costs herein are expressed in U.S. dollars, converted where necessary from Lebanese pounds at the rate LL 4.00 = U.S. \$1.00.

Chapter 1

INTRODUCTION

1.1 Background of Study

Because of civil war conditions that have prevailed in Lebanon since 1975, and the recent Israeli invasion, serious deficiencies in water and waste systems and facilities have accumulated in Lebanon.

This study was initiated by the U.S. Agency for International Development (USAID) with the purpose of establishing a basis for foreign assistance in rehabilitation and urgent improvement of such systems and facilities in Beirut and parts of southern Lebanon.

Lebanon has an area of approximately 10,200 km² and a population approaching 4 million. This population is largely concentrated in the coastal cities, with about 50 percent of the total residing in the Beirut area. Figure 1 shows the principal geographical features, population centers and administrative subdivisions of Lebanon. References herein to southern Lebanon apply to areas south of the Beirut-Damascus highway and embrace all or portions of four Mohafazas: Beirut, Southern Lebanon, Mount Lebanon and the Bekaa.

Although most of the population is served by public water supply systems (an estimated 95 percent of total population and 85 percent of all communities), serious deficiencies in the quantity and quality of public supply have encouraged the widespread use of private well supplies. Well water is often brackish and polluted. In the Beirut system, there is a high level of leakage losses, and the source capacity is inadequate for part of the year, requiring rationing in the dry season. No recent overall water supply planning studies for either Beirut or Lebanon as a whole have been conducted.

A waste management master plan study¹⁾ conducted in 1980/2 showed that, of the total estimated design population (including displaced persons and second homes) of approximately 4.7 million, about 50 percent were served by public sewers, 42 percent by septic tanks/cesspits and 8 percent by dry methods. Beirut Municipality is fully sewered, Mount Lebanon is 54 percent sewered and South Lebanon is only 19 percent sewered, on a population served basis. Sewer systems were in general designed as separate systems but have become combined with drainage. Because of lack of capacity and clogging, serious local flooding by polluted water occurs in low areas in major cities during rainstorms. Sewage is discharged through short outfalls near popular beaches.

The 1980/2 waste management study¹⁾ also showed that there were systems for solid wastes collection in most communities with populations over 5,000 but irregular collection led to littering. Disposal was generally by uncontrolled dumping. Refuse burning at dumps was common. There was an operating compost

1) Reference No. 1 in Appendix G.

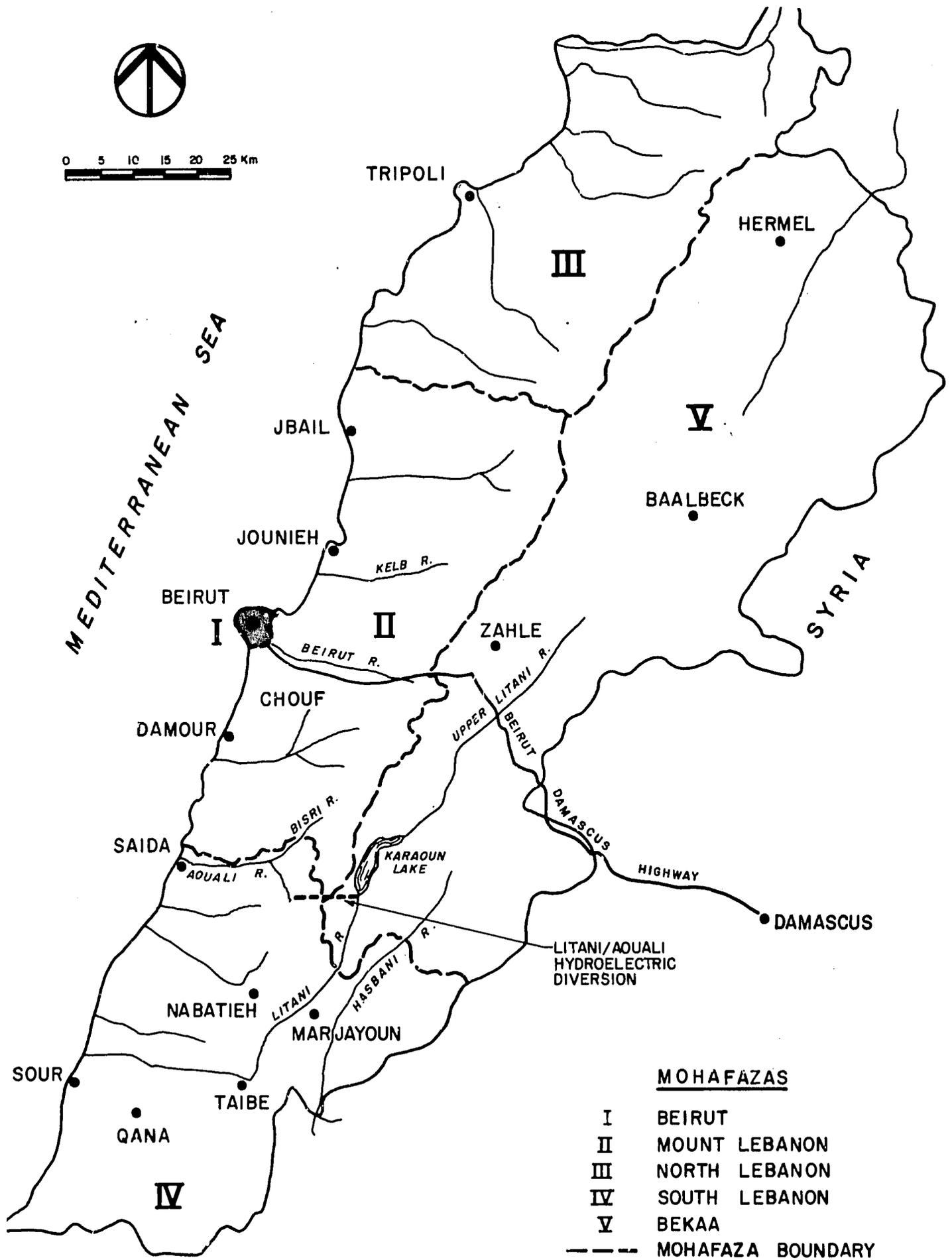


Fig. 1 LOCATION MAP

plant in east Beirut but most collected waste was dumped at the shore. The waste disposal problem has been severely compounded by the rubble created by demolition of war-damaged buildings and other facilities.

Under the project Water and Sanitation for Health (WASH), an Order of Technical Direction (OTD) No. 124 was issued by USAID on October 25, 1982 covering the work described herein.

1.2 Scope of Work and Methodology

Following preliminary evaluation by the study team after arrival in Lebanon, in agreement with the USAID mission in Beirut, minor amendments to the scope of work and a plan of work were developed. Together with the OTD, these are presented in Appendix A. In summary, they require the determination of broad conditions and needs, and of specific opportunities and priorities for short-term foreign assistance, in the areas of water supply, wastewater, drainage and solid wastes management in the Beirut metropolitan area and major cities of southern Lebanon.

The WASH study team arrived in Beirut on November 3 and departed on November 23, 1982. Their detailed itineraries are presented in Appendix B.

In coordination with the USAID mission in Beirut, interviews were conducted with senior representatives of the Council for Development and Reconstruction (CDR), the Ministry of Hydraulic and Electric Resources, and other relevant executing, operating and assisting organizations and agencies. The persons interviewed are listed in Appendix C. In addition, visits of inspection were made to relevant facilities and operations to obtain additional information. Such relevant existing documentation as was available was reviewed. A preliminary draft of this report was reviewed with the USAID mission, discussed and amended in minor respects before final production in the Boston, Massachusetts headquarters offices of Camp Dresser & McKee Inc. (CDM) and the WASH office in Arlington Virginia.

There were few travel difficulties for the team. However, the planned visit to Sour was not made because it was established by the U.S. Embassy in Beirut that security in the south was inadequate to permit this following the destruction of the Israeli headquarters in Sour on 10 November. No visit to the Chouf region was planned or possible because of continuing disturbances there.

Chapter 2

CONDITIONS AND NEEDS

2.1 General Conditions

Damage to buildings, roads and other infrastructure elements in Lebanon has been very extensive. Some of the damage, such as the total devastation of the central business district in Beirut, dates from the civil war which began in 1975. In other places, such as the coastal portion of west Beirut, the main damage was done during April 1981 and the summer of 1982.

War damage is evident throughout Lebanon. Some towns, such as Damour, were virtually completely destroyed. Damage was also extensive in mountain villages in the south and in the cities of Sour and Saida. Some illustrations of typical visible damage are included in Appendix D.

Somewhat surprisingly, there appear to have been no serious outbreaks of water-or food-borne disease in spite of the fact that the water supply of Beirut was almost completely shut off for 28 days and is still effectively shut off from some areas. There is typhoid in Lebanon¹⁾, but little beyond the normal seasonal outbreak in October occurred. The lack of public health crisis has been attributed to the open availability of bottled water and soft drinks during the siege, and to the lack of fresh vegetables (often irrigated with sewage) during this period.

By the time of the arrival in Lebanon of the WASH study team, major clean-up operations were already well in hand, especially in Beirut. The work of removing refuse and debris from public and private property continued during the team's stay. Day by day, more people could be seen moving back into usable parts of damaged buildings, and more buildings were undergoing repair. Food vending and other commercial operations were taking place even in badly damaged areas. Sidewalks and other areas formerly covered with squatter shanties and open stores have now been completely cleared.

While the roads both in and outside the cities show evidence of past lack of maintenance and partially repaired cratering, travel by car is feasible almost everywhere, subject only to halts at check-points. There were four reported bomb blasts in Greater Beirut during the team's stay. A residual effect of the recent military activity is the continuing receipt at the Beirut compost/incineration plant of unused ammunition, some of which explodes during handling or incineration.

2.2 Water Supply Organizations

The central government agency responsible for water supply is the Ministry of Hydraulic and Electric Resources. Operational responsibility rests with 15 water authorities. The areas covered by these authorities are indicated on

1) -----
See reference 4 in Appendix G.

Figure 2; The boundaries of jurisdiction in general bear no relation to water catchment areas. Largest of the authorities is the Beirut Water Office (Office des Eaux de Beyrouth, or OEB).

Among other functions, the Ministry of Hydraulic and Electric Resources:

- o Plans, designs (using consultants for major and special projects) and supervises construction of water supply facilities (except that minor planning and design is undertaken by the Beirut Water Office).
- o Supervises the water authorities.
- o Conducts water quality analyses (apparently limited to chemical and physical analyses, with bacteriological testing carried out by the Ministry of Health).

All water systems in Lebanon have suffered from an eight-year period during which conditions were not conducive to effective operation or maintenance. Collection of revenues was severely impacted, especially in the south. Except in Beirut, the water authority personnel are untrained. In all water authorities, recruitment and effectiveness of personnel are severely hampered by the very low salary levels. (This factor impacts upon government generally in Lebanon; many public servants, especially at lower levels, have more than one job.) Coordination between the Ministry and the authorities has been inadequate to ensure that designs are fully appropriate.

In 1974, enabling legislation was enacted permitting the establishment of five consolidated water supply authorities with the same boundaries as the five mohafazas, including Beirut. This was never implemented in practice. UNICEF coordinates its water supply activities closely with the Ministry of Hydraulic and Electric Resources, which has stationed an engineer in the UNICEF office for this purpose. Over the years, UNICEF has provided assistance to Lebanon amounting to \$50 million in the health, education, and water supply sectors. Since 1976, UNICEF has been playing an increasingly direct role in rehabilitation of public water supply facilities because of the emergency conditions.

The Beirut Water Office has been assisted since the invasion by a watermain repair group provided by the government of West Germany. This is discussed in section 3.1.1.

On the basis of discussions with UNICEF and water authority personnel, and from on-site observation, it is clear that the southern water authorities need personnel training and technical guidance. The water authorities of Sour and Environs, Jabal Amel, Nabaa Et-Tasseh, and Saida. If training is provided, however, administrative changes will be necessary to ensure that trained personnel are not lost to the more financially attractive private sector and that a suitable organizational management environment is provided so they can work effectively. Have a combined staff of 261 persons, but only 3 engineers.

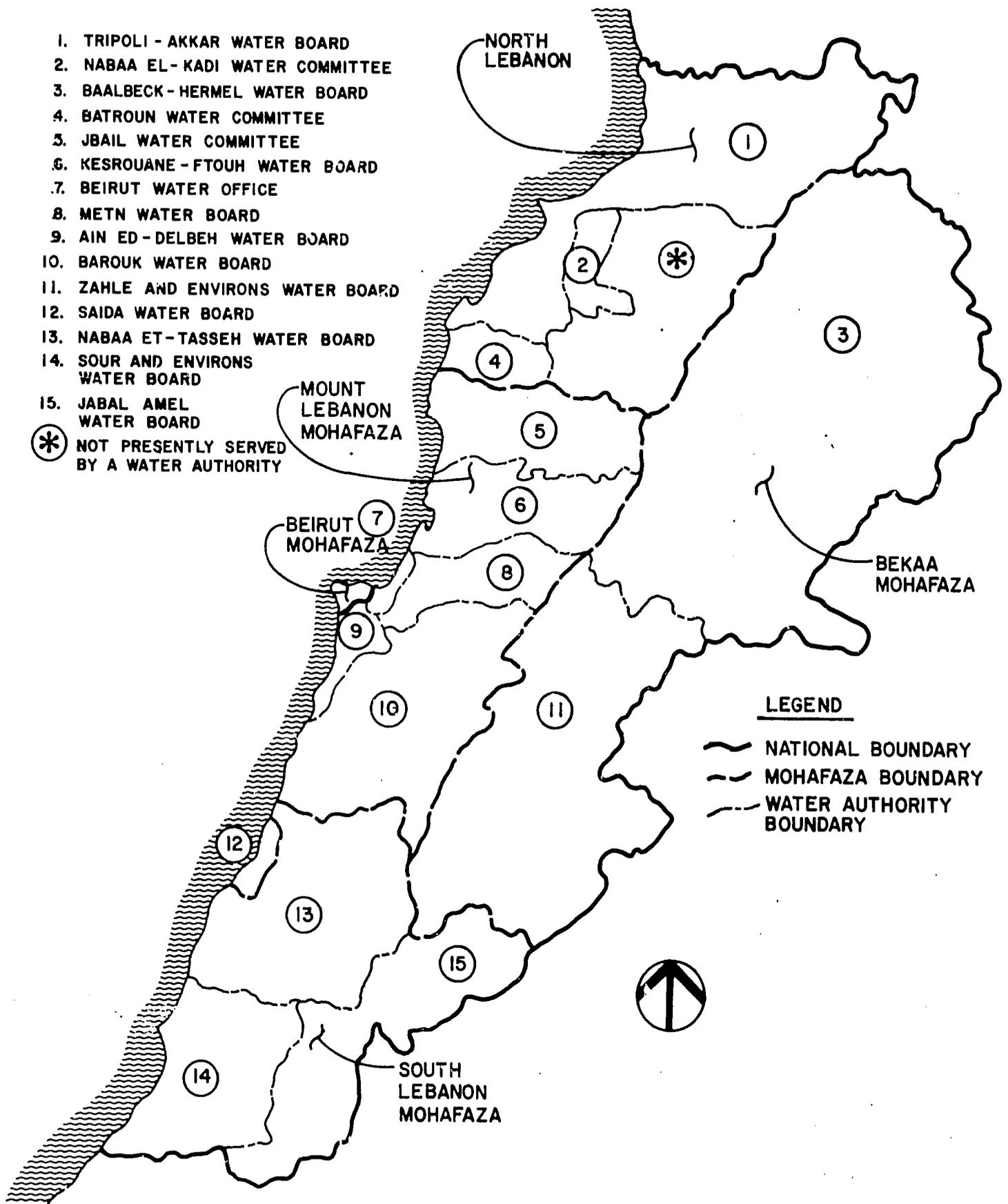


Fig. 2 WATER AUTHORITIES AND MOHAFAZAS

2.3 Water Supply Conditions and Needs

2.3.1 General

Most water supply systems in Lebanon were designed and constructed before 1965, but they have received virtually no maintenance from 1975 to now. In many cases they suffered war damage before and during the Israeli invasion. Distribution systems are inadequately sized and have excessive leakage. Except in Tripoli (which is metered), domestic water connections are not metered but are provided with orifices of various sizes to limit peak demands and to serve as a basis for charges for service.

The major public systems utilize spring sources but these are now inadequate. The supplies are supplemented by public and private use of groundwater. Most of the geological formations from which groundwater is obtained are fractured limestone. Groundwaters are contaminated by polluted surface water and, in the major coastal cities, suffer from saline intrusion¹⁾. There is no effective control of well drilling or pumping.

There is competition for water sources. Competition occurs between irrigation and urban uses and between central and southern needs. The rivers (except the Litani River) are short and most of their wet-season flows are lost to the sea. The Litani River, including Karaoun Lake, is the major surface water source in the country. It is imperative that its use be optimized for power generation, irrigation and urban water supply. It will probably become a major water supply source for urban developments (including Beirut) extending from Jounieh to Saida. It is also important for the south.

Because of the steep topography of Lebanon, except for the Bekaa Valley and a narrow coastal strip, and because of the prevalent limestone formations, it is very difficult to find locations for economical, leak-free storage reservoirs.

Catchment areas above about 1000m elevation are in general undeveloped, but there will be an increasing tendency to develop them for recreation, requiring consideration of the possible need to protect certain critical areas against access.

A study is being conducted by PRC/ECI and Dar Al-Handasah Nazih Taleb for the Litani River Authority. This study is funded by the World Bank, addresses the feasibility of constructing a multi-purpose dam on the Bisri tributary of the Aouali River.

There are other problems that are common to all or most urban water supply authorities and systems. These include: how to protect spring sources against pollution; how to train and guide operation and maintenance personnel; what common engineering standards should be adopted for such features as design flows, pipe materials, service connections and meter installations; how to determine and control leakage losses; and what central technical support should be provided for local water supply operating entities.

1) -----
Reference No. 5 in Appendix G.

There is a need for a nation-wide water supply and resources study to address all of the above matters. The construction cost for improved modern potable supply systems in Lebanon would probably exceed one billion dollars and would take many years to implement. A national plan would be valuable in resolving or quarantining potential conflicts, allocating and prioritizing the development of water from potential sources, and identifying a rational, least-cost strategy for development of regional water supply systems.

2.3.2 Beirut Water Office

The Beirut Water Office supplies potable water to about one million people. The basic system is shown in Figure 3.

Even without the recent wars this system would be in serious trouble. It suffers from inadequate source supply, inadequate transmission facilities, antiquated pumping stations and a severely inadequate distribution network.

The major effect of the wars was damage to the pumping and distribution facilities, particularly in the southern areas of the system. The distribution pipes and reservoirs were heavily damaged, and in many places the pipes are totally destroyed. Some repair work has been done on the reservoirs, but more is needed.

At this time, the only source of water to the southern areas is by truck. In these areas the refugee camps were heavily damaged but not totally destroyed. A large population of refugees remains. A significant section of this area is occupied by well-built modern high-rise (10-12 story) apartment buildings. These buildings suffered significant damage, but most appear to be repairable. In fact, repair work was already starting on many units at the time of the team's visit.

The main water supply to this area has been shut off, as a result of heavy damage to the 700mm and 6-in lines which serve the area.

As was mentioned above, the system suffers from inadequate source supply. For that reason alone, it is critical that the current severe leakage from damaged pipes and reservoirs be corrected as quickly as possible. This severe loss of water will affect the entire population served regardless of location in less war damaged or undamaged areas.

Leakage from the Lower Ashrafiyeh reservoirs was observed to be in the order of 4 percent of total storage (this is equivalent to the daily consumption of about 6,000 people).

The OEB does not have any significant equipment and supplies to undertake the necessary repair work. All of its repair equipment was looted and destroyed during the wars.

Another serious problem confronting the OEB system, is that of relatively frequent power outages in Beirut. These outages cause interruption of supply, often for periods up to half a day. The antiquated electrical controls and switchgear are dangerous, and they require slow restart procedures. Standby diesel generator sets are badly needed at all pumping facilities. UNICEF has

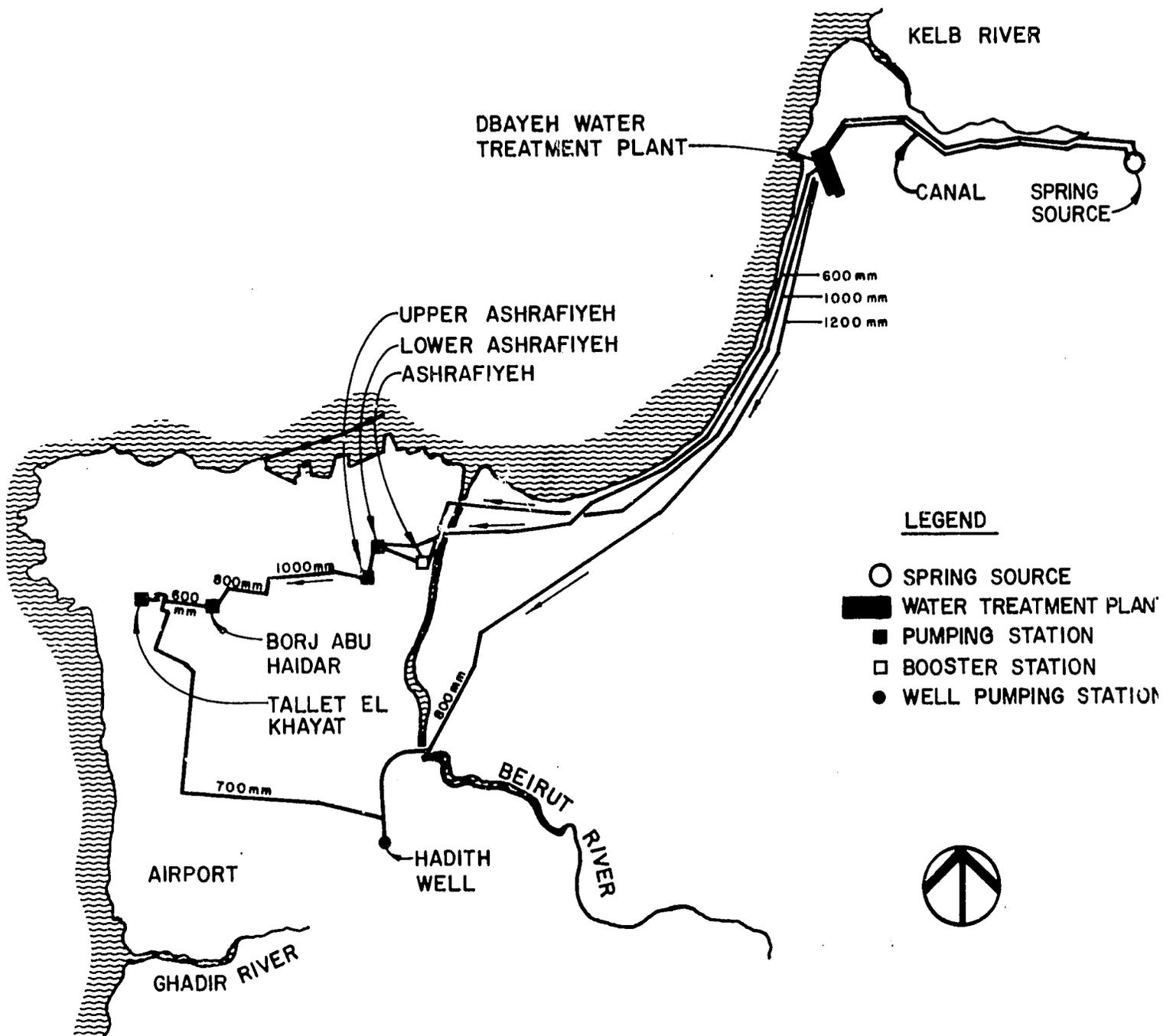


Fig. 3 BEIRUT WATER SYSTEM SCHEMATIC

installed gen-sets at several pump stations. However, neither the treatment plant, which is the sole source of water to the system, nor the main reservoir pump station are provided with standby power. There is a need for two large (3000 kw and 6000 kw) standby generators at the water treatment plant and main pump station.

As the most seriously damaged buildings are being torn down, severe loads from heavy equipment and debris are imposed on the already weakened pipelines. This will continue to cause further breaks in the pipes.

In summary, the OEB is currently managing to provide water to most parts of the city but just barely. Loss of any component or a major break in a pipeline has serious consequences for the entire system. The quantity of water being lost aggravates an already serious lack of source supply.

2.3.3 Ain Ed-Delbeh Water Authority

War damage was extensive in the service area of this water authority, which serves the southern suburbs of Beirut. Officials for 13 of these communities containing about 500,000 people estimated that 15km of water mains were destroyed during the invasion (see Appendix E). Information from the Ministry indicated a total of 35km of galvanized steel pipe, 1/2-in to 4-in size, is needed for rehabilitation (see Appendix E). Discussions with the director of the water authority indicated several additional projects which are urgently needed, and are reportedly being considered by UNICEF and World Bank for implementation:

- o Repair of wells in Hazmiyeh and Damour (at the southern edge of the service area).
- o Additional water mains from wells to a central storage reservoir in Hazmiyeh.
- o Additional 5000 cu m storage reservoir for the southern portion of the network.
- o Standby generators at Galerie Semaan, Dachounieh, and Hazmiyeh.
- o Replacement of a heavily-damaged 8-in transmission line from wells in Damour to the airport by a new 12-in transmission line.
- o Replacement of seven war-damaged maintenance vehicles (nine vehicles still in service).
- o Installation of a 24-in transmission line from the Dachounieh diversion dam on the Beirut River to a recently-completed sedimentation basin (to be operated during the wet season for groundwater recharge and also to feed a new treatment plant at Hazmiyeh).
- o Provision of water conditioning equipment and a transmission line to carry hard well water from Galerie Semaan to the Hazmiyeh water treatment plant.

2.3.4 Other Water Authorities

Lists of rehabilitation needs were submitted to the Ministry of Hydraulic and Electric Resources by the water authorities, and these were passed on to the WASH team. During subsequent discussions by the team with senior staff of the Saida, Nabaa Et-Tasseh, Jabal Amel, and Sour and Environs Water Authorities, adjustments were made to these lists. Most of these adjustments resulted from additional pipe quantities added by the authorities. The adjusted lists are presented in Appendix E.

The pipe quantities in Appendix E combine estimated replacement needs due to deterioration and to damage, and may also in some cases include provisions for local systems planned but not installed.

Pipes used are generally imported ductile iron and locally made asbestos cement in the larger sizes, and locally made galvanized steel in the smaller sizes. Galvanized steel deteriorates rapidly by rusting. During the team's visit to Marjayoun and Qlia (supplied with water by the Jabal Amel Water Authority), visible leakage was occurring at about 25 percent of the road crossings.

During the team's discussions with the water authorities, some additional needs were identified. These included:

- o The Nabaa Et-Tasseh Water Authority has already received some pipes from the Ministry of Hydraulic and Electric Resources but lacks funds to install them.
- o The possible use of high density polyethylene pipe in small diameters was discussed. Several authorities felt their pressures (100m of head in village networks, and up to 400m of head in transmission lines) would be too high and that rats would eat the pipe. (Neither is in fact true.)
- o The Jabal Amel Water Authority cannot use its Litani River high lift pump station (supplying the Taibe treatment plant) for two months each year because of the sand and gravel content of the water. A redesigned intake is needed. This pump station also lacks an access road. Access into the Litani gorge is by foot or by donkey and takes 4-1/2 hours for the round trip from the treatment plant. Improved access is needed. Included in Appendix E is provision for reconstruction of the destroyed 320 m³/hour rapid sand filter plant at Taibe. At present the old slow sand plant is being used at a rate of about 350 m³/hour. When the plant is rebuilt there will be a need for added raw water supply, requiring additional pumping capacity at the river and replacement of 2000 m of the badly damaged 3600-m long 10-in diameter raw water main which parallels the 12 inch main currently in use.
- o The Saida Water Authority has a twin 4 km gravity pipeline (understood to comprise 14-in asbestos cement and 10-in ductile iron) from its spring source to a 5000 m³ service reservoir. Both lines were severely damaged. The road to the spring was damaged to the point that there is now no access to it. There is also no power supply. A new chlorinator and generator are required, and a rebuilt access road. However, the most urgent need of this system is additional operating and standby capacity

for the wells which are currently the only source of supply. There are five existing wells: two of unknown characteristics and lacking pumps, in the Palestinian camp at Halweh, and three others nearby of which one has recently began to pump gravel and was therefore put out of service. The remaining two wells, which are now the only ones in service, supply 800 m³/hr for 15 hr per day, compared with a normal dry-weather suppressed demand of 18,000 m³/day and a wet season demand (making use of the higher wet season yield of the spring) of 25,000 m³/day. The Saida rapid sand filter plant was reported to be badly deteriorated and in need of rehabilitation or replacement. This should await an overall technical evaluation of the system and its future development.

2.4 Solid Waste Organizations

Operational responsibility for solid waste collection and disposal lies with the local municipalities and communities of Lebanon. Of the 1,800 communities in Lebanon, 625 are legally defined as municipalities, although of these 211 are classified as "inactive" municipalities. The Ministry of Interior provides administrators, solid-waste equipment, project funds, and general revenues for local government. The Municipal Affairs section of the Ministry is the primary channel for funds for the municipalities. Rural areas and unincorporated communities are served from the mohafaza and caza levels of government by a separate section of the Ministry. In general, the level of funding to rural areas is minimal.

Although municipalities are authorized to collect certain types of local taxes, in actual practice only about a dozen communities receive significant revenues from local industries or other sources. Although the Ministry is thus the major source of municipal revenue, the amounts received are very low by U.S. standards, averaging only \$12/capita/year before the war.

The larger communities in each mohafaza perform some solid wastes collection and disposal. The smaller ones in many cases have formed formal or informal unions for this purpose. In Greater Beirut there are two unions of municipalities, for North Metn and the south Beirut suburbs. These have been formed in part to provide regional solid waste services. In South Lebanon, Saida provides collection and disposal services for itself and 12 surrounding communities which have also formed a union.

In Beirut Municipality, which has the status of a mohafaza, the responsibility for solid wastes collection has been delegated to two divisions as follows:

- Sanitation Division: operation of collection and transportation services.
- Engineering Division: supervision of turnkey operation of the Qarantina compost plant; maintenance of collection vehicles.

A direct result of the shelling, strafing and bombing of Beirut, particularly west Beirut, was the creation of enormous quantities of building rubble and debris. The Lebanese construction contractor OGER Liban, under funding from

the Government of Saudi Arabia, took over the removal of rubble (and, as necessary, garbage) on a temporary basis from September 6, 1982, acting under the general direction of the Governor of the Mohafaza. It was understood that the company was to give up this work at the end of November.

At the start of its work, OGER Liban tried to use the existing municipal sanitation labor force of 1600 men, but found their attendance and effectiveness to be so poor that they replaced them with 700 directly hired personnel. (By the first week of November, this force had been reduced to 150.) It is understood that, even for semi-skilled positions such as drivers and mechanical maintenance personnel, the problem is not lack of competent people but salary and administrative conditions in the municipality.

The World Health Organization (WHO), as executing agency for the United Nations Development Programme (UNDP), sponsored the preparation of a National Waste Management Plan. This was to have been paralleled and followed by preliminary engineering and feasibility (PE/F) studies for solid waste management, sewerage and drainage for four priority areas: Tripoli, Jounieh, Zahle and Saida. These latter studies were in fact not able to be performed.

2.5 Solid Waste Conditions and Needs

2.5.1 Greater Beirut

Prior to the Israeli invasion, east and west Beirut had effectively been separated by the civil war. Solid wastes from east Beirut were conveyed to the Qarantina compost/incineration plant by trucks maintained in private garages in east Beirut after destruction of the former maintenance facility at Qarantina. Waste from west Beirut was carried to a shore dump at Normandie in trucks maintained in an open yard near the Arab University. (Refer to Figure 4 for locations of solid waste facilities in Beirut.)

The Qarantina plant was provided and is operated by a French company under contract to the municipality. It has a design capacity of 600 T/day. It was intended to serve the whole of the municipality. Because of hostilities, it was closed from mid-1975 through 1978, and it has been operated at reduced capacity since then. The plant was damaged slightly after the invasion by a bomb which had been picked up with refuse. The damage was repaired within two weeks, and the plant is currently treating 80 to 100 T/day of refuse. There is a marketing problem in disposing of the finished compost, which is accumulating on-site. Non-compostible material is incinerated, and the residue is disposed of on-site. Ferrous metal is recovered and baled.

Before the invasion, the Ministry of the Interior had in 1981 purchased 77 compactor trucks, ranging in capacity from 6 to 16 cyd for municipalities throughout Lebanon. Beirut Municipality had a prewar total of 80 compactors and 40 open trucks and received 29 replacement compactors from the Ministry in 1981 (14 of 14 cyd capacity and 15 of 16 cyd capacity).

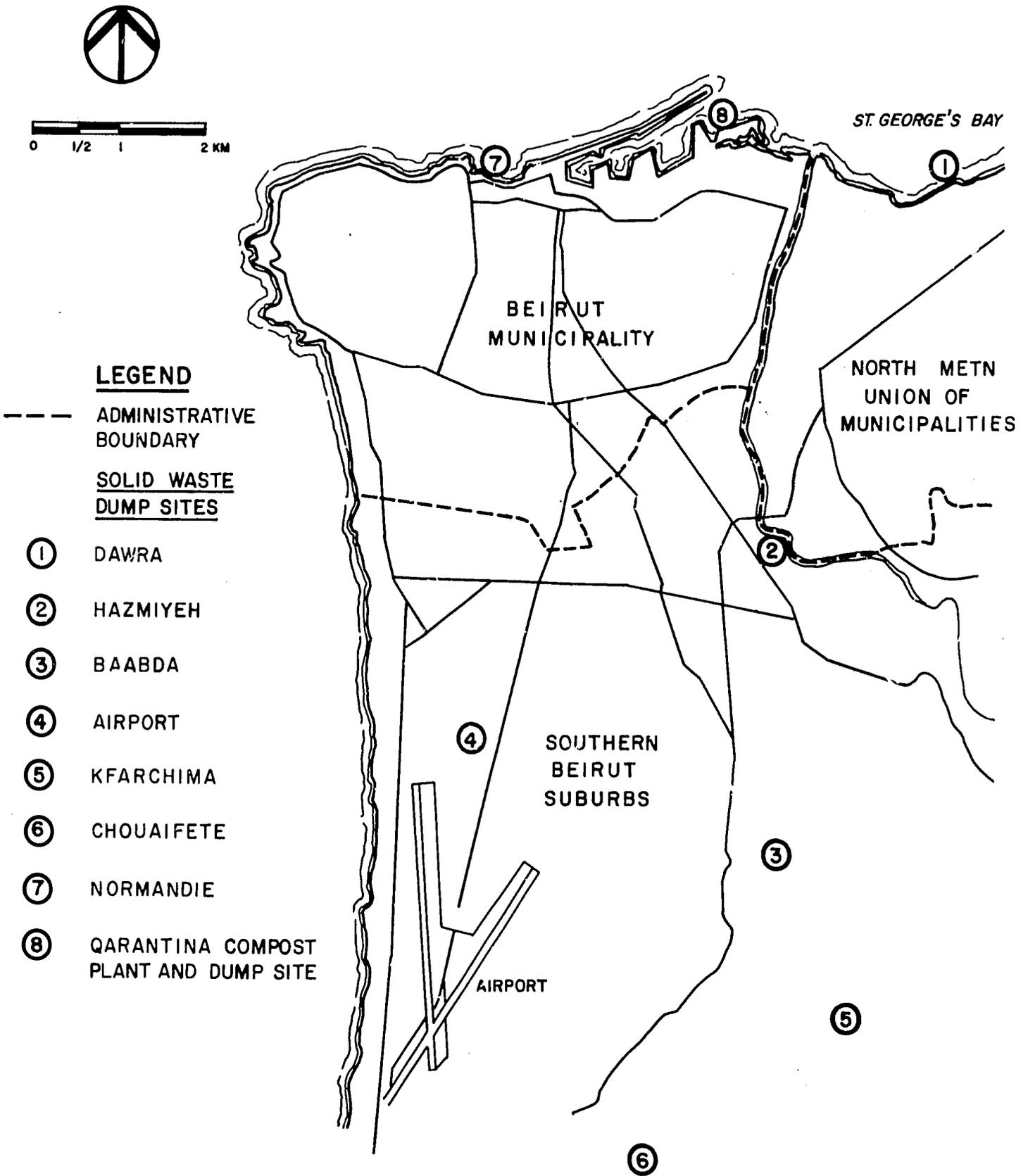


Fig. 4 BEIRUT SOLID WASTE FACILITIES

The Lebanese contracting firm OGER Liban lent Beirut Municipality 10 compactor trucks and 20 open trucks. (These vehicles are understood to have been brought from Saudi Arabia. It has been indicated but not confirmed that the 10 compactors are to be donated to Saida.) In addition, the municipality rented 25 open trucks. That is to say, there have been 75 trucks available in Beirut for municipal waste disposal purposes since the invasion, of which number 30 were compactor vehicles.

The Beirut Municipality has decided that it intends to use 1.5-cyd bins for the pre-collection storage of solid wastes taken from buildings along streets and alleys that are too narrow for 16-cyd packer vehicles. It is understood that OGER Liban will provide initially 450 and ultimately up to 900, as needed, of these bins. The use of bins will require that packer vehicles be equipped with hydraulic lifters matched to the bins.

The WASH team was informed that the municipality's estimate of the number of compactor trucks needed is 100 of 16-cyd capacity plus 20 dump trucks. The municipality also needs pick-up trucks, front-end loaders, tank trucks, street sweepers, sedan cars and a bulldozer (refer to Appendix E).

As a check on the above estimate for packer vehicles, one would expect that the approximately 600,000 population of Beirut would, at the estimated rate of 0.8 kg/day per person of refuse,¹⁾ generate about 480 T/day. This is in accordance with the municipality's estimate of 400 - 500 T/day but is very low by U.S. standards. On the basis of the 4-hour shifts actually worked by municipal personnel, with an average of 1.5 trips per shift, allowing for 20 percent of vehicles down for repair, the required number of 16-cyd packer vehicles needed would be 120. The number of such new vehicles needed, disregarding the 9 vehicles currently undergoing major repair, would then be 100. However, there appears to be no reason why each vehicle should not be used for two shifts each day, in which case the effective number of trips per vehicle would be doubled, reducing the required number of new vehicles to 40. (It is understood that security conditions are such that night work is not feasible.)

The Normandie dump has been enlarged greatly since the invasion because building rubble as well as refuse is being dumped there. The dump is being flattened and regraded by OGER Liban and has been given a good soil cover. Refuse burning, which was previously a problem, has now been controlled (although occasional fires still occur). There is some dust and odor, and floatable materials are carried away from the dump faces by the sea. A floating boom has been provided along part of the west side (facing the St. Georges Hotel) to contain floatable materials.

Except for the swimming pool at the St. Georges Hotel and the landfill operation, there is no current residential or commercial use of the land in the vicinity. Nearby buildings have been heavily damaged and are not usable at present. This will of course change in the future.

Since it is expected that all of the refuse of Beirut will soon be able to be taken to the Quarantina compost plant, it appears that dumping at Normandie can and should soon cease. The principal needs are therefore to decide the use

1)-----
Reference No. 1 in Appendix G.

and final shape of the filled area, to provide any necessary extensions of the outfall sewers on either side of it, and to finish it off with impervious and durable slopes against the sea. A possible interim measure would be to provide a floating boom around the full perimeter to contain floatables. The proposal in the National Waste Management Plan to provide a bund around the site and then to fill out to the bund no longer applies, as Beirut is no longer a divided city.

The North Metn suburbs of Beirut, lying to the east of the Beirut River and extending northward along the coast to the Kelb River, have been using the Dawra dump site in Borj Hammoud (see Fig. 4) for the past 25 years. The Dawra site is operated by the municipality of Borj Hammoud using supplementary funds from the user communities. In addition to the member communities of the Union of North Metn Municipalities, the south Beirut suburbs of Chiyah and Fourn Ech Chebbak use the Dawra site. The total population served by the site is about 450,000, and the quantity of solid wastes is reported to be 240 T/day. Within the large service area of Dawra, there are also many small open dumps in wadis and along roadsides.

The Dawra dump is recognized by local officials as a major environmental blight (see photograph in Appendix D). Open fires contribute to air pollution and mats of floating material are carried out to sea and deposited on shores northward from Dawra (as well as on the shores of Turkey and Cyprus). Limited amounts of cover material are used to bury the trash and ashes, and the access road is barely navigable by passenger cars.

Informal discussions with local officials indicated that the Qarantina compost plant has remained closed to collection vehicles from west Beirut, primarily because of political pressure on Beirut to allow the wastes now going to Dawra to be taken to Qarantina. However, the capacity of Qarantina is insufficient to handle wastes from east and west Beirut plus the communities served by Dawra.

As a result, two urgent interim needs are evident: the Qarantina plant should be opened for use by west Beirut; and the Dawra site must be modified to minimize environmental impacts.

The Dawra site is within the limits of a coastal land reclamation development planned by Dar Al Handasah (Shair and Partners) for the Union of North Metn Municipalities¹⁾. A number of political, legal and administrative hurdles remain before this scheme can proceed, and those involved believe 5 to 10 years may pass before it is implemented. A perimeter sea wall at the 5m to 7m depth contour, lying 300m to 500m offshore, would be built and then sand and sediments from St. George's Bay would be dredged to create the reclaimed land. Under this scheme, the Dawra site is within a planned industrial zone, on land allocated to a secondary sewage treatment plant for northern Beirut and North Metn (in the event that pre-treatment is insufficient for marine disposal to St. George's Bay).

1) Reference No. 2 in Appendix G.

To permit future construction of industrial or sewage-treatment facilities at the Dawra site, it is important to dispose of building rubble at restricted portions of the site. Rubble will not provide a stable structural foundation for buildings, and driving piles through it would be difficult and expensive.

The South Beirut suburbs use five dump sites in addition to the Dawra site. The locations are shown on Figure 4. These sites serve the following members of the Syndicate of south Beirut coastal municipalities:

<u>Dump Site</u>	<u>Communities Served</u>
Dawra	Chiyah, Fourn Ech Chebbak
Hazmiyeh	Hazmiyeh
Baabda	Baabda, Hadath, Louaize, Wadi Chahrour
Airport	Ghbaire, Bourj El Barajne, Haret Hraik, Mraije
Kfarchima	Kfarchima
Chouaifate	Chouaifete

The Hazmiyeh site (see photograph in Appendix D) is an open burning dump on the flood plain of the west bank of the Beirut River. Trash, burned residues, and minimal soil cover have accumulated to a height of 15m encroaching on the river. Oils and litter are carried into the river. Odors from burning garbage permeate the air over a densely inhabited area. A major highway along the west bank of the river has permitted dumping of trash at random locations along the bank upstream from the Dawra site.

During the civil war, a considerable amount of trash and sediment accumulated in the Beirut River flood channel, a concrete structure 500m wide and about 2km long built to provide flood protection for portions of Beirut, Senn El Fil and Borj Hammoud. Recently, the Ministry of Hydraulic and Electric Resources undertook a channel cleaning operation which has proceeded downstream to within 200m of the river mouth.

The Baabda dump site was also visited and similar environmental degradation noted. The smoke, odor, and accumulation of debris at the site despoils the forested mountain-side environment, visible from the urban area below.

An incinerator/compost plant at Fourn Ech Chebbak was under construction at the outbreak of the civil war, as a turnkey construct/operate contract to the same French firm involved in the Qarantina compost plant. Much of the structural work was completed, and equipment had been delivered but not installed. Officials of the South Beirut suburbs indicated that it may cost LL 7 million to replace unusable original equipment and finish the construction. Reservations on the adequacy of the scheme were expressed by several local officials, with respect to plant capacity, the 25/75 split between incineration/compost, the intended service area and the likelihood of air pollution in a densely-inhabited area where smog forms and becomes trapped against the mountain slope.

An attempt was also made to build an incinerator at Chouaifete, to serve portions of Beirut, south Beirut, and possibly North Metn. Demonstrations and protests by local inhabitants prevented any progress beyond fencing in of a proposed site, and several officials made reference to an "impending" decision on a new site. Grants from the French government were provided several years ago for equipment for this and other sites in Lebanon, but none of the planned incinerators have been built.

This brief review of solid wastes conditions in Greater Beirut provides an indication of the high priority given by local officials to finding appropriate solutions to the solid waste problems of Greater Beirut.

In response to inquiries by the WASH team, 30 communities in Greater Beirut, comprising a population of 1.5 million, identified the number and types of vehicles required for municipal solid wastes operations. The requirements are based in part on replacement of vehicles damaged or stolen during the civil war and Israeli invasion, and also on a desired improvement in level of service. Details are given in Appendix E, and the stated requirements for new vehicles are summarized in Table 2-1.

The 30 municipalities in Greater Beirut have an urgent need for a rational regional solid-wastes management plan. Although solving solid-waste problems is recognized by local officials as a high-priority need, very little has been accomplished to date for several reasons. Municipalities have responsibility for collecting solid wastes, but must develop their own ad hoc agreements on the location and operation of disposal sites. The Ministry of Interior provides garbage trucks and operating funds to municipalities, but without technical input regarding the appropriate allocation, type and number of vehicles, and without stipulating appropriate locations and practices for landfill disposal. There is also evidence of politically-powerful communities bringing their influence to bear to solve their own solid wastes problems at the expense of other cities in the region.

A coordinated approach to seeking appropriate technical solutions, and identifying the required steps in organization, staffing, finance and operation, is a badly needed contribution toward restoration of both satisfactory environmental conditions and government effectiveness.

2.5.2 Other Municipalities

Solid waste dumps and operating conditions in Lebanon as a whole are similar to those described for the Greater Beirut area. Coastal dumps serve Saida and (it is understood) Sour in the war-damaged areas, as well as the major northern cities including Tripoli and Jbail. Small informal open dumps and burning trash and garbage can be found in essentially all inhabited regions of the country.

The shore dump at Saida appears to be the most environmentally objectionable dump site outside the Greater Beirut region. It has been in use for more than 40 years, and now occupies an area of about 20 ha. The dump, which is not provided with adequate soil cover, accepts among other materials, waste from

TABLE 2-1

Solid Wastes Vehicles Requested by Greater Beirut Municipalities

<u>Item</u>	<u>Beirut Municipality</u>	<u>South Beirut Suburbs</u>	<u>North Metn Municipalities</u>	<u>Totals</u>
Communities Population	1 600,000	13 520,000	16 400,000	30 1,520,000
<u>Vehicles Requested</u>				
Compactor trucks	51	52	11	114
Dump trucks	30	0	3	33
Pick-up trucks	16	0	3	19
Front-end loaders	1	3	2	6
Tank trucks	4	0	1	5
Bulldozers	1	0	0	1
Dumpsters	0	0	1	1
Jeeps	0	4	10	14
Sedans	4	0	1	5
Street cleaners	8	11	1	20

the adjacent abattoir. Fly breeding, smoke and odor production are significant (see photograph in Appendix D). The face of the dump has now advanced to the high tide mark. That floatables will be carried into the sea by wave action is evident. The city has plans to acquire a landfill site in the hills southeast of the city, which would enable the shore dump to be closed. However, covering and sea protection of the shore dump are urgently needed.

Security conditions did not permit a visit by the WASH team to the Sour dump site.

The Ministry of Interior collected data on the needs of municipalities for replacement of vehicles lost during the war, in response to a request by the WASH team. Information on 57 municipalities was obtained, covering most of the major communities in Lebanon (total population of about 2.5 million, or about 55% of the national total). Details are given in Appendix E. Many communities in Greater Beirut appear on two lists: one obtained through the Ministry and one obtained through the regional unions of municipalities. For these communities, inconsistencies in the number and type of vehicles requested are apparent. Also, coverage by the Ministry data is high in the Mohafazas of Mount Lebanon, Beirut and North Lebanon, but covers only half the urban population in South Lebanon and Bekaa due to current security problems in these areas. The results of the Ministry survey are summarized below:

<u>Type of Vehicle</u>	<u>Number Requested</u>
Compactor trucks (6, 10, and 16 cyd)	144
Bulldozers	13
Front-end loaders	2
Dump trucks	84
Street cleaners	13
Dumpsters	32
Jeeps	75

2.6 Sewerage and Drainage Organizations

Although sewerage and drainage systems have become intertwined physically, they are separately administered at the national level. Drainage and flood-control construction and (except for Beirut) maintenance are responsibilities of the Ministry of Hydraulic and Electric Resources. Currently, the Ministry is executing two stormwater drainage rehabilitation projects in greater Beirut. The Grand Projects of Lebanon in the past executed such major flood control projects as channelization of the Beirut River.

Sewerage, as a municipal function, is administered at national level by the Ministry of the Interior. However, study, design and estimation of costs of sewerage systems have been performed by the Ministry of Public Works for some smaller communities. For others, the Ministry of Housing and Cooperatives and the Grand Projects of Beirut have prepared designs and supervised construction. The Grand Projects of Beirut awarded a contract in mid-1981 to a British

firm for the construction of a sea outfall at Ghadir (refer to Figure 5). By the time of the Israeli invasion, the work was well advanced (see Appendix D), and the Grand Projects is planning to complete the work. It has also invited bids for interceptors and pump stations in north Beirut and an outfall at North Metn (refer to Figure 5).

In the Municipality of Beirut, the Engineering Division has a maintenance section, which maintains roads, drains and sewers, and a mechanical equipment section.

There are traditional difficulties of low pay and low performance of personnel in the Lebanese civil service. This is one of the major reasons why special purpose autonomous or semi-autonomous bodies have often been created to deal with urgent problems and programs. Examples are CDR, the Grand Projects of Beirut and the Grand Projects of Lebanon.

While water authorities are currently organized independently of both territorial authorities and catchment boundaries, sewerage and solid waste management are organized within either municipalities or various unions of municipalities. Technically and economically, sewerage systems are ultimately limited by catchment boundaries. Pollution of surface and ground water due to sewerage deficiencies affects water supplies within the same catchments, and the owners and users of those water supplies have the strongest motivation for controlling such pollution. In addition, revenue collection for sewerage can most conveniently be combined with that for water supply. There are therefore very compelling reasons for combining water supply and sewerage responsibilities in basin-wide regional authorities.

It is recognized that establishment of combined water supply and wastewater regional authorities may not be easily accomplished because these functions are currently administered separately at both the national and local levels. Nevertheless, this is a very important objective, achievement of which will permit an adequate degree of decentralization of both initiative and technical competence and will also be beneficial for the above-mentioned reasons.

There are very important nation-wide water resources, water supply and wastewater management problems to be solved. Their solution requires that a mechanism for coordinated water and wastewater management be set up at the national government level. This mechanism must provide for both capital development, and ongoing administration and control. While certain emergency measures can and are being taken in advance of such measures, any effective program development and implementation will depend on the earliest possible decisions on these matters.

In the Greater Beirut area, it is also very important that a regional solution (or set of solutions) be found for solid waste management. However, this does not necessarily require common management with sewerage, if this is precluded by association of sewerage with water supply. Regional combination of sewerage and solid wastes management, as was proposed in the National Waste Management Plan¹⁾, would, however, enable effective mobilization and efficient use of technical skills.

1)-----
Reference No. 1 in Appendix C.



0 1 2 3 4 Km

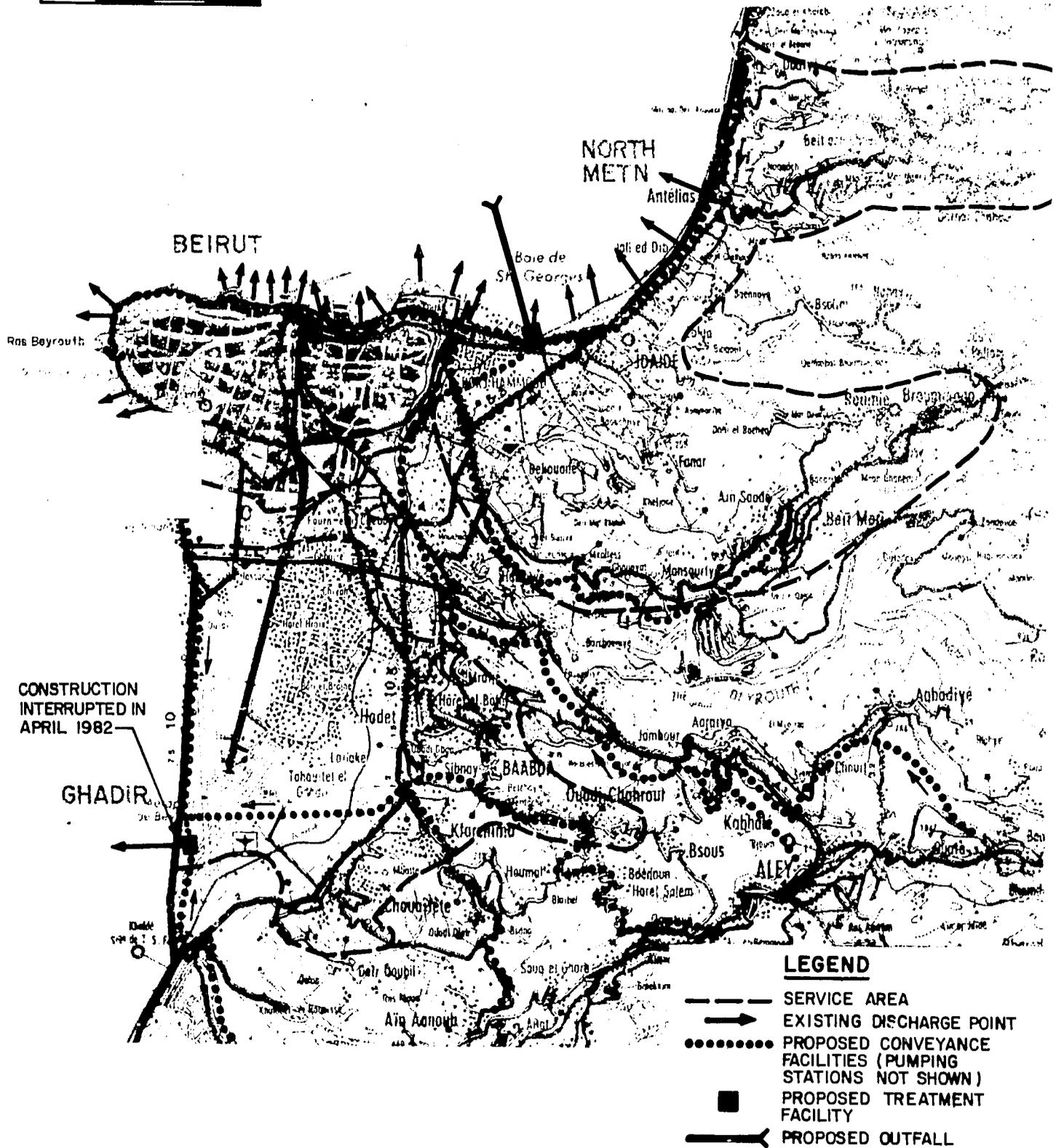


Fig. 5 BEIRUT SEWERAGE FACILITIES

As indicated in section 2.4, WHO, as executing agency for UNDP, sponsored the preparation of the National Waste Management Plan¹⁾ but the intended PE/F studies for four priority areas, including Saida (the only such priority area included among the municipalities covered by this report), could not in fact be carried out.

Other assisting agencies include: the World Bank, which is planning to assist implementation of portions of the National Wastewater Master Plan; and OGER Liban, which has made a number of emergency repairs to critical portions of some stormwater drainage systems using Saudi funds. The West German government provided the services of THW which has assisted in reconstruction of a section of the Sabra Drain of Beirut.

2.7 Sewerage and Drainage Conditions and Needs

2.7.1 Beirut Municipality

The Beirut municipal sewer system is, in effect, a combined sewerage/drainage system and covers an area of 1,800 ha, serving about 600,000 people. As shown in Figure 5, the system is subdivided into drainage areas which discharge raw sewage and stormwater along the north and west shores of Beirut. There are 15 outfall locations.

The system includes two small pump stations, one in the Sabra district and the other near the U.S. Embassy. The Sabra pump station is not functioning, with the result that wastewater flows from this area are discharged into a large nearby drainage conduit which eventually discharges to the Ghadir drainage tunnel system passing under the airport.

The system is old and of poor construction, badly undersized, and subject to frequent collapses. Drawings of sewer routes and sizes have been lost or sequestered. The system has received little maintenance and suffers from poorly constructed service connections. Even before the war, blockages caused by large objects and collapses were common. Such blockages are removed manually by entering the larger sewers and by rodding the smaller sewers.

Maintenance staff is small (35) and drawn from a central pool responsible for all municipal facilities (buildings, roads, etc).

The recent war has accelerated sewer collapses, and it appears that this situation will probably worsen as heavy equipment and building demolition materials are passed over the streets of the most war-damaged parts of Beirut.

The municipality currently has one hydraulic jetting machine and a pot-pourri of small hand equipment. It desperately needs more equipment and tools.

1) -----
Reference No. 1 in Appendix G.

At the onset of the rainy season (late October), wastewater consistently backs up and flows through manholes onto streets in various locations throughout the city, despite the steep terrain. The seasonal first flush of rainwater, aided by hand cleaning of the worst blockages, reduces backing-up problems during the remainder of the wet season but does not eliminate the problems.

2.7.2 North Metn Union of Municipalities

The North Metn area suffers from essentially the same problems as Beirut. The district of Borj Hammoud and the immediate coastal area need an improved sewer cleaning and maintenance program. War-related damage is primarily limited to Borj Hammoud.

From discussions with the Grand Projects of Beirut, bids on construction of the North Metn system (consisting of coastal interceptors, a preliminary treatment plant and marine outfall) are to be opened in December 1982. The North Metn system would intercept flows from all the discharge points along the northern shore of Beirut, starting from Ras Beirut in the west to the Beirut River discharge point to the east, and carry the flows to a proposed preliminary treatment facility and outfall in Borj Hammoud (see Figure 5). This same installation would serve the North Metn communities by coastal interceptors extending from the Kelb River south to the Beirut River.

2.7.3 Saida Municipality

The Saida sewerage system consists of small pipes, the largest being 400mm in diameter, which discharge to the sea at five locations. The municipality had a sewer cleaning jet machine and a vacuum machine, but these were lost during the Israeli invasion.

Considerable pollution of roadside irrigation channels is visible. The system is badly in need of expansion to cope with the population which includes refugees in camps.

Damage to the system in the recent war was reportedly severe, but OGER Liban had finished many of the necessary repairs before the WASH team arrived. The major problems are caused by overloading and blockages.

2.7.4 South Beirut Suburbs

The South Beirut suburbs are served by the 137 km Ghadir system of trunk sewers, which is only 10 to 12 years old and presently discharges to the sea near the Beirut airport.

An ambitious program for additional collectors, a preliminary treatment plant and sea outfall is currently underway. Construction on the outfall was halted by the recent invasion but is expected to resume in the very near future. Little visible damage was done to the work in progress (refer to Appendix D).

Communities in the South Beirut suburbs reported war damage to 50 km of sewer lines, which is a sizable portion of the total length of sewers. Although this area was very heavily affected by the Israeli siege of west Beirut it is expected that detailed field checking will indicate that the length of damaged sewers is actually less than this estimate.

2.8 Overall Administrative Needs

The current high level of activity in repair and rehabilitation of water supply systems is due primarily to foreign assistance that has included actual field work and has not been limited to technical assistance and funds. Such work will not continue indefinitely. There has been and appears still to be extreme difficulty in making and implementing decisions that are potentially controversial. For example, water resources development projects and water rights disputes become politically sensitive subjects which are seldom exposed to systematic evaluation. The available means and required measures to protect groundwater from saline intrusion and pollution have seldom been implemented or enforced. Water supply problems are made doubly difficult by the fact that water authority boundaries do not follow catchment topographic boundaries.

While the Ministry of Hydraulic and Electric Resources has had World Bank capital development funds available to it for some years, it has not spent this money. It appears that the reason is in part a lack of counterpart local funds and of a reliable source of revenue. Capital improvements in water supply that have been implemented at the national level have been inadequately coordinated with the responsible operating authorities.

There is an urgent need for water authorities to collect revenues from their customers and also to obtain training for their operations and maintenance personnel.

The above problems are common to all water authorities and central to the whole water industry in Lebanon, indicating a great need for administrative measures at the national level that would ensure that these and other similar problems are addressed and solved and that the solutions are implemented.

While the two outfalls under construction or bidding in the Greater Beirut Area are being executed by the Grand Projects of Beirut, their operation will be undertaken by the municipalities, which have no staff experienced in operation of such facilities. There are no planned concurrent measures for control of industrial wastes. Sewer system maintenance costs are supported by general municipal revenues, with no individual user charges for sewer service. For inland towns, there is no control over wastewater discharges which contaminate vegetables irrigated with surface water, and which pollute surface and groundwater used for drinking.

While the WASH team was told that a decision had been made by the Council of Ministers to create within CDR a Waste Management Technical Group (WMTG), as was proposed in the National Waste Management Plan¹⁾, this decision has in

1)-----
Reference No. 1 in Appendix G.

fact not been implemented. The Plan proposed establishment of an interim WMTG of initially eight and ultimately about 20 professionals, with subsequent formation of an independent National Waste Management Authority.

Regional waste (including sewerage and solid wastes management) construction and operating authorities based on existing organizations were proposed. A national water supply master plan study was proposed which would determine, among other matters, whether water supply and sewerage should have common management.

In 1974, legislation was enacted to enable the amalgamation of the 15 water authorities into five authorities with boundaries corresponding to those of mohafazas. This was never implemented, but the Ministry of Hydraulic and Electric Resources did set up a small sewerage section in the expectation of administering both water supply and sewerage. The Ministry is understood to favor implementation of this legislation and inclusion of sewerage with water supply.

During the WASH team's visit, a different solution was mentioned (by the Director General of the Sour and Environs Water Authority and, independently, by a member of the visiting World Bank mission). This was the formation of a single nation-wide autonomous water authority for water supply and sewerage.

While the management of solid wastes frequently requires regional solutions, these can generally be arrived at by cooperative action between municipalities, coordinated where necessary at the national level. Economical service areas are related primarily to population distribution and to transportation routes, which are also the bases for territorial authority boundary selection. It does not appear that there are immediate wide-ranging organizational measures needed for solid waste management.

For water supply and wastewater system development and management, however, there are urgent organizational needs. These include providing for (a) involvement of the operating organizations in planning, design and construction, (b) common administration and management of water supply and sewerage, (c) collection of adequate revenues through charges for water supply and sewerage service, (d) training of operating personnel, (e) provision of sufficient numbers of qualified professionals in the operating organizations, and providing specialist technical support from a central organization to the extent that its cost cannot be justified regionally, (f) amalgamation of authorities to optimize the use of skilled personnel and (g) use of watershed boundaries to define the boundaries of regional organizations. Most important of all, there must be a clear-cut decision at the highest level to assign full responsibility for programming, planning, coordination, and ensuring satisfactory design, construction and operation, to a single agency, headed by a person or group at ministerial level that can ensure continued government interest and funding, and can fend off attempts by competing organizations to carve off portions of the funding and activity.

Chapter 3

RESPONSES TO THE NEEDS

3.1 Responses to Date

3.1.1 Water Supply

Because of lack of funds and lack of security, the water authorities are hard pressed to continue day to day operations and have had to rely heavily on foreign assistance, both financial and technical, for rehabilitation of damaged systems.

Following the invasion in the summer of 1982, UNICEF's budget for reconstruction in war damaged areas was increased, in part through other funding-agency (including USAID) contributions. A budget of \$60 million was established for such reconstruction through October 15, 1984 in the fields of health, education, drinking water supply and community self-help projects. This assistance was to be provided in west Beirut and areas south of the Beirut-Damascus highway. On November 17, 1982, a \$32 million two-year program within that budget was approved. This is understood to include \$10 million of USAID funds. In addition, negotiations are continuing with CDR on the disposition of the remaining \$28 million.

The WASH team was given a copy of a draft work plan, understood to be reflected in the approved \$32 million program. This work plan is a collection of specific projects, including 18 for water supply. The water supply projects have a total projected cost of approximately \$16.3 million, including \$2.0 million for the Beirut Water Office. The team was given some information but no details of the additional program still under negotiation. It is understood to include several water supply projects.

The approved work plan is understood to include the following:

1. Repair of 150 reservoirs	\$ 400,000
2. Replacement of 100 reservoirs	5,000,000
3. Construction of new treatment plant at Taibe (Jabal Amel Water Authority)	1,000,000
4. Rehabilitation of the Ras El-Ain pump station (Sour and Environs Water Authority)	1,600,000
5. Construct water treatment plant at Ras El-Ain	1,000,000
6. Repair pumping mains in S. Lebanon	900,000
7. Repair pumping mains in west Beirut (Beirut Water Office)	250,000
8. Provide generators for pump stations in S. Lebanon	800,000

9. Install generators for pump stations in Beirut	1,000,000
10. Repair Damour pump station (Beirut Water Office)	100,000
11. Provide pipes for rehabilitation of main networks in S. Lebanon	2,500,000
12. Provide tools and equipment for water authorities in the south	300,000
13. Repair Bhamdoun Tunnel (Barouk Water Authority)	72,000
14. Rehabilitate pump stations (Ain Ed-Delbeh Water Authority)	600,000
15. Rehabilitate Hadath pump station (Beirut Water Office)	300,000
16. Rehabilitate Borj El-Brajneh station (Beirut Water Office)	150,000
17. Rehabilitate Zalet El-Khayat station (Beirut Water Office)	150,000
18. Rehabilitate Borj Abu Haidar station (Beirut Water Office)	<u>150,000</u>
	TOTAL \$16,272,000

Some of the above-listed work has already been completed.

The Beirut Water Office has also been assisted by a watermain repair group provided by the government of West Germany. The German team comprised 70 technicians. They were equipped with repair vans containing a wide array of leak detection and repair equipment. The Beirut Water Office provided replacement pipe, UNICEF provided fittings and valves, and the contractor OGER Liban provided trucks and excavators to support the German team. The team is understood to have left Lebanon on November 18.

During the WASH team's stay, all facilities were operational as a result of significant repairs and provision of equipment (such as standby generators) by UNICEF. However, it was apparent that the system needs a great deal of re-inforcement and further repair. Work was continuing on repairs to leaking pipes, but was severely hampered by a lack of materials and equipment. The German (THW) teams were able to locate and repair major leaks.

It is understood that the visiting World Bank Mission was very concerned at the generally feeble and inert water supply administration in Lebanon, and regarded an early decision on major reorganization as essential to effective future development.

The Bank is understood to be considering providing \$500,000 to fund a management study to give guidance on the establishment of and financial planning for the new authorities once the basic decision has been made by the government.

It is also understood that the current Bank-funded water distribution study for Beirut includes consideration of consumer metering. Depending on the results of the proposed water authority management study, the Bank will be considering the possible funding of a computer for billing and accounting purposes for at least the Beirut Water Office.

3.1.2 Solid Wastes

The Lebanese construction firm OGER Liban provided prompt and massive support to west Beirut in cleanup of recently-created rubble and debris from streets and other public areas, and trash and debris which had accumulated during the war years. It also demonstrated how effective solid wastes operations can be when not constrained by civil service labor conditions. Using funds and equipment from Saudi Arabia, OGER Liban has conducted solid wastes collection and street sweeping to the extent that conditions are now better than before the invasion and approaching pre-1975 conditions.

The Normandie dump site (formerly a burning, malodorous pile of garbage 25m high) has been graded down to approximately street level by OGER Liban. In addition, rubble and soil has been carried onto the Normandie site to disguise its origin; and temporary earth channels have been placed on either side to carry sewage from existing outfalls.

In Saida also, OGER Liban provided much of the equipment and manpower to clear away rubble and worked for two months starting the day after the invasion. OGER Liban lent 10 compactor trucks to Beirut and was reported to be about to donate them to Saida. However, the Mayor of Saida indicated that he has not received any commitment from OGER Liban concerning these vehicles.

Security conditions did not permit the WASH team to conduct direct interviews and inspections in Sour. OGER Liban is understood to have provided limited assistance in rubble clearance, but to have concentrated primarily on repairs to schools. An attempt was made by UNICEF to allow military trucks from UNIFIL into Sour for garbage collection and rubble clearance, but was reportedly prevented from doing so by the Israeli forces. There is some indication that the Israelis have been preparing a plan for reconstruction of Sour, but no actions on implementation have been evident.

It is understood that WHO is interested in sponsoring the waste management PE/F studies that were to have been performed with the development of the National Waste Management Plan. The intended source of funds was not indicated.

Indirect and late mention was made to the team (by a U.S. equipment supplier operating in Saudi Arabia and Lebanon) that there was said to be an intention for Saudi Arabia to provide refuse compactor vehicles (not the vehicles already brought from Saudi Arabia by OGER Liban) to Lebanon.

Although it is understood that a decision in principle has been made to establish a Waste Management Technical Group (WMTG) under CDR, the details have not been established. It is unofficially understood that (a) consideration is being given to retaining a Lebanese consulting engineering firm (Dar

Al-Handasah (Shair and Partners)) either to serve as or to supplement the WMTG, and (b) the Italian government has offered to provide supporting consulting services to the WMTG.

3.1.3 Sewerage and Drainage

In the Greater Beirut area, the Grand Projects of Beirut intends to have the contractor recommence work on the Ghadir outfall and has called for bids on the North Metn outfall system.

A sewerage system feasibility study for Greater Beirut is to be funded by World Bank. It is understood that WHO may act as executing agency.

It is also understood that WHO is interested in carrying out wastewater and solid waste preliminary engineering and feasibility studies for sewerage, solid wastes and drainage for other areas in Lebanon. The source of funds for this work is not clear. Such studies were to have been carried out in conjunction with the National Waste Management Plan studies but could not be done. Prerequisites to executing them include: decisions in principle by the government on organizational and jurisdictional matters; conduct of oceanographic studies; preparation of suitable, agreed terms of reference; and identification of a source of funds.

The World Bank intends to fund the oceanographic studies. It is understood that WHO may act as executing agency for these.

3.2 Other Needed Responses

3.2.1 Water Supply

Beirut Water Office

As described in section 2.2.2, the OEB system suffers from inadequate supply, serious lack of capacity in its distribution facilities, badly leaking reservoirs and pipes, antiquated pump stations which have been subject to temporary repair only, and very serious damage to pipelines in the most seriously war-affected areas.

The responses required to meet the most urgent needs, without creating any potential conflicts with the results of the current distribution system planning study, are:

- o A pipeline repair program which would include provision of repair tools, equipment and materials, together with two fully equipped repair vans and training of OEB personnel in the use of the vans and equipment. In the course of their work, the trainee field crews would, under skilled direction, not only repair pipe leaks but also install public stand-pipes to serve areas where piped water supply is no longer available pending installation of new pipelines.

- o A pipeline replacement program, to provide for replacement of pipes that either have been subjected to temporary major repairs but are still leaking or are so badly damaged that the supply has been shut off pending pipe replacement. This is not intended to be an upgrading program, although it would be reasonable to establish a minimum pipe diameter consonant with modern water system practices.
- o Provision of standby electrical generators at the Dbayeh water treatment plant and at the Ashrafiyeh pump station, together with modernization of the electrical equipment at both locations.
- o Installation of a standby pump at the Ashrafiyeh lower reservoir and pump station, which at present operates continuously at full available capacity.

Other Water Authorities

Many of the immediate needs expressed in the lists prepared by the six southern water authorities are included in the work plan for UNICEF's approved 1983/4 program. There are some items not in this program, however, that were either included in the lists or made known separately to the WASH team. These include:

- o Provision of urgently needed additional active well capacity for the Saida Water Authority: Great concern about this problem was expressed by the Director of the Authority. It is understood that there are hydro-geological skills in the Ministry of Hydraulic and Electric Resources and also in the Geology Department of the American University of Beirut. There are also competent well drilling firms in Lebanon, one of which is reported to be located in Saida. There are also competent consulting engineering firms. Nevertheless, it is believed that rapid and effective mobilization of these skills will require not only funds but also overall technical orientation. It is therefore proposed that the Ministry of Hydraulic and Electric Resources execute a project to determine the specific needs (rehabilitation or replacement, quantity of water needed, how to link into the distribution system, etc.), including conducting the necessary field testing, and to design and construct the necessary works, making use of foreign technical assistance and specialized equipment.
- o Repair and replacement of pipelines: In terms of total cost, this is the biggest category of rehabilitation and replacement need. While the water authorities have made estimates of their needs in this respect, those estimates are necessarily very approximate, except in the case of specific main pipe lines. In addition, it is not clear what pipeline replacements are included in the UNICEF program. As part of any reorganization and development planning of water authorities, it is important that a comprehensive plan be developed for distribution system rehabilitation, reinforcement and development, taking into account the completed and planned work of UNICEF. This planning, however, must await overall master planning and decisions on reorganization of water supply administration in Lebanon.

- o Training and provision of maintenance and repair equipment (in addition to the \$300,000 item in the UNICEF program for provision of small tools): The water authorities outside of Greater Beirut have lost virtually all of their maintenance and repair equipment and acknowledge the need for training of their personnel in pump station and pipeline maintenance and repair. This need was also pointed out by UNICEF personnel. Provision for personnel development and training and for system operation and maintenance should be part of the necessary long-term master planning and feasibility studies for water development in Lebanon. In the short term, however, there is an unmet need for each existing water authority to be provided with mobile work shops and with key personnel to train authority personnel in their use for routine maintenance and emergency repair of pipelines and pump stations.

Ministry of Hydraulic and Electric Resources

During the war, the Ministry of Hydraulic and Electric Resources lost practically all of its central laboratory equipment, well pump testing equipment and survey equipment. Replacement of at least part of this equipment is necessary to the continued effectiveness of the Ministry.

Nation-Wide Water Planning

It is very important that a comprehensive plan be prepared and implemented for water resources development and for the development of water supply authorities and systems in Lebanon. Effective use of surface water in Lebanon is not easy because of the generally very short rivers and lack of upland storage sites. There are also very serious groundwater problems, including sewage contamination and saline intrusion. These matters and management and technical problems common to all water supply authorities, as indicated in section 2.3.1, should be subject to rigorous and rational analysis. Because of the internal and external political overtones, it will require a serious decision at a high level in the government even to expose these questions to scrutiny, but it is essential that it be done.

3.2.2 Solid Wastes

It is very important that erosion by the sea be stopped at the Normandie and Dawra dumps and be prevented from happening at the Saida dump. With the possibility now emerging that wastes generated in west Beirut can be carried to east Beirut, the Normandie dump can now be closed. This will require that, as an immediate short-term measure, refuse now dumped there be taken to the Qarantina plant and that building rubble now being dumped at Normandie be taken to Dawra. Dawra must be kept open to handle North Metn wastes, although in the long term it may be more economical to take North Metn refuse to Qarantina and divert wastes from south-west Beirut elsewhere.

The above measures will require decisions by the Beirut Municipality, the North Metn Union of Municipalities and Saida Municipality, and the allocation of funds by the central government. It appears that the necessary coordination and funding can be provided only by the Ministry of the Interior. The

estimated costs are: Normandie \$400,000, Dawra \$800,000 and Saida \$200,000, including the necessary local consulting services. For Dawra and Saida, there will be additional ongoing costs of landfill management, including providing, spreading and compacting the necessary soil cover.

In view of the planning proposals¹⁾ prepared for the General Directorate of Urbanism for land reclamation along the shore of North Metn, it appears that disposal of all building rubble from Greater Beirut will be possible in this area. It must be remembered, however, that not only will rubble-filled areas subside over time, but also conventional piles cannot be driven through rubble. Therefore, rubble should be dumped in areas where structures are not proposed, and records should be kept of areas filled with rubble.

Beirut Municipality has made a decision as to the type of collection container (1.5 cyd bins) and packer vehicle (16 cyd) it wants, recognizing that after some years it may be better to provide individual household bins. The Municipality's indicated numbers of needed replacement vehicles are discussed in section 2.4. Taking into account the large number of sanitation workers, who work only a 4-hour day, we propose that provision of new vehicles be based on the use of each vehicle for two 4-hour shifts. (We understand that security is not adequate to permit night-time collection).

In the longer term, it is necessary to evaluate the cost to the municipality of continuing to use the Qarantina compost/incineration plant in comparison with the cost of alternatives such as landfill. Technical and economic evaluation of options for the urgently needed new treatment/disposal facilities to the south of Beirut is also necessary.

While it is feasible and necessary in the short term to bring waste across Beirut to Qarantina, it is probable that a regional arrangement for all three parts of Greater Beirut (Beirut Municipality, North Metn, and the south Beirut suburbs) will enable transportation costs to be reduced by shortening of haul distances. Where long distances are involved, as may be the case to the south of Beirut, possible transfer to larger vehicles should be considered.

The possible benefits of private sector refuse collection (for which a contract could be a possible foreign assistance item) were discussed with staff of Beirut Municipality. The response was that this had been considered (which appears probable, in view of the high regard in Lebanon for private sector involvement in what in other countries would often be publicly performed services) and discarded because of the social problem of what to do with the 1,600 municipal sanitation workers in Beirut. A private contractor would not be satisfied with four hours' work per day and would be unlikely to retain many of these persons. (This is supported by OGER Liban's experience at the start of their clean-up of Beirut.)

The proposed early measures are therefore as follows:

- o Provision of 40 additional 16-cyd compactor refuse trucks for Beirut Municipality. The supply contract should preferably include maintenance for a 2-year period (by which time municipal repair facilities should be completed).

1) -----
Reference No. 2 in Appendix G.

- o Provision of two front-end loaders and ten dump trucks for Beirut Municipality. The municipality should arrange all necessary maintenance of this equipment through the private sector in Beirut.
- o Closure and protection against the sea of the Normandie dump and covering and protection of the Dawra and Saida dumps. Associated with this work would be short-term transportation of all Beirut municipal refuse to Qarantina and rubble to Dawra.
- o Preparation of a solid waste management feasibility study for Greater Beirut.
- o Provision of replacement solid waste vehicles for other municipalities besides Beirut.
- o Proper interim management, including provision of soil cover, for the other refuse dumps in the Greater Beirut area (with the eventual closure of unsuitable dump sites in accordance with the results of the feasibility study).
- o Provision of consulting advisory services to the Waste Management Technical Group, if this is in fact set up by CDR (and if these services are not provided by the Italian government).

3.2.3 Sewerage and Drainage

Greater Beirut

As was described in section 2.7, the sewerage and drainage systems of Greater Beirut are: (1) severely undersized, (2) aged and deteriorating, (3) heavily damaged by the recent wars.

A program which will provide relief in the very near future is vital. This program should encompass not only rapid alleviation of problems, but also effective training of maintenance staff, coupled with provision of badly needed equipment and tools.

This program would be limited to provision of interim relief. A major sewerage system expansion is also essential in order to provide significant alleviation of the problems of inadequate sewerage in Beirut.

For such long term development, both physical and administrative planning are needed. It is important that the organization and financial needs (especially revenue collection) of sewerage be taken into account in any reorganization of water supply authorities. This is particularly true for Greater Beirut, where the need for area-wide wastewater treatment and disposal design and construction can be seen to be recognized in the activities of the Grand Projects of Beirut. The area-wide administrative and operations needs appear, however, not to have been addressed.

Pending organizational decision-making and performance of the planned feasibility studies, there does not appear to be an immediate need for any major efforts to be made in relation to sewerage or drainage system development in Greater Beirut.

An immediate program of cleaning, inspection and mapping, coupled with provision of both equipment and training, will result in significant alleviation of street ponding of stormwater and sewage. An inspection of the main collectors will allow for identification and location of potential future breaks. A program of repair can then be established in which corrective actions can be undertaken during the dry season (April to October). This should reduce the number of collapses and blockages which currently plague the system at the start of each rainy season.

A further important element of such a program would be to train maintenance personnel in the use and care of modern equipment. Training in proper safety procedures should also be provided, along with safety equipment.

A beneficial by-product of a program such as that described above is that it will provide important input to the system-development preliminary engineering and feasibility study.

Saida

The Saida sewerage system, although small, suffered war damage and blockages are a serious problem. Some areas of the city are not sewered, and in these areas septic tank effluents flow in open drains. The principal need of Saida is for development of an adequate system, although some relief can be provided by cleaning of existing sewers. As for Beirut, mapping carried out in association with cleanup and inspection would be a valuable input to a system development feasibility study. Saida is one of the priority areas for which it is understood that WHO is interested in executing waste management feasibility studies.

Work proposed for Saida at present, pending organizational decision-making and system development studies, is limited to level-of-effort sewer cleaning, inspection, mapping and training.

Other Municipalities

While the sewerage systems of other municipalities, including Sour, are believed to have suffered damage, the systems consist primarily of small diameter pipes. Their repair can be accomplished locally. Their major need is for development planning, which depends on organizational decision-making by the government.

Chapter 4

OPPORTUNITIES FOR SHORT-TERM FOREIGN ASSISTANCE

4.1 Opportunities and Costs

4.1.1 General

Opportunities for foreign assistance occur primarily in the areas of technical assistance and supply of equipment and materials. UNICEF and the German disaster assistance team have provided more-direct assistance (actual performance of work in the field). The UNICEF program for such work is understood to be intended to continue through October 1984. While the work to be done under this program is very important and will probably be accomplished more effectively in this way than by leaving its execution to the Lebanese authorities, it is proposed that additional foreign inputs be aimed at strengthening, rather than acting in lieu of, the relevant Lebanese agencies.

The specific inputs proposed herein are therefore based on the assumption that project execution will in each case be a matter for the government. Although, as pointed out in section 2.8, major water supply and sewerage administrative reorganization is urgently needed, the short-term proposals made herein do not, except where specifically indicated otherwise, depend on such reorganization as a prior condition.

It was not possible or intended for the WASH team to propose any specific overall organizational solution. However, it is possible that the international assisting agencies, including USAID, may be able to influence the decision that will be made, and may in fact need to arrive at a consensus. The following comments are therefore offered on the three solutions that have been proposed by others, and that are mentioned above, together with some suggested additional measures seen to be needed to make them effective:

o Five Water and Sewerage Authorities under the Ministry of Hydraulic and Electric Resources

Since the Ministry is already responsible for both capital development and supervision of operations, this solution would involve the least reorganization at the national level. No new national agency would be needed. On the other hand, the inadequate salaries and other civil service constraints would apply unless solved for the whole civil service. The most serious drawbacks relate to the regional authority boundaries. The boundary between South Lebanon and Mount Lebanon is the Aouali River, not a watershed, and Beirut Mohafaza is only a portion of the area currently served by the Beirut Water Office. At the very least, the whole of Mount Lebanon and Beirut should be covered by a single authority, in view of the common water source problems of all the existing authorities in this area. The Ministry would need to make positive efforts to decentralize design and construction efforts and to provide training and technical support for operations.

o A Waste Management Technical Group under CDR and a Study of Water Supply Management Needs

This proposal defers solution of the water supply management problems but gives strong emphasis to early interim solution of the waste management problems. It does build on what already exists, recognizing the fact that no single national agency currently has total sewerage, solid waste or pollution control responsibility and technical competence. It provides maximum flexibility for political and technical influences on establishing regional authority boundaries and for staged growth of the served areas. Whether this is an advantage or a disadvantage depends on political factors. Implementation at the regional level will require early decisions to be taken cooperatively with local authorities. It requires strong central technical direction and administrative coordination, initially within CDR. It defers decision-making regarding the permanent central authority but will in time require that a new agency be formed.

o A Single National Water Supply and Sewerage Authority

This proposal would provide for assignment of all necessary power and responsibilities in a single agency not bound by civil service constraints. It must be sponsored by a person or group at ministerial level interested and able to ensure continuing central government support. The successful Electricite du Liban may provide a valuable model in some respects. A degree of decentralization of design and construction will be necessary, along with operational decentralization, so regional offices will be required. With common central management, more flexibility will be available in determining regional boundaries although they should still not cut across physical systems. Training and technical support for operations will be required from the center. This arrangement provides the optimum opportunity for making effective and economical use of specialist personnel and for ensuring proper engineering and operational procedures. It has the disadvantages that it requires the creation of a new agency and that it will reduce the power and responsibility of the Ministry of Hydraulic and Electric Resources.

4.1.2 Water Supply

Beirut Water Office

All of the needed responses for the OEB system listed in section 3.2.1 are suited to foreign participation, since they all involve supply of imported equipment. The opportunities and proposed project details are as follows:

(a) Pipeline Repair and Stand-Pipe Project:

The program would continue urgently needed repairs to the distribution system pipes and reservoirs until all significant leakage has been halted and service restored to the level which the system enjoyed before the wars.

Additionally this program would include the installation of projected water distribution standpipes in the war ravaged camp sites and adjacent areas.

Such a program would consist of the following main components:

- Engagement of a U.S. contractor to come to Beirut with all necessary materials, equipment and key personnel to locate and repair all significant leaks and to install strategically located and protected standpipes.
- All equipment and tools will be contractor-owned and returned to the USA after completion of the contract. The contractor would bring materials primarily consisting of repair clamps, couplings, caulking, sealants, materials for standpipes, and tank liners. The quantity and types would be established in the contract. All unused material would be turned over to the OEB.
- Procurement of two fully equipped repair vans to be delivered to Beirut as soon as practicable. The contractor would train OEB personnel in the use and maintenance of these vans. These vans would be turned over to OEB at the end of the contract.
- In addition, other equipment and tools necessary for maintenance and repair work would be procured and furnished as above.
- Engagement of a U.S. consultant to prepare the necessary procurement documents for the contractor's work and purchase of the maintenance equipment. In addition the consultant would monitor the work of the contractor and furnish specialists to inspect the reservoirs and establish repair details to assess the effect of all repairs. The consultant would prepare a final report which would summarize the work accomplished and provide recommendations for on-going improvements to the system. An outline scope of work for the consulting services is presented in Appendix F.

The repair contract would be a level-of-effort contract spanning a period of approximately eight months.

The estimated cost of this program is summarized below:

		<u>Foreign</u> <u>Currency</u>	<u>Local</u> <u>Currency*</u>
- Consultant services	-	\$ 260,000	40,000
- Contractor's work	-	\$ 1,100,000	300,000
- Equipment	-	\$ 700,000	-
TOTAL		\$ <u>2,060,000</u>	<u>\$340,000</u>

*Expressed as U.S. dollars

Figure 6 displays the recommended program tasks and their duration. Table 4-1 provides a breakdown of equipment to be furnished.

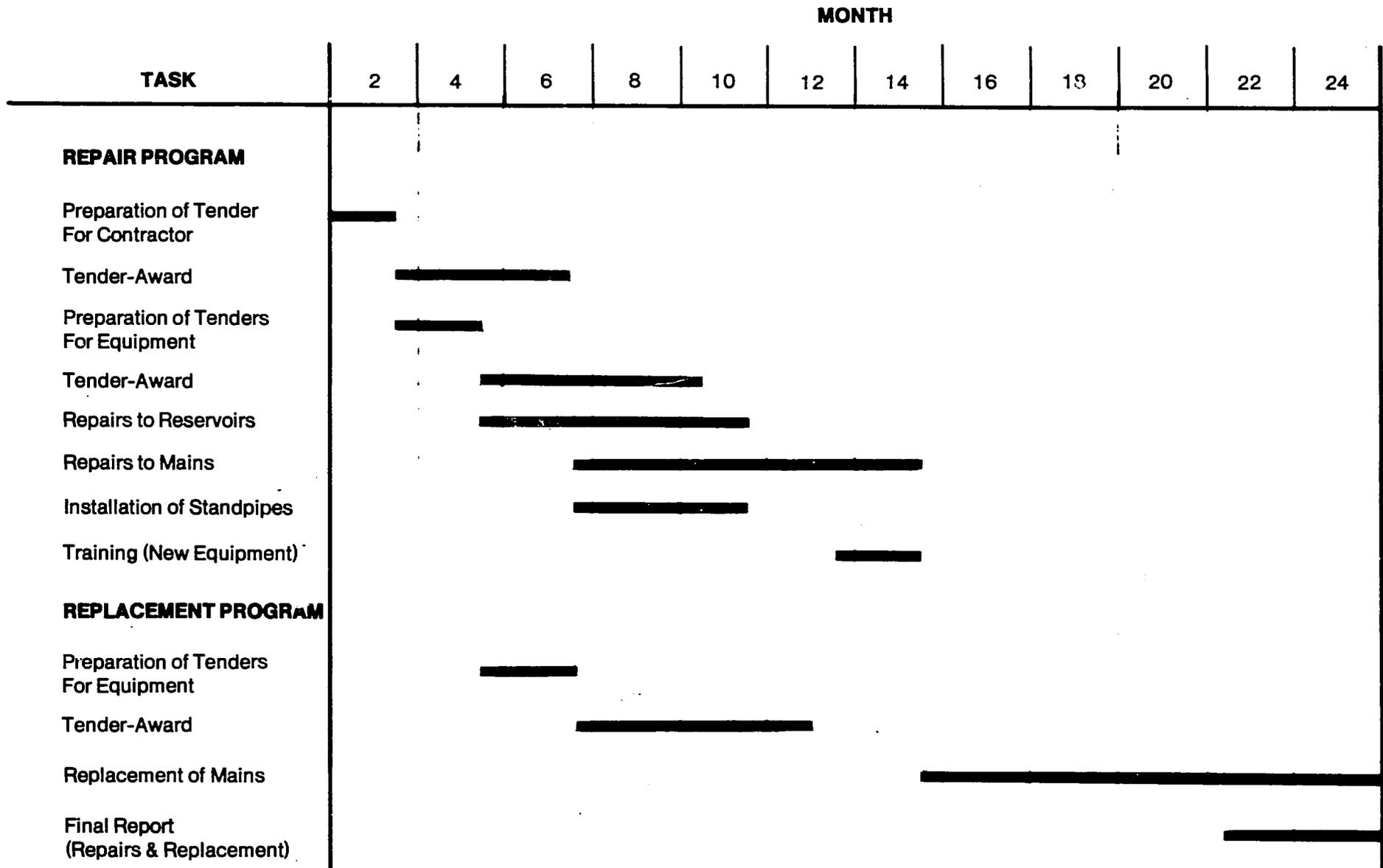


Fig. 6
PROPOSED BEIRUT WATER OFFICE
SCHEDULES FOR
(1) REPAIR PROJECT
(2) REPLACEMENT PROJECT

TABLE 4-1

Beirut Water Office System Repair Program

<u>ITEM</u>	<u>QUANTITY</u>	<u>ESTIMATED COST</u> <u>\$ X 10³</u>
Repair van	2	200
Combination backhoe and front-end loader	2	140
Rotary compressors	2	30
Portable pumps	6	25
6 cyd trucks	2	45
Pick-up trucks	3	35
Misc small tools	Allowance	50
Misc commodities		175
Clamps, collars, etc.		—
	TOTAL	\$ 700

(b) Pipeline Replacement Project:

This program would include the supply of all necessary materials and equipment to allow for the OEB to perform the necessary work of replacing leaking pipelines. Additionally some technical assistance would be provided, as the materials furnished would be of U.S. origin and style. (The OEB systems made up of all French material and equipment.)

It should be emphasized that this program would essentially be for replacement purposes and not an expansion of the pre-war system. Furthermore, it would be limited to the most severely damaged areas. However, establishment of a new minimum pipe diameter should be considered.

The completion of this program would provide time necessary for current system-wide distribution studies, followed by actual design and construction. It is anticipated that those efforts will result in considerably larger mains installed with some significant changes in distribution pattern. Assuming work is now about to commence on the studies, a period of five to ten years for final realization of system expansion does not seem unreasonable. For that reason, it is recommended that a replacement program proceed immediately following the repair program.

This replacement program would consist of the following main components:

- Engagement of a U.S. consultant to prepare the necessary procurement documents, monitor progress by provision of on-site experts, to advise OEB on details of installation and to prepare a final project report.
- Procurement of materials (primarily pipe and fittings) and equipment necessary to install the pipe.

The estimated cost of this program is:

		<u>Foreign Currency</u>	<u>Local Currency*</u>
-	Consultant Services	600,000	200,000
-	Materials	2,000,000	-
-	Equipment	900,000	-
	TOTAL	<u>3,500,000</u>	<u>200,000</u>

*Expressed as U.S. dollars

Figure 6 displays the recommended program tasks and duration. Table 4-2 provides a breakdown of equipment to be furnished.

(c) Provision of Standby Generators:

Provision of two large diesel standby generators along with modernization of electrical gear at those facilities would eliminate the long interruptions of water supply due to power outages. Units of 3000 kw and 1000 kw for Dbayeh and Ashrafiyeh respectively, are needed. Both units are relatively "long

TABLE 4-2

Beirut Water Office System Replacement ProgramMATERIALS

<u>ITEM</u>	<u>QUANTITY</u>	<u>ESTIMATED COST</u> <u>\$ X 10³</u>
12" Ductile iron pipe	3000 m	200
10"	3000 m	150
8"	3000 m	110
6"	6000 m	160
4"	6000 m	120
3"	6000 m	100
Fittings 3" - 12"	2000,000#	500
Valves 3" - 12"	700	200
Sleeves, taps, couplings	ALLOW	<u>460</u>

SUB TOTAL \$ 2,000

EQUIPMENT

Excavators (Gradall G3R equiv.)	2	315
1.5 cyd front end loader	2	150
6 cyd dump truck	4	90
Pick-up truck	4	50
Rotary compressor	2	30
Portable pumps	4	15
Hydraulic crane	1	100
Hand Tools	ALLOW	<u>150</u>

SUB TOTAL \$ 900

lead" items and will require significant time for manufacture and delivery to the site (12 to 18 months). Additionally some engineering will be necessary to prepare procurement documents for both the generator sets and new switch gear (8-10 months).

The cost of this program would be approximately \$2,000,000. This would cover the necessary engineering, equipment procurement and electrical installation. Receiving facilities such as support pads, enclosures and site improvements are not included in the above estimate. These would need to be provided by OEB. Following is a cost breakdown:

		<u>Foreign Currency</u>	<u>Local Currency*</u>
-	Consultant services	\$ 170,000	\$ 30,000
-	Equipment	1,500,000	-
-	Local installation	-	300,000
	TOTAL	<u>\$1,670,000</u>	<u>\$ 330,000</u>

*Expressed as U.S. dollars

(d) Standby Pump Capacity at Ashrafiyeh:

Installation of a new vertical pump of about 450 lps capacity, mounted atop the reservoirs and connected to existing adjacent piping, would quickly provide adequate standby capacity, replacing that which was lost due to war damage. Figure 7 shows a possible arrangement. Installation could be by local contractor.

The cost of this installation is estimated to be:

		<u>Foreign Currency</u>	<u>Local Currency*</u>
-	Consultant	\$ 25,000	-
-	Equipment	75,000	-
-	Local installation	-	35,000
	TOTAL	<u>\$ 100,000</u>	<u>35,000</u>

*Expressed as U.S. dollars

Other Water Authorities

In terms of total cost, pipelines constitute the biggest rehabilitation and replacement need for all water authorities except OEB Pipes which could usefully be imported at some stage include ductile iron in large diameter and high density polyethylene in small diameters. (Asbestos cement and galvanized steel pipes are made in Lebanon.) Considering the ill-defined quantities of pipe (a) needed and (b) intended to be provided by UNICEF; the fact that UNICEF-supplied ductile iron pipes are still on hand and not installed; and the need for overall water supply organizational and technical planning, it is not proposed that early provision of ductile iron pipe be undertaken unless this is requested by UNICEF in connection with its programs.

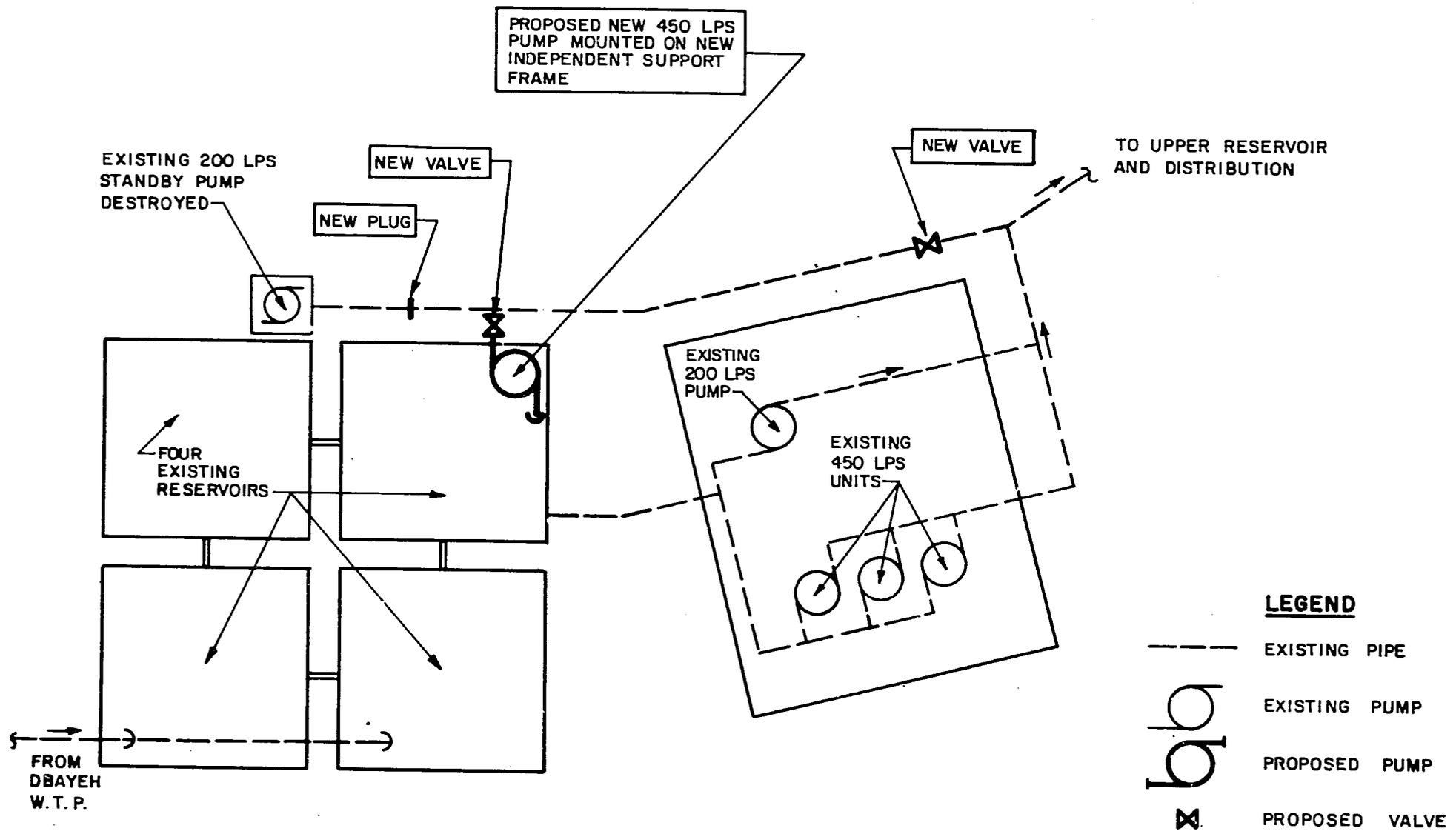


Fig. 7 PROPOSED STANDBY PUMP INSTALLATION AT LOWER ASHRAFIYEH

While CDM regards high density polyethylene as a much more suitable material (if properly installed) than galvanized steel for service connections and small distribution mains, there is a lack of familiarity with and trust in it in Lebanon. In addition, it would appear to compete with the local galvanized steel pipe industry. Therefore, while supply of high density polyethylene pipe may be useful in the long term, it also is not proposed as short-term material supply measure.

As indicated in section 3.2.1, an urgent need is to provide supplementary well supply capacity for Saida. There is an opportunity in this case both to provide specialized equipment, including well pumps, screens and possibly other equipment, and also for providing initiative and overall technical orientation through technical assistance. It is understood that there have been examples of unnecessary failure of certain groundwater development efforts in the past for procedural and other reasons, regardless of the presence in Lebanon of technically skilled people.

It is therefore concluded that foreign technical assistance and specialized equipment can usefully be provided to assist the Ministry of Hydraulic and Electric Resources to make effective use of Lebanese consulting engineering and well drilling, testing and development capabilities to solve the urgent water source problem of Saida. Including the proposed technical assistance (the suggested scope of work for which is presented in Appendix F), and assuming that the equipment to be supplied from foreign sources would comprise two submersible pumpsets, each of approximately 500 cum/hr capacity, with electrical controls and well screens, the estimated foreign source cost is approximately \$350,000. The local cost could be as low as \$200,000 if all that is needed is to drill two wells. However, depending on the work needed to connect to the distribution system, it could exceed this. This will not be known until completion of the technical assistance phase. It is possible that the technical assistance phase may also reveal additional needs for foreign source equipment.

Provision of maintenance equipment and training for water authorities, as proposed in section 3.2.1, will necessarily depend on foreign assistance and is not included in the UNICEF program. To meet this need, it is proposed that each authority be provided with repair vans, excavating equipment, and other vehicles and equipment, together with the services of a trainer/advisor for a period of four months. Each assistance module, comprising various equipment items and four months of trainer/advisor services, is estimated to cost \$600,000. This cost and the equipment types are itemized in Table 4-3. Preparatory technical assistance will be needed. A suggested scope of work for this is presented in Appendix F.

Ministry of Hydraulic and Electric Resources

Table 4-4 lists some of the equipment requested by the Ministry of Hydraulic and Electric Resources.

TABLE 4-3

Repair Equipment and Training Module for Each
Southern Lebanon Water Authority

<u>ITEM</u>	<u>QUANTITY</u>	<u>\$ x 10³</u> <u>ESTIMATE</u>
Training advisor	4 m.m.	100
Repair vans	2	150
Small backhoe-front- end loader	2	130
Portable compressor	2	30
Pick-up truck	2	20
Portable pump	4	15
Misc small tools, etc.	Allow	55
Misc supplies, clamps, etc.	Allow	<u>100</u>
	TOTAL	600

Technical assistance for all six modules = 100

Summary

Total 6 modules	3,600
Technical Assistance	<u>100</u>
Grand Total	3,700

TABLE 4-4

Ministry of Hydraulic and Electric Resources Equipment

<u>ITEM</u>	<u>QUANTITY</u>	<u>\$ x 10³</u> <u>ESTIMATED COST</u>
Water quality testing		
Laboratory equipment	Various	125
Winch truck w/boom	1	150
Pick-up truck 4W/OR	1	25
Jeep	4	40
Portable electric generator	3	20
Submersible pumps	4	50
Misc instruments	Allow	125
Tents and supplies	10	15
Theodolite	3	15
Level	5	10
Misc survey equipment	Allow	<u>25</u>
	TOTAL	\$ 600

The estimate of the equipment is as follows:

			<u>Foreign Currency</u>
- Laboratory equipment	-	\$	125,000
- Well testing equipment and vehicles	-	\$	425,000
- Survey equipment	-	\$	50,000
TOTAL		\$	<u>600,000</u>

Preliminary technical assistance would be needed to sharpen the definition of needs and to prepare procurement specifications for the equipment. A suggested scope of work for this technical assistance effort is presented in Appendix F.

National Water Resources Study

Because of the skills and experience needed, and also because of the political overtones, the proposed water resources and water supply development study (refer to sections 2.3.1 and 3.2.1) is a very significant opportunity for foreign assistance, especially for U.S. assistance.

The details of the scope of the study will depend on whether or not a prior decision has been made on the amalgamation of water supply and sewerage authorities. It would at least include: evaluation of data adequacy; filling data gaps in such areas as groundwater quality and potential water storage locations; projecting urban, agricultural, hydroelectric and other demands; preparation of alternative water resource protection and development strategies; analyzing the alternatives; preparing a staged water resources development plan and a staged urban water supply conceptual plan; and projection of staffing, management, financial and other needs and recommendations.

Preparatory technical assistance will be needed to develop detailed terms of reference for the study. A suggested scope of work for this is presented in Appendix F. For budgeting purposes it is assumed the master plan would be carried out over a 15-month period by two groups, a facilities planning team and a management team. Foreign assistance would consist of 150 person-months of professional services in Lebanon and 20 person-months of home-office support, for the following types of professionals: hydrologist, hydrogeologist, irrigation engineer, hydropower engineer, water resources systems analyst, dam design engineer, structural engineer, pilot plant/laboratory specialist, leakage and water-use field-studies specialist, cost engineer, urgent-works engineer, water reuse engineer, land-use planner/demographer, environmental impact assessment specialist, economist, and financial specialist, all related to facilities planning. The management team would contain four specialists in utilities management, organizational development, technical training and institutional management.

Total foreign assistance for the water resources study is estimated at \$3 million, including costs of equipment for leakage detection, flow and pressure measurement; six cars; a microcomputer; and a portion (\$200,000) of the costs for pilot well drilling, soil borings and surveying. Local costs are

estimated at \$1.4 million to cover the following; 90 person-months of professional assistance and 20 person-months for draftsmen to be provided by a Lebanese consulting firm; office rental; drivers and car maintenance; laborers and engineers from regional water authorities, to assist water-use and leakage-detection studies; and the remaining cost (\$300,000) for well drilling, borings and surveying.

The cost elements having the highest degree of uncertainty are those concerned with identifying sites for large seasonal or drought water storage. Aside from additional storage obtained by raising the existing dam at Karaoun Lake, the possibilities for large economical surface-water reservoirs appear slim. Discussions with AUB faculty indicate large confined (sealed off from the sea) aquifers could provide significant seasonal groundwater storage for coastal communities. However, tapping the 3 or 4 aquifers underlying Beirut would require wells 1500m deep, and development of a single production well might cost \$2 million according to AUB estimates.

4.1.3 Solid Wastes

Based on the needs and responses identified in previous sections, the following are the principal opportunities for short-term foreign assistance in solid waste management:

1) Collection and Conveyance

- o Provide additional 16-cyd compactor refuse trucks for Beirut Municipality. This will satisfy an urgent need and should provide an opportunity to encourage closure and protection of the Normandie dump. The estimated number of new vehicles required (on a 2-shift per day basis) is 40. The procurement specification should preferably provide for two years' maintenance by the supplier and should call for the following features (among others): gasoline powered (as diesel vehicles cannot be registered in Lebanon), cab-over-engine (to shorten the wheelbase for maneuverability), hydraulic hoist to suit the 1.5-cyd bins to be provided by OGER Liban, compactor mechanism outside the trash compartment, and the compaction cycle to be interruptible and reversible. The estimated cost is \$2,500,000.
- o Provide additional solid waste vehicles including: (a) two 2-cyd front-end loaders and ten 6-cyd dump trucks for Beirut Municipality at an estimated cost of \$1,000,000, and (b) replacement vehicles from the list provided by the Ministry of the Interior. This list comprised the following (including Beirut but excluding items proposed above):

	<u>Capacity</u>	<u>Quantity</u>
Compactor trucks	6 cyd	6
	10 cyd	30
	16 cyd	68
Bulldozers		2
Front-end loaders	2 cyd	11

Dump trucks	6 cyd	74
Street cleaners		13
Dumpsters		32
Jeeps		75

Provision of some of these vehicles, especially for Beirut suburbs and Saida, will help satisfy an urgent need and should provide an opportunity to encourage protection and proper management of those dump sites that are now grossly offensive. This assistance should be provided through the Ministry of the Interior. The cost of providing the full listed number would be about \$10,000,000.

(Note that, in view of the late and admittedly unconfirmed and indirect information received by the team from a source based in Saudi Arabia that solid waste vehicles may be provided by the Saudi Arabian government, no final commitment to supply vehicles should be made without up-to-date information on this.)

2) Overall Management

- o Provide consulting services for the preparation of a solid waste management feasibility study for the Greater Beirut area. Outline terms of reference for this study are presented in Appendix F. The study is expected to take 9 months to completion of a draft report and 12 months to completion of the final report. The anticipated inputs are 40 man-months of U.S. consulting engineering services (including 33 man-months in Lebanon) and 40 man-months of professional support services from a Lebanese consulting firm. The estimated cost of the U.S. consultant services is \$750,000 and that of the local consultant, plus office space, local transportation and local subcontracts, is \$700,000. It is not evident at present which national government agency should sponsor this study. If CDR does proceed to establish the proposed Waste Management Technical Group, then it would be logical for it to sponsor the preparation of the Greater Beirut study. However, the Ministry of the Interior has administrative responsibility for municipal affairs and has in the past arranged for the provision of refuse trucks. It has, however, no technical capability in the solid waste field. The Grand Projects of Beirut does have engineering staff and would appear to be the logical executing agency if CDR does not implement the WMTG. In either case, it will be necessary to work cooperatively with the Ministry of the Interior.
- o Provide consulting advisory services to the Waste Management Technical Group, if this is in fact set up by CDR. These services would cover other areas of waste management in addition to solid wastes. Outline terms of reference are presented in Appendix F. The services would cover an 18-month period and are expected to cost \$1,000,000. This level of effort is predicated upon establishment of the WMTG to consist of either directly employed CDR staff or a combination of such staff and local consultant personnel. It assumes that specialist skills in solid wastes management, sewerage program management and various technical areas will be required from a foreign source.

- o Provide consulting services for the preparation of solid waste PE/F studies for locations other than Greater Beirut. Their cost would depend on their study areas and scopes of work, including whether or not wastewater and drainage are included. In view of the urgent need for water and wastewater administrative decision making, and the likelihood that such decisions will be made independently of any regional solid waste study results, combined solid waste and sewerage PE/F studies are not seen as useful at the present time. Formal solid waste PE/F studies themselves (other than for Greater Beirut) are not an urgent need and, if conducted independently of sewerage and following completion of the Greater Beirut study, could be effectively performed by Lebanese consulting engineers, working under the guidance of the WMTG and its advisory consultants.

4.1.4 Sewerage and Drainage

Beirut Municipality

Potential foreign assistance for short-term improvement of sewerage and drainage conditions in Beirut Municipality appears to be limited to the provision of sewer cleaning, inspection, mapping and training. All measures beyond this are dependent on preparation of a Greater Beirut sewerage feasibility study, which it is understood will be funded by the World Bank.

Because of the lack of precise information as to the sizes, locations and condition of the sewers, it is proposed that the assistance be provided on a level-of-effort basis. The proposed work is similar to that recently carried out in Cairo with USAID funding. The proposed principal work components are:

- o Engagement of a U.S. sewer maintenance contractor to come to Beirut with all necessary equipment and key personnel to clean, inspect and map the main collectors and trunks. Equipment will be contractor-owned and returned to the USA at the end of the contract.
- o Procurement of sewer system cleaning equipment and tools to be delivered to Beirut at approximately the 75 percent point of the U.S. contractor's work. The U.S. contractor would then train municipal personnel in the use and maintenance of this equipment. This equipment would be turned over to the Beirut Municipality.
- o Engagement of a U.S. consultant to prepare the necessary procurement documents for the U.S. contractor's work and sewerage maintenance equipment furnished to the municipality. The consultant would monitor the work of the contractor and prepare progress reports and a final report on the accomplishments of the program, including maps and profiles of the sewers cleaned and inspected. Any recommendations for continued improvement in the system would be included as well.

The proposed sewer cleaning contract would be a level-of-effort contract spanning a period of nine months.

The estimated cost of this program is summarized below:

		<u>Foreign Currency</u>	<u>Local Currency*</u>
-	Consultant Services	\$ 250,000	\$ 50,000
-	Contractors Work	600,000	300,000
-	Equipment	600,000	-
	TOTAL	<u>\$1,450,000</u>	<u>\$ 350,000</u>
		TOTAL	\$1,800,000

*Expressed as U.S. dollars.

Figure 8 displays the recommended project tasks and durations. Table 4-5 provides a list of equipment to be furnished.

North Metn

The North Metn sewerage system, which borders the Beirut system, suffers from similar problems. For that reason, a cleaning/inspection/mapping/training program covering the Borj Hammoud and other immediate coastal areas of the district is formulated here.

An estimate of cost for such a program is as follows:

		<u>Foreign Currency</u>	<u>Local Currency*</u>
-	Consultant Services	\$ 150,000	\$ 50,000
-	Contractor's Work	100,000	200,000
-	Equipment	400,000	-
	TOTAL	\$ 950,000	\$ 250,000

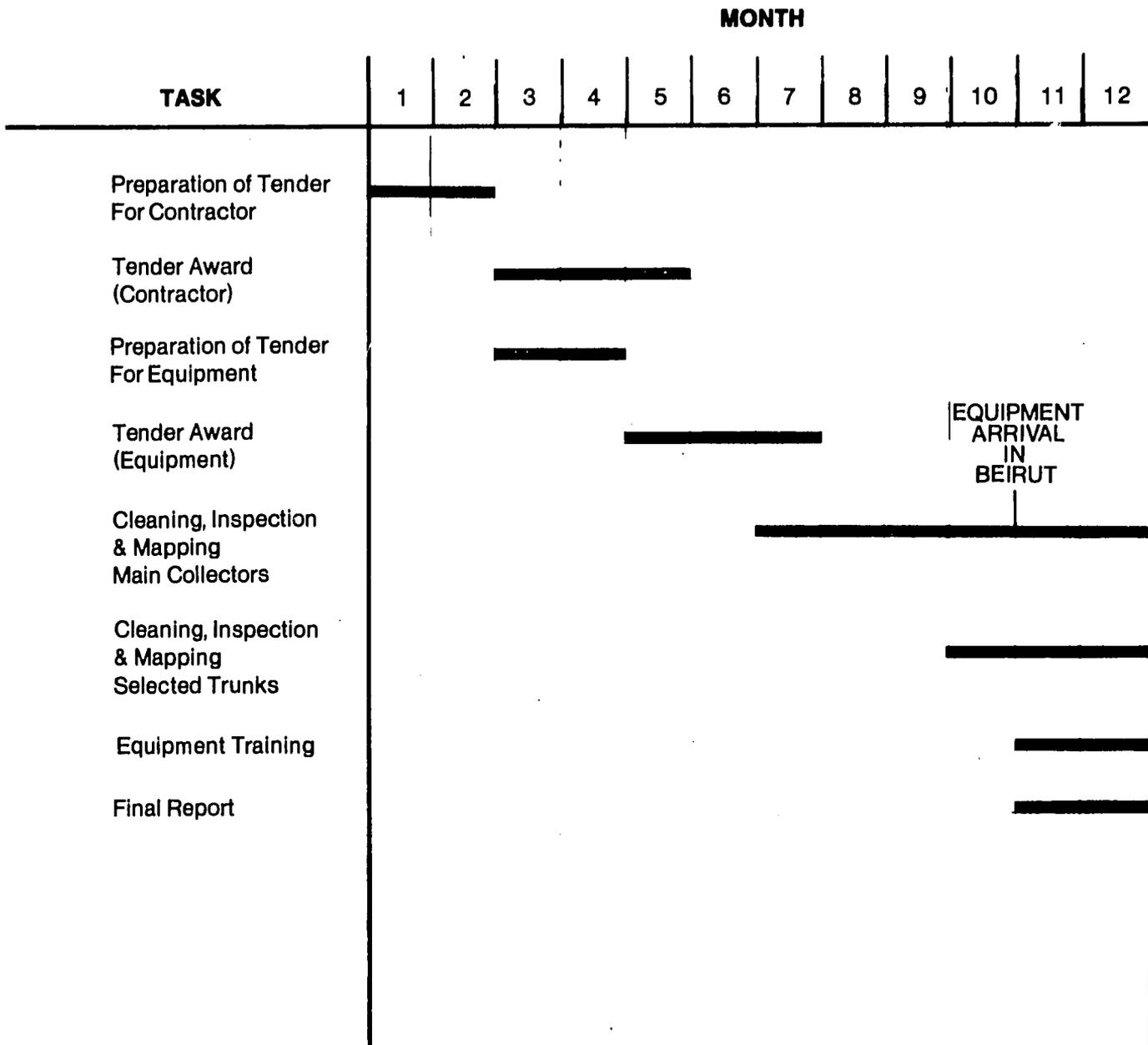
*Expressed as U.S. dollars

The program would be similar to that shown in Figure 8 except that the duration of actual contractor work would be only six months. Table 4-6 provides a list of equipment to be furnished.

Because of the relatively small size of this system, it would be advisable to combine this work with that for Beirut. It is shown here separately to permit prioritizing, but the cost estimates assume incorporation with the Beirut work.

Saida

The Saida sewerage system, although small, suffered war damage, and blockages are a serious problem. Therefore, a scaled-down version of the Beirut program is proposed.



**Fig. 8
PROPOSED BEIRUT MUNICIPALITY SEWER CLEANING,
INSPECTION, MAPPING AND TRAINING PROJECT**

TABLE 4-5

Equipment to be Furnished Under Beirut Sewer Cleaning
Inspection/Mapping/Training Program

<u>ITEM</u>	<u>QUANTITY</u>	<u>ESTIMATED COST \$ (000)</u>
Hydraulic jetting		
Machine	2	190
Catch basin cleaner		
(orange peel type)	e	215
TV inspection unit	1	80
Dump trucks (6 C.Y.)	2	45
Power rodding machine	2	10
Rotary compressors	2	30
Misc small tools	ALLOWANCE	100
Safety equipment	ALLOWANCE	<u>30</u>
	TOTAL	700

An outline scope of work for the proposed U.S. consulting engineering services is presented in Appendix F.

TABLE 4-6

Equipment to be Furnished under North Metn
Sewer Cleaning/Inspection/Mapping/Training Program

<u>ITEM</u>	<u>QUANTITY</u>	<u>ESTIMATED COST \$ (000)</u>
Hydraulic Jetting Machine	2	190
Catch Basin Cleaner (Orange Peel)	2	145
Dump Trucks (6 C.Y.)	2	45
Power Rodding Machine	2	10
Rotary Compressor	2	30
Misc Small Tools	ALLOWANCE	30
Safety Equipment	ALLOWANCE	<u>10</u>
	TOTAL	460

The estimated cost of this program is summarized below:

		<u>Foreign Currency</u>	<u>Local Currency*</u>
-	Consultant Services	\$ 60,000	\$ 20,000
-	Contractor's Work	180,000	100,000
-	Equipment	240,000	-
	TOTAL	<u>\$ 480,000</u>	<u>\$ 120,000</u>
		TOTAL	\$ 600,000

* Expressed as U.S. dollars.

The program would be similar to that shown in Figure 8 for Beirut except that the contractor's work duration would be only six months. Table 4-7 provides a list of equipment to be furnished.

Because of the relatively small size of this system, it would be advisable to combine this work with that for Beirut. It is shown here separately to permit prioritizing, but the cost estimates assume incorporation with the Beirut work.

4.2 Priorities

On the basis of need, feasible rapidity of response, the relationship of the need to war damage, and opportunity to influence beneficially any subsequent work, priorities have been proposed for the potential assistance projects as follows:

<u>PROJECT</u>	<u>ESTIMATED COST IN DOLLARS</u>	
	<u>FOREIGN COST</u>	<u>LOCAL COST</u>
<u>A. High Priority Projects</u>		
<u>(in priority order)</u>		
1. Beirut Municipality: provide 40 solid waste packer vehicles	2,500,000	
2. Beirut Municipality: sewer cleaning, inspection, mapping, training	1,900,000	
3. CDR: consultant advisory technical services to Waste Management Technical Group ¹⁾	1,000,000	

1) If CDR does establish the WMTG and if consulting advisory services are not provided by the Italian government.

TABLE 4-7

Equipment to Be Furnished under Saida
Sewer Cleaning/Inspection/Mapping/Training Program

<u>ITEM</u>	<u>QUANTITY</u>	<u>ESTIMATED COST \$ (000)</u>
Hydraulic jetting machine	1	95
Catch basin cleaner (orange peel)	1	75
Dump trucks (6 cyd)	1	25
Power rodding machine	1	5
Rotary compressor	1	15
Misc small tools	ALLOWANCE	20
Safety equipment	ALLOWANCE	<u>5</u>
	TOTAL	240

4. Beirut Water Office: repair damaged watermains, provide standpipe supplies	2,400,000	
5. Ministry of Hydraulic and Electric Resources (for Saida Water Authority): provide equipment to augment well capacity	350,000 ²⁾	200,000 ²⁾
6. CDR or Grand Projects of Beirut: Greater Beirut Area solid waste feasibility study	750,000	700,000
7. Ministry of Interior (for other communities): provide solid waste packer and other vehicles	1,000,000	-
8. Ministry of Hydraulic and Electric Resources: provide laboratory, well-testing and survey equipment	600,000	-
9. Ministry of Hydraulic and Electric Resources (for the Ain Ed-Delbeh, Barouk, Saida, Nabaa Et-Tassah, Sour and Environs, and Jabel Amel Water Authorities): repair watermains, provide training and equipment	3,700,000	-
10. Beirut Water Office: provide standby pumping capacity at Ashrafiyeh	100,000	-
11. Ministry of Hydraulic and Electric Resources: prepare water resources and water supply development master plan	<u>3,000,000</u>	<u>1,400,000</u>
Subtotal	\$17,300,000	\$ 2,300,000

B. Other Projects
(not in priority order)

o Beirut Municipality: provide 10 dump trucks and two front-end loaders	1,000,000	-
o Ministry of the Interior (for Saida Municipality): sewer cleaning, inspection, mapping, training	600,000	-

²⁾May need to be amended following preparatory technical assistance.

o	Ministry of the Interior (for the North Metn Union of Municipalities): sewer cleaning, inspection, mapping, training	1,000,000	-
o	Beirut Water Office: replace damaged mains	3,700,000	-
o	Beirut Water Office: provide standby generator sets at treatment plant and main pump station	2,000,000	-
o	Ministry of Hydraulic and Electric Resources (for the Jabal Amel Water Authority): provide additional raw water pumping and mains capacity	600,000	-
o	Ministry of the Interior: replace damaged vehicles (divisible item)	<u>10,000,000</u>	-
	Subtotal	\$18,900,000	
	TOTAL	\$36,200,000	

APPENDIX A

Order of Technical Direction
and Additional Materials

OCT 25 1982

WATER AND SANITATION FOR HEALTH (WASH) PROJECT
ORDER OF TECHNICAL DIRECTION (OTD) NUMBER 124
October 24, 1982

TO: Dr. Dennis Warner, Ph.D., P.E.
WASH Contract Project Director

FROM: Mr. Victor W.R. Wehman Jr., P.E., R.S. *VWW*
AID WASH Project Manager
S&T/H/WS

SUBJECT: Provision of Technical Assistance Under WASH Project
Scope of Work for USAID/Lebanon and NE Bureau

REFERENCES: A) Memo White (A/DLTF) to Wehman (S&T/H/WS) dated
21 October 1982
B) State , dated 21 October 1982
C) Beirut (7344)
D) State 291043

1. WASH contractor requested to provide technical assistance to USAID/Lebanon and Near East Bureau as per Ref A., para A-I.
2. WASH contractor/subcontractor/consultants authorized to expend up to 140 person days of effort over a 4 month period to accomplish this technical assistance effort.
3. Contractor authorized up to 128 person days of international and or domestic per diem to accomplish this effort.
4. Contractor to coordinate with NE/Tech/HNP (J. Haratani), Lebanon Project Development Officer (NE/PD), Lebanon Desk Officer, NE/PD/Engr (J. Habron) and USAID/Lebanon staff as appropriate and should provide copies of this OTD along with periodic progress reports as requested by S&T/H or NE/W or USAID/Lebanon staff.
5. Contractor authorized to provide up to five (5) international round trips from consultants home base through Washington D.C. (for briefings) to Athens Greece to Beirut Lebanon and return to consultants home base through Washington D.C. (for debriefings) during life of this OTD.
6. Contractor authorized local travel within Lebanon as appropriate and necessary to accomplish this technical assistance NTE \$7800 without the prior written approval of the AID WASH Project Manager. USAID/Lebanon and GOL are encouraged to provide technical assistance team with vehicle and logistics support as appropriate and convenient to the USAID or GOL sources.
7. Contractor authorized to obtain interpreter services in Lebanon as appropriate and necessary to provide the technical assistance services effectively and efficiently NTE \$11500 without the written approval of the AID WASH Project Manager. These interpreter services are in addition to the level of effort specified in para 2 and 3 above.

8. Contractor authorized to obtain secretarial, graphics, reproduction, and administrative services as necessary and appropriate to provide effective and efficient technical assistance NTE \$ 4200 without the prior written approval of the AID WASH Project Manager.
9. Contractor authorized to provide for car/vehicle/conveyance rental (not purchase) as necessary and appropriate NTE \$ 7600 without the prior written approval of the AID WASH Project Manager. Contractor authorized logistical support in Lebanon to include the renting of office space within a building, home or other area NTE 800 square feet of space and NTE \$ 6700 without the written approval of the AID WASH Project Manager. Contractor is to document thoroughly the appropriateness of the space rented, and cost of space rental provided. USAID Lebanon and/or GOL is encouraged to provide adequate space for technical assistance team if appropriate and available. These services are in addition to the level of effort specified in para 2 and 3 above.
10. WASH contractor will adhere to normal established administrative and financial controls as established for WASH mechanism in WASH contract.
11. WASH contractor should definitely be prepared to administratively or technically backstop field consultants and subcontractors.
12. Contractor to brief USAID/Lebanon and/or GOL staff in Lebanon at least once every 8 days, regarding progress and findings as tentative as they may be. Team leader should be prepared to brief WASH Project Director and task manager by phone at least once every two weeks or at schedule deemed necessary and appropriate by team leader or WASH Project Director/task manager.
13. As per Ref A, para H., Contractor to prepare and submit to the USAID prior to departure, a draft summary report of the teams findings and recommendations including the basic data obtained in Ref A, para A-E. After review by the USAID and/or GOL a coordinated draft shall be prepared by the team and left with the USAID and GOL. Reports are to be written in English with no translation to other languages without the written approval of the AID WASH Project Manager.
14. USAID/Lebanon, NE/TECH/HNP, NE/PD, ~~NE~~ NE/PD/ENGR and Lebanon Desk Officer should be contacted immediately and technical assistance initiated before the end of October 1982 or as may be of convenience to the USAID.
15. Appreciate your prompt attention to this matter. Good Luck..

UNITED STATES GOVERNMENT

Memorandum

TO : S&T/HEA, Mr. Victor W. R. Wehman

DATE: 10/21/82

FROM : A/DLTF, Alfred *White*

SUBJECT: Provision of Technical Assistance under WASH Project Scope of Work for AID/Lebanon

This is to request the provision of technical assistance in Lebanon under the WASH project for the following scope of work:

- A. Contact relevant domestic and foreign organizations operating in the waste and water supply subsector.
- B. Describe the purpose/goal of each organization; their institutional, human, technical and material resources, and their present and planned activities in the waste and water supply subsector and to what extent the activities of each organization are being coordinated and by whom.
- C. Conduct an on-the-ground assessment of the status (damage, repair operation and needs) of solid waste, wastewater and water supply systems for the purpose of confirming activity information obtained in Para B above and to identify areas of need.
- D. Determine the level of ongoing response (satisfactory, unsatisfactory, overlap/duplication, no action, etc.) being provided by organizations surveyed above in Paras A and B above.
- E. Identify areas of need in the subsectors (including the need for data collection, coordination, and clearing house functions) and describe recommended course of immediate action consistent with long-term requirements (i.e., wastewater master plan) for each area of need, describe the magnitude of the problem, prepare an implementation schedule and an estimate of institutional, human, technical, material and financial (budget) resources required.
- F. Identify and describe the degree of urgency and magnitude of areas of need which require supplemental (foreign) assistance.
- G. Provide general recommendations regarding the operational steps to be taken next.
- H. Prepare and submit to the Mission prior to departure a draft summary report of the team's findings and recommendations including the basic data obtained in A to E above.



I. Travel to AID/W for debriefing, timing to be determined upon team's return.

This scope of work is to be performed by a team of technical experts over a period of up to ten weeks beginning as soon as possible. It is estimated that a maximum of 120 person days will be required to complete the services requested above. The team should have authority to secure clerical, interpreter, transport, logistical, administrative and technical support within Lebanon as deemed necessary to implement this scope of work. --

cc:

NE/TECH:KSherper

NE/TECH/EPN:BTurner

NE/DP:ACoch

NE/PD:DMadel

UNCLASSIFIED
Department of State

OUTGOING
TELEGRAM

WASH
Pry
Dir.
Dowdson

PAGE 01 STATE 297139 1871 071886 AID4287
ORIGIN AID-00

ORIGIN OFFICE NETC-04
INFO NEPD-04 AANE-01 NEDP-03 OFDA-02 FM-02 HO-04 STHE-01
SAST-01 LEBI-02 NEME-03 RELO-01 STHP-01 MAST-01 LFT-01
3M-00 /031 A0

INFO OCT-00 SS-10 NEA-07 /052 R

DRAFTED BY AID/NE/TECH/HPN: J. HARATANI: L
APPROVED BY AID/DLTF: A. D. WHITE
AID/NE/TECH/HPN: B. TURNER DRAFT
AID/NE/ME: T. MILLER (DRAFT)
AID/NE/PO: D. MANDEL (SUBS)
AID/NE/TECH: K. SHERPER (INFO)
AID/NE/PO: P. SELLAR (INFO)
AID/PRE/HUD: J. GROSSMAN (INFO)
AID/S&T/HEA: V. WEHMAN (DRAFT)
AID/CFDA: J. SLUSSER (SUBS)

-----020110 220356Z /38

P 220151Z OCT 82
FM SECSTATE WASHDC
TO AMEMBASSY BEIRUT PRIORITY
INFO AMEMBASSY DAMASCUS PRIORITY

UNCLAS STATE 297139

AIDAC

E. O. 12356: N/A

TAGS:

SUBJ: HEALTH RELIEF: WASH TEAM

REF: (A) BEIRUT 7344, (B) STATE 291043

1. SCOPE OF WORK: AID/W HAS ADVISED WASH OF POSSIBLE EXPANSION OF STUDY AREA AND EXTENSION OF VISIT. EXPANSION OF STUDY AREA POSES NO PROBLEMS; HOWEVER AID/W RECOMM NDS THAT NEED TO EXTEND VISIT BE DECIDED BY WASH TEAM AND AID/W AFTER SAY FIRST WEEK IN COUNTRY. IF EXTENSION NEEDED, AID/L CAN ADVISE NE/TECH/HPN AND INFO S AND T/HEALTH.

2. TEAM MEMBERS: ROBERT J. KACHINSKY REPLACING CHARLES E. FULLER. KACHINSKY IS VICE PRESIDENT/CDM, RESPONSIBLE FOR TECHNICAL OPERATIONS WORLDWIDE, 20 YEARS EXPERIENCE IN ENVIRONMENTAL ENGINEERING WITH SUBSTANTIAL OVERSEAS EXPERIENCE INCLUDING THE MIDDLE EAST. BOTH KACHINSKY AND ROBERT H. THOMAS ARE PRESENTLY ON TRAVEL STATUS; THEREFORE FURTHER SUBSTITUTIONS MAY BECOME NECESSARY. TO AVOID DELAYS, AID/W REQUESTS AID/L FOR REVIEW/APPROVAL AUTHORITY FOR ANY FURTHER SUBSTITUTIONS.

3. FUNDING: WASH TEAM WILL BE FUNDED FROM AID/W

4. TIMING: WASH ADVISES THAT PRESENT PROPOSED TEAM CAN ETA BEIRUT O/A 11/1/82. SHULTZ

Mr. Jenkins
Austin
Wehman
UW

Received 57/14 (Wehman) 10-24-82
Passed to WASH 10-24-82

COPY

Department of State

TELEGRAM

PAGE 01 BEIRUT 07344 191532Z 7989 066636 AID1296

BEIRUT 07344 191532Z 7989 066636 AID1296

ACTION AID-08

5. UNEXPLODED ORDNANCE: DCD/EOD TEAM CAN ADVISE WASH TEAM UPON ARRIVAL. NOT PERCEIVED TO BE A PROBLEM. PUGH

ACTION OFFICE HETC-04

INFO NEPD-04 NEOP-03 OFOA-02 GC-01 GCFL-01 GCHE-01 NO-04
STHE-01 SAST-01 ENGR-01 LEB1-02 NEME-03 RELO-01 STMP-01
DAEN-01 MAST-01 /032 AS 1219

INFO OCT-00 SS-10 10-15 NEA-07 AHAD-01 FDRE-00 RP-10
/078 V

-----253520 191539Z /38

P 191148Z OCT 82
FM AMEMBASSY BEIRUT
TO SECSTATE WASHDC PRIORITY 9381

UNCLAS BEIRUT 7344

AIDAC

FOR WHITE, NE/TECH/HPM, AND OFDA

PASS TO STATE/RP/DAS DEVEY

E.O. 12356: N/A
SUBJECT: HEALTH RELIEF: WASH TEAM

REF: STATE 291043

1. SCOPE OF WORK: AID/L AGREES IN PRINCIPLE WITH SCOPE OF WORK AS OO TOYS LGKEN, COLE, AND CROWLEY. UNICEF FOUND THE SCOPE SATISFACTORY AS FAR AS IT GOES BUT MADE THE RECOMMENDATION THAT SIDON, TYRE, AND DAMOUR IN THE SOUTH ALSO BE INCLUDED. UNICEF ESTIMATES THESE SITES WOULD REQUIRE ONE ADDITIONAL WEEK. WE WILL ALSO HAVE TO REVIEW SCOPE WITH CDR, WHICH MEANS MUHAMMED ATALLAH GIVEN HIS DEEP INTEREST IN SUBJECT. ATALLAH IS ABROAD WITH PRESIDENTIAL PARTY AND CANNOT BE REACHED UNTIL OCTOBER 25 AT EARLIEST. HOWEVER, WOULD NOT BE SURPRISED IF HE WERE ALSO INTERESTED IN EXTENDING THE METHODOLOGY TO SOUTHERN SITES MENTIONED BY UNICEF. THEREFORE, REQUEST AID/STATE, CONSIDER FUNDING IMPLICATIONS (IN THE CONTEXT OF OUR COMMENTS BELOW PARA 3) OF ADDING THESE SITES TO SCOPE USING UNICEF ESTIMATE OF ONE ADDITIONAL WEEK AND PROVIDE ADDITIONAL ITEM FOR SCOPE OF WORK PRIOR TO OCTOBER 25.

2. TEAM MEMBERS: APPEAR EXCELLENT.

3. FUNDING: AID/L SURPRISED AT SUGGESTED CHANGE OF FUNDING SOURCE AT THIS STAGE. MISSION OFFERED THIS ASSISTANCE TO CDR BASED ON THE ASSURANCE OF CENTRAL FUNDING AND SWIFT RESPONSE. TO NOW ASK CDR TO FOOT THE BILL WOULD BE COUNTER-PRODUCTIVE. USG VISITORS TO LEBANON HAVE ALL MENTIONED INCREASINGLY HIGH ASSISTANCE LEVELS BUT NOTHING NEAR THE MAGNITUDE BEING DISCUSSED HAS ACTUALLY BEEN OBLIGATED. FURTHERMORE, WHAT HAS BEEN OBLIGATED HAS NOT GENERALLY GONE TO THE GOL. WASH TEAM WOULD BE A TANGIBLE DEMONSTRATION OF USG FOLLOW-THROUGH TO GOL DIRECTLY. WATER AND SANITATION REMAIN CRITICAL HEALTH PROBLEMS WHICH AID/L AID RELIEF TEAM VIEW IN RELIEF CONTEXT. COLE SEES NO REASON WHY IDA ACCOUNT CANNOT BE JUSTIFIED, IF NECESSARY. UNLESS ALL WASH TEAM VISIT ISSUES WERE RESOLVED WITH ATALLAH DURING HIS OCTOBER 19 WASHINGTON VISIT, THE FUNDING ISSUE CAN LOGICALLY BE EXPECTED TO COME UP WHEN WE CLEAR THE SCOPE OF WORK WITH CDR. WE URGE ASSURANCE BEFORE OCTOBER 25 THAT WASH TEAM CAN BE CENTRALLY FUNDED.

4. TIMING: IF FUNDING ISSUE CAN BE EXPEDITIOUSLY SETTLED, WE WOULD HOPE TEAM COULD ARRIVE IMMEDIATELY AFTER THE WORKSCOPE HAS BEEN AGREED TO BY CDR AND A DECISION MADE ON THE ADDITIONAL SITES MENTIONED PARA 1.

191539Z OCT 82
FM AMEMBASSY BEIRUT

OCT 20 1982

UNCLASSIFIED

WASH PROJECT OTD 124
AGREED FIELD WORK AND
REPORT TO BE PREPARED

Scope of Work

The scope of work as listed in the OTD Reference A addresses the work needed to establish items, costs and priorities for possible foreign assistance in rehabilitation and urgent improvements in the water supply and waste subsectors. It is subject to the following agreed clarifications:

- o It covers solid waste, wastewater and water supply but does not mention drainage. The last is closely related to the first three, is an infrastructure area which has suffered damage, and should therefore be included
- o It calls for development of areas of need regardless of immediacy and for selection of foreign assistance opportunities from among these needs. Considering the objectives of the study, it is agreed that it should focus clearly on early foreign assistance opportunities. The work will include review of already identified needs and identification of additional needs in broad terms, with more detailed development of opportunities for foreign assistance. Principal emphasis will be given to quickly implementable opportunities.
- o The geographical coverage is not defined. Travel in Greater Beirut and to the principal southern cities and towns is possible and is understood to be safe. The study will cover Greater Beirut and the larger southern cities of Saida and Sour (Tyre), while providing for collection of data from sources in Beirut and Qana on the other southern population centers, with visits to them only if and as needed.

The agreed report outline is attached.

Methodology

Conduct interviews to inquire into the facilities, resources, damage suffered, priorities for rehabilitation and urgent improvement, active organizations, and coordination of efforts in relation to water supply, sewerage, drainage, rubble and garbage collection/disposal. Such interviews to be conducted with representatives of, inter alia, the following responsible agencies/organizations:

- Council for Development and Reconstruction
- Office des Eaux de Beyrouth
- Executive Council of Grand Projects of Beirut
- Ministry of Hydraulic and Electric Resources
- Beirut Municipality
- North Metn Union of Municipalities
- South Beirut Suburbs Union of Municipalities
- Metn Water Board
- Ain Ed-Delbeh Water Board
- Saida Water Board
- Sour Water Board
- Nabaa Et Tasseh Water Board
- Mayors of Saida, Tyre
- Governors of Mount Lebanon and South Lebanon
- Department of Municipal Affairs, Ministry of Interior

Conduct interviews to inquire into available and potential resources and current and planned activities in relation to water supply, sewerage, drainage, rubble and garbage collection/disposal. Such interviews to be conducted, inter alia, with the following assisting and private organizations:

- World Bank team in Lebanon
- UNICEF water supply teams in Beirut and Kana
- Local consultants
- OCER Liban
- Representatives of U.S. equipment suppliers in Lebanon

Inquire of relevant organizations listed above concerning conditions in Jezzine, Nabatiyeh and Marjayoun and, if appropriate, visit relevant officials in these towns.

Make necessary prior arrangements through the appropriate officials and pay visits of inspection to representative and other significant operations and facilities, including damaged facilities.

Prepare a draft report in conformity with Reference A of the OTD, as amended hereby, review it with AID representatives and, if so required by them, with representatives of CDR, and prepare a revised draft. All cost estimates in the draft report will be subject to final adjustment after return of the team to USA.

Work Plan

Proposed work schedule:

Conduct interviews and inspections in the Beirut area, 4-13 Nov.

Conduct interviews and inspections in the South, 15,16 Nov.

Conduct supplementary interviews in the Beirut area, 17,18 Nov.

Draft report, 10-18 Nov.

Review draft report, 18 Nov.

Revise draft report, 19,21 Nov.

Depart Lebanon, 22 Nov.

Polish draft in Boston, 26 Nov. - 3 Dec.

Review with AID Washington, 6-8 Dec.

Complete and submit final report, 9-13 Dec.

Proposed Report Outline

Preface (Few words on background and acknowledgement of DAR's help)

EXECUTIVE SUMMARY (Brief summary of OTD scope of work (Appendix A) with agreed variations; and summary of critical conditions, recommendations and opportunities for foreign investment)

1. INTRODUCTION (Background of study, summary OTD scope and agreed variations, study duration and methodology (Appendix B) and persons interviewed - refer to Appendix C)
2. WATER SUPPLY CONDITIONS AND NEEDS
 - 2.1 Organizations (Responsible and assisting organizations and their goals, functions, resources, activities and coordination)
 - 2.2 Physical Conditions and Needs (System deficiencies, damage and losses, rehabilitation and other urgent needs, by geographical region)
3. SOLID WASTES CONDITIONS AND NEEDS
 - 3.1 Organizations
 - 3.2 Physical Conditions and Needs
4. SEWERAGE AND DRAINAGE CONDITIONS AND NEEDS
 - 4.1 Organizations
 - 4.2 Physical Conditions and Needs
5. RESPONSES TO THE NEEDS
 - 5.1 Responses to Date (Past, current and planned actions including any coordination of these)
 - 5.2 Other Needed Responses (Findings on further urgent actions needed, both physical and operational; needs for coordination and suggested actions in this regard)
6. OPPORTUNITIES FOR SHORT-TERM FOREIGN ASSISTANCE
 - 6.1 Opportunities and Costs (Listing of items, by subsector and geographical location, with preliminary cost estimates)
 - 6.2 Priorities (Discussion of priorities, listing of items, with cumulative costs, in proposed priority order)

INTENTIONALLY

LEFT BLANK

APPENDIX B

Study Team Itineraries

	<u>RHT</u>	<u>RJK</u>	<u>MSC</u>
Athens - Beirut (by air)	Nov 3	Nov 3	Nov 3
Beirut - Saida - Nabatiyeh - Marjayoun - Karaoune Lake - Jezzine - Beirut (by car)	Nov 14	Nov 14	Nov 14
Beirut - Saida - Qana - Beirut (by car)	Nov 15	-	Nov 15
Beirut - Paris - Boston (by air)	-	Nov 19/20	-
Beirut - London - Boston (by air)	Nov 23/24	-	Nov 23/24
Boston - Washington DC - Boston (by air)	Dec 7	-	Dec 7
Boston - Singapore (by air)	Dec 8/10	-	-

APPENDIX C

Persons Interviewed

- Council for Development and Reconstruction - 220000*
 - Dr. Mohamed Atallah, President
 - Hagop Dimerjian, Council Member
 - Courtney Nelson, Consultant
- Ministry of Interior
 - Sami Shaib, Director-General, Acting - 371317
- Ministry of Hydraulic and Electric Resources
 - Rida Dihayni, Director General - 274275, 270256
 - Bassam A Jaber, Director of Technical Studies
 - Samir Corbane, Research and Major Works
 - Naaman Ajam, Groundwater
 - Emile Abu Jideh, UNICEF Liaison
- Grand Projects of Beirut
 - Assem Sinnu, Director General - 365017
- Union of North Metn Municipalities
 - Habib Hakim, President and Mayor of Sinn El Fill - 892000
 - Burros Saade, Director
 - Raymond Ryaichi, Public Works
 - Joseph Hakim, Engineer
- Syndicate of Municipalities for South Coast of Beirut
 - Elias Helou, President and Mayor of Baabda - 420573, 420457
- Union of Municipalities of Saida
 - M. Kalash, President and Mayor of Saida - 724264 (office)
- Municipality of Beirut
 - Mounir Bekdash, solid wastes engineer, east Beirut - 305972, 310531
 - Wahid Boukhari, solid wastes engineer, west Beirut
 - Osama Hourri, sewerage and drainage engineer - 308060
- Municipality of Chiyah
 - Maroun Maroun, Mayor

*Telephone numbers (Beirut unless otherwise indicated)

- Beirut Water Office
 - Lucien Moubayed, Director General - 386551, 386550
 - Gabriel Zarife, Chief Engineer
- Ain Ed-Delbeh Water Authority
 - Nasser Nasrullah, Director - 385150
- Saida Water Authority
 - Mohamed Khalili, Director - 721605 (Saida)
- Nabaa Et-Tasseh Water Authority
 - Samir Farchouk, Director - 721271 (Saida)
 - Kamel Chearawi, Chief, Administrative Section
- Jabal Amel Water Authority
 - Abdel Hadi Nouriddine, Director
 - Mohamed Khalifeh, Technician
 - Radwan Achi, Engineer
- Sour and Environs Water Authority
 - Ismail Debouk, Director
- U.S. Agency for International Development - 361800
 - Malcolm Butler, Mission Director
 - Robert H Bell, Acting Deputy Mission Director
 - David H Mandel, Project Officer
 - Albert Hotvedt, Telecommunications Engineer, Near East Bureau
- UNDP - 804658, 807925
 - Guy Van Doosselaere, Resident Representative, Lebanon
 - Mustafa Al-Jaff, Deputy Resident Representative
- UNICEF - 368490, 368720, 366270
 - John Gulmar Andersson, Chief, Reconstruction So. Lebanon
 - Karl-Axel Larsson, Chief, Field Operations and Liaison, Qana
 - Office
 - Raymond Naimey, Acting Chief Engineer, Beirut Office
 - J. Keith Andrew, Water Engineer, Qana Office
- World Health Organization - 366760, 812187
 - Dr. P. Tissan, Programme Coordinator, Lebanon

- The World Bank
 - Gerard R. Tenaille, member of visiting mission to Lebanon
- American University of Beirut - 340740
 - Aftim Akra, Prof. of Environmental Health
 - Ziad Beydoun, Prof. of Geology
- OGER Liban (construction company) - 319321
 - Fadl Chalak, Beirut Project Manager
 - Omar Daouk, Engineer
- Dar Al Handasah (Shair and Partners) - 814134, 300256
 - Dr. Salim Macksoud
 - Elie Saab
 - Haykal Sawaya
 - George Habib
- Dar Al Handasah Nazih Taleb - 813523
 - Nizar Karam, Vice President - 308260
 - Gibran Taleb, Administrative Manager - 308260
- Omnium Traitement et Valorisation
 - Pierre Michenaud, Director, Qarantina Compost Plant - 222066
- Cedar Motor Trading Co. (International Harvester distributor)
 - Shawki Saudi, Chairman
- Universal Equipment Co. (Wayne Engineering distributor)
 - Mr. Chatila, Chairman
- Wayne Engineering Co.
 - Stanley Worthington, Manager of International Sales
- Advance Disposal Services, Inc.
 - Al Schaheen, President

APPENDIX D

ILLUSTRATIONS

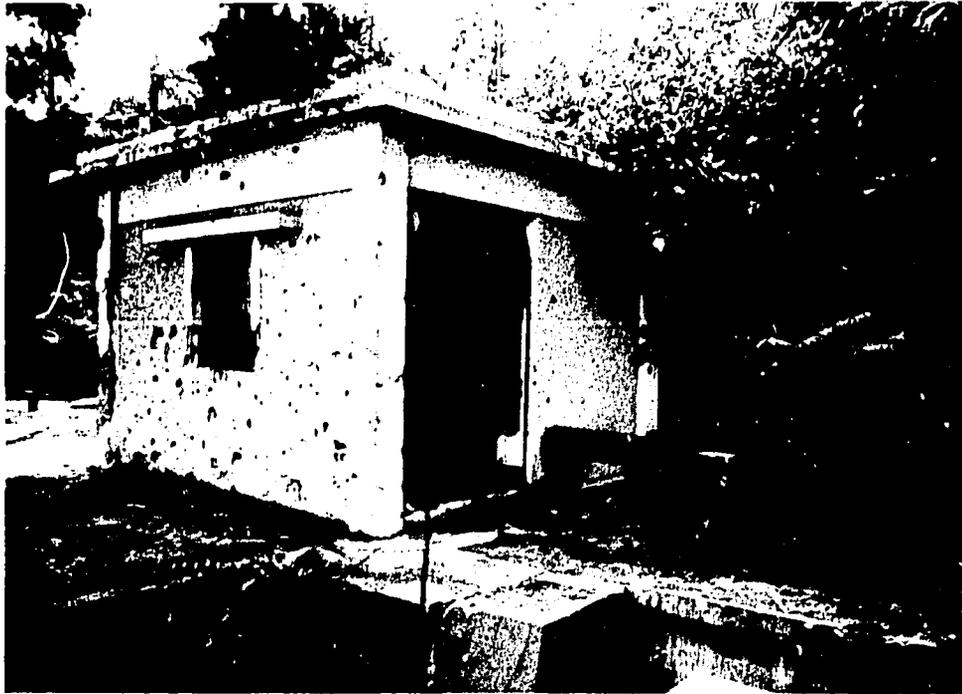


Beirut Commercial District, heavily damaged in the civil war. Rubble clearance recently undertaken by OGER Liban, a Lebanese construction firm, using funds from Saudi Arabia.



Buildings near Arab University in west Beirut, heavily damaged during Israeli siege; demolition underway by OGER Liban.

*All photographs taken November 3-22, 1982



Beirut Water Office. Standby pump at Ashrafiyeh destroyed during the invasion.



Beirut Water Office. Storage reservoirs at Ashrafiyeh, damaged and leaking.



UNICEF emergency water supply at Sabra refugee camp.



Typical leakage from water main at Marjayoun.



UNICEF ductile iron water mains (supplied by USAID)
stockpiled at Jezzine.



Typical infiltration gallery at water supply spring in Jezzine.



Building demolition and rubble clearance by OGER Liban near Arab University, Beirut.



Damaged packer vehicle owned by Beirut municipality.



Typical five-man crew collecting trash on a Sunday in west Beirut.



Packer vehicle making daily collection under difficult traffic conditions in west Beirut.



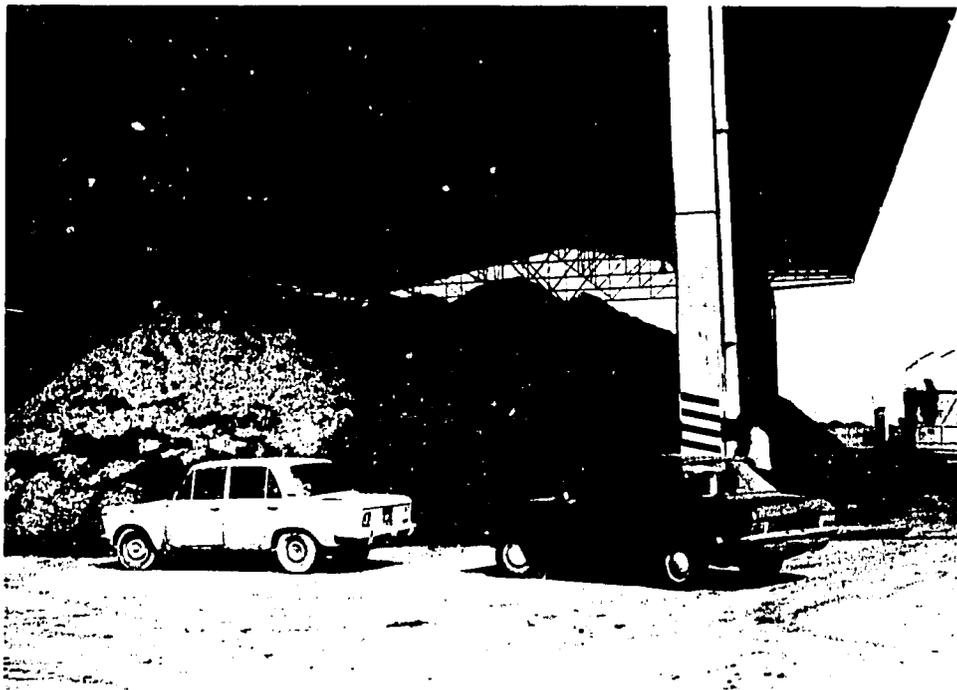
Regrading of Normandie dump site by OGER Liban bulldozer (left, foreground) while dumping continues (background), west Beirut.



Floating boom to contain floatable materials at Normandie dump site, rendered ineffective by heavy seas.



Floating material carried into the Mediterranean at the Dawra dump site in Borj Hammoud.



Finished product stockpiled at the Qarantina compost plant in east Beirut.



Open burning dump at shore in Saida.



Disposal of rubble along shore in Saida.



Beirut sewer jetting machine, destroyed packer vehicle (right, background).



Ghadir outfall (near Beirut International Airport) on cradles ready for launching. Construction interrupted by Israeli invasion.



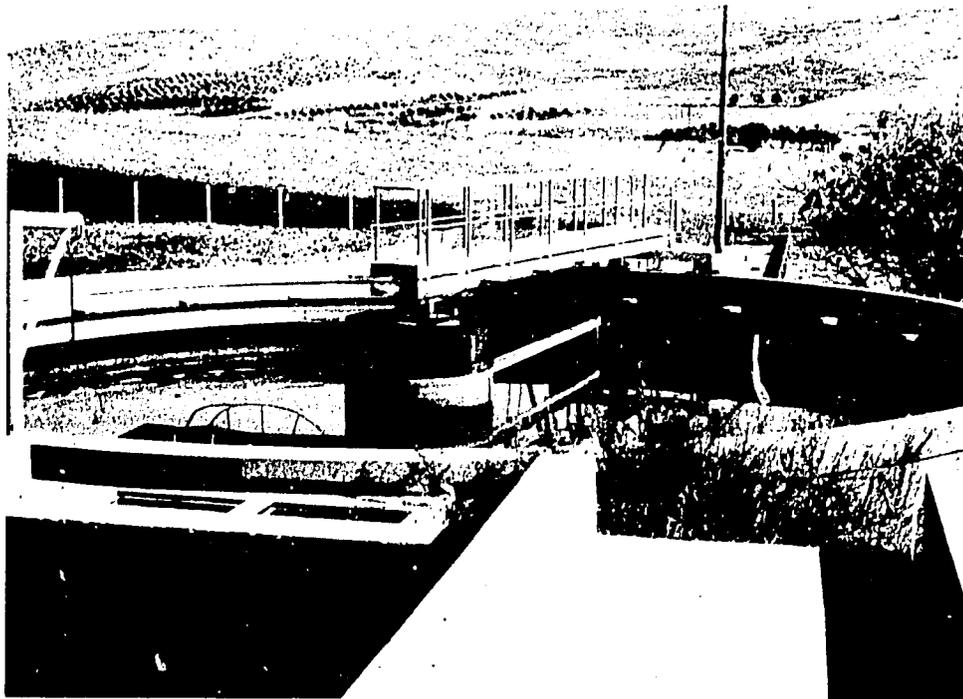
Crew working on blocked sewer in Beirut.



Short sewer outfall, partially collapsed, near Riviera Hotel in Ras Beirut.



Poor-quality concrete drainage pipe stockpiled at municipal repair yard near Arab University, west Beirut.



Abandoned activated sludge sewage treatment plant at Marjayoun. All the mechanical and electrical equipment disappeared during the civil war.

APPENDIX E

Part 1 - Needs Identified by Municipalities

The Municipal Affairs section of the Ministry of Interior is the primary source of funds for equipment and operating revenues for the 625 legally-defined "municipalities" in Lebanon. Rural areas and unincorporated communities are served from the mohafaza and caza levels of government by a separate section of the Ministry; in general, the level of funding and government services provided to rural communities is minimal. Although municipalities are authorized to collect certain types of local taxes, in actual practice only about a dozen communities receive significant revenues from local industries or other local bases for taxation.

As a result, the Municipal Affairs section is considered to be the agency most knowledgeable about the needs of individual municipalities. In response to a request from the WASH team, the former Chief of the Municipal Affairs section (who was promoted to Director General, Acting, of the Ministry during the WASH team's visit) solicited information and held a meeting of mayors in Beirut. The specific information requested by the WASH team related to damages and urgent needs in the waste management sector. However, the information received consists of a list of a broad range of vehicles that were reportedly destroyed during the period of conflict (1975 to date) and for which replacement is urgently needed.

Requests for replacement vehicles were received from 57 municipalities (or unions of municipalities) having a total population of about 2.5 million, or about 55% of the national population. The requests are summarized in Table E-1 by type of vehicle, number requested, the number of municipalities making requests, and their estimated populations.

In general, the number of vehicles requested is modest compared to U.S. standards. For example, the population to be served by each garbage compactor truck is about 17,000, while an EPA survey of the USA in 1968 showed one compactor truck per 2,100 persons in the national (rather than the served) population. The total cost to replace all vehicles is about \$20 million, or about \$ 8 per capita served. Although this amount is low by U.S. standards, it should be noted that annual municipal revenues averaged only 50 LL/capita before 1975, and have been much lower in recent years.

The 57 municipalities requesting assistance represent less than 10 percent of all municipalities in Lebanon, but include most of the large communities in Lebanon. As shown in Table E-2, the sample of 57 contains more than 80 percent of the population living in urban communities (defined as towns larger than 5,000 persons). Survey coverage ranges from 85 to 100 percent of urban population for the mohafazas of Beirut, North Lebanon and Mount Lebanon. However, in the Bekaa and South Lebanon, only half the urban population is represented due to the continuing strife and military occupation of these regions.

Based on several meetings with engineers of Beirut municipality, a list of mobile equipment and fixed plant needed for solid wastes operations was developed, shown in Table E-3. For comparison, the total equipment needs are compared with the equipment available before the civil war in 1975, and that available after the Israeli invasion. Information was also provided on the number of personnel involved in solid wastes operations, and is included in the table.

There are obvious differences between the information on equipment needs provided to the Ministry of Interior (Table E-1) and that provided directly by Beirut Municipality in (Table E-3). The Municipality's list requests more equipment, in large part to permit an improvement in level of service in addition to replacing war-damaged equipment. In the Ministry of Interior's list, no pick-up trucks or street sweepers are requested, and only 11 open dump trucks (rather than 30) are asked for. The collection bins requested by the municipality are presently being fabricated by OGER Liban. Excluding the civil construction cost for the proposed maintenance garage, the estimated costs for equipment varies between \$3.0 million (Ministry of Interior list) and \$4.7 million (list from the municipality).

For the North Metn municipalities, the needs for repair and replacement of war-damaged equipment are summarized in Table E-4. The totals shown for this region are in good agreement with the Ministry of Interior list, although the distribution of equipment among communities is quite different. The information was abstracted from letters written by the individual communities to the Union. It is apparent that some estimates are exaggerated, particularly in the case of Mar Moussa. At the same time, omissions are likely, as the towns were not responding to a single questionnaire.

For the South Beirut suburbs, Table E-5 shows information provided to the Syndicate of municipalities in this region. It would seem that this list corresponds more closely to the felt needs and desired level of service for the municipalities, rather than being limited to the replacement of war-damaged equipment. For example, the Ministry of Interior list (Table E-1) shows only 17 compactors (one truck per 30,000 population) to be replaced while the Syndicate list shows 52 compactors (one truck per 10,000 population.)

TABLE E-1

Municipal Vehicles Lost During The War and Urgently Needed^{(1)*}

<u>Vehicle Type</u>	<u>Number of Vehicles Needed</u>	<u>Number of Municipalities Indicating Need</u>	<u>Population of Municipalities</u> ^{(2)*} (Thousands)
Compactor Trucks			
6 cyd	6	6	28
10 cyd	30	22	288
16 cyd	108	27	2,160
	<u>144</u>	<u>55</u>	<u>2,476</u>
Bulldozers			
on tracks	2	2	700
on wheels	13	12	1,218
	<u>15</u>	<u>14</u>	<u>1,718</u>
Dump Trucks	84	47	2,395
Sewer Cleaning Machines	15	14	1,558
Cherry Pickers ^{(3)*}	20	19	1,814
Street Sweepers	13	13	932
Asphalt Rollers	15	14	1,540
Fire Trucks	29	14	1,575
Jeeps	75	54	2,492
Solid Waste Dumpsters ^{(4)*}	32	20	533
Ambulances	16	7	1,202

*See notes next page.

Notes

- (1) Information (in Arabic) provided by Director General (Acting) of Ministry of Interior, formerly Chief of Municipal Affairs; data for 57 municipalities (out of 625 legally-defined municipalities and a total of 1900 communities in Lebanon).
- (2) Estimated 1980 populations from the National Waste Management Plan; includes displaced persons counted twice (at both home community and community of temporary residence) and allowance for second homes.
- (3) Truck-mounted hydraulic lift used to repair street lights.
- (4) Small motor-driven vehicles containing a 0.5 cyd tilting scoop, front-mounted; used in narrow alleys to collect trash.

TABLE E-2

Municipalities Requesting Assistance Compared to National Totals

Mohafaza	Number of Municipa- lities ⁽¹⁾	Number of Urban Communities ⁽²⁾	Urban Population	Municipal Requests to Ministry of Interior		
				Towns	Population	Garbage Trucks Requested ⁽³⁾
Beirut	1	1	600,000	1	600,000	52
North Lebanon	131	17	630,000	7	530,000	13
Mount Lebanon	222	56	1,280,000	39	1,120,000	59
South Lebanon	153	31	350,000	7	200,000	17
Bekaa	118	22	270,000	3	130,000	3
Totals	625	127	3,130,000	57	2,580,000	144

Notes

- (1) From 1981 information; 414 municipalities classified as "active" and 211 classified as "inactive".
- (2) Urban communities: larger than 5000 population in 1980, from estimates in the National Waste Management Plan.
- (3) Compactor trucks, capacities of 6, 10, and 16 cyd.

TABLE E-3
Beirut Municipality: Solid Wastes Equipment, Plant and
 Personnel ^{(1)*}

ITEM	Available in 1975			Available after 1982 Israeli Invasion			Total** Needed	Remarks on Needs
	West	East	Total	West	East	Total		
MOBILE EQUIPMENT								
Compactor trucks	47	33	80	25	24	49 ^{(2)*}	100	16 cyd
Open trucks	28	12	40	8	6 ^{(3)*}	14 ^{(4)*}	30	12 cyd
Pick-up trucks	--	--	10	1	0	1	4	1.5 Tonne
Front-end loaders	--	--	2	1 ^{(5)*}	--	1	1	2.5 cyd
							1	1.0 cyd
Tank truck for street washing	--	--	2	--	--	0	4	
Street sweepers	--	--	2	--	1	1	3	Large
							5	Medium
Bulldozer	--	--	1 ^{(6)*}	--	--	1 ^{(6)*}	1	275 HP
Sedan cars	--	--	6 ^{(7)*}	2	--	2	10	1500 cc motor
Container bins	--	--	0	--	--	0	800	1.5 cyd
FIXED PLANT								
Repair garage	--	1	1 ^{(8)*}	--	1	1	1	near Arab University
Winch	--	--	1	--	--	0	2	10 Tonnes
PERSONNEL								
Street cleaning	--	--	550	425	50	475	700	
Truck maintenance	--	--	14	--	--	14	29	
Drivers	--	--	135	--	--	130	180	
Trash collection	--	--	<u>1650</u>	<u>1391</u>	<u>84</u>	<u>1475</u>	<u>2012</u>	
TOTALS			2345	1816	134	2094	2921	

*See notes next page.

** Includes both available equipment and new equipment required.

Notes

- (1) Information provided by engineer W. Boukhari, Municipality of Beirut.
- (2) Excluding 10 compactors provided temporarily by OGER Liban.
- (3) Old, in bad condition.
- (4) Excluding 25 trucks rented temporarily for rubble clearance.
- (5) Not available for solid wastes operations.
- (6) Rented.
- (7) Land Rovers.
- (8) Quarantine repair garage destroyed during the civil war, currently being reconstructed at the same site.

TABLE E-4

Water and Waste Needs of North Metn Municipalities⁽¹⁾

Community	Estimated Population (2)	Notes	Losses to Municipalities Resulting from the War ⁽³⁾									
			Compactor Trucks	Sewer Repairs (1000LL)	Water Repairs (1000LL)	Drainage Repairs (1000LL)	Jeeps	Front-end Loaders	Street Cleaners	Pick-up Trucks	Dump Trucks	Sewer Cleaners
Broumanna	8,000		2	--	--	--	1	--	--	--	--	1
Mar Moussa	1,000		--	300	250	200	1	--	--	1	1	--
Coastal	125,000	(4)	2	--	--	--	--	1	--	--	1	1
Saqiet El Misk	7,000	(5)	1	100	--	--	1	--	--	--	--	--
Antelias - Naccache	20,000	(6)	--	--	--	--	1	--	--	2	--	--
Borj Hammoud	140,000	(7)	5	2,650	--	--	3	--	--	--	--	--
Douar	3,000		--	20	8	10	--	--	--	--	--	--
Aayroun	2,000		--	40	10	30	--	--	--	--	--	--
Fanar	5,000		--	--	--	--	1	--	--	--	1	--
Byaqout	4,000	(8)	1	--	--	--	--	--	--	--	--	--
Senn El Fil	80,000		--	750	--	500	2	1	--	--	--	1
Bolonyya-Mrouj	4,000		--	300	--	100	--	--	1	--	--	1
TOTALS	399,000		11	4,160	268	840	10	2	1	3	3	4

Notes

- (1) Information from correspondence with municipalities (in Arabic) provided by Mr. H. Hakim, President, Union of Municipalities of North Metn.
- (2) From National Waste Management Plan.
- (3) As number of vehicles lost, or as cost of repairs.
- (4) Cities of Jdaide, Dekouane, Dbaye, and Zalqa; 1 dumpster and 3 vacuum tankers for emptying septic tanks also lost.
- (5) LL 100,000 repair costs include sewers, drainage channels, side walks and roads; LL 12,000 to repair trucks.
- (6) Sedan car also lost.
- (7) Sewer damage includes LL 650,000 caused by Israeli tanks; tank truck to water green areas also lost.
- (8) Requested a sewer system; water network improvements needed; war damage to drainage channels.

TABLE E-5
Water and Waste Needs of South Beirut Suburbs⁽¹⁾

<u>Community</u>	Estimated Population	Facilities Lost During the War					
		Compactor Trucks	Sewer Lines (km)	Water Lines (km)	Jeeps	Front-end Loaders	Street Cleaners
	(2)		(3)	(4)			
Hadeth	100,000	4	3	2	--	--	--
Baabda	24,000	4	5	2	1	1	1
Chiya	40,000	7	7	4	--	1	1
Ghbaire	45,000	7	7	4	--	1	1
Bourj El Barajne	120,000	7	7	4	--	--	1
Fourn Ech Chebbak	25,000	5	4	2	--	--	1
Hazmiyeh	50,000	2	2	1	--	--	--
Mraije	2,000	2	3	2	1	--	1
Wadi Chahrour	5,000	2	2	2	2	--	1
Chouaifete	30,000	3	2	2	--	--	1
Kfarchima	6,000	3	2	2	--	--	1
Haret Hraik	70,000	5	4	2	--	--	1
Louaize	<u>1,000</u>	<u>1</u>	<u>2</u>	<u>2</u>	<u>--</u>	<u>--</u>	<u>1</u>
TOTALS	518,000	52 ⁽⁵⁾	50	15	4	3	11

Notes

- (1) Information (in Arabic) provided by Mr. Elias Helou, President of the Syndicate of Municipalities for the South Coast of Beirut.
- (2) From the National Waste Management Plan.
- (3) Average diameter 16 in.
- (4) Range in diameter 1/2 in to 3 in.
- (5) Total of 17 compactors requested from Ministry of Interior (Table E-1)

Part 2 - Needs Identified by Water Authorities

The Ministry of Hydraulic and Electrical Resources, at the request of the WASH team, contacted each of the six water authorities in the war-damaged area to obtain a list of damages to facilities and rehabilitation needs. These lists were used subsequently by the WASH team in interviews with UNICEF and the water authorities, and revised as judged necessary. The results are summarized in Table E-6.

TABLE E-6

WATER SUPPLY REHABILITATION NEEDS - DATA FROM WATER AUTHORITIES¹⁾

		Beirut	Ain Ed- Delbeh	Barouk	Nabaa Et- Tasseh ²⁾	Jabal Arel	Sour and Environs
PIPELINES	12" (m)	3,000					
	10" (m)	3,000				2,000	
	8" (m)	3,000				490	
	6" (m)	6,000		1,000	4,000	4,300	
	5" (m)	--		--	--	300	
	4" (m)	6,000	5,000	2,000	5,060	1,150	5,000
	3" (m)	6,000	5,000	2,000	6,470	480	5,000
	2-1/2" (m)	--	--	2,000	520	1,150	5,000
	2" (m)	500	5,000	3,000	6,630	2,080	5,000
	1-1/2" (m)	1,500	4,000	3,000	6,877	1,620	4,000
	1-1/4" (m)	1,500	6,000	3,000	7,600	4,000	6,800
	1" (m)	3,000	4,500		8,235	3,200	4,500
	3/4" (m)	6,000	3,000		13,800	7,400	3,000
	1/2" (m)		2,000		3,000	--	--
RESERVOIRS							
Repairs (no.)		5)			1		
Rebuilding (no.)					4		
PUMP STATIONS							
Rehab'n (no.)							
Rebuilding (no.)						2	
WATER TREATMENT PLANTS							
Rebuilding (no.)						1	
GENERATORS							
700 KVA + (no.)			1	--	--	--	2
200-600 KVA (no.)			2	1	3	--	3
EQUIPMENT							
Cars (no.)		3	--	--	--	1	--
Workshop vehicles (no.)		4	3	3	3	3	3)
Leak detectors (no.)		3	3	3	3	3	3
Altimeters (no.)		--	4	4	4	4	--
Pressure gauges (no.)		5	5	5	5	5	5
2-way radio syst. (sets)		1	1	--	--	--	--
Pipe tools (sets)		4	6	5	5	10	5
Tapping machine					12	--	--
Water qual. test's eq't (sets)					2	--	--
Minicomputer (no.)					--	1	
Training					--	yes	yes
TOTAL EST. COST ⁴⁾ (US \$)					930,000	2,587,500	237,500

1) Data collected by Ministry of Hydraulic and Electric Resources; adjusted. No data provided for Saida water authority.

2) The water authority expanded the original pipe lengths greatly during the team's visit to its office, additional data provided by certain authorities during team visits.

3) Needed, but training needed first, said the Director of the Authority.

4) Not including extra items added during team visits; in some cases pipe laying included, in others excluded.

5) See section 4.1.2 for list of remaining requirements for Beirut Water Office.

APPENDIX F

Scopes of Work for Technical Assistance and Consulting Services

1. Proposed Scopes of Work for Technical Assistance:
 - a) Provision of Well Pumps and Ancillary Equipment for the Saïda Water Authority
 - b) Supply of Laboratory, Well Testing and Survey Equipment
 - c) Repair of Watermains and Provision of Training and Equipment for Southern Lebanon Water Authorities
 - d) Preparation of Terms of Reference for National Water Resources/Water Supply Master Plan

2. Outline Scopes of Work for Consulting Services:
 - a) Sewer Cleaning, Inspection, Mapping and Training for Beirut Municipality
 - b) Advisory Services to Waste Management Technical Group
 - c) Repair of Damaged Watermains and Provision of Standpipe Supplies in Beirut
 - d) Greater Beirut Solid Waste Management Feasibility Study
 - e) Provision of Stand-by Pumping Capacity at Ashrafiyeh

PROPOSED SCOPE OF WORK FOR TECHNICAL ASSISTANCE
IN LEBANON REGARDING PROVISION OF WELL PUMPS AND ANCILLARY
EQUIPMENT FOR THE SAIDA WATER AUTHORITY

- A. Conduct interviews and field visits, and collect and evaluate available data, and estimate the short-term groundwater needs of the Saida Water Authority. Interviews are to include the USAID Mission, the Ministry of Hydraulic and Electric Resources, the Saida Water Authority, the American University of Beirut Geology Department, local well drillers and Lebanese consulting engineering firms.
- B. Evaluate alternative means of meeting those needs, including possible rehabilitation of the two existing wells in the Ain El-Halweh Palestinian camp, construction of new wells and construction of facilities needed to deliver groundwater to the distribution system.
- C. Develop terms of reference for a Lebanese consulting engineering firm which will (a) prepare bid documents for well drilling/testing and construction contractor(s) to perform the necessary well drilling; casing, screen and shroud installation; pump and other field testing; pump and motor installation; and construction of ancillary works, all in accordance with relevant procedures of both USAID and the Ministry of Hydraulic and Electric Resources; (b) evaluate bids and advise the Ministry on the selection of such contractor(s); (c) observe and check the work of such contractor(s); (d) evaluate the results of all field tests, and (e) design all relevant civil works and prepare procurement specifications for equipment (to be of Lebanese or U.S. origin). Such terms of reference are to include instructions to proposers' scope of work, and method of evaluation of proposal.
- D. Evaluate the proposals and advise the USAID Mission on the selection of the Lebanese consulting engineering firm.
- E. Review the designs and procurement documents prepared by the Lebanese consulting engineering firm and advise the USAID Mission on them and on any necessary actions.
- F. Prepare a report on items A and B, and the terms of references called for in item C, in Lebanon, leaving a draft copy with the USAID Mission before departing. The terms of reference in particular shall be final as to technical content and shall be reviewed with the Mission before departure. Submit final versions within 15 days after departure. In subsequent visits, submit final drafts of reports on items D and E to the USAID Mission before departing from Lebanon, and the final within 10 days.

The above work is estimated to require a total input of 40 person-days of professional services, including 30 person-days in Lebanon and three international round trips to Lebanon. The above includes provision for briefing and debriefing at USAID Washington. Direct expenses will include international air fares, per diem expenses, local transportation, local technical interpretation/translation services and typing, and are expected to total not over \$10,000.

PROPOSED SCOPE OF WORK FOR
TECHNICAL ASSISTANCE IN LEBANON REGARDING
SUPPLY OF LABORATORY, WELL TESTING AND SURVEY EQUIPMENT

- A. Review lists of equipment requested by staff of the Ministry of Hydraulic and Electric Resources.
- B. Conduct interviews with Ministry staff and collect data to determine frequency and types of laboratory analyses, well testing and surveying performed, under prewar conditions and expected future conditions.
- C. Review qualifications and experience of Ministry staff to assure capability to utilize equipment effectively; identify as necessary needs for training, staffing or start-up assistance.
- D. Determine supplementary needs of the Ministry to be performed by outside agencies, including the Ministry of Health Central Laboratory, National Council for Scientific Research, the Industrial Institute and local universities.
- E. Identify and evaluate capabilities of private-sector firms in laboratory testing and development of wells.
- F. Select equipment most suitable to the Ministry's role in development of potable water supplies.
- G. Estimate costs, identify potential suppliers, and assist USAID in preparation of specifications and procurement documents.
- H. Prepare and submit to the mission prior to departure a draft summary report of findings and recommendations including basic data obtained in B to E above. A final report shall be submitted within 30 days after departure.

The above work is estimated to require a total input of 30 person-days of professional services, including 20 person-days for one round trip to Lebanon and provision for briefing and debriefing in USAID Washington. Direct expenses will include international air fares, per diem expenses, local transportation, local technical translation services and typing, and should not exceed \$5,000.

PROPOSED SCOPE OF WORK
FOR TECHNICAL ASSISTANCE IN LEBANON REGARDING
REPAIR OF WATERMAINS AND PROVISION OF TRAINING AND EQUIPMENT FOR
SOUTHERN WATER AUTHORITIES

- A. Conduct interviews and field visits, and review work completed and continuing by UNICEF to obtain a current understanding of needs for repair and replacement of water mains and service connections in the six southern water authorities (Ain ed Delbeh, Barouk, Saïda, Nabaa et Tasseh, Sour and Jabal Amel).
- B. Evaluate existing capabilities of each authority both equipment and personnel, to undertake a repair and replacement program.
- C. Establish, working with each authority, lists of equipment, tools, materials on hand and needed to undertake repairs and replacements.
- D. Prepare outline specifications for needed equipment, tools and technical support (expatriate).
- E. Establish a program for each authority including position descriptions of the necessary technical advisors.
- F. Assist USAID in the evaluation of bids for equipment and materials, and consulting contract(s) for the technical advisor(s).
- G. Maintain technical liaison with UNICEF during the execution of the project.
- H. Evaluate the results of the project at the conclusion of the advisory services, and prepare a report.

The above work is estimated to require a total professional input of 100 working days in Lebanon and 15 days in USA. This includes allowance for briefing and debriefing at USAID Washington and three visits to Lebanon.

Direct expenses include international and domestic airfares, per diem expenses in Lebanon, local transportation, interpreter and typing services, and are expected not to exceed \$30,000.

PROPOSED SCOPE OF WORK FOR
TECHNICAL ASSISTANCE TO LEBANON REGARDING
A NATIONAL WATER RESOURCES/WATER SUPPLY MASTER PLAN

- A. Conduct interviews and field visits, and collect and review typical relevant data and previous reports, sufficient to obtain a current understanding of water resources planning in Lebanon. Interviews are to include USAID, Ministry of Hydraulic and Electric Resources, regional water authorities, Office of Litani, Meteorological Service, Green Plan, Ministry of Agriculture, Departments of Civil Engineering and Geology at American University of Beirut, engineering faculty at St. Joseph University, U.N. FAO and private well-drilling contractors.
- B. Assess adequacy of available data for planning purposes, and identify if possible the means to fill critical data gaps resulting from war losses and/or recent inactivity of government. Data of interest include records of streamflow and rainfall; data covering climatological, water-quality, and hydrogeological conditions; information about existing water supply, irrigation, and hydroelectric systems; and previous reports and plans on potential water resources projects.
- C. Evaluate technical qualifications and experience of staff in the designated Lebanese lead agency; identify potential training needs and availability of counterpart staff to work on the master plan.
- D. Develop the terms of reference for the master plan study, including instructions to the proposers, background information, scope of work, and method of evaluation of proposals. In conjunction with USAID and the lead agency, establish approximate duration, phasing, and geographic priorities for the study, and designate the outputs expected from the plan including the following: an inventory of available data and relevant reports, maps and drawings; the basis of design including populations, water-use projections and needs, and technical criteria used for planning and design; analysis of alternatives and development of a phased facilities development plan; conceptual design and estimated costs of significant and/or typical facilities or systems; and elaboration of the technical, economic, financial, institutional, and management aspects of implementing the plan. Field work and special studies to be carried out should be defined and might include: water-use and leakage-detection programs, drilling of deep exploratory wells, study on metering of potable supplies, mapping of distribution systems, surveying and soil borings at facility sites, computer modeling, training of counterpart staff, and technology transfer activities.
- E. Prepare a preliminary estimate of required technical resources and a project schedule and budget to carry out the master plan.
- F. Prepare a report incorporating the findings and products of the above items, leaving a draft copy with the USAID mission before departure from Lebanon. Submit a final version within 15 days after departure.

The above work is estimated to require a total input of 30 person-days of professional services, including 20 person-days in Lebanon. The above includes provision for briefing and debriefing at USAID Washington. Direct expenses would include one international round trip air fare to Lebanon, per diem expenses, local transportation, and interpreter and typist services and are expected to be less than \$5,000.

OUTLINE SCOPE OF WORK FOR
CONSULTING ENGINEERING SERVICES FOR
SEWER CLEANING, INSPECTION, MAPPING AND
TRAINING FOR BEIRUT MUNICIPALITY

- A. Prepare all tender documents necessary to engage a U.S. Contractor to furnish equipment and personnel to clean, inspect and map approximately 14km of main collectors and 6km of selected sub trunk sewers. As part of the above work, the Contractor will train municipality personnel in the use of modern sewer cleaning equipment, TV inspection equipment and appropriate safety procedures. In the earlier stages, the equipment will be Contractor-owned; the latter stages will be with USAID-furnished equipment.
- B. The Consultant's work will include: (a) development of the program tender documents, (b) review of tenders and recommendation of award, (c) on-site (not continuous) monitoring of Contractor's work, (d) preparation of periodic payments to the Contractor, (e) preparation of documents and tender evaluations for new equipment and tools to be provided to the municipality, (f) compilation of all field data into sewer maps (plans and profiles), (g) evaluation of the effectiveness of municipality personnel training, (h) making recommendations for ongoing repairs and cleaning programs.
- C. Prepare monthly progress reports for Beirut Municipality and USAID-Lebanon.
- D. Prepare a final report which will include: sewer maps and profiles, recommendations for immediate and longer range repairs including methodologies and materials, and an outline routine maintenance program for the main collectors, no later than six weeks after completion of the Contractor's work.

It is envisaged that these services will be provided by a U.S. consulting engineering firm.

OUTLINE SCOPE OF WORK FOR
TECHNICAL ASSISTANCE TO LEBANON
REGARDING ADVISORY SERVICES TO
WASTE MANAGEMENT TECHNICAL GROUP

- A. Advise the (proposed) Waste Management Technical Group (WMTG) within CDR on project management and general technical aspects of waste management projects.
- B. At the request of the WMTG, advise municipalities on solutions to solid-wastes problems including: suitable disposal of rubble from war-damaged buildings; closure of coastal dump sites; selection and operation of interim landfill sites; clean-up of solid wastes from drainage channels and beaches; operations, staffing and equipment for solid wastes collection and street cleaning; technical evaluation of solid waste equipment tenders; record-keeping procedures for solid-wastes data; technical aspects affecting formation of regional systems; and handling and disposal of hazardous wastes.
- C. Advise and assist the WMTG in the following aspects of wastewater management projects: developing terms of reference for engineering consultancy services; evaluation of proposals; monitoring and technical evaluation of progress on planning, design and/or construction projects; evaluation of equipment vendors; and advisory services related to operations and maintenance of wastewater systems.
- D. Submit quarterly reports to USAID on progress and on-going activities for each three-month period.

It is believed that a total of 50 expatriate person-months in advisory services should be provided in the form of two persons on-site for 18 months plus 14 months' home-office support. One individual would specialize in solid wastes management, and the second in project management related to wastewater facilities. Including direct expenses, the estimated cost of the advisory services contract would be about \$1,000,000.

OUTLINE SCOPE OF WORK FOR
CONSULTING ENGINEERING SERVICES IN LEBANON FOR
REPAIR OF DAMAGED WATER MAINS AND PROVISION OF
STANDPIPE SUPPLIES IN BEIRUT

- A. Prepare all bid documents necessary to engage a U.S. Contractor to furnish equipment, materials and personnel to locate and repair leaks in war-damaged mains; to repair leaks in storage reservoirs; and to install a specified number of standpipe water supplies at designated locations. As part of the above work, the Contractor will train personnel of the Beirut Water Office in the use of leak detection equipment and installation techniques using water system materials of U.S. origin. In the earlier stages, equipment will be Contractor-owned; the latter stages will involve training using USAID-furnished equipment.
- B. The Consultant's work will include: (a) On-site evaluation of the repair work completed by UNICEF and the German civil defense teams, (b) On-site evaluation of damage to the storage reservoirs and subsequent leakage, (c) development of a repair program including all necessary bid documents, (d) review of bids and making recommendations for awards, (e) On-site (continuous) monitoring of the Contractor's work, (f) Review and approval of progress payments to the Contractor, (g) preparation of bid documents for equipment, tools and materials to be provided to the Beirut Water Office, (h) evaluation of the effectiveness of the training, (i) making recommendations for ongoing repairs.
- C. Prepare monthly progress reports for the Beirut Water Office and for USAID-Lebanon.
- D. Prepare a final report, which will include a system map indicating location of repairs and standpipe locations, sketches showing details of repairs to reservoirs and recommendations for continuing repair work, not later than six weeks after completion of the Contractor's work.

It is envisaged that these services will be provided by a U.S. consulting engineering firm.

OUTLINE SCOPE OF WORK FOR GREATER BEIRUT
SOLID WASTE MANAGEMENT FEASIBILITY STUDY

Propose the most economical and feasible methods, facilities and development plan for solid waste management in the Project Area comprising Beirut Mohafaza, the North Metn Union of Municipalities and the south Beirut suburbs, as illustrated in Figure F-1.

The work will comprise: (a) review of existing solid waste facilities, methods, conditions and needs, (b) preparation of population, economic and other planning projections and envelopes, (c) field studies, (d) development of alternative collection, conveyance, treatment and disposal methods and systems, including facilities and sites, for domestic and commercial refuse, (e) economic and functional evaluation and comparison of the alternatives, (f) preparation of a staged development plan covering in broad terms a period of fifteen years with detailed attention to a first stage of approximately five years, (g) evaluation of administrative, management and financing alternatives, (h) evaluation of technical, economic and financial feasibility with particular reference to the first stage, (i) preparation of a draft report and, after review by USAID and the Ministry of the Interior, a final hard-cover report in 75 copies.

The field studies will include refuse sampling, weighing and analysis, and topographic surveys of potential treatment and disposal sites.

Time-phased options for collection, conveyance, treatment and disposal will be analyzed economically on a system-wide basis.

Consideration will be given to the following: (a) the economic, functional and administrative feasibility of extending the service area(s) beyond the boundaries of the Project Area as defined above, (b) measures required to minimize environmental damage, (c) procedures for monitoring and safe disposal of hazardous wastes, (d) advantages and disadvantages of satellite collection systems, (e) street cleaning needs, (f) building rubble disposal (but not its pick-up or transportation from private property), (g) urban planning needs and proposals including possible land reclamation along the shore at North Metn, (h) composting, incineration, sanitary landfill and energy recovery, (i) the economics (from the point of view of the municipal authorities) of continued use of the privately owned and operated Qarantina compost/incineration plant, (j) marketing and disposal of final products, (k) residential building solid waste collection facilities including the content and means of enforcement of relevant building code provisions, (l) for treatment and disposal sites: soil types, depth to groundwater and to bedrock, availability of cover material, potential for surface water contamination, and zoning considerations, (m) the possible use of transfer stations, including economic, environmental, zoning and other factors, (n) alternative types and capacities of collection containers and conveyance vehicles, (o) possible involvement of the private sector in operation of the proposed system, and (p) alternative sources of local and foreign capital, and methods of revenue collection, for the proposed system.

The report will include design criteria, preliminary engineering designs showing in outline form the principal features of proposed major and typical facilities, functional descriptions of major items of equipment, and cost estimates. It will also include an outline management and staffing plan, a plan for capital funding and revenue collection, and financial projections of income statement, balance sheet, and source and application of funds through a period 10 years beyond completion of the first stage.

The draft report will be submitted within nine months of the start date. The final report will be submitted not more than two months after receipt of comments on the draft.

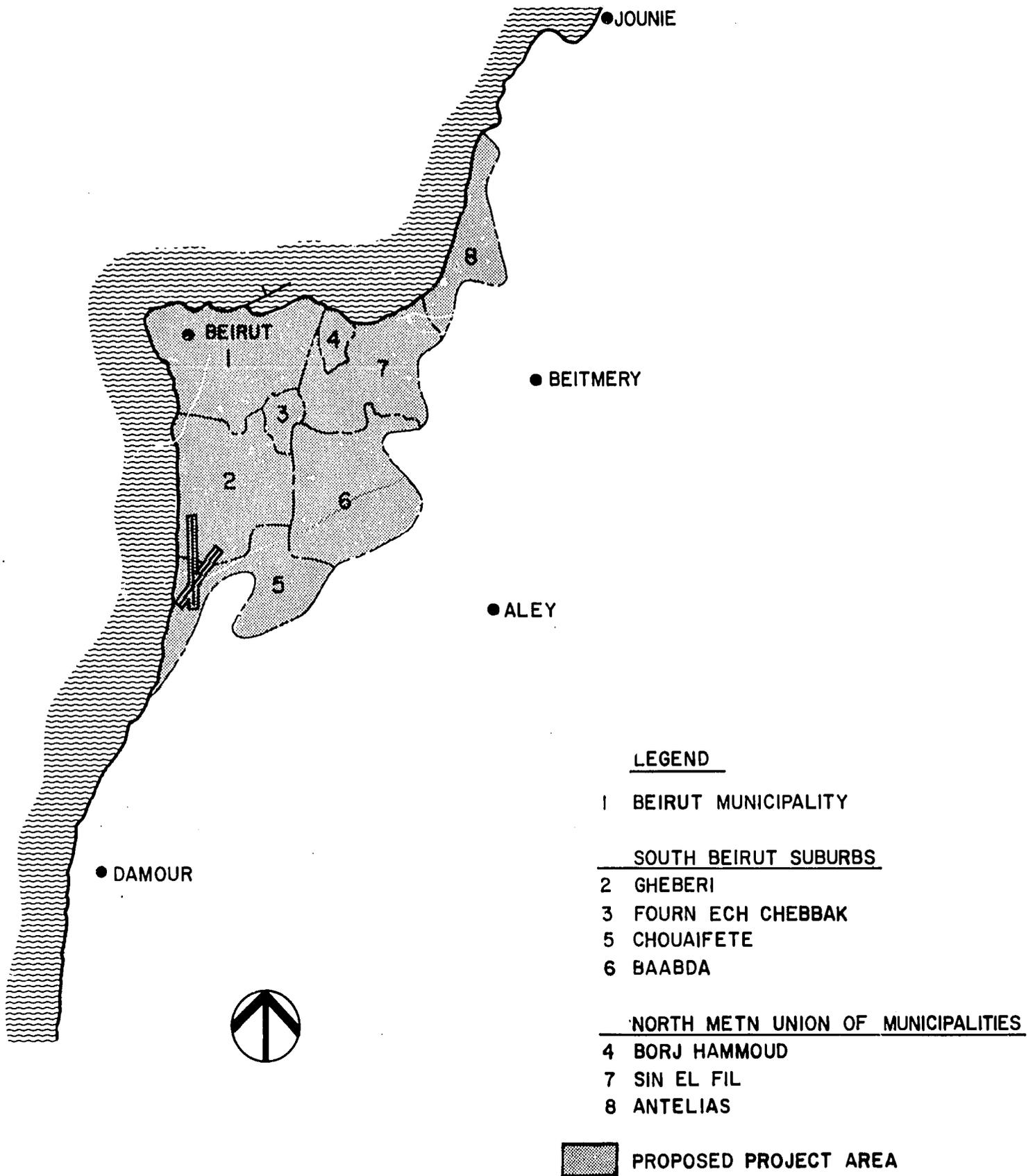


Fig F-1. PROJECT AREA OF PROPOSED GREATER BEIRUT SOLID WASTE MANAGEMENT FEASIBILITY STUDY

OUTLINE SCOPE OF WORK FOR
CONSULTING ENGINEERING SERVICES FOR
PROVISION OF STANDBY PUMPING CAPACITY AT ASHRAFIYEH

- A. Prepare all bid documents necessary to purchase a new 450 lps pump set and motor including necessary pipe, valves and adapters to connect to existing piping. Installation of the new pump will be on top of the existing reservoir at Ashrafiyeh. The work of installation will be done by local contractor and/or Beirut Water Office personnel.
- B. Evaluate the reservoir to check its structural capability to support the new pump. In the event the reservoir is found to be unable to support the new pump, design an independent frame to support the new pump.
- C. The Consultants' work will include: (a) site inspection (b) design of the support and electrical-mechanical connections necessary, (c) preparation of tender documents to procure the pump, motor, controls, pipe, valves and adapters, (d) preparation of drawings necessary for local contractor installation, (e) inspection of the completed installation including witnessing of performance tests, (f) preparation of record drawings of the new installation.

It is envisaged that these services will be provided by a U.S. consulting engineering firm in conjunction with the consulting services for watermain repair.

APPENDIX G

References

1. Camp Dresser & McKee Inc. in association with Khatib and Alami, National Waste Management Plan, report prepared for the World Health Organization as Executing Agency for the United Nations Development Programme, and the Council for Development and Reconstruction (February, 1982).
2. Dar Al-Handasah Consultants (Shair & Partners), "Plan Directeur In Littoral Nord" (May, 1981).
3. Direction Generale De L'Urbanisme "Livre Blanc" (June, 1983).
4. Kamal T. Abou-Daoud "Final Report on Foodborne and Waterborne Disease Surveillance in Lebanon during the Year 1980" (July, 1981).
5. Md Muriruzzaman Pathan "Pollutional Aspects of Water Resources in Lebanon," M.E. Thesis, American University of Beirut (March, 1977).