SUSTAINABLE ENVIRONMENTAL PRACTICES AND POLICIES (SEPP)

Ain Baal Solid Waste Treatment Facility

FINAL NARRATIVE REPORT

Reporting Period
July 2003 – February 2009

Date: June 2009

YMCA

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ACRONYM GLOSSARY

LEBANESE MINISTRIES

Ministry of Agriculture (MoA)

Ministry of Education (MoE)

Ministry of Energy and Water (MEW)

Ministry of Environment (MoEnv)

Ministry of Finance (MoF)

Ministry of Interior (MoI)

Ministry of Labor (MoL)

Ministry of Public Health (MPH)

Ministry of Public Works (MPW)

Office of Minister of the State for Administrative Reform (OMSAR)

MUNICIPALITIES

Arabsaleem Municipality (AM)

Bakka Municipality Council (BAMC)

Benwati Municipality Council (BMC)

Haytoura Municipality Council (HMC)

Hosh Municipality Council (HOMC)

Rachaya Municipality Council (RMC)

Snayyah Municipality Council (SMC)

Union of Tyre Municipalities (UTM)

Wadi Jezzine Municipality Council (WJMC)

MISCELLANEOUS

Biochemical Oxygen Demand (BOD)

Chemical Oxygen Demand (COD)

Development for People & Nature Association (DPNA)

Environmental Impact Assessment (EIA)

European Union (EU)

Internally Displaced People (IDPs)

Integrated Rural Development Program (IRDP)

International Business Consultants (IBC)

Memorandum of Understanding (MOU)

Acidity (PH)

Request for Quotes (RFQ)

Solid Waste Treatment Plant (SWTP)

Total Suspended Solids (TSS)

Wastewater Treatment Plant (WWTP)

INTRODUCTION

On July 15, 2003, the YMCA of the USA with the YMCA of Lebanon, signed the Cooperative Agreement number: 268-A-00-03-00228-00 with the U.S. Agency for International Development (USAID) to undertake an integrated environment program initiative - *Sustainable Environmental Practices and Policies Program (SEPP)*. The aim of the SEPP program is to improve environmental practices and policies for the management of both solid waste and water waste in rural Lebanon.

The SEPP program set out to benefit 98 communities. The goal was to establish **one (1) solid waste treatment plants (SWTP)** that was to process waste from 88 villages and **nine (9) wastewater treatment plants (WWTP)** that treat wastewater from 10 villages. Combined, the facilities were to cover the areas of the Bekaa (South-West Rachaya) and South Lebanon (Tyre Caza[1]).

Another component of the program includes the **comprehensive environmental educational and waste management** portion for the local communities that will benefit from the facilities. That has remained the same. The awareness component of the program mostly targets women and students and aims to strengthen the capacity of local municipalities and communities in an effort to implement a comprehensive and sustainable environmental management program in the region.

This final report details all accomplishments of the project, as agreed upon with the USAID:

- Monitoring of sewage networks
- Selection and installation of the best suited technologies for both wastewater and solid waste treatment plants for the communities
- Finalization of the policy dialogue on solid waste and wastewater management with all stakeholders involved in the planning
- Construction of all nine (9) WWTPs that are already operating
- With regard to the SWTP, the Ain Baal facility construction and installation of equipment have been completed and delays of implementation were due to some unforeseen circumstances in internal official procedures within the EU, the contributing support funding agency, which took more time than initially anticipated, especially also with external force majeure such as the July 2006 war[2] and the 2008 civil strife[3]

In order to complete the Solid waste treatment project in full, the USAID and YMCA have made several modifications of assistance extending the period of the grant until February 28, 2009.

[1] A *Caza* is the second largest administrative district in the country. The largest being the mouhafaza which is equivalent to a province. The *Caza* is a large cluster of geographically attached villages. A province is usually constituted of around four *Cazas*. Lebanon is made of 26 C*azas*.
[2] The July 2006 war is a 33-day war that engaged Lebanon and Israel in massive confrontations leaving the country with more than 1200 dead, 4500 injured and major economic losses and infrastructure destruction. The war ended by mid August with a UN brokered resolution (UN Security Council Resolution 1701)
[3] The 2008 civil strife is a confrontation amongst political groups in the country in May 2008 after nearly a year of political mobilization and stalemate. The strife ended after nearly ten days with an Arab brokered agreement in Doha-Qatar

Activities under this program are grouped into three components as follows:

1. Dissemination of information on environmental management practices
2. Physical infrastructure development for solid waste and wastewater management
3. Engaging in dialogue and influencing policy on environmental management

KEY GRANT MODIFICATIONS

The following key grant modifications were agreed upon with the USAID during the lifetime of the whole project.

#	Date of Modification	Description of Modification	New Extension Period
1	09-25-2003	To provide incremental funding of $767,795.00 to the cooperative agreement	N/A
2	07-15-2003	To add the reporting of Foreign Taxes clause to the Cooperative Agreement.	
3	07-27-2004	To provide incremental funding of $2,500,000.00 to the cooperative agreement and revise the final report address	
4	09-13-2004	To modify the program description to include the construction of one central solid waste treatment facility instead of 3 solid waste treatment facilities	
5	11-17-2004	To add a standard provision for activities related to human trafficking in compliance with the Trafficking Protection Reauthorization Act of 2003	
6	06-15-2005	To modify the program description to cancel two solid waste treatment facilities and instead construct one larger facility in a different area and move one waste water treatment facility from one village to another within the same district	
7	09-19-2005	To provide incremental funding of $500,000.00 to the subject cooperative agreement thereby increasing the total amount obligated from $3,267,795 to $3,767,795 in support of waste management activities	
8	06-01-2006	1. Revise the Program Description to reprogram $200,000 earmarked for construction of a solid waste treatment facility in Arabsaleem	

		village, Nabatiyeh district towards new projects within the same purpose of the cooperative agreement to promote sustainable environmental practices and policies. 2. Revise the budget by moving $134,150 from the Equipment budget to the Supplies, Contractual and Construction. No charges will be made to USAID contribution towards Personnel, Fringe Benefits, Travel, Other Direct Costs and indirect Costs. Total USAID contribution will remain unchanged. The cost-sharing amount by the Recipient will increase from $2,242,824.00 to $4,160,501.00 3. Extend the estimated completion date of this agreement from 07/14/2006 to 13/30/2007 total USAID contribution remaining unchanged.	
9	03-07-2007	1. Revise the Program Description 2. Revise the budget by moving $101,500 from the equipment budget $6800 from the Supplies, and $7700 from the Contractual to the Construction budget as result of the changes in the Program description. 3. Move $47,400 USAID funds from the Monitoring and Evaluation budget to the Construction budget for use in further addressing health, safety and environmental features as well as in possible repair of damages inflicted in July 2006 conflict to waste management facilities funded by USAID and implemented by recipient. 4. No charges will be made to USAID contribution towards Personnel Fringe benefits, Travel and indirect Costs. Total USAID contribution will remain unchanged.	

		The cost-sharing amount by the Recipient will remain constant. All the terms and conditions of the agreement remain unchanged.	
10	03-21-2007	To extend the estimation completion date through December 31, 2007. No additional funds will be added. All other terms and conditions of the agreement remain unchanged.	12-31-07
11	12-31-07	1. Extend the estimated completion date of this agreement from December 31, 2007 to September 30, 2008. 2. Cancel Solid waste treatment plant of As-Sahel Union of municipalities in the west Bekaa and move its equipment to upgrade the Ain Baal Solid Waste Treatment Plant without increase in USAID funding, and 3. Add the Provision entitled Marking under USAID-Funded Assistance Instruments.	09-30-08
12	09-11-2008	To extend the estimated completion date of this agreement from September 30, 2008 to February 28, 2009. This is a no cost extension	02-28-09

PROGRAM INDICATORS

The key measures of success as per the agreed upon indicators are detailed henceforth in the table below showing progress over the course of the duration of the whole project.

PMP Indicators	FY06 actual	FY07 target	FY07 actual	FY08 target	FY 08 actual	FY 2009 target***	FY 09 Actual
Number of Jobs created	9	37	1	36	0	50	forecast at 60*
Cubic meters of WW treated/day	1320	1570	1570	1570	1570	1570	1570
$ value of Income generated from compost per year per solid waste facility	0	0	0	13500	0	15000	forecast at 15,000*
Amount of compost (tons per day)	0	0	0	15 tons per day of dry compost	0	15 tons per day of dry compost	forecast at 15 tons per day of dry compost*
$ value of Income generated from recyclables per year per solid waste facility	0	0	0	30000	0	30000	forecast at 30,000*
Community training on SW (# persons)	50000	100000	85000	100000	103237	110000	forecast at 112,000**
Student training on SW (# persons)	30000	60000	55000	70000	71515	75000	forecast at 80,000**
Community training on WW (# persons)	500	1000	500	1000	738	1000	738

* forecast on the basis of requirements for operations and calculations made when the center is at minimum two thirds of its capacity or full capacity by the end of 2009

** UTM will pursue the campaigns when the Ain Baal SW facility is fully operational to sensitize more people on the subject matter

*** targets of earlier years before 2009 for the solid waste were unreachable especially that by grant extensions and contracts amendments the solid waste facility could not be completed before end of February 2009 due to conflicts in Lebanon and delays by other donor agencies supported contractors

COMPONENT 1

DISSEMINATION OF INFORMATION ON ENVIRONMENT MANAGEMENT PRACTICES

The YMCA collaborated with ECODIT[4] to promote better environmental management practices under the SEPP program by evaluating the previously built solid waste treatment plants (SWTP) and wastewater treatment plants (WWTP) under the earlier USAID funded and YMCA implemented, *Integrated Rural Development Program (IRDP)*. ECODIT prepared and submitted the final draft of the *Lessons Learned* report on WWTP and SWTP under IRDP.

During the period of the project, the program closely monitored the operations of the older SWTPs and WWTPs to determine both the successes and the challenges that they are facing in their day-to-day operations. The team also identified and assessed the opinions and attitudes of the local authorities and beneficiaries toward the already existing facilities. Identifying the challenges in the post-operations phases allowed them to recommend strategies to address or avoid altogether any similar challenges and barriers that could be faced during the implementation phase under SEPP.

YMCA has been in ongoing negotiations with various Lebanese ministries to obtain certain basic guarantees. For instance, these guarantees include cooperation with the Ministry of Education (MoE) to implement ongoing environment awareness sessions in public schools, Ministry of Energy and Water (MEW) to provide stable and continuous electricity to the facilities, Ministry of Agriculture (MoA) to develop/put into law and implement standards for compost and treated wastewater for agriculture use, etc.

The results of the negotiations were subsequently discussed and analyzed. The outcome of those meetings produced the two *Lessons Learned* reports that documented the successes and challenges that could potentially arise in the planning, construction and operation of SWTP and WWTP in the rural areas of Lebanon.

The recommendations resulted from the lessons learned were discussed in greater detail during this project with the MoE, Ministry of Public Works (MPW), MEW, MoE, Ministry of Public Health (MPH) and the Ministry of Labor (MoL).

Under the SEPP program, YMCA and ECODIT have been engaged in high-level policy dialogue on small-scale solid waste and wastewater treatment facilities in Lebanon. This dialogue comes following the completion of the two *Lessons Learned* reports.

Objectives of Policy Dialogue:

1. Review key issues related to the planning, construction and operation of small-scale waste management facilities
2. Discuss options and solutions to improve the performance of existing/prospective small-scale waste management facilities in the country
3. Formulate standards for SWTP and WWTP in rural communities in Lebanon

[4] ECODIT is a an American company with a branch in Lebanon that specializes in environmental matters especially assessments

The policy dialogue meetings that have taken place under the program are outlined below as follows:

- December 14-31, 2005: One-on-one meetings with core stakeholders, in the policy dialogue
- January 25, 2006: The opening session to launch the policy dialogue and present key lessons learned.
- February 2 and 8 2006: Two full-day site visits to three (3) SWTPs and three (3) WWTPs to engage practically and demonstrate operations with a total of 40 participants. The visited treatment plants included in the South: Nabatiye (operational), Bint Jbeil, and Tyre, and in West Bekaa: Yanta in the Caza of Rachaya, Ain Horsha in the Caza of Rachaya; and Rachaya in the Caza of Rachaya
- February 28, 2006: A roundtable discussion to formulate the standards for those facilities and any that will be built in the future.

Roundtable Discussion:

On February 28, 2006, following the two site visits, YMCA and ECODIT organized a roundtable discussion at the Le Meridien/Commodore Hotel in Hamra (Beirut). The objectives of the roundtable were to discuss key planning, construction, and operation and management issues as they relate to solid waste and wastewater management in Lebanon and develop a draft Memorandum of Understanding (MOU) outlining the guiding policy principles for the running and management of the plants and facilities. This MoU outlines the relation amongst all stakeholders including the key Ministries such as Environment, Energy and Water, NGOs, local municipalities and governmental agencies…

ECODIT developed and sent out the first draft of the MOU for all the participants in the policy dialogue. The YMCA, with USAID, organized a press conference to present the MOU on July 25, 2006 at the Le Meridien/Commodore Hotel, but due to the war that erupted on July 12, 2006, the final MOU was sent by mail to all the participants.

Key participants in the roundtable discussions and policy formulation meetings included director generals of key ministries such as Environment, Health, Interior, and Information, parliamentarians namely those heading specialized committees (environment and public works…), and heads of government and private organizations active in the field of environmental protection, preservation or regulation.

Key Outcomes

The key outcomes of the policy dialogue were two fold especially on a long-term perspective:

1. The intervention and approach to waste water treatment is adopted and replicated by various organizations and donor agencies, whereby the YMCA was often consulted to present support or technical advice. This is the case for instance of the Economic and Social Fund for development (ESFD) which consulted the YMCA for a potential replication in the Baalbeck area (Bekaa) of a waste water treatment center
2. Initial interest expressed by the Ministry of Environment to consider and adopt a financial support scheme to municipalities in order to boost their capacities to sustain their waste treatment centers. Such interest is pending political decisions and most importantly availability of resources with the central government.

COMPONENT 2

PHYSICAL INFRASTRUCTURE DEVELOPMENT FOR SOLID AND WASTEWATER MANAGEMENT:

As part of the SEPP program, the YMCA proposed originally the building of **12 waste facilities** in rural areas of Lebanon including three solid waste facilities and nine wastewater treatment plants. USAID and YMCA, under the Modification of Assistance signed, agreed to combine the three SWTP into one large facility that serves completely a geographic district in Ain baal (Tyre, South Lebanon).

As such, the YMCA has built a total number of **10 waste treatment facilities**: One (1) solid waste treatment center to improve the waste management of 55 villages and 9 wastewater treatment centers to improve the sanitation and wastewater conditions of 10 villages. Over **65 communities and 384,817 persons have ultimately directly benefited while over 1,000,000 persons have indirectly benefited** from the improved waste management with safer disposal practices and treatment of solid waste and wastewater and the protection of natural resources (water and soil). The YMCA solid waste facilities will also convert part of the collected waste stream into valuable by-products by turning it into compost - a high-value soil conditioner. In addition, where wastewater had previously been deposited raw and untreated will, once it is processed, serve as an important source of irrigation for trees especially during the dryer summer months. **All objectives under this component were successfully completed and met.**

The YMCA is applying new technologies to manage the larger amounts of solid waste collected daily in the central facility in Ain Baal. These technologies utilize:

- Ventilation pipes and electrical blowers to provide the needed air for the composting system which render the process faster
- A turner mixing system to homogenize and mature the compost during its maturation phase as means to speed up the process and most importantly ensure treatment of the large piled stocks of waste
- State-of-the-art equipment for the measurement and registration of compost temperatures and humidity

The treatment facilities idea was initially met with resistance from community leaders due to the negative opinions people held of such facilities. The misperceptions included, fear of offensive odors and fumes, concerns of leachate getting into the soil, mismanagement of operations, and a general apprehension that other villages may take advantage of the facility and dump their own waste there.

The YMCA held Town Hall meetings within the individual communities. In those meetings, the plans were described in detail and the program directors fielded all questions and concerns. Because of the meetings, the plans for Ain Baal SWTP were accepted and the works proceeded accordingly.

THE SOLID WASTE TREATMENT PLANT

1. Ain Baal Center (150 Tons/day):

As described earlier, the Ain Baal Center obtained USAID's approval to replace the Jezzine and Zawtar el Gharbieh SWTPs on January 1, 2005. Upon its completion, the Ain Baal facility serves almost the entire Tyre caza – 55 villages and the city of Tyre.

Key Figures about Ain Baal Solid Waste Treatment Center:

- **75% of total cost raised by local contributions**
- **150 tons capacity per day**
- **33,000 m^2 of land**
- **3,000 m^2 operations area**

YMCA signed a contract to collaborate with the Union of Tyre Municipalities (UTM) on April 4, 2005. In the contract, UTM agreed to undertake all costs associated with land leveling, the construction of the buildings and even some equipment for the facility. YMCA, in turn, agreed to assume all costs associated with the purchase of the bulk of the equipment, thus dividing the expenses equally between the two partners - YMCA and UTM.

Design quotations and technical assistance requests were officially released. A contract subsequently was signed with *Grossimex, LLC*[5] on April 25, 2005, to equip and consult with on the general layout of the Center. Excavation and design plans were finalized by June 30, 2005, and a public hearing was held at UTM's headquarters on May 13, 2005 - open to all the mayors in the Tyre caza to attend.

The Environmental Impact Assessment (EIA) was submitted to the Office of Minister of the State for Administrative Reform (OMSAR) and the MoEnv on May 21, 2005.

Topographic work was completed by the end of August 2005. Land levels were set and the specifications of the excavation works approved by the UTM Council and the local governor by the beginning of September 2005.

A Request for Quotations (RFQ) was issued by UTM, opened and subcontracted out in October 2005. Excavation works were completed by January 2006. The equipment bought from the USA arrived into Lebanon by December 27, 2005. All equipment required necessary official documentation to be cleared from the seaport. Until all central bureaucratic red tape was bypassed, the UTM ultimately issued all documents needed to have the equipment cleared from port authority and transported to the site by March 30, 2006.

In February 2006, UTM signed a contract with OMSAR. OMSAR agreed to assume all costs associated with the building of the hangars and concrete construction, the purchase of the large-scale weighing unit and bio-filter unit. UTM also agreed to assume all outstanding costs associated with the purchase of the remaining equipment and the infrastructure networks.

Toward the end of June 2006, OMSAR was to have initiated a two-month RFQ that was to have ended in August 2006. However, a major 33-day war erupted in July 2006 that left the country in massive destruction, economic deterioration and social disruption. Hence, in light of this war, the RFQ was postponed to begin by mid-September (pending the war and cessation of fighting) and ran through December. Due to the unforeseen circumstances, the YMCA put in officially a request to USAID to extend the project end date until the end of

[5] Grossimex, LLC is an American company specialized in waste management through equipment provision, design and execution

March 2007. USAID agreed to the time extension. The key challenges that were faced at the time are as follows:

- Difficulties clearing the USA imported equipment with the port authorities
- Due to internal formalities within OMSAR, their portion of the project was delayed thus delaying the implementation of the entire plan, especially OMSAR undertook all necessary infrastructure works that host the processing equipment and provide their necessary support.

In June 2007, the OMSAR contractor started the concrete works in Ain Baal Solid waste center. The time of completion was set to April 2008. However, due to formal procedures followed between the contractor and the EU through OMSAR, the due date was extended further until the end of June 2008. Because of the delay that falls beyond the control of the YMCA, the latter requested in November 2007, a no cost extension until the end of September 2008. USAID approved this request.

Unexpectedly, The OMSAR contractor did not deliver the concrete works in June 2008 as promised and a new date of completion was set for him by OMSAR for October 2008. The YMCA requested another extension for the duration of the grant until February 28, 2009, the USAID approved the request, and a Modification of Assistance was signed accordingly. Some of the commissioned works undertaken by the OMSAR fell short from complying with the required standards and criteria, a process that the OMSAR should have had monitored and controlled. This deviation from the set standards inflicted a delay in the installation of the equipment.

The center is completed and was tested employing a dry run test, which is a preliminary step required to oversee the whole process without putting an actual load on the machinery. The YMCA and UTM are undertaking all necessary measures and steps in order to render the center operational using its fully capacity.

Ain Baal Construction Process

The Completed Center

The key success of the Ain Baal facility resides in the ability to leverage resources and mobilize local partners to contribute towards the completion of the center. The YMCA

was able to leverage additional resources aimed at completing the infrastructure works at the center, providing additional equipment and ensuring personnel engagement. These resources exceeded by far the contribution allocated under the SEPP towards Ain Baal. Specifically, the YMCA was able to mobilize the UTM and the OMSAR-EU to contribute towards the center by nearly three folds the amount contributed by the USAID-YMCA.

The construction process was complemented by a thorough training of municipal staffers and a public awareness campaign that promotes sorting at the source.

The training focused staffers who will operate the solid waste treatment facility providing them with the necessary theoretical and practical know how on the safe usage, efficient operation and adequate use of the machinery and equipment. Training was conducted in two phases with a theoretical initial phase, and a practical one that followed. Four staffers were trained.

Public awareness campaigns were organized in the beneficiary communities of the Tyre district as to engage them positively in the solid waste management and encourage sorting at the source. Awareness campaigns were focused on three main components as following:

- Risks associated with waste accumulation and uncontrolled disposal
- Ways and benefits of waste management
- Easy and efficient methods of sorting at the source

The awareness campaigns targeted mostly the public through fliers and informational toolkits. School sessions were also delivered through a facilitator employing games, songs and interactive tools especially designed for the purpose of the program. Targeted schools included intermediate and elementary schools. The focus was on schools since children and youth are often the element of change within their communities and especially within the household.

At least 71,515 students were engaged in the awareness sessions in more than 125 schools located in the district of Tyre and in the Western Bekaa (Sultan Yaacoub) were a solid waste treatment center was supposed to be established. Samples of awareness sessions are detailed in the table henceforth.


Schools Awareness Sessions

Sample List of some of the Awareness Sessions in Schools:

School (all levels)	Region
Shouhada Maaraka Elementary school	South
Tayr Dibba Intermediate school	South
Wadi Jilo Elementary school	South
Aytit Intermediate school	South
Bazourieh Elementary school	South
Bazourieh Intermediate school	South
Yanouh Elementary school	South
Qana Intermediate school	South
Bayad Elementary school	South
Deir Ames Public School	South
Siddikin Intermediate school	South
Jabal El Botom Intermediate school	South
Zibqin Intermediate school	South
Rmadiya Elementary school	South
Al shiita Al Knisa Intermediate school	South
Malikiya El Sahel Elementary school	South
Deir Qanoun Ras El Ein Intermediate school	South
Smaiya Intermediate school	South
Batouliya Elementary school	South
Ein Baal Intermediate school	South
Hannawiya Intermediate school	South
Qlayleh Intermediate school	South
Honey Elementary school	South
Al Mansouri Intermediate school	South
Majdel zounIntermediate school	South
Teyr Herfa Intermediate school	South
Alma Elshaab Intermediate school	South
Zahira Elementary school	South
Yarin Intermediate school	South
Marwahin Elementary school	South
Naqoura Intermediate school	South
Darwish Makki Elementary school	South
Al Jiin Elementary school	South
Rashkananiyeh Public school	South
Al Shahid Mohamed Zaarour Public School - Srifa	South

Tyr Intermediate school for girls	South
Tyr 1st Intermediate school	South
Tyr 2nd Intermediate school (mixed)	South
Al massaken Al Shaabiya Public School	South
Borj Eshamali Public School (Tyr)	South
Bergheliyeh Intermediate school	South
Abbasiyeh Intermediate school	South
Borj Rahhal Intermediate school	South
Toura Intermediate school	South
Al Shahid Morshed Nahhas – Bidas	South
Al Shahid Hassan Qassir	South
Maaroub Intermediate school	South
Al shahid Mounir Saad Elementary school - Barish	South
Homeiry Elementary school	South
Teir Flissah Intermediate school	South
Hallousiyeh Elementary school	South
Srifa Intermediate school	South
Deir Kifa Intermediate school	South
Shehabiyeh Elementary school	South
Shehabiyeh Intermediate school	South
Dr. Afif Baydoun public school	South
Jowayya Elementary school	South
Jowayya Intermediate school	South
Majadel Elementary school	South
Mahzouna Elementary school	South
debaal Elementary school	South
Bafliyyeh Elementary school	South
Maarakeh Intermediate school	South
Al Bazourieh	South
Al shahid Khalil Jaradi – Maarakeh	South
Deir Kifa	South
Jowayya (Alshehabiyyeh section)	South
Tyr for girls	South
Tyr for Boys	South
Al Abbasiyeh	South
Ein Baal	South
Qana	South
Al Shahid Nehmeh Hashem- Al Zerariyeh	South
Teyr Harfa for Boys	South
Teyr Harfa for Boys	South
Aana Intermediate Public School	Bekaa
Al Mansoura Intermediate Public School	Bekaa
Al khiyara Intermediate Public School	Bekaa
Hosh Intermediate Public School	Bekaa
Al Rawda Intermediate Public School	Bekaa
Al Marj Intermediate Public School	Bekaa
Kamed El Loz Intermediate Public School	Bekaa

Sultan Yacoub (El Tahta) Intermediate Public School	Bekaa
Ghazza Intermediate Public School	Bekaa
Sultan Yacoub (El Fawka) Intermediate Public School	Bekaa
Second Manarah Intermediate Public School	Bekaa
First Manarah Intermediate Public School	Bekaa
Al Souweiri Intermediate Public School	Bekaa
Tal Al Danoub Intermediate Public School	Bekaa

The list of villages that are served by the Ain Baal Facility is detailed henceforth:

	Village Served	# of Households	# of Individuals	Altitude m
1	Abassieh	2,500	20,000	3 m – 160 m
2	Ain Baal	1,000	8,000	75 m – 150 m
3	Al Batoulieh	625	5,000	120 m
4	Al Bayad	150	1,200	430 m
5	Al Borgholieh	700	5,500	72 m
6	Al Haloussieh	420	3,000	275 m
7	Al Henieh	220	1,500	100 m – 110 m
8	Al Houmairy	200	1,650	350 m
9	Al Mansoury	620	5,000	200 m
10	Al Ramadieh	250	2,080	375 m
11 & 12	Al Shaaytieh Wamalikiyat Al Sahel	300	2,750	275 m
13	Arzoun	120	1,070	320 m
14	Ayteet	500	4,000	250 m
15	Bafilieh	425	3,000	250 m
16	Bariech	430	3,500	650 m
17	Bazourieh	880	7,000	150 m
18	Bedyass	220	1,500	180 m
19	Bestyat	125	1,000	400 m
20	Borj Rahal	610	4,250	120 m
21	Borj Shemaly	1,900	15,000	60 m
22	Chahour	1,000	8,000	350 m
23	Debaal	280	2,500	270 m
24	Deir Amess	435	3,500	450 m
25	Deir Kanoun El Ain	625	5,000	150 m
26	Deir Kanoun El Naher	900	7,000	276 m
27	Deir Kifa	430	3,000	350 m-550 m
28	Derdaghaya	140	1,200	450 m

29	Genata	120	912	210 m- 220 m
30	Henaweh	440	3,500	210 m
31	Jibal al Boutom	250	1,900	450 m
32	Jouaya	2,000	15,000	400 m
33	Kalileh	800	6,000	25 m – 125 m
34	Kana	2,000	14,000	250 m – 300 m
35	Kenaysseh	280	2,500	150 m
36	Maarakeh	1,200	9,200	256 m – 280 m
37	Maaroub	700	5,500	320 m – 340m
38	Mahrouneh	450	3,500	400 m
39	Mazraat Meshref	430	3,000	425
40	Mejadel	640	4,500	350 m
41	Rechkananieh	130	1,235	450m
42	Salaa	450	3,500	450 m
43	Samayeh	200	1,500	50 m
44	Sedikeen	630	4,500	370 m
45	Shebreeha	160	1,250	50 m
46	Shehabieh	920	7,000	450 m
47	Sour/Tyre	15,000	120,000	1m – 18 m
48	Sreifa	1,000	8,000	400 m – 450m
49	Teir Deba	815	6,500	185 m
50	Teir Felseye	600	4,620	270 m- 300 m
51	Teir harfa	280	2,500	500
52	Toura	950	7,500	125 m
53	Wadi Jillo	100	800	160 m
54	Yanouh	200	1,500	210 m – 220 m
55	Zebkeen	300	2,700	460 m
	55 villages	**47,050**	**368,817**	

Note: 25% percent of the populations referenced above live outside their villages either in Lebanon or abroad. The villages are rarely at maximum capacity.

Ain Baal Solid Waste Treatment Center

2. Ain Baal Facility Working Process

The conceptual design for the solid waste processing system has been developed and is based on sound technical parameters and utilizes various pieces of equipment with very satisfactory field performance history. The objective is to convert incoming MSW into proper feedstock for composting and reuse. Concurrent with this effort will be the removal and recovery of materials for recycling. The proposed system provides a processing sequence, which will give the operator considerable flexibility in selection of recyclables to be recovered while protecting processing equipment from unwanted damage or jam-ups and providing both efficient and safe conditions for operating personnel. The system has been designed to process the expected MSW throughput of 150 tons per day in a one-shift operation. This gives the opportunity to increase daily throughput by the addition of a second shift.

Assumptions

The design is based on the following assumptions:

1. Incoming Daily Unsorted Municipal Waste = 150 tons
2. No medical, industrial or hazardous dangerous waste is to enter the facility
3. Density of incoming waste = 300 kg/m³
4. Waste Composition 60% organics and 40% non organic
5. Non organic composition:
    - Nylon bags + rubber wheels = 3%
    - Clothes and shoes = 2%
    - Organic Matter (including slaughter waste) = 65%
    - Papers + Cartons = 11%
    - Glass = 5%
    - Plastics = 8%
    - Metals = 5%
    - Household hazardous waste (inc. batteries, paint residues) = <1%.
6. Density of organic material prior to composting = 700 kg/m³
7. Volume reduction during composting process = 25%
8. The system is designed to meet EPA 503 regulation and the Lebanese Ministry of Environment that states that in order to achieve the Pathogen Reduction Factor the compost pile must be maintained at a temperature of 65 ˚C for at least seven days. The obtained compost will be of either the Grade A type if yard waste or sludge is used, or the Grade B type is MSW is used.

Process Description

The Ain Baal plant is divided into six sections:

1. Unloading Bay/ Tipping floor
2. Sorting Line
3. Composting Plant
4. Curing Area
5. Product Refining

Unloading Bay/ Tipping floor

The trucks unload their content on the tipping floor. It is important to note that the design has been specially elaborated to reduce circulation of heavy machinery inside the facility.

Incoming solid waste will be unloaded on a tipping floor, which has adequate capacity to store up to two-day receipts at the 150 tons per day (TPD) level. A front-end loader will operate on this floor to perform both the stacking of the solid waste during heavy receiving hours and the delivery of solid waste from the storage pile to the system in-feed conveyor. The loader operator will also perform a preliminary inspection of the waste to remove any large, materials that cannot be processed, such as carpets, furniture, and appliances. The front-end loader will break open compactor loads and spread them out for inspection. Floor sorting staff needs to be vigilant in removing materials that are inappropriate for composting, and to ensure the incoming putrescible waste are not creating odor problems or attracting vectors (birds, rats, flies, etc.).

Picking Line

Picking line staff will manually remove contaminants (primarily plastics and glass) to ensure the organic fraction of the MSW is as contaminant free as possible. The negative sort will pull contaminants off the line and into refuse containers located near the picking line conveyor. The picking line will be equipped with a variable speed electrical motor to allow for more flexibility during stream variations. Its total length is 14 m with a width of 1 meter. The rubber belt is extra heavy duty with an 8.0 mm thickness.

In order to ease the access to the recycling bays and the composting zone, the tipping and sorting zones have been elevated to + 4.1 m above the composting level. The sorted organics will then pass over a pulley type magnet, prior to being shredded and dumped in the tunnel-loading bay.

The recycling pits are located below the sorting line at the composting bay level (+0.00 m). These have been equipped with small steel container to ease emptying of the recyclables; the recyclable will then be directed to the recycling bays. The capacity of the recycling bays will be increased by shredding and compacting the recyclables. Non recyclable material like tires, cloth, shoes etc… can be stocked in one single bay and sent to a landfill.

Compost Processing Area

The Siemens/ IPS Composting System is a forced air, agitated-bed and aerobic system of composting and is contained in 1745 m² of building. This area includes the loading area, ten compost bays and unloading area at the end of the bays. The in-vessel system operates under controlled aerobic conditions, in open-topped concrete bays. The system is sheltered in a weather-proof building to allow year-round operation and effective odor control.

Each of the ten (10) 56 meters-long, 2 meters-wide and 2.13 meters deep concrete bays are considered separate composting units. Each bay has three independently controlled aeration zones. Each bay can receive up to 15 cubic meters of combined material. The bays will be loaded approximately every other day, which totals about 128 m³ per day that can be processed in the facility. When a bay is agitated more frequently, then more material can be processed.

A front-end loader (Bobcat type) with a bucket will pick up the mixture from the loading or holding area and will load it directly into a bay.

A Siemens/ IPS agitator/mixer machine mixes and moves the material down the bay at an average of 3.65 meters per day, maximizing and maintaining the same depth throughout the bay. After each agitation, space to load another 15 cubic meters of waste material into the bay is made available.

One automated agitator/mixer with a movable, toothed drum and conveyor will be supplied. When the machine reaches the front of the bay, a trip switch activates controls to raise the drum and conveyor unit and the machine moves on to its transfer dolly. The dolly moves to the next bay, and the agitator then proceeds down the bay to the finishing end.

The drum and conveyor lowers and the process is then repeated. Because of the automatic control, an operator is not required to be present while the unit is working. The machine is capable of processing ten bays in a nine-hour shift.

For the Ain Baal Mixed Solid Waste Facility, the compost will remain in the bays for at least 14 days. This retention time is based on operating the agitator once daily during a seven-day workweek. The retention time can be increased or decreased by operating the machine less or more frequently. Because each bay is a separate unit, the retention time of each bay can be individually adjusted.

The daily agitation of the compost in the bays thoroughly mixes and exposes all of the compost mixture to microbial degradation, thereby producing a stabilized product and minimizing the need for additional curing. The mixing accelerates the compost process by providing a loose, porous material that facilitates optimal movement of air to create aerobic conditions and a uniform distribution of temperature in the compost mass.

After the mixture has been conveyed through the system for approximately 14 days, it is then ready for discharge and further refining and curing. The finished mixture is conveyed onto the concrete discharge pad at the end of the bays and directly off-loaded out of the bays by a front-end loader.

Discharge Area

After the material has been processed in the Siemens/ IPS system (active phase), the material at the end of each bay will be removed. The agitator will remove the compost from the bay and dump it into the unloading three meters below. The front-end loader will then remove the finished material to the curing bays.

Curing Area

The composted material removed from the refining area will be further processed in the curing area for an additional 30 + days. The curing area will be comprised of a covered concrete pad; to reduce cost, the cover shall be of the white nylon type (greenhouse).

Refining Area

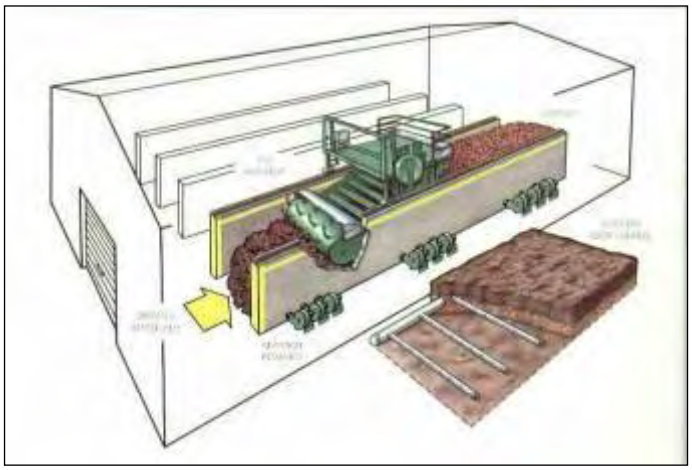
After 30 days or so, the front-end loader will deposit the composted material in a fine trommel screen where all fine particles (stones, plastic and glass) will be removed. The screen will remove the final rejects from the compost prior to distribution.

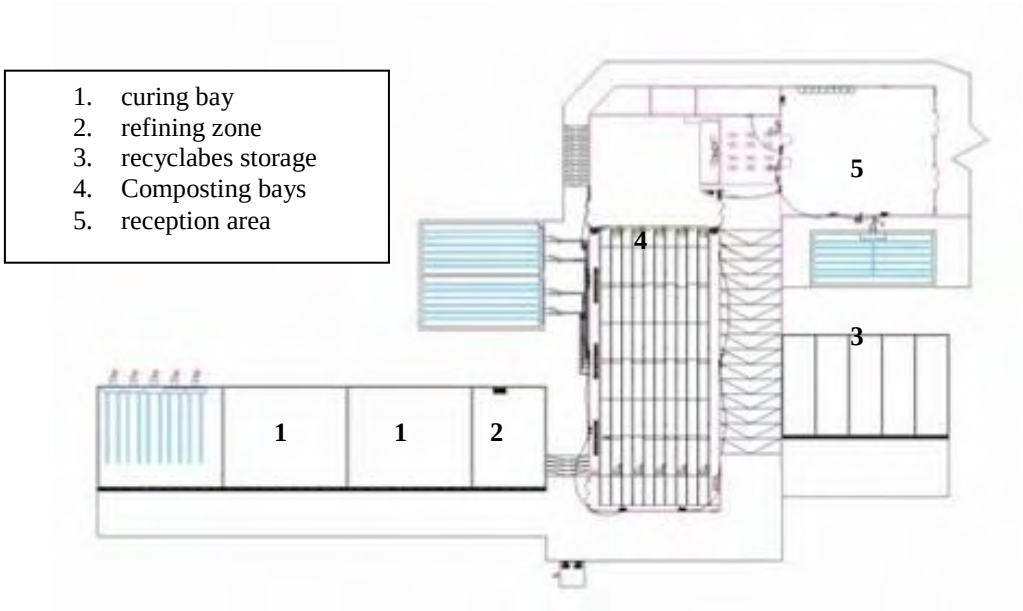
3. Ain Baal Facility Layout

The solid waste treatment facility in Ain Ball utilizes a Siemens/ IPS Composting System as the primary in-vessel composting technology. The land area required for the proposed facility with buildings, paved areas and buffer is less than 32,000 m^3.

The IPS Composting System alternative affords immense flexibility for long-term management of the caza's solid waste. Siemens/ IPS system will easily allow the production of a quality range of compost products that can be beneficially used for lower end projects such as daily landfill cover to higher end projects such as landscaping and soils blending.

Comprised of ten (10) adjacent, parallel bays, the composting facility can **dedicate each individual bay to specific organic recycling materials**. Each bay acts as an independent composting vessel so that yard-waste, source-separated and/or pre-consumer food residuals can be segregated and processed from the remaining mixed solid waste. The higher quality organics can bypass the pre-processing operation and go directly into the designated bays.





Ain Baal Solid Waste Facility Layout

4. Ain Baal Facility Sustainability

The sustainability of the Ain Baal solid waste treatment facility will be ensured through a solid partnership that the YMCA had secured with the Union of Tyre Municipalities. The arrangement for sustainability relies on a dual pronged process that will ensure the needed support for operations, management and maintenance. This process consists of:

1. Income generation opportunities through two major sources that will ensure funds to the treatment facility. The first source consists of revenues collected by the municipalities of the Tyre district that will be paid as fees for treating their waste within the facility. As such, municipalities in the Tyre district will pay a fee to the UTM per kilogram of waste that they send to the facility for treatment. The second source of income consists of the revenues that the UTM will make from the sales of the recyclables generated out of the treatment center including plastics, glass and metals.
2. Self-reliance through the UTM. The UTM will cover the necessary costs of operation, management and maintenance of the whole facility as commitment towards safeguarding the environment in Tyre, and dedication to the success of the project and the process on the long run.

NINE WASTEWATER NETWORKS AND TREATMENT PLANTS

The design of all the centers takes into account the fact that the villages referenced do not have consistent population numbers throughout the year. They are more populated during the summer season with the influx of immigrants and the return of people living in the cities. Accordingly, the number of residents during the summer months increases, proportionally elevating the flow of wastewater.

SOUTH LEBANON CENTERS

1. Wadi Jezzine Center:

VILLAGE NAME	WADI JEZZINE
Range of population served (capita)	**600-1200**
Forecast population served (capita)	**1500**
Altitude (m above sea level)	**750**
Wastewater treatment plant (m^3)	**150**
New sewer network length (m)	**4100**

YMCA signed a contract on October 10, 2003 with the Wadi Jezzine Municipality Council (WJMC) to jointly build and install both a WWTP and a sewer network. Upon its completion, the plant will serve all the inhabitants of the village. By December 2003, WJMC had secured the land area needed for the plant.

In the contract, the WJMC agreed to assume all costs associated with sewer network installation. YMCA agreed to assume all costs associated with the implementation of the WWTP and its accessories, thus dividing the expenses equally between the two partners - YMCA and WJMC. Although new WJMC members were elected by June of 2004, their election did not affect construction efforts.

A contract with the company *Polytech*[6] was signed with YMCA and WJMC to build, equip and consult with on the general layout of the plant and excavation plans on April 15, 2004.

The EIA was submitted to the MoEnv in June 2004. Excavation and design plans were finalized by June 15, 2004. Topographic work was completed by the end of June 2004. Land levels were set and the specifications of the excavation works were approved by the WJMC by end of July 2005. The excavation and building works were started on July 15, 2004 and were completed by June 30, 2005. The main sewer network lines were completed by May 20, 2005. On July 10, 2005, the WJMC began with the home installation connections in order to link them into the network.

The WWTP began it operations on August 30, 2005.

A public awareness session was held at WJMC's headquarters on November 13, 2005 - open for the public. The YMCA program designers provided the participants with detailed information on the plant and its benefits – what it can do and how it will improve

[6] Polytech is a local company specialized in environmental solutions and waste management, especially waste water related matters.

their environment in the long run. They also fielded questions from the public. The YMCA also trained a plant operator, identified by the municipality, on plant upkeep and monitoring. A technician from Polytech has been contracted out by WJMC to do site visits monthly in order to maintain and make adjustments where necessary – e.g. adjust the air blower, sump pump, monitor the quality of discharge, etc.

The main challenge faced in this particular WWTP, in summary, was as follows:

- Difficulty finding the land for the plant. Wadi Jezzine is a small village and no public lands were available. In the end, the WJMC was able to negotiate and secure a plot of land, owned by the *Litani Association*[7], to build the WWTP.

The wastewater treatment plant in the Wadi Jezzine village was designed to serve the current population of 800 persons. However, the population growth of up to 1500 persons was taken into consideration– the maximum capacity of the WWTP.

In September 2005, the plant was ready and operating. It was being supervised and maintained by a local person assigned by the contractor, and everything was running smoothly with low odor emissions. On June 29, 2006, an effluent test was conducted and the results complied with the MoEnv's standards and specifications - BOD, COD, TSS and PH.

By the start of July 2006, the Municipality had hired a person to operate and maintain the plant according to a written operation guide and everything was moving along as planned.

Wadi Jezzine WWT Plant

2. Haytoura Center:

VILLAGE NAME	HAYTOURA
Range of population served (capita)	**600-800**
Forecast population served (capita)	**1000**
Altitude (m above sea level)	**1000**
Wastewater treatment plant (m^3)	**100**
New sewer network length (m)	**500**

[7] The Litani Association is a local government organization engaged in water resources and management around the Litani River in Lebanon

The Haytoura WWTP obtained USAID's approval to replace the Jezzine WWTP on June 16, 2005. Upon its completion, it will serve all the inhabitants of the village.

YMCA proposed, to the Haytoura Municipality Council (HMC), the building of a 100 m^3 daily capacity WWTP for their existent sewage network, with a 500 m sewer line that connects from the original discharge point of the sewage network to the new WWTP.

On June 28, 2005, the YMCA signed a contract with the HMC to build the WWTP and to add the 400 m connector sewer line. By the end of June 2005, HMC had secured the land area needed for the development of the plant. HMC agreed to assume all costs associated with the creation and in maintaining the access road to the plant and the connector sewer between the original wastewater discharge point and the new plant. The YMCA, in turn, agreed to assume all costs associated with the implementation of the WWTP and its accessories, thus dividing the expenses equally between the two partners - YMCA and HMC.

After signing the contract agreement and securing the land, the YMCA issued an RFQ for the construction of the plant on August 02, 2005. By September 2005, work on the 400 m connection to the existing sewage network was completed. In the interim, a contract with the company *Grossimex* was signed on August 20, 2005, with YMCA and HMC, to build, equip and consult with on the general layout of the plant and excavation plans.

The EIA of the plant was submitted to the municipality on September 10, 2005. Construction of the plant began in October 2005 and was completed, as scheduled, by the end of February 2006. Sanitary installations and internal plant connections were started on March 15, 2006 and were completed by the beginning of April. In April 2006, the plant was ready and operating. It was being supervised and maintained by a local person assigned by the municipality, and everything was running smoothly (low odor). On June 11, 2006, an effluent test was conducted and the results complied with the MoEnv's standards and specifications - BOD, COD, TSS and PH.

A public workshop for community members was held, as scheduled, on June 17, 2006 to provide the participants with detailed information on the plant and its benefits – what it can do and how it will improve on their environment on the long-run. The program organizers also fielded questions from the public.

The main challenges faced in this particular WWTP were as follows:

- The plant was surrounded by pine trees that the YMCA and municipality were unwilling to uproot.
- The access road was steep making accessibility to the plant during the rainy season almost impossible.

The solutions to the challenges were as follows:

- To deal with the challenge of saving the pine trees and working around them, the contractor used smaller excavation tools and equipment to avoid damaging the root systems, or uprooting entirely, any of the pine trees.
- Because the access road was so steep, the municipality had to come out to pack it down on three separate occasions to ensure plant accessibility during the construction phase. Access roads are usually not made permanent during the excavation and building stages of the plant because the use of heavy equipment can damage more expensive surface areas – defeating the purpose.

- During the war that started on July 12, 2006, there were large population shifts throughout the country. One place that received a large number of the IDPs was the village of Haytoura. Not only did the numbers reach the maximum output of the WWTP but also it exceeded that number by some 1,000 - approximately 2,000 persons. Consequently, there was an increase in wastewater influent that, in turn, affected the WWTP's ability to treat the influent. This was something the YMCA could not have anticipated when the WWTP was designed. Nothing could be done but wait for the end of the war and return of the IDPs to their homes

Haytoura WWTP

3. Snayyah Center:

VILLAGE NAME	SNAYYAH
Range of population served (capita)	**400-500**
Forecast population served (capita)	**600**
Altitude (m above sea level)	**800**
Wastewater treatment plant (m^3)	**60**
New sewer network length (m)	**2742**

This project required the installation of 2,742 m of sewage networks and the building of a 60 m^3/day capacity treatment plant.

YMCA signed a contract on September 9, 2003 with the Snayyah Municipality Council (SMC) to jointly build a WWTP and install 2,040 m of sewage networks. By the end of September 2003, SMC had secured the land area needed for the plant.

In the contract, the SMC agreed to assume all costs associated with the access road to the plant and the sewer network installation. YMCA, in turn, agreed to assume all costs associated with the implementation of the WWTP and its accessories, the pipes, the manhole covers and the construction materials needed for the manholes, thus dividing the expenses equally between the two partners - YMCA and SMC.

After securing the land, the YMCA issued an RFQ for the construction of the plant beginning, January 29, 2004. On February 29, 2004, a contract with the company *International Business Consultants (IBC)*[8] was signed, with YMCA and SMC, to build, equip and consult with on the general layout of the plant and excavation plans. By April

[8] IBC is American company based in Lebanon specialized in environmental solutions including solid waste and waste water management

20, 2004, all works for the sewage network were completed by SMC, and the accessories to the network, by the YMCA.

The EIA for the plant was submitted to the Municipality and the MoEnv on April 26, 2004. Although new SMC member were elected by June of 2004, their election did not affect construction efforts. Construction of the WWTP began by the end of April 2004 and was completed by the beginning of June 2005.

The plant has been operational since the end of June 2005. Ninety percent of the village homes are connected to the sewage network and WWTP. The remaining 10% of the homes could not be connected to the plant because they are located below the network. It was not feasible to link them into the network because of their position relative to the WWTP, and building the WWTP below the remaining 10% was not an option due to the limited land space.

A public workshop for community members was held, as scheduled, on September 3, 2005 to provide the participants with detailed information on the plant and its benefits – what it can do and how it will improve on their environment on the long-run. The program organizers also fielded questions from the public.

A technician from IBC has been contracted out by SMC to do site visits monthly in order to monitor, maintain and make adjustments where necessary – e.g. removal of excess sand and oil, inspect the manhole, monitor the quality of discharge, etc.

Several effluence tests were carried out prior to the handing over of responsibilities to the local municipality in order to ensure that the plant – at the time of hand– is functioning optimally. A recent effluent test was conducted on November 8, 2007 and the results complied with the MoEnv's standards and specifications - BOD, COD, TSS and PH.

The main challenges faced in this particular WWTP were as follows:

- Difficulty in the excavation works phase due to the steep, difficult-to-maneuver-around, and lightweight, terrain where the WWTP was to be built.
- During the rainy season, the original access road, built over the location of the sewage network, washed over on several occasions making access to the site with the heavy equipment difficult at times and posed a potential risk to the sewage network below its surface.

The solutions to the challenges were as follows:

- To deal with the challenges of the steep incline, the contractor used heavier excavator equipment in order to reach the higher weight bearing layers below the ground surface versus the top, lighter-weight soil.
- Because the access road had been washed over on several occasions due to the torrential rains, the contractor decided to excavate another access road in an area where there was more gravel, away from the sewage network, in order to ensure plant accessibility during the construction phase.
- During the war that started on July 12, 2006 there were large population shifts throughout the country. Another place that received large numbers IDPs was Snayyah. The numbers reached the maximum output of the WWTP - approximately 600 persons. Consequently, there was an increase in wastewater influent. The larger number of people did not affect the WWTP's ability to treat the influent.

Snayyah WWTP

4. Aychiyyeh CENTER:

VILLAGE NAME	AYCHIYYEH
Range of population served (capita)	**700-1250**
Forecast population served (capita)	**1500**
Altitude (m above sea level)	**750**
Wastewater treatment plant (m^3)	**150**
New sewer network length (m)	**4416**

This project required the installation of 4,416 m of sewage networks and the building of a 150 m^3/day capacity treatment plant.

YMCA signed a contract on September 4, 2003 with the Aychiyyeh Municipality Council (AMC) to jointly build a WWTP and install 4,416 m of sewage networks. By the end of September 2003, AMC had secured the land area needed for the plant and they had begun with the installation of the sewage network. The mayor succeeded in raising the needed funds from the Council of the South[9] for the installation of 1000 m of the sewer network.

In the contract, the AMC agreed to assume all costs associated with the access road to the plant and the sewer network installation. YMCA agreed to assume all costs associated with the implementation of the WWTP and its accessories, the manhole covers and the construction materials needed for the manholes, thus dividing the expenses equally between the two partners - YMCA and AMC.

After securing the land, the YMCA issued an RFQ for the construction of the plant on January 29, 2004. On March 27, 2004, a contract was signed between the company IBC on one hand and the YMCA and AMC on the other, to build, equip and consult with on the general layout of the plant and excavation plans.

The EIA of the plant was submitted to the Municipality and MoEnv on June 6, 2004. Although a new AMC was elected by June of 2004, their election did not affect construction efforts. The construction works on the WWTP itself began by the end of June 2004 and it was completed at the beginning of June 2005.

[9] The Council of the South is a governmental agency specialized in reconstruction and development works

In the interim, new houses were constructed in the village requiring an additional 80 m of sewage pipes that the Municipality agreed to assume their responsibility. The entire sewage network was completed at the end of June 2005.

The plant has been operational since the end of June 2005. Ninety five percent of the village homes are connected to the sewage network. The remaining 5% of the homes are either located below the network or too far from the main sewage network.

A technician from IBC was contracted out by AMC to do site visits monthly in order to monitor, maintain, and make adjustments where necessary – e.g. removal of excess sand and oil, inspect the manhole, monitor the quality of discharge, etc.

A public workshop for community members was held, as scheduled, on September 10, 2005 to provide the participants with detailed information on the plant and its benefits – what it can do and how it will improve on their environment on the long-run. The program organizers also fielded questions from the public.

Several effluence tests were carried out prior to the handing over of responsibilities to the local municipality in order to ensure that the plant – at the time of hand– is functioning optimally. A recent effluent test was conducted on November 8, 2007 and the results complied with the MoEnv's standards and specifications - BOD, COD, TSS and PH.

The main challenges faced in this particular WWTP were as follows:

- Difficulty in excavation works due to the rocky terrain where the plant was to build.
- The access road was equally as rocky and difficult to navigate the machinery and equipment over.
- Extremely narrow streets inside the village. Getting the large equipment to and from the site was always very challenging.

The solutions to the challenges were as follows:

- To deal with the rocky terrain, the contractor used heavier equipment for excavation.
- Because the access road was also rocky, the AMC invested in heavy equipment to excavate/clear away the boulders and rocks as to enable the equipment and trucks to be delivered to the site of the WWTP.
- Due to the narrow, inaccessible to vehicles, streets the AMC hired people to install the internal main sewer manually and without the use of large equipment, where possible.
- Two effluence tests were conducted. The first test, on June 6, 2006, did not comply with the MoE's standards and specifications. The contractor made some improvements to the facility and a second sample was taken on June 29, 2006. The results of the second test complied with the MoE's standards and specifications - BOD, COD, TSS and PH. The final test result was submitted to the Municipality, and now the local municipality has assumed all responsibility for the facility, assuring that it continues to function properly.

Ayshiyyeh WWTP

5. Ghobbatieh Center:

VILLAGE NAME	MACHMOUCHEH	BENWATI	AL GHOBATTIEH	TOTAL
Range of population served (capita)	300-400	1750-1800	200-250	**2300- 2450**
Forecast population served (capita)	500	2000	300	**2800**
Altitude (m above sea level)	950	800	700	
Wastewater treatment plant (m^3)	0	0	250	**250**
New sewer network length (m)	Executed	Executed	5500	**5500**

This project required the installation of 5,500 m of sewage networks and the building of a 250 m^3/day capacity treatment plant.

The original Machmoucheh village sewage network has always fed into the Benwati village's sewage network. Benwati, in turn, has always discharged its untreated, raw sewage directly into Ghobbatieh's forest on the outskirts of the village. Ghobbatieh is a section/subdivision of the larger, Benwati village, located at its lowest elevation point.

YMCA proposed to the Benwati Municipality Council (BMC), that they build a WWTP capable of treating upward of 250 m^3 a day in the Ghobbatieh area for the existing sewage network, with an additional 5,500 m sewer line that connects from the original discharge point of the sewer network, the forest, to the new WWTP. The BMC negotiated a contract with the MEW to fund their 5,500 m of sewage network.

By June 10, 2004, the YMCA and BMC had signed a contract to jointly build the WWTP and install the 5,500 m sewer network – with the funding from the MEW. By the end of June 2004, the BMC had secured a plot of land in the village of Ghobbatieh for the plant.

They selected Ghobbatieh to build the WWTP because of its ideal location at the lowest elevation point of the greater Benwati village.

Although the MEW agreed to fund the 5,500 m of sewage network, implementation was postponed due to the Ministry's 2005 budget allocation delays and cuts.

The YMCA issued an RFQ for construction of the plant on January 29, 2004. Due to the installation of the sewage network delays by the MEW, the YMCA delayed the signature of the contract with the contractor *IBC* to build, equip and consult with on the general layout of the plant and excavation plans until November 11, 2004.

The EIA of the plant was submitted to the municipality and the MoEnv by the YMCA on January 18, 2005. All execution plans were submitted by IBC to the Municipality by the end of February 2005. The excavation works began in April 2005 but they were interrupted on several occasions due to inclement weather and the, difficult-to-handle, sandy top soil. Due to the challenges of the weather and the sandy top soil where the WWTP was to be built, the excavation works could not be completed within the forecasted period - October 2005. The YMCA had to dig 4-meters deeper than originally anticipated in order to reach the heavier weight-bearing soil – the kind able to withstand the structure. IBC modified the plant plans to meet the new specifications.

New plans for the structures were drawn up once again and construction works commenced under extremely challenging conditions. The deeper foundations increased the risk of landslides, water accumulation with the rains and limited stocking surface area for materials. In addition, the sandy soil leading to the site remained a challenge throughout the project for the heavy trucks and machinery trying to get to and from the site. The construction works were to have been completed by the end of March 2006, but due to inclement weather, the construction works had to be postponed and were slated to be completed by the end of July 2006. When the war erupted on July 12, 2006, works on the facility came to a halt. The construction works were completed on October 30, 2006..

A public workshop for community members was held on November September 25, 2006 to provide the participants with detailed information on the plant and its benefits – what it can do and how it will improve on their environment on the long-run. The program organizers also fielded questions from the public.

The MEW could not fund the 5,500 m of sewage network, as the annual budget of the Lebanese government was not approved, therefore the USAID approved the funding of this network. Then YMCA signed a contract on November 27, 2006 2003 with the Benwati Municipality Council (BMC) to jointly build a WWTP and install 5,500 m of sewage networks. By the end of March 2007, BMC had completed the installation of the sewage network with the contribution of the Harriri Foundation for Rural Development. In fact, the mayor succeeded in raising the needed funds from the Harriri Foundation for the installation of 5,500 m of the sewer network. The network and the wastewater treatment plant are operational since March 30, 2007.

Ghobbatieh WWTP

BEKAA CENTERS

1. Rachaya Center:

VILLAGE NAME	RACHAYA
Range of population served (capita)	**4000-6000**
Forecast population served (capita)	**6000**
Altitude (m above sea level)	**1250**
Wastewater Treatment plant (m^3)	**600**
New Sewer Network Length (m)	**13452**

This project required the installation of 13,452 m of sewage networks and the building of a 600 m^3/day capacity treatment plant.

The original site for the WWTP had originally been located too close to natural springs and cultivated fields. A joint decision between the YMCA and the RMC was made to move the plant farther away from both the original site and the village. Consequently, it increased the sewage network from the original estimate of 8,000 m to 11,288 m. The new site was approved by the YMCA on August 18, 2004.

The contract for the building of the facility on the new site was signed between the YMCA and the RMC on September 29, 2004. The Municipality agreed to assume responsibility for all costs associated with the installation of the sewage network and securing the land for the plant. The YMCA, in turn, agreed to assume responsibility for all costs associated with the purchase of sewer pipes and manhole covers and the construction of the plant itself.

The RMC issued an RFQ for the installation of the sewage network on January 10, 2005. The YMCA received bids for the construction of the plant on November 25, 2004 and a contract with the *Grossimex, LLC* was signed on December 13, 2004 to equip and advise-on the general layout of the Center. The EIA for the plant was submitted to the MoE on December 17, 2005.

They started with the topographic work on January 15, 2005 and it was completed by the middle of February 2005. Excavation and design plans were finalized by March 30, 2005. Designs, execution plans, and land levels were set and the specifications of the excavation works approved by the RMC and YMCA on April 15, 2005. They began excavation works on April 30, 2005 and completed by August 10, 2005

Due to the lack of labor that was caused by many Syrian workers leaving Lebanon due to political tensions, the works were delayed until July. Unfortunately, due to the war of July 2006, most works in Lebanon came to a standstill.

All of the 13,452 m of PVC piping, and all the manhole covers were completely installed and started operation on October 25, 2006. The construction works of the WWTP plant were completed on September 16, 2006.

A public awareness workshop for community members was held on November 11, 2005. The YMCA program designers provided the participants with detailed information on the plant and its benefits – what it can do and how it will improve on their environment on the long run. They also fielded questions from the public.

The main challenges that were faced in constructing the WWTP were as follows:

- Cold and snowy weather in Rachaya due to its location 1,400 m above sea level
- Security-risk area as it is located within the free zone area between Lebanon, Syria and the Chebaa farms.
- Extremely narrow streets inside the village. Getting the large equipment to and from the site was always challenging.

The presented solutions were as following:

- The snow impeded construction; little could be done until it had melted
- The contractor could do little with the second challenge. There were times when he had to stop works completely – e.g. during the withdrawal of Syrian troops. In addition, there were times when the workers either did not show up or left their work when tensions were high between the Lebanese army and Palestinian troops.
- Due to the narrow, inaccessible to vehicles, streets in the village, the RMC hired people to manually install the internal main sewer.

Rachaya WWTP

2. Al Hosh Center:

VILLAGE NAME	AL HOSH
Range of population served (capita)	**400-600**
Forecast population served (capita)	**1000**
Altitude (m above sea level)	**850**
Wastewater treatment plant (m^3)	**100**
New sewer network length (m)	**4098**

The project required the installation of 4,098 m of sewage networks and the building of a 100 m^3/day capacity treatment plant.

YMCA signed a contract on October 10, 2004 with the Hosh Municipality Council (HOMC) to jointly build a WWTP and install 4,098 m of sewage networks. By the end of October 2004, HOMC had secured the land area needed for the plant. The Mayor succeeded in raising the needed funds from the MEW for the installation of the 4,098 m sewer network.

In the contract, the HOMC agreed to assume all costs associated with the access road to the plant. YMCA agreed to assume all costs associated with the implementation of the WWTP and its accessories, thus dividing the expenses equally between the two partners - YMCA and HOMC.

The same quotes were used as those for the construction of the, similar capacity size, Bakka plant. The YMCA and HOMC signed the contract agreement with the contractor *IBC*, on November 11, 2004 to build, equip and consult with on the general layout of the plant and excavation plans of the WWTP.

The EIA of the plant was submitted to the MoEnv on September 9, 2005. Although the MEW agreed to fund the 4,098 m of sewage network that was needed to connect the houses to the WWTP located at the bottom of El Hosh, implementation was postponed due to the Ministry's 2005 budget allocation delays and cuts.

All execution plans were submitted by IBC to the municipality by the end of December 2004. The excavation works were started by March 30, 2005 and was complete by the end of April 2005. Construction of the WWTP started by the beginning of April 2005 and was put on hold several times due to inclement weather. The construction works were completed on April 15, 2006.

Sanitary installations and internal plant connections were completed on May 30, 2006.

Because the MPW has the assemblage of the sewage network tied into its 2005 and 2006 budgets, work on the network did not begin. The plant would not be operational as long as the sewage network was not installed.

The MEW was not able to implement the network in the village due to the lack of money. Hence, negotiations between the YMCA and the local community, in February 2006, to implement the network by sharing the cost between them were initiated.

The Mayor did not want to depend on the MEW to install the network and expressed his readiness to contribute toward the installation of the sewage network from HOMC's budget and sharing the costs between HOMC and YMCA.

Part of the monies that were reallocated from the Arabsaleem Center was put toward El Hosh's network. Pipe installation works were started as soon as the YMCA obtained the approval from USAID and materials were delivered on site. The wastewater network of 4,098 m were completely installed October 10, 2006.

A public workshop for community members was held on November 19, 2005. The YMCA program designers provided the participants with detailed information on the plant and its benefits – what it can do and how it will improve on their environment on the long run. They also fielded questions from the public.

Several effluence tests were carried out prior to the handing over of responsibilities to the local municipality in order to ensure that the plant – at the time of hand– is functioning optimally. A recent effluent test was conducted on November 8, 2007 and the results complied with the MoEnv's standards and specifications - BOD, COD, TSS and PH.

The main challenge faced in this particular WWTP was as follows:

- The commitment of MEW to install the sewage network never materialized.

Challenges were faced as following:

- HMC agreed to divert finances to the project to cover their share and to install the sewage network to save face with the local residents.

El Hoch WWTP

3. Bakka 1 Center (Eastern Slope):

VILLAGE NAME	BAKKA
Range of population served (capita)	**600-800**
Forecast population served (capita)	**1000**
Altitude (m above sea level)	**1200**
Wastewater treatment plant (m^3)	**100**
New sewer network length (m)	**4370**

This project required the installation of 4,370 m of sewage networks and the building of a 100 m^3/day capacity treatment plant.

YMCA signed a contract on September 30, 2003 with the BAMC to jointly build a WWTP and install 4,370 m of sewage networks. By the end October 2003, BAMC had secured the land area needed for the plant.

In the contract, the BAMC agreed to assume all costs associated with the access road to the plant and the sewage network installation. YMCA agreed to assume all costs associated with the implementation of the WWTP and its accessories, the pipes, the manhole covers and the construction materials needed for the manholes, thus dividing the expenses equally between the two partners - YMCA and BAMC.

After securing the land, the YMCA issued an RFQ for the construction of the plant beginning, January 29, 2004. On February 2, 2004, a contract with the company *IBC* was signed with YMCA and BAMC, to build, equip and consult with on the general layout of the plant and excavation plans.

The YMCA submitted the EIA for the plant to the Municipality and the MoEnv on June 30, 2004. During that time, although a new cabinet for the BAMC was elected, the mayor remained the same, which did not affect the project or construction efforts. The sewage network was completed on June 30, 2004 by the BAMC, and the accessories for the network were put into place by the YMCA. The construction works on the WWTP began by the end of April 1, 2004 and it was completed on May 15, 2005.

The plant has been operational since the end of May 2005. Sixty five percent of the village homes, on the eastern side of Bakka, were connected into the sewage network and WWTP. The remaining 35% of the homes could not be connected to the plant because they are located on the western slope and below the village and the level of the treatment plant.

In order to assure the homes of the western slope of Bakka a sewage network and a WWTP, the new BAMC submitted a request to the YMCA to build a second WWTP and share the cost equally between the YMCA and the BAMC. YMCA studied the proposal and decided to create a second Bakka WWTP known today as Bakka 2 (details below under Bakka 2 heading).

A public workshop for community members was held on November 11, 2005. The YMCA program designers provided the participants with detailed information on the plant and its benefits – what it can do and how it will improve on their environment on the long run. They also fielded questions from the public.

A technician from IBC was contracted out by BAMC to do site visits monthly in order to monitor, maintain and make adjustments where necessary – e.g. removal of excess sand and oil, inspect the manhole, monitor the quality of discharge, etc.

Several effluence tests were carried out prior to the handing over of responsibilities to the local municipality in order to ensure that the plant – at the time of hand– is functioning optimally. An effluent test was conducted on February 28, 2007 and the results complied with the MoEnv's standards and specifications - BOD, COD, TSS and PH.

The main challenges faced in this particular WWTP, were as follows:

- Difficulty in the excavation works phase due to the rocky terrain where the WWTP was to be built.
- Heavy snowfall in the winter months made working conditions difficult.

Challenges were faced as following:

- To deal with the challenges of the rocky location, the contractor used heavier excavator equipment in order to clear the boulders and rocks.
- Due to the snow, the contractor had to stop work on several occasions. There were occasions where the contractor was forced to break the concrete he had poured the day before due to the drop in temperatures (below 0 degrees Celsius) overnight.

Bakka1 WWTP

4. Bakka 2 Center (Western Slope):

VILLAGE NAME	BAKKA
Range of population served (capita)	**200-400**
Forecast population served (capita)	**600**
Altitude (m above sea level)	**1200**
Wastewater treatment plant (m^3)	**60**
New sewer network length (m)	**2000**

This project required the installation of 2,000 m of sewage network and the building of 60 m^3/day capacity treatment plant.

YMCA signed a second contract on August 8, 2004 with BAMC to jointly build a WWTP and install 2,000 m of sewage networks. By the end August 2004, BAMC had secured the second land area needed for the plant on the Western slopes of Bakka.

In the contract, BAMC agreed to assume all costs associated with the access road to the plant and the sewer network installation. YMCA, in turn, agreed to assume all costs associated with the implementation of the WWTP and its accessories, the pipes, the manhole covers and the construction materials needed for the manholes, thus dividing the expenses equally between the two partners - YMCA and BAMC.

After securing the land, the YMCA purchased the pipes and manhole covers using the same quotes as the Bakka 1 Center. The installation of the 2,000 m of the sewage networks started on September 15, 2005 and was completed on August 2, 2005. The contract was signed on August 20, 2004 with the contractor IBC for the construction of the plant using the same quotes as those for the similar in size and structure, Snayyah Center.

The YMCA submitted the EIA for the plant to the Municipality and MoEnv on June 30, 2004. In the interim, a new cabinet for the BAMC was elected but the mayor was re-elected. In this case, the elections did not affect construction efforts.

Topographic works were first started on September 30, 2004 and were completed by the middle of October 2004. Excavation and design plans were finalized by end of November 2004. Designs and execution plans, and land levels were set and the specifications of the excavation works approved by the BAMC and YMCA on December 15, 2004.

Excavation works began on January 15, 2005 and completed by February 10, 2005. All the reinforced concrete foundations were finished by the end of February 2005. Due to the wet and icy conditions of the 2005 winter, the access road to the WWTP became inaccessible delaying construction works on the WWTP until May 1, 2005.

On May 5, 2005, construction works were resumed, to be completed by September 30, 2005. By the end of October 2005, sanitation and internal connection works were also completed. The network could not be fully connected due to the wet and muddy conditions of the soil.

The plant has been operational since the end of May 2006. Effluence tests will be conducted prior to the handing over of responsibilities to the local municipality in order to ensure that the plant – at the time of hand-over was functioning optimally.

A public workshop for community members was held on November 11, 2005. The YMCA program designers provided the participants with detailed information on the plant and its benefits – what it can do and how it will improve on their environment on the long run. They also fielded questions from the public.

A technician from IBC was contracted out by BAMC to do site visits monthly in order to monitor, maintain and make adjustments where necessary – e.g. removal of excess sand and oil, inspect the manhole, monitor the quality of discharge, etc.

Several effluence tests were carried out prior to the handing over of responsibilities to the local municipality in order to ensure that the plant – at the time of hand– is functioning optimally. An effluent test was conducted on February 28, 2007 and the results complied with the MoE's standards and specifications - BOD, COD, TSS and PH.

The main challenges faced in this particular WWTP, were as follows:

- Difficulty in the excavation works phase due to muddy and icy conditions where the WWTP was to be built.
- During the winter season, the snow on the ground made access to the plant location at times impossible.

Challenges were faced as following:

- To deal with the challenges of the muddy and often icy surface, the contractor used heavier excavator equipment in order to reach the higher weight bearing layers below the ground surface.
- Due to the snow cover on the ground and the frigid temperatures in the winter months, the contractor had to stop all construction works on several occasions in order not to have to break up concrete, after it had been poured.

A public workshop for community members took place on November 25, 2005. The YMCA program designers provided the participants with detailed information on the plant and its benefits – what it can do and how it will improve on their environment on the long run. They also fielded questions from the public. Effluence tests will be conducted prior

to the handing over of responsibilities to the local municipality in order to ensure that the plant – at the time of hand-over on July 15, 2006– was functioning optimally.

Bakka2 WWTP

The infrastructure works of the wastewater treatment plants were complemented by training sessions to the municipal staffers and awareness to the public.

The training sessions, addressed to key staffers or workers in each beneficiary municipality, focused on three main tracks:

1. importance of waste water treatment and environmental protection
2. process of waste water treatment
3. maintenance procedures and trouble shooting skills of the facility

Nine training sessions targeting 14 key workers in municipalities were delivered. The details of the training sessions are in the table henceforth.

Community name	Participants	Date
Wadi Jezzine	**2**	**July 2, 2006**
Haytoura	**2**	**July 2, 2006**
Snayyah	**1**	**March 5, 2006**
Aychiyyeh	**2**	**March 5, 2006**
Ghobbatieh	**1**	**March 6, 2009**
Rachayyah	**3**	**April 2, 2006**
Al Hosh	**1**	**April 2, 2006**
Bakka 1	**1**	**April 11, 2005**
Bakka 2	**1**	**April 11, 2005**

General public awareness campaigns were also held in the villages as means to disseminate information about the wastewater treatment plants. The awareness focused on means and ways to sustain an efficient operation of the plants through responsible behavior of the residents. Responsibility for instance refers to avoiding deflecting olive oil residues to the treatment plant that could shut down its operation, and refraining from throwing solid material into the sewers such as diapers… The targeted population in the sessions including key local officials and stakeholders such as mayors, school directors, dispensary heads and religious leaders.

Nine awareness sessions were completed targeting 433 key local representatives. Details are in the table henceforth.

Community	Participants	Date
Wadi Jezzine	46	13-Nov-05
Haytoura	31	17-Jun-06
Snayyah	27	3-Sep-05
Aychiyyeh	53	10-Sep-05
Ghobbatieh	42	25-Sep-06
Rachayyah	89	11-Nov-05
Al Hosh	39	19-Nov-05
Bakka 1	53	11-Nov-05
Bakka 2	53	11-Nov-05

El Hosh Awareness Campaign

The sustainability of the wastewater treatment plants will be secured through the municipalities and potentially through the MoE. Most plants require minimal maintenance and operational costs since they are operated by gravity, wind and sun and do not consume fuel or energy.

VISIBILITY

The YMCA employed all necessary measures and tools required to ensure donor and supporting agencies visibility, especially the USAID. These tools included:

- Word of mouth in all negotiations and discussions held with the local communities, partners and beneficiaries: the YMCA informed all stakeholders of the origin and source of the funding through dissemination of information and clearly marked flyers that were posted on municipal banners
- Publications: informational material (such as invitation letters to training sessions, invitations to awareness sessions, inauguration letters…) included an explicit reference to the USAID as funding and supporting agency. Logos were used in official publications produced under the program such as an informational solid waste sorting brochure. Such measures were also undertaken in all audio-visual material produced namely presentations used for informational purposes to the public or professionals.
- Signage: all completed infrastructure works (namely solid waste and waste water treatment plants) bear an explicit reference to the USAID as funding and supporting agency. Furthermore, all equipment and machinery procured under the program have clear and explicit tagging about the USAID.

- Press releases: media outreach was a decent part of the YMCA's strategy in order to inform the widest public of the programmatic activities, its sponsors and supporters. Press releases were communicated with the USAID Mission in Beirut

A sample of visibility tools is shown hereunder:

1 *2*

1- Invitation Letters on Municipal Boards
2-Project Signage

Public Awareness Information

KEY CHALLENGES

Key challenges related to the program could be grouped into three categories depending on their level of effect and the managerial capacity to mitigate them.

1. Strategic challenges are those that affect the course of implementation at large with minimal capacity of the YMCA to mitigate or manage. These challenges include:
    a. The July 2006 war and the May 2008 events which hampered progress due to internal tensions and conflicts
    b. Delays by the OMSAR contractors and OMSAR-EU bureaucracy in the completion of the infrastructure works at the Ain Baal solid waste facility
    c. Red tape bureaucracy at the sea port authority that affected the clearance of the Ain Baal facility equipment
    d. Reneging of the MoEnv towards its commitment in some villages to contribute to the installation or funding of sewage networks

2. Operational challenges are those that affect the operations within limits of time or resources and fall short from the total control of the YMCA such as:
    a. bad and heavy weather conditions that delayed construction works in some regions
    b. increase in the price of raw materials especially fuel and metals which affected the cost of construction
    c. temporary return of Syrian workers to their home during times of internal conflict which renders the whole country in shortage of skilled labor namely in the construction field

3. Technical challenges are those that affect a specific aspect of the implementation and fall within the limits of management and mitigation. These include:
    a. Difficulty in some regions to secure a piece of land that meets all requirements in order to establish a wastewater treatment plant, namely criteria related to accessibility
    b. Nature of land, especially in rocky areas, that placed strenuous efforts on municipalities to complete excavation works within the limits of local contributions and agreed upon timeframes

KEY SUCCESSES

In spite of the challenges faced under the program, the YMCA has successfully accomplished all objectives under the project, namely:

- Nine wastewater treatment plants mostly operated mechanically though innovative approaches that rely on natural resources without a financial burden on the municipalities
- A solid waste treatment center that serves a whole geographic district of more than 50 villages
- High capacities of mobilization, communal dedication and commitment expressed in massive local contributions, financial and in kind towards the program, that have often equaled 50% or more of the individual plants costs
- Ability to leverage resources from other donor agencies towards the completion of major infrastructural works, namely through the EU-OMSAR support
- A strong public-private partnership as represented by the relation with the UTM whereby the latter is committing all necessary efforts, finances and guidance to

overcome challenges and difficulties towards a successful operation of Ain Baal facility

- Possibilities of replication of the wastewater treatment facilities locally as adopted by different donor agencies and internationally especially with the YMCA's successful participation in a London conference to discuss wastewater management in Africa
- High levels of local communities' participation and contribution financially towards the completion of the program. Nearly 50%, or at least matching funds, were raised under the program to complete all activities namely through the provision of land, infrastructure works and equipment. The distinctive local contribution is that of the Ain Baal solid waste treatment facility whereby the the **local community and supporting agencies contributed around 75% of the total** resources allocated and raised for the completion of the facility. Such contributions enabled the program to be financially efficient minimizing costs on the USAID and maximizing outputs and deliverables.

LESSONS LEARNT

The key lessons drawn from the program include the following:

- Public-private partnerships are highly essential to the success of any local community program, especially for its long term sustainability
- Leveraging of resources from a multitude of donor agencies requires a high level coordination and collaboration amongst all supporting agencies in order to render all tasks and activities measurable within set timeframes and deadlines
- New innovative techniques are required in order to ensure low cost operations of plants that cut burdens on the tight financial municipal resources. These techniques include usage of natural resources such as wind energy and gravity that replace electrically supported air blowers and pumps
- Communal participation is often optimal but falls sometimes in the cracks of neglect when it comes to adherence to standards of operation and maintenance. As such, a minimal section of communities is often found to throw diapers and solid material in the sewers which could block the wastewater treatment plants simply because of their local of active citizenship rather than ignorance of technical knowledge about the WWTP
- Central governmental commitment, in spite of national directives and orientation to environmental protection, often fall short than actual promises. This is due to fluctuations in governmental policies with the change of governments, strain on financial resources and high level bureaucracy