PARTICIPATORY IMPROVEMENT OF WATER AND SANITATION SERVICES IN TRIPOLI THROUGH A COMPARATIVE ANALYSIS WITH IRBID

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Abstract

The Tebbaneh region is considered one of the poorest urban areas in the City of Tripoli, Lebanon with an evident lack and/or degradation of basic service provision, in particular, the absence of proper hygienic sanitation, inadequate access to clean water, and poor waste management practices. These conditions are contributing directly to the exacerbation of poverty and the environmental degradation of the area. Under these conditions and with the support and endorsement of the Municipality of Tripoli and consultation with local non-governmental organizations, the American University of Beirut (AUB) implemented a participatory study to improve water and sanitation services. The study relied on a combination of a top-down and bottom-up strategy and a comparative approach in a community in Irbid, Jordan with nearly similar cultural and demographic characteristics and where water and sanitation issues have improved in recent years. The project encompassed validation of the community needs and an assessment of the socio-economic benefits-costs of improved or lack of water supply and hygienic sanitation provisions and promoting awareness on the community's role in environmental sustainability and resources preservation. Based on community surveys coupled with comparative analyses, pilot interventions were defined and implemented, including replacing corroded water tanks in attics in 19 buildings with new plastic water tanks on roof tops and the replacement of water pipes in 4 buildings. A framework for sustainable urban development was developed to serve as a guide for current and future urban environmental planning specifically in the Tebbaneh areas with potential scaling up and/or extension to other similar urban areas.

Keywords: urban slum, poverty alleviation, water and sanitation, socio-economic assessment, pilot intervention, cost benefit analysis, sustainable urban development framework

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ABBREVIATIONS

AB	=	Averted Behavior
ANOVA	=	Analysis of Variance
AUB	=	American University of Beirut
CFU	=	Colony Forming Unit
CBA	=	Cost Benefit Analysis
CDR	=	Council for Development and Reconstruction
CFU	=	Colony Forming Unit
COI	=	Cost of Illness
DALY	=	Disability Adjusted Life Years
FC	=	Fecal Coliform
GDP	=	Gross Domestic Product
GIS	=	Geographical Information System
HC	=	Human Capital
IDRC	=	International Development Research Center
IVF	=	Intravenous Fluids
JUST	=	Jordan University of Science and Technology
MoEHE	=	Ministry of Education and Higher Education
MoEW	=	Ministry of Energy and Water
MoIM	=	Ministry of Interior and Municipalities
MoPH	=	Ministry of Public Health
MUS$	=	Million United States Dollars
NGO	=	Non Governmental Organization
NLWE	=	North Lebanon Water Establishment
NTU	=	Nephlometric Turbidity Unit
SPSS	=	Statistical Package for the Social Sciences
TC	=	Total Coliform
TDS	=	Total Dissolved Solids
USD	=	United States Dollars
WB	=	World Bank
WHO	=	World Health Organization
WTP	=	Willingness to Pay

1. RESEARCH PROBLEM

Inadequate and sometimes absent urban infrastructure service provision present a major environmental and health concern in poor urban areas. In this context, safe drinking water, adequate sanitation, and proper hygienic practices constitute preconditions for health improvement and livelihood enhancement, and contribute to the fight against poverty and often gender inequality. Globally, increased pre-mature mortality particularly amongst infants and children as well as increased water borne diseases are well documented and acknowledged by various international organizations with nearly 3 billion people lacking safe drinking water and adequate sanitation facilities, many of whom (30 to 40%) are considered dwellers of impoverished urban areas or slums in inner cities. As a result of poor water quality, the urban poor in particular incur additional expenditures on medical treatment and medicines for water borne diseases like diarrhea, gastro-enteritis, or cholera, causing children to miss school and adults to miss work with loss of income. Thus, the lack of access to a safe water supply and adequate sanitation services is directly linked to the livelihoods and incomes of the urban poor and impacts their health and ability to earn, thus exacerbating poverty. Hence, safe drinking water, adequate sanitation, and hygiene promotion are expected to contribute to poverty alleviation and livelihood enhancement particularly in urban areas. It is within the same logic and context presented here that AUB implemented this participatory project in the Tebbaneh region at the outskirts of Tripoli, the second largest city in Lebanon.

2. OBJECTIVES

The project aims at easing environmental and health burdens in the area of Tebbaneh through a better understanding of the linkages of how poor environmental services exacerbate poverty as well as piloting interventions that improve such services. More specifically, the project will attempt to:

- Draw on lessons learned from a community with similar cultural background and demographic characteristics in Jordan and transfer lessons and positive outcomes in the implementation process of the project in the Tebbaneh region

- Rely on social field surveys and the comparative analysis with a nearly similar community in Jordan, to define priority needs and develop pilot interventions with the participation of the community and the municipality

- Implement pilot interventions, monitor their direct impacts and evaluate their effectiveness

- Develop a sustainable environmental management framework that relies on the outcomes of the pilot interventions while defining potential constraints that could prevent scaling up of the pilot model to areas within the same region or to other areas with similar characteristics

- Disseminate the experience with the pilot interventions to better serve as a model for potential scaling up and knowledge transfer

3. METHODOLOGY

To achieve the objectives outlined above, an adaptive or hybrid approach, that reconciles top-down and bottom-up approaches, was followed in implementing the project based on participatory communication between the local government represented by the municipality and the local community represented by various stakeholders. Particular emphasis was placed on women organizations, given the important role that women play in water and sanitation service provision and being the most adversely affected by the lack of such services. In addition, this approach benefited from a comparative analysis, based on well-defined indicators, with another community in Jordan with nearly similar cultural and demographic characteristics and where water and sanitation issues have been improved in recent years. Using this approach, the project sought an in-depth understanding of the reasons behind poor environmental services and subsequent environmental degradation (How? Why?) while working on devising appropriate pilot interventions (What is currently done? What more can be done? How to sustain interventions?); the framework of analysis and interventions was then revised based on comparative analysis results, the community's input, and close monitoring and evaluation of the process (Figure 1).

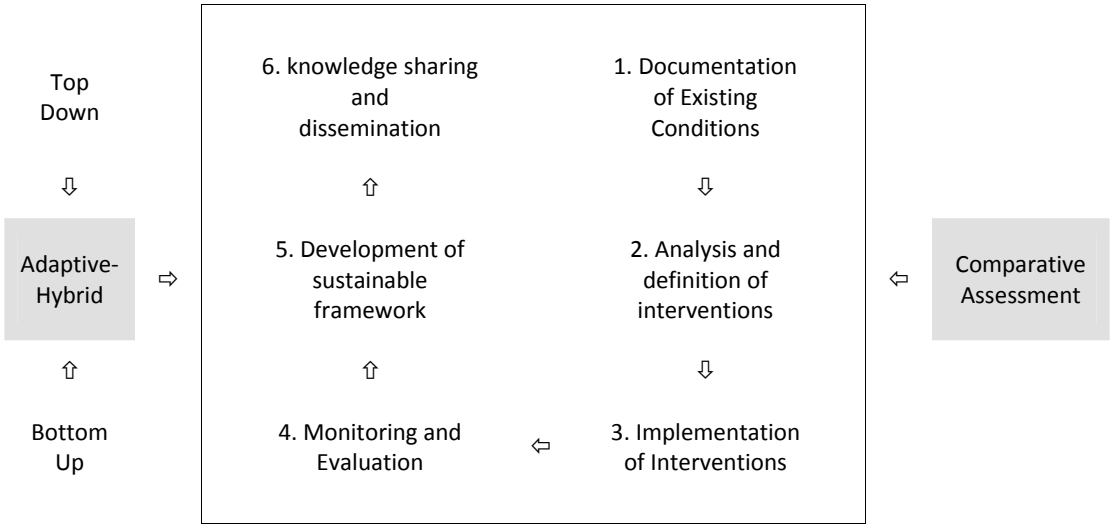


Figure 1. General approach framework

For this purpose, a multi-disciplinary research methodology combining quantitative and qualitative approaches was adopted to document the existing conditions, analyze and interpret the social and cultural factors that determine or influence the situation, identify and assess current prevention and intervention strategies, develop and implement pilot interventions and evaluate them. These included administration of targeted questionnaires, face to face interviewing of key informants (people with comprehensive knowledge of their community), laypeople (housewives, workers, young men and women), field observations, extraction of relevant information from available records and databases, analyzing relevant documents about existing laws, policies, current projects, etc., conducting workshops, and construction and/or rehabilitation of water, sanitation, drainage and/or wastewater networks.

A water quality monitoring program was added to the initially proposed methodologies. This was deemed essential in helping the research team understand the various sources of water pollution in Tebbaneh and define the needed interventions. GIS application was re-oriented to serve as a platform for spatial analysis rather than mapping as initially envisaged, since a new sewage network and a new water distribution network had been installed by the time the project was initiated.

4. PROJECT ACTIVITIES

A series of interrelated activities formed the basis of the project implementation. These activities are outlined below followed with corresponding detailed methodologies. During the course of the project and based on interim findings, some of these activities were revised or modified while other activities were added in order to cater for the needs of the project. Revisions or modifications were invariably discussed with and approved by IDRC.

- Establishing a comparative framework
- Needs assessment validation and prioritization
- Infrastructure mapping and GIS development
- Pilot interventions: Definition, implementation and evaluation
- Sustainable urban development framework
- Dissemination

4.1 Establishing a Comparative Framework

Several coordination meetings were held in Jordan between the AUB team leader and the Jordan University of Science and Technology (JUST) team in order to initiate and follow-up on the tasks under this activity. As a first step, and based on similarities with the Tebbaneh area in terms of socio-demographics, the An-Nasr area in the northern region of the city of Irbid, was selected for conducting the social field survey and the comparative analysis with the Tebbaneh area. An-Nasr area, like the Tebbaneh area, is characterized by a high population density reaching more than tenfold of other urban areas in the country (Table 1), a high percentage of young population associated with a high natural birth rate, and very low income of less than 200 USD per household. Both regions have similar religious background with the predominant population composed of Sunni Muslims and a Christian minority. The location of An-Nasr area within the City of Irbid is presented in Figure 2. Note that while the population densities seem to differ significantly between the two areas, they are considered among the highest densities in their corresponding countries.

Table 1. Demographic characteristics of An-Nasr and Tebbaneh areas

Parameter	*An-Nasr, Irbid*	*Tebbaneh, Tripoli*
Project area	1.9 Km^2	0.4 Km^2
Population	8,875	27,804
Average family size	6.2 capita/family	6 capita/family
Population density	4,671/Km^2	69,510/Km^2

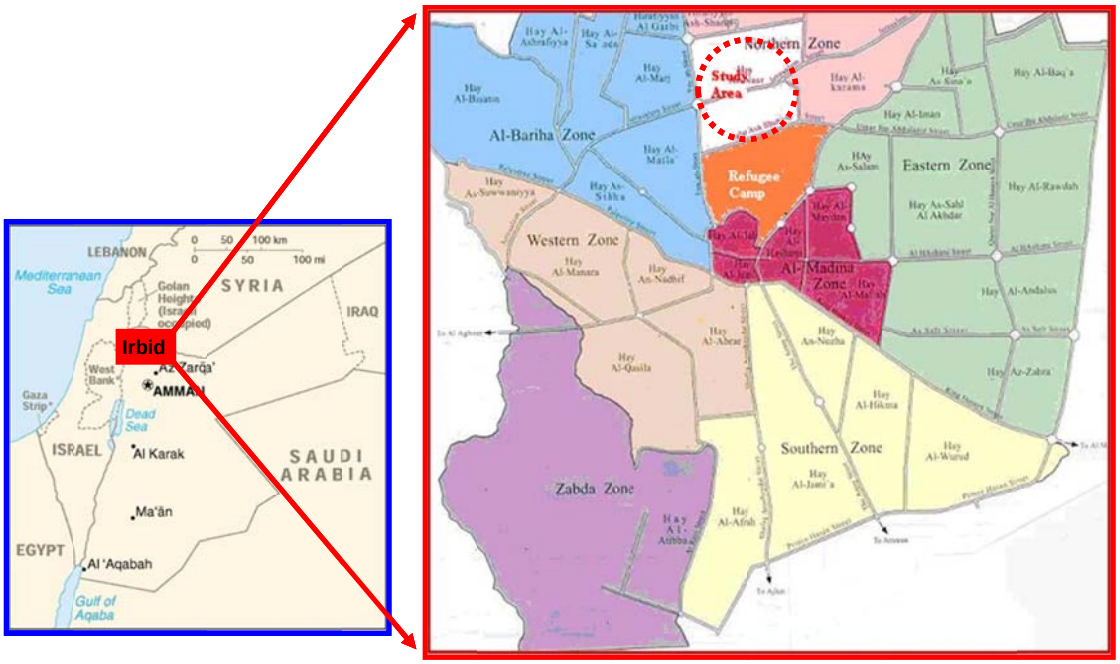


Figure 2. Location of An-Nasr area within the City of Irbid

The AUB and JUST teams proceeded with the development of a field questionnaire for the Irbid area, taking into consideration to the extent feasible the characteristics, similarities and differences between the Tebbaneh and Irbid regions. The questionnaire focused on the collection of data related to socio-demographics, working force, financial and health indicators, water resources and network system, groundwater wells, water tankers and storage tanks, hand carried water, drinking water, and bottled water, personal hygiene and fixtures, wastewater disposal, solid waste disposal, and prioritization (see Annex 1). Survey teams were formed from qualified women specialists from the study area with relevant background (see Annex 2). Meetings were held with the municipality at Irbid as well as local stakeholders to appraise them about the project and its objectives. The survey team was then trained prior to conducting household surveys in a well-defined zone in the Northern Irbid area, known as An-Nasr. Around three hundred households were visited and surveyed at an average of 4 to 5 visits per day. The teams were faced with few individuals who questioned the motives of the study and at times, inciting others not to cooperate posing some difficulties and challenges. The survey team reported complaints about the length of the survey particularly that the main part of the survey was conducted during the Holy month of Ramadan followed by Eid El-Fitr holidays. Information from the survey questionnaires was entered into Excel spreadsheets with proper indexing to facilitate subsequent analysis. Data processing was conducted to define basic statistics from the surveys and guidelines on how to refine the questionnaires and improve its administration in the Tebbaneh region were provided by the JUST Team. The main recommendations which were relied upon by the AUB team to revise the questionnaire's structure and/or its administration included:

- Use of female surveyors
- Provide adequate explanation of the purpose of the questionnaire

- Include the willingness of the people to pay for the provision of better services
- Enquire about local regulations and authorities in charge of providing water and wastewater collection
- Enquire about who are the children caregivers and their practice of hygienic behavior and whether they have been subjected to any training or awareness programs/ education
- Cover the time (before the preparation of food, after changing diapers and using toilets) frequency, and technique used for hand washing
- Modify the age category for children to include a new category for age from 1 to 3 years

As for the main findings of the survey, they included relatively high levels of diarrhea among children (56 incidents of diarrhea per 1,000 children (< 1 yr of age) in the last three months and 34 incidents of diarrhea per 1,000 children (1-10 yrs of age) in the last three months), despite the infrastructure and service improvements in An-Nasr area. This may be attributed to the relatively low average water available for consumption (42 liters per capita per day), which may be associated with increased poor hygiene. Another striking finding was the high percentage of housewives with high educational levels, whereby more than 75 percent have a secondary degree or higher.

A draft report summarizing the social survey in Irbid was prepared by the JUST team detailing the tasks completed and relevant statistics. The report was revised and analyzed further by the AUB Team in an effort to draw relevant lessons from the Irbid experience, which will help in defining the planned pilot intervention in Tebbaneh (Annex 3). The survey data from the subsequent survey that was implemented in Tebbaneh were analyzed and compared to those from Irbid to assess similarities and differences and discern lessons from the Irbid case, when possible. The main results of this analysis are detailed in section 4.2 below.

4.2 Needs Assessment Validation and Prioritization

As a first step, a project initiation meeting was held at the Rachid Karameh Municipal Cultural Center in Tripoli with the objective to introduce the project and associated activities to local stakeholders and solicit the participation of interested active Non Governmental Organizations (NGOs) who were invited to attend the meeting in coordination with the municipality. In addition to the Head of the Tripoli Municipality, a representative from the Ministry of Social Affairs, and a representative from the Lebanese University around 10 local NGOs attended the meeting. Annex 4 provides a list of attendees with selected photos taken during the meeting.

The meeting was initiated with an introductory speech by Engineer Rachid Jamali (head of Tripoli municipality) who highlighted the need of the Tebbaneh area for various types of developmental works to complement on-going plans and projects by the municipality. He expressed the support of the municipality for the project and called on the active participation of local NGOs and stakeholders for the successful implementation of the project activities. Engineer Jamali introduced the AUB project team present at the meeting and a presentation was made by Dr. Mutasem El Fadel the Project Director at AUB. Dr. El-Fadel presented the history of the project: how it was conceived, its objectives and activities, aided by power point slides (Annex 5). The presentation, slides, and ensuing

discussion were all carried out in Arabic. Participants inquired about the rationale behind the selection of Irbid for the comparative assessment with Tripoli, how the project will address the apparent needs of Tebbaneh area, the required level of contribution from the NGOs, and the timeframe of the project and its overall budget. These issues and others were clarified by Dr. El-Fadel. Most importantly, Dr. El-Fadel explained for the participants that the project should be considered more in terms of developmental community-based research with a serious component of field implementation aiming at providing pilot interventions that could become examples for future projects in the area or similar areas. A follow-up meeting was conducted at the Tripoli municipality (Annex 6) with three local NGOs who expressed the strongest interest in participating in the project implementation including: Women's Work Organization (جمعية العمل النسوي), *With You* Charitable Organization (جمعية معكم الخيرية الاجتماعية), and Women's Group Charitable Organization (جمعية اللقاء النسائي الخيري). After reminding the participants of the project objectives, activities, and schedule, consultation with the NGOs and the Municipality of Tripoli resulted in the delineation of the survey area in the Tebbaneh region which was then divided into 5 zones using GIS (Figure 3). A group of field surveyors was also selected from these NGOs as well as the municipality. The group consisted of 5 female surveyors who work and/or live in the study area and are social workers with prior experience in questionnaire administration (Annex 7). The AUB Team worked directly with the group and monitored closely the questionnaire testing and administration process.

Figure 3. Delineation of survey zones in the Tebbaneh area

4.2.1 Social survey in Tebbaneh

The next step was the implementation of the social survey in Tebbaneh, with the aim of assessing and validating the needs in Tebbaneh and completing the comparative assessment with An-Nasr in Irbid. The questionnaire was first revised, based on the recommendations from the Irbid Team. Training sessions for the survey team were then conducted and

followed with pilot testing, whereby 30 questionnaires were administered by the surveyors and the AUB team. The pilot test results were processed and the questionnaire was revised a second time (Annex 8). The full survey was then implemented over a period of 6 weeks, whereby a total of 332 questionnaires were administered. To facilitate the sampling procedure, the study area was divided into five zones containing almost equal numbers of buildings. Each of the five local surveyors was assigned a zone, from which 60 to 70 households were randomly selected. The local surveyors were accompanied by members of the AUB team during their household visits. The number of sampled households was almost evenly distributed between the five zones that constitute the Tebbaneh study area, as illustrated in Figure 4. The respondents were very cooperative, translating into a high response rate of about 86 percent. The collected data were entered into SPSS by the AUB Team. The data were then cleaned and analyzed.

Figure 4. Distribution of sampled households in the Tebbaneh Study Area

The survey revealed strong similarities between the Tebbaneh and the Irbid areas in selected socio-demographic indicators, including the mean number of rooms per household, the mean number of household members and families within the household, and the mean age of male and female household heads (Table 2).

Table 2. Selected socio-demographic indicators: Tebbaneh vs Irbid

Parameter	*Tebbaneh Mean (Range)*	*Irbid Mean (Range)*
Number of rooms in household	3.2 (1-12)	3.4 (1-8)
Number of household members	5.7 (1-14)	6.1 (2-15)
Number of families within the household	1.2 (1-5)	1.1 (1-3)
Age of male household head	45.0 (22-88)	44.2 (23-96)
Age of female household head	41.4 (16-79)	38.7 (17-67)

However, a striking difference was the level of education of housewives, whereby more than 75 percent of housewives in Irbid have a secondary degree or higher as compared to 4 percent of housewives in Tebbaneh (Figure 5). This has important implications for hygienic practices within households and the associated risk of water-borne diseases.

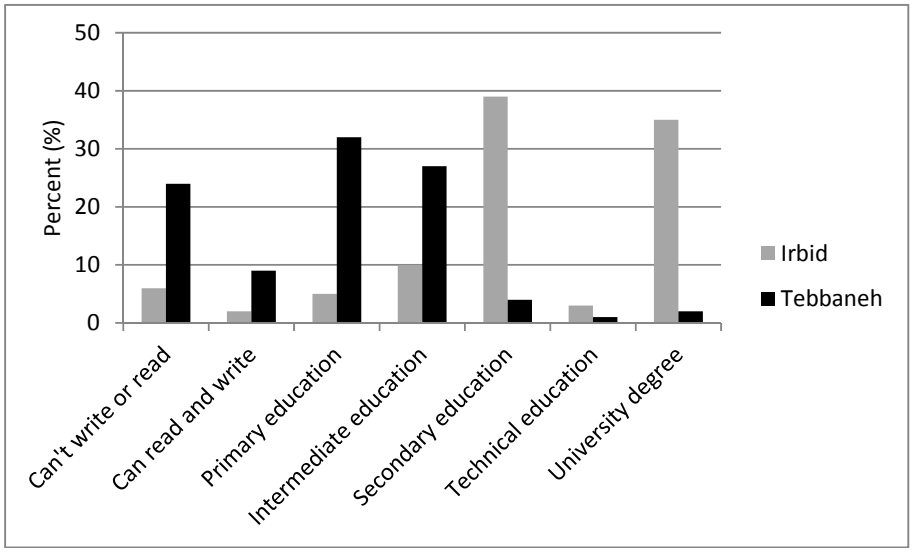


Figure 5. Education level of housewives in Tebbaneh and Irbid

In the last three months prior to administering the questionnaire, 56 incidents of diarrhea per 1,000 children (< 1 yr of age)and 34 incidents of diarrhea per 1,000 children (1-10 yrs of age) were reported. In comparison, levels of diarrhea among children in the Tebbaneh region were found to be 3 to 5 times higher [281 incidents of diarrhea per 1,000 children (< 1 yr of age) and 113 incidents of diarrhea per 1,000 children (1-10 yrs of age) in the last three months]. Since the wastewater infrastructure has been improved lately in Tebbaneh similar to An-Nasr area, the difference in diarrheal incidence can be attributed more to water sources, the water supply system, or hygienic practices rather than wastewater

management. Actually, more than 99 percent of respondents in Tebbaneh were connected to the new sewage network. The main wastewater problems reported in the Tebbaneh area were within the buildings (57 percent), including wastewater accumulation in basements, clogging of pipes, foul odors, and fissures and leakages (Figure 6).

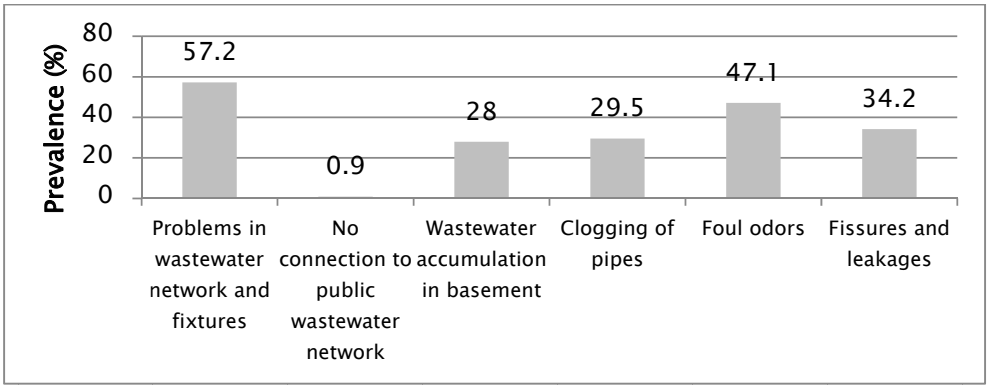


Figure 6: Reported prevalence of problems in wastewater network and fixtures in Tebbaneh

In Tebbaneh, nearly 99 percent of respondents reported using water from the public water supply network providing almost continuous supply throughout the day, but reaching the consumer at significantly low pressure. As a result, residents installed water pumps directly on the water valves connecting the network pipe to the individual apartments in the building basement (Figure 7). These pumps work on boosting the water pressure for it to reach the consumer. It is worth mentioning that two main problems can arise from such a system: 1) Serious pressure loss within the distribution network as a result of the pumps applying negative pressure within the whole study area; 2) Potential water contamination by wastewater within each building where wastewater problems were previously reported (especially when the pumps are not operational).

Figure 7. Water pumps in basements of buildings in the Tebbaneh area

Another important finding was that around 26 percent of respondents reported supplementing water from the network with bottled water. Many residents mentioned buying bottled water when the network water appeared turbid and when a member of the household was ill.

Although the water supply is almost continuous in the Tebbaneh study area, people stored water in tanks (around 96 percent of respondents). The stored water is not used for drinking purposes but usually used for common household chores such as cleaning, bathing, washing fruits and vegetables, etc. The survey revealed that household storage tanks were either located in the attic (around 45 percent of respondents) or on the building's roof. Most storage tanks are not well covered and often not covered at all. Uncovered attic storage tanks, which are usually located below toilet plumbing systems of upper floors, are prone to water contamination from leaking pipes, particularly that a significant number of households had reported the presence of wastewater problems in their buildings (such as leakages, clogging, broken pipes, etc…).

Similarly, in An-Nasr area in Irbid, ~97 percent used water from the public water supply network and ~47 percent used bottled water for drinking purposes. While the water supply is intermittent, it reaches the consumers at an acceptable pressure. Incoming water is either stored in a reservoir at ground level from where it is pumped to roof-top storage tanks, or it reaches the roof top storage tanks directly. No attic storage tanks are present in the An-Nasr area. In addition, buildings in An-Nasr area seldom exceed three storeys.

4.2.2 Water quality analysis campaign

The household survey identified a general community perception that the drinking water reaching the Tebbaneh area is of low quality. As such, a water sampling program (Figure 8) was initiated to assess the quality of drinking water in the study area and the validity of the recorded perception. The sampling program targeted the drinking water supply network as well as the bottled water commonly used by residents of the project area. A total of 76 water samples were collected between December 2009 and January 2010 from the drinking water tap within households in Tebbaneh, where diarrhea cases had been reported during the social survey. Another 63 water samples were collected from stored water taps at the same households within the study area. A balanced approach was followed to ensure a uniform distribution of the samples for all zones (Figure 9). Assessment of stored water quality was conducted to shed light on the quality evolution after supply and to detect possible contamination within the water storage tanks.

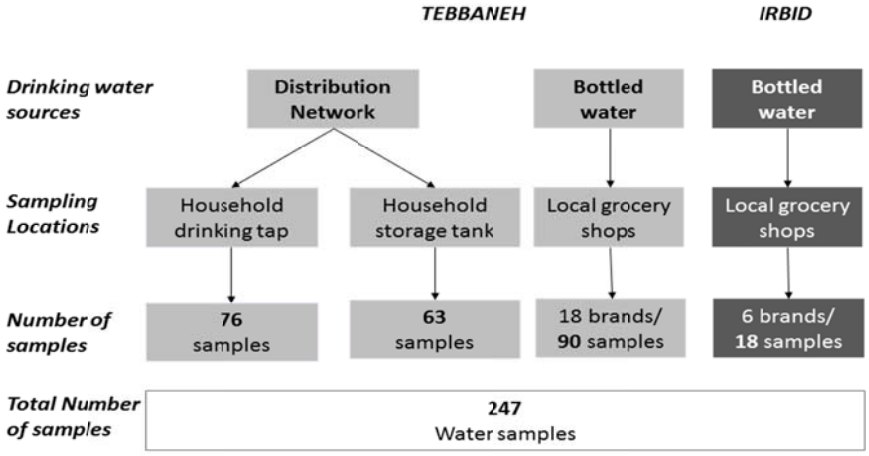


Figure 8. Water sampling program in Tebbaneh and Irbid

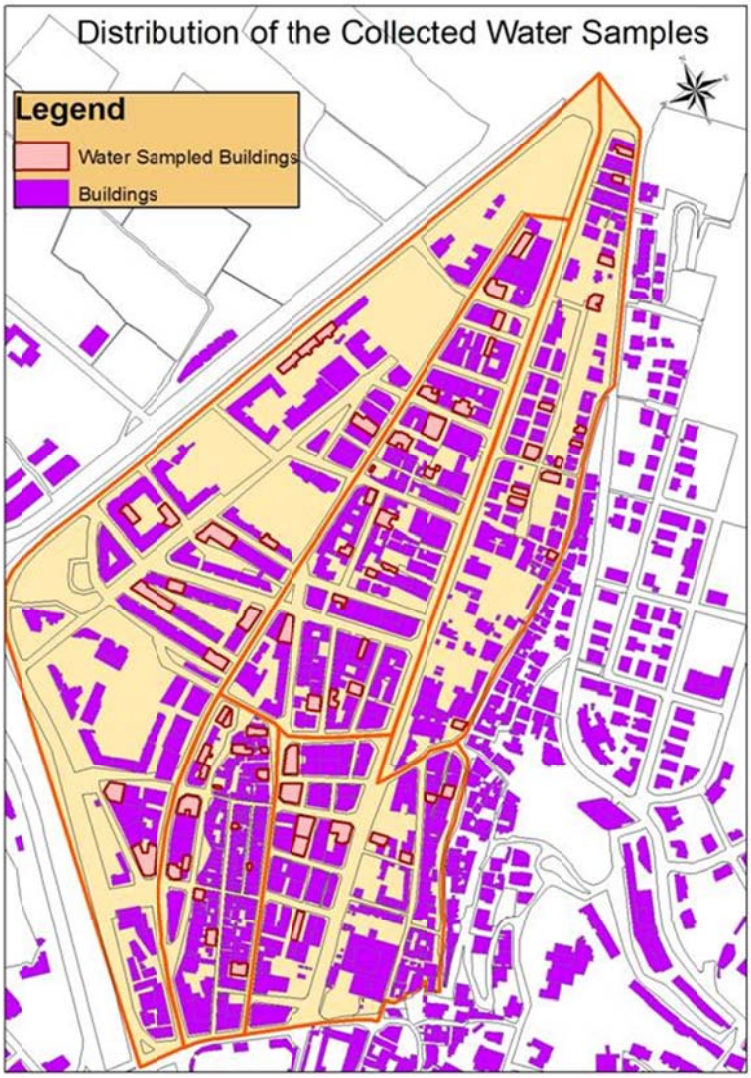


Figure 9. Distribution of buildings in Tebbaneh from which water samples were collected

The collected water samples were analyzed for selected physico-chemical (temperature, pH, color, turbidity, total dissolved solids, residual chlorine and nitrate) and microbiological parameters (fecal coliform and total coliform) (Table 3) at the AUB Environmental Engineering Research Center Laboratory. The results of the laboratory analysis are detailed in Annex 9 and summarized in Table 4 and 5. The water sampling program revealed that the residual chlorine in the water is relatively low (0.11 mg/l) indicating that by the time the water reaches the consumer, its disinfection ability has been exhausted, thus increasing the potential of the water of getting contaminated. Color and turbidity in the water were detected, as reported by residents in the social survey. Fecal and total contamination was also detected in several storage tanks. It was suspected that the contamination is originating from the water plumbing system withing the buildings/households and the lack of maintenance and cleaning of storage tanks.

Table 3. List of analyzed parameters and adopted analytical procedures

Parameter	*Type of analysis*	*Method reference*[1]
pH	Potentiometry	4500-H^+ B
Color	Colorimetry, Pt-Co	SM 2120C
TDS	Electrometry	SM 2510B
Turbidity	Nephelometry	SM 2130B
Nitrate	Colorimetry: Cd reduction	SM 4500 NO3-B
Residual chlorine	Colorimetry, DPD	SM 4500 Cl G
Fecal coliform	Membrane filtration technique	SM 9222B
Total coliform	Membrane filtration technique	SM 9222D

[1]APHA *et al.*, 2005

Table 4. Summary of results of laboratory analysis of drinking network water in Tebbaneh

Parameter	*Range*	*Standard (EPA/ EU/ WHO)*	*Standard Exceedance*	
			N	*(%)*
Fecal coliform (CFU/100 ml)	0-3	0	3	(4)
Total coliform (CFU/100 ml)	0-500	0	18	(24)
Nitrate (mg/L $NO3^-$)	6.1-27.8	40-50	0	(0)
pH	6.04-7.84	6.5-8.5	0	(0)
Residual chlorine (mg/L Cl_2)	0.01-0.3	> 0.5	76	(100)
TDS (mg/L)	208-862	500	24	(32)
Color (PtCo APHA)	0-67	15	14	(22)
Turbidity (NTU)	0.98-1.6	1	6	(10)

Table 5. Summary of results of laboratory analysis of water from storage tanks in Tebbaneh

Parameter	*Range*	*Standard (EPA/ EU/ WHO)*	*Standard Exceedance*	
			N	*(%)*
Fecal coliform (CFU/100 ml)	0-9	0	6	(10)
Total coliform (CFU/100 ml)	0-177	0	26	(41)
Nitrate (mg/L $NO3^-$)	12-31.8	40-50	0	(0)
pH	6.36-8	6.5-8.5	1	(0)
TDS (mg/L)	214-897	500	26	(44)
Color (PtCo APHA)	0-67	15	14	(24)
Turbidity (NTU)	0.98-1.6	1	6	(10)

Samples from 15 bottled water brands commonly sold in the Tebbaneh area were collected (5 different batches per brand) and analyzed for fecal and total coliforms, as well as nitrates

over a period of three months (December to February). The results of the laboratory analysis are presented in Table 6 revealing that, out of 15 brands, 2 were contaminated with fecal coliform, 7 with total coliform, and none with nitrates. These results raise some concern, since the residents of Tebbaneh perceive the quality of bottled water to be acceptable and better than that of the network water, thus resorting to it when a household member is sick.

Table 6. Summary of results of laboratory analysis of bottle water in Tebbaneh

Parameter	*Range*	*Standard (EPA/ EU/ WHO)*	*Standard Exceedance*	
			N	(%)
Fecal coliform (CFU/100 ml)	0-207	0	1	(4)
Total coliform (CFU/100 ml)	0-147	0	4	(24)
Nitrate (mg/L NO3-)	2.2-49.5	40-50	0	(0)

For comparative assessment, the sampling program was expanded to Jordan whereby bottled water samples from six brands commonly sold in Jordan were collected, transported on ice, and analyzed for the same parameters at the AUB laboratory. Fecal coliform, total coliform, and nitrate levels were found to be within national and international drinking water standards. Samples from surveyed households in Jordan could not be obtained because of required governmental approval and potential sensitivities. It was also intended to extend the sampling program in Jordan to the water supply network in An-Nasr to compare its quality with that of Tebbaneh and gain better insight on the potential sources of contamination. However, this was not feasible due to restrictions by the water authority in Jordan.

In August 2010, around 34 samples from the drinking water network and 40 samples from household tanks were collected from households that were not covered in the initial water sampling campaign and where diarrhea cases were reported during the social field survey. Total coliform was detected in 20 tank water samples, 15 of which are located in the attic. The results of the laboratory analysis are summarized in Table 7 and detailed in Annex 10.

Table 7. Summary of results of laboratory analysis of addtional water sampling in Tebbaneh

Parameter	*Range*	*Standard (EPA/ EU/ WHO)*	*Standard Exceedance*	
			N	*(%)*
DRINKING NETWORK WATER				
Fecal coliform (CFU/100 ml)	0-1	0	3	(2.9)
Total coliform (CFU/100 ml)	0-160	0	18	(47.1)
STORAGE TANK WATER				
Fecal coliform (CFU/100 ml)	0-80	0	3	(7.5)
Total coliform (CFU/100 ml)	0-200	0	18	(57.5)

4.2.3 Medical survey

Alongside the social survey, a survey of medical facilities frequented by Tebbaneh residents was conducted. As a first step, the Lebanese Ministry of Health was contacted to explore the type of official data that might be present on waterborne diseases, particularly diarrhea and typhoid. However, due to significant under-reporting, it was decided to collect the data directly from the health facilities in the Tebbaneh study area. According to the data collected in the needs assessment survey, nearly 77 percent of surveyed households in Tebbaneh resorted to dispensaries for medical care. Furthermore, more than 90 percent of these households frequented five main dispensaries in the area, namely, Al Rahmah, Al Azm Wal Saadah, Al Daawah, Al Hariri, and Al Hamidi. As such, the survey of medical facilities targeted these five dispensaries, with three of them located within Tebbaneh (Al Rahmah dispensary having an additional branch for illnesses requiring therapy using intravenous fluids (IVF)) and the other two outside Tebbaneh (Figure 10).

Figure 10. Location of surveyed dispensaries within Tebbaneh

For this purpose, a questionnaire was developed and administered to responsible personnel at the five dispensaries (Annex 11). The questionnaire inquired about the number of diarrhea and typhoid cases recorded in each dispensary during the period extending

between September 2008 and September 2009. It also solicited information about common medications prescribed for diarrhea and typhoid cases, as well as the average cost of treatment. The sources of data used regarding the number of diarrhea and typhoid cases differed from one dispensary to the other. Data were obtained from physicians' daily log books, patients' medical files, or from the dispensary's admittance records (Table 8 and Table 9). The AUB team along with the local surveyors assisted in collecting data on the number of diarrhea and typhoid cases in certain dispensaries. Note that data from some dispensaries contained some gaps. The total reported annual diarrhea cases were estimated at 61 per 1000 population. This number is significantly lower than the estimated prevalence of diarrhea among children based on the social survey (281 per 1000 for children under 1 yr and 113 per 1000 for children between 1 and 10 yrs). This may be attributed to the fact that not all diarrhea cases resort to a dispensary for treatment. Many are self-treated at home, using medication prescribed by the local pharmacists.

Table 8. Number of diarrheal cases as reported by the most frequented dispensaries in Tebbaneh

Dispensary	*Types of investigated records*	*Reported Period*	*Number of Diarrheal Cases*				*Notes*
			≤ 5 yrs	*> 5 yrs*	*Unspecified*	*Total*	
Al Azem wal Saadah	Patients files	01/09/08 to 01/09/09	194	196		390	
Al Rahmeh	Physicians log books	01/03/08 to 08/09/09	100	78	19	197	Data over a 6 months period
Al Rahmeh (Cases requiring IVF)	Entrance log books	02/09/08 to 31/08/09			442	442	
Al Hariri	Computer database	01/09/08 to 01/09/09			202	202	
Al Daawah	Entrance log books	01/09/08 to 01/09/09	50	131		181	Calculated as the annual average of reported cases for the past 3 years
Al Hamidi	Patients files	01/01/09 to 28/02/09 and 01/07/09 to 21/08/09	25	40		65	Data over 2 2-months period

Table 9. Cost of medication and treatment of diarrhea and typhoid cases as reported by the top five dispensaries in Tebbaneh

Dispensary	*Dispensary fees (LL/ admittance)*	*Medication costs for Diarrhea cases (LL/ case)*	*Medication costs for Typhoid cases (LL/ case)*
Al Azem wal Saadah	1,000	0 (Free)	0 (Free)
Al Rahmeh	3,000	10,000-15,000	-
Al Rahmeh (Cases requiring IVF)	0	10,000-75,000	45,000
Al Hariri	5,000	6,000-36,000	24,000
Al Daawah	0-5,000	4,500-20,000	4,000-25,000
Al Hamidi	6,000-9,000	22,000-55,000	17,500

Data collected through the household and medical surveys were used to conduct the assessment of health and socio-economic burden of water pollution on the Tebbaneh residents, as detailed in Section 4.4.2.

4.2.4 General observations

Finally, it was observed that, in general, in Tebbaneh, significantly low hygiene practices persist on streets and within households, which may also contribute to diarrheal diseases (Figure 11). Furthermore, solid waste management was considered to be another important environmental issue in Tebbaneh that required attention, whereby excessive littering was noted in building stairways and on empty land, despite the adequate distribution of solid waste collection bins in the area (Figure 12). Residents complained about this issue and the associated pest infestation, including mosquitoes and rats.

Figure 11. Some observations illustrating low hygiene

Figure 12. Some observations illustrating solid waste dumpimg and littering

4.3 Infrastructure Mapping and GIS Development

As a first step in this activity, several meetings were held between the AUB team and the Tripoli Municipality Engineering Department and GIS office, with the aim of delineating the 'Actual Tebbaneh', which spans over 5 cadastral zones of Tripoli and to initiate the development of the GIS based socio-economic database for Tebbaneh besides its infrastructure (Figure 13).

Figure 13. GIS Data layers for the study area
(buildings, sewer network, manholes, storm water drainage network)

The development of the concept for the GIS Municipal Support System was then initiated based on the fact that, while sanitation is at the core of Municipal mandate, limited resources are available to deal with the needed investment and interventions. As such, prioritization of investment to maximize the number of poor population served is essential to minimize negative health impacts and cope with budget limitations. The GIS Municipal

Support System was anticipated to assist the Municipality in the prioritization of investments. Figure 14 outlines the proposed Sanitation GIS Optimization Concept Model.

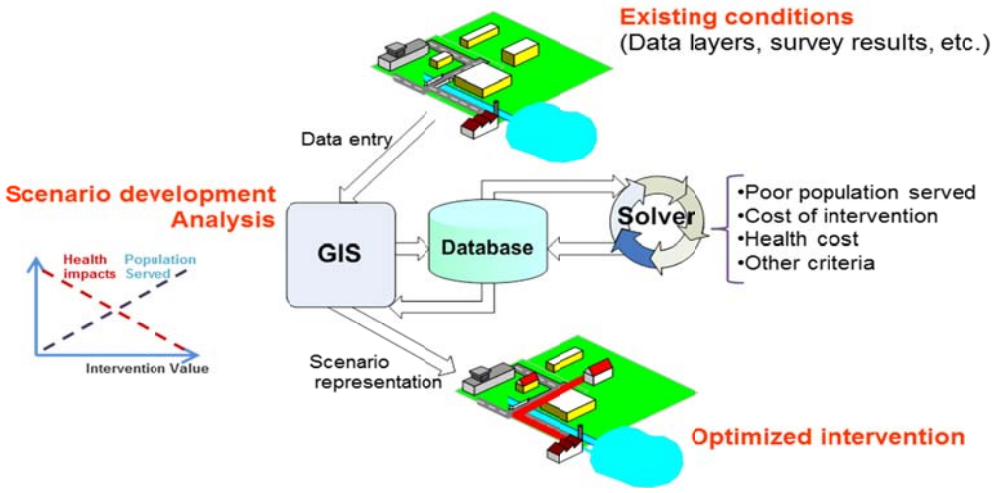


Figure 14. Sanitation GIS Optimization Concept Model

The conceptual model was planned to cover the mapping of existing conditions and the results of the social and infrastructure surveys in a compatible geographic database for the pilot project area. The database was expected to include layers representing buildings, neighborhoods, sewer and drainage networks, and to integrate data and information related to population, health condition, buildings location, buildings internal sewer and drainage network conditions, cost of rehabilitation/upgrade of these internal networks, connectivity conditions of buildings to existing sewer and drainage networks, cost of sewer and drainage network coverage, sewer and drainage network conditions, cost of rehabilitation/upgrade of these sewer and drainage networks, etc. Once the database was set, it was intended to develop the model to examine potential interventions using the geographic database under various conditions. Thereafter, simulation results would be analyzed in the context of intervention cost, poor population served, and alleviation of health burdens to select the optimal intervention according to preset criteria. Finally, the optimized solution would be mapped in terms of how and where the intervention occured.

However, based on the fact that new sewage and water networks have been recently installed in the Tebbaneh area, it was decided that the development of a GIS Municipal Support System will not be as beneficial as it was first envisaged in terms of locating potential pilot interventions, which will be restricted to individual buildings/ households. Accordingly, the GIS use was concentrated on spatial analysis, whereby the results of the social survey and the water sampling program were mapped in an effort to identify priority areas for pilot interventions. The main parameters that were mapped included the distribution of diarrhea cases, the distribution of buildings reporting wastewater related problems, and the buildings where water pollution was detected. A sample of the GIS spatial analysis output is presented in Annex 12. The analysis revealed that all five zones within the Tebbaneh area suffered almost equally from wastewater related problems and from the prevalence of diarrhea, despite the fact that the field observations revealed that Zone 1, or what is commonly known as the vegetable market, exhibited the worst conditions. Thus, no clustering of environmental problems was discerned.

The GIS spatial analysis also assisted in selecting buildings as a first alternative for potential interventions (**Error! Reference source not found.**). The selection process of the 10 buildings is detailed in Section 4.4 below.

Figure 15. Location of the selected buildings for intervention

4.4 Pilot Interventions: Definition and Implementation

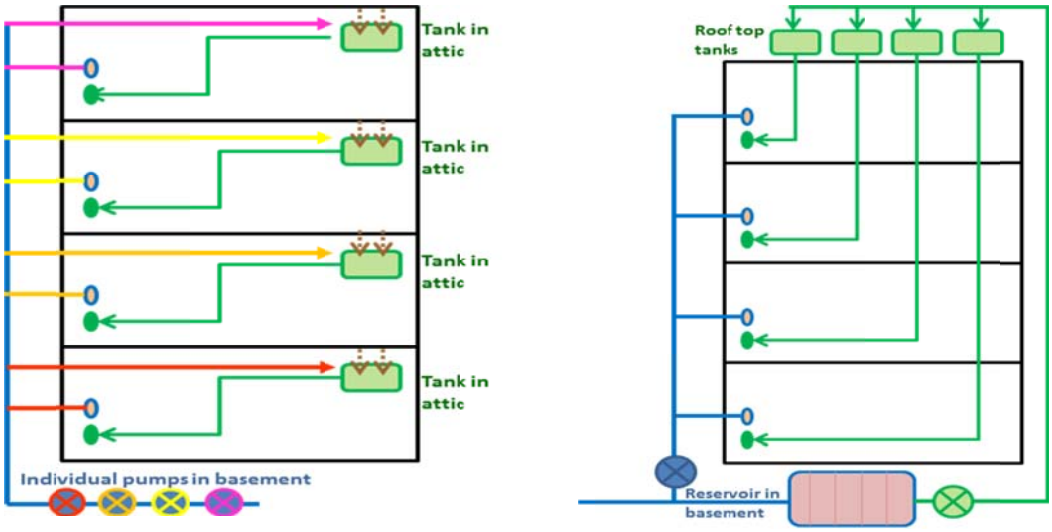
Based on the outcome of the field surveys in the An-Nasr region of Jordan and the Tebbaneh region in Lebanon, and the comparative analyses, pilot interventions were defined and implemented in coordination with the community and the municipality. These interventions are either structural or non-structural in nature as described below.

4.4.1 Structural Pilot intervention

The definition of the structural pilot interventions was an extensive, iterative process, whereby various modifications to the original idea were required due to community and physical constraints, as detailed in this section.

Based on the comparative assessment between An Nasr region of Jordan and the Tebbaneh region in Lebanon, it was evident that pilot interventions need to target water supply in Tebbaneh, rather than wastewater disposal, whereby a new sewage network was already in place. The high incidence rate of diarrhea among children in Tebbaneh as compared to that

reported in Irbid was likely to be associated with the uncommon aspects of the water supply system observed in Tebbaneh, including the absence of storage reservoirs in the building basement, the presence of individual water pumps installed in the basement and the old storage tanks located in attics. In Irbid, incoming water in a building was stored in a common, sometimes compartmentalized reservoir, before being pumped to roof-top tanks (Figure 16). The negative pressure created by the individual water pumps as well as the use of attic water storage tanks increase the risk of water pollution in Tebbaneh. Accordingly, the first proposed intervention involved collecting the incoming water for the whole building in a common reservoir at ground level. Water can then be pumped to roof-top into individual storage tanks (Figure 16).



a) Existing condition

b) First proposed intervention (commonly encountered in Irbid)

Figure 16. Existing water supply conditions in Tebbaneh and the first proposed intervention

In order to select the buildings where this intervention may be implemented, associations between selected variables were tested using SPSS. The variables of interest from the social survey included the reported incidence of diarrhea in the three months preceeding data collection and the type of household storage tank (roof top vs attic). The variable of interest from the water sampling program was the presence/absence of fecal and total coliforms in the analyzed water samples. The Chi Square test was used to test associations between categorical variables (type of storage tank, presence/absence of diarrhea incidence, presence/absence of water pollution) and the Analysis of Variance (ANOVA) test was used to test associations between categorical and continuous variables (mean incidence of diarrhea cases, concentrations of fecal and total coliforms). The detailed results of the tested associations are presented in Annex 13. Significant associations were found between the type of storage tank used (attic vs. roof top) and the presence of total ($p = 0.07$) and fecal ($p = 0.005$) coliforms in the water and between the type of storage tank and the reporting of diarrhea cases ($p = 0.067$). No association was found between diarrhea cases and reporting of wastewater problems (Table 10).

Table 10. Tested associations between selected variables

Variables tested	*Association*	*P-value*
'Tank Type' × 'Presence/absence of Total Coliform'	Yes	0.07
'Tank Type' × 'Presence/absence of Fecal Coliform'	Yes	0.005
'Diarrhea cases' × 'Water Quality'	Cannot be tested	
'Diarrhea cases' × 'Tank Type'	Yes	0.067
'Wastewater Problems' × 'Diarrhea cases'	No	0.246
'Wastewater Problems' × 'Presence/absence of Total Coliform'	No	0.122
'Wastewater Problems' × 'Presence/absence of Fecal Coliform'	No	0.391

Hence, buildings exhibiting diarrhea cases, elevated total coliforms, and storage tanks in the attic were short-listed (10 buildings). Based on the field survey, diarrhea cases were detected in 121 of the total 330 surveyed households. A total 74 of these households were visited and water samples were collected from their drinking water tap (74 samples) and from their storage tanks (63 samples). Total coliforms were detected in water from 26 of the surveyed households with 10 of them having their storage tanks in the attic. Since no association was found between wastewater problems and diarrhea cases, the former variable was not included in the selection process. Annex 14 shows the details of the building selection process.

A meeting was held at the Tripoli Municipality with representatives from the municipality and the local NGOs who were cooperating with the AUB team, including Women's Work Organization (جمعية العمل النسوي), *With You* Charitable Organization (جمعية معكم الخيرية الاجتماعية), and Women's Group Charitable Organization (جمعية اللقاء النسائي الخيري). During this meeting, the results of the social surveys and comparative assessment were presented and the proposed type of pilot intervention was discussed (Annex 15). The participants communicated their interest in the survey results and their willingness to assist in the implementation of the pilot intervention.

Following the meeting with the local NGOs, the buildings were inspected in the field by the AUB team to explore the possibility of implementing the proposed intervention. Physical constraints such as the number of storeys per building, the presence of space in the basement for the water reservoir, and social acceptability were naturally taken into consideration in the selection process. Annex 16 presents a summary of the characteristics of the inspected buildings as well as photos taken of these buildings during the inspection. Two buildings were found to meet the above mentioned selection criteria, particularly in terms of space availability: building TJ0002 and building TB0539. Building TB0539 turned out to be located in Jabal Mohsen, although geographically it appears to be part of Tebbaneh. Hence, detailed field exploration for implementing the pilot project in building TJ0002 was initiated. The selected building has a space of around 4X4m^2 at ground level as well as a basement. The ground level space was filled with solid waste and the basement was full of water leaking from deteriorated pipelines. A meeting was held with the residents of the building and the proposed pilot project was presented. While the residents expressed great interest and consent to the proposed project, two constraints surfaced out during the discussions and field inspections:

1 The building's system is practically connected to an adjoining building increasing the total number of apartments to be rehabilitated to 13

2 The building is owned by someone who recently passed away. His inheritance consisted of seven individuals who may have different plans about the building

The AUB team contacted the new owners of the building to seek their permission before proceeding with the implementation of pilot project. However, the building owners did not allow the installation of water storage tanks in basements. Thus, the pilot intervention then focused on the replacement of old tanks in the attic with new tanks to be placed on roof-tops (with associated pumps, piping system, and disconnection of storage tanks located in attics) to eliminate potential pollution from leaking sewage pipes within the buildings. The latter intervetion (Figure 17) required the approval of the tenants only who invariably granted their permission. The process led to interventions in 19 buildings where diarrhea cases were reported during the social surveys in 2009 and had exhibited bacteriological pollution in water samples collected from their storage tanks. Figure 18 illustrates the distribution of the buildings where the interventions were implemented. Details of each pilot intervention with corresponding photographic documentation are included in Annex 17.

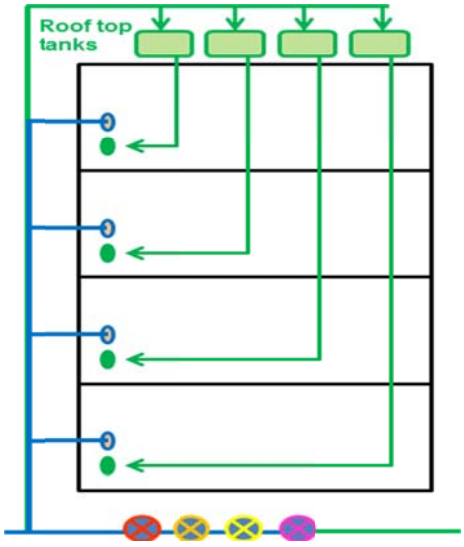


Figure 17. The second proposed interventions

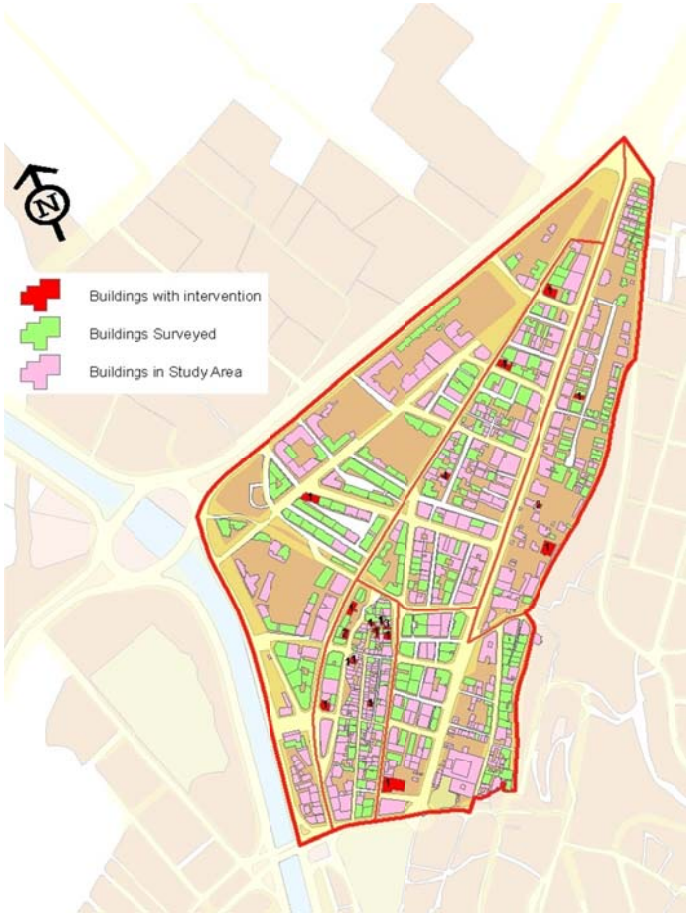


Figure 18. Distribution of buildings in Tebbaneh with pilot intervention

Following the implementation of the pilot intervention, the water quality monitoring program was continued to assess the level of improvement in water quality. Accordingly, water samples were collected periodically from taps connected directly to the public network and taps connected to newly installed storage tanks in households where interventions took place. The samples were analyzed for selected indicators in the field (residual chlorine) and at the AUB Environmental Engineering Research Center Laboratory (microbiological parameters: fecal and total coliform). The results were assessed continuously to provide feedback into the performance of the interventions. While improvement in water quality was noticeable at many locations, the initial assessment at other locations highlighted several other potential sources of pollution: within the drinking water network, within the building pipes, and leakages into the pipes within the building after the water leaves the storage tank and on its way to the tap outlet (Figure 19).

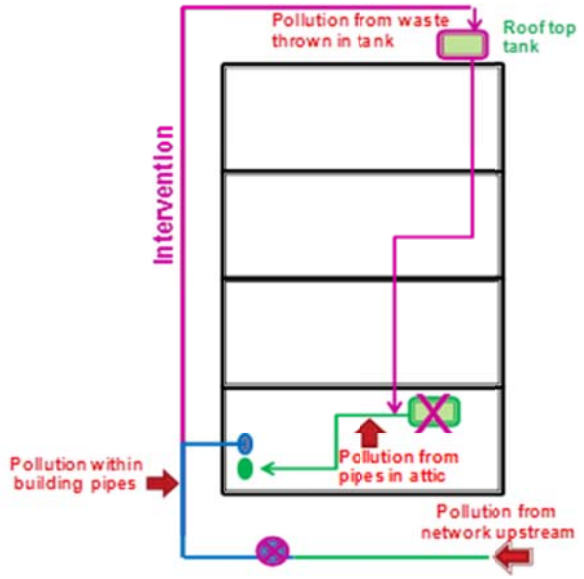


Figure 19. Potential sources of pollution at the building level

Regarding the drinking water network, it was found that during the summer, water from the Al-Mallouli well is used to supplement the dwindling water supply from the spring sources, namely Hab and Rashine. While water from the springs is treated by filtration and chlorination before distribution, water from the Al Mallouli Well is chlorinated as it is pumped into the network, not allowing for adequate contact time for effective disinfection. This resulted in the supply of polluted network water to various buildings being monitored. Another issue at the level of the network was water pollution noted immediately following power cutoffs, which occur on a daily basis, when negative pressure in the network allows the seepage of wastewater into corroded water pipes. Negative pressure is exacerbated by the presence of the individual water pumps discussed earlier. Pollution in the incoming water to the building masked the potential improvement in water quality due to the implemented intervention. In addition, an unexpected pollution source was noted, whereby residents spend the evenings on building roof tops, uncapping the newly installed storage tanks and discarding waste items inside. These sources of pollution were investigated with on-going mitigation measures. As such, to eliminate waste discarding into water tanks, locks were installed on most of them. Furthermore, in an attempt to eliminate pollution from corroded building pipes, an additional intervention was implemented, which included the installation of new water pipes in 4 buildings where attic tanks were replaced with roof top tanks. The corresponding households were selected based on the results of the water quality monitoring, whereby the water sample collected from the drinking tap was consistently found to be of better quality than the water sample taken from the tap connected to the tank. This was further confirmed by field inspection. Annex 18 lists the locations of this intervention, along with illustrating photos.

The analysis of the water quality monitoring results was complex, with the data showing no clear spatial or temporal trends, due to the various pollution sources and incidents. A holistic, relatively rough analysis considered each household alone and calculated the incidences when the quality of the water from the replaced tank was better than the quality of the water sampled from the attic, before the intervention. Each household was

monitored, on average, 10 times, with a minimum of 6 times and a maximum of 12 times. In the cases where no data was available before the intervention, only instances when microbiological pollution was zero were counted. Accordingly, and taking Total Coliform as a surrogate indicator, the percent of the times when improvement in water quality was detected following the replacement of tanks in attic with roof-top tanks ranged between zero and 100 percent, with an average of 52 percent. In fact, in 18 out of 29 households, improvement was detected 50 percent or more of the times the water was sampled. Annex 19 presents the detailed results of the Water Quality Monitoring Program.

4.4.2 Non-structural activity: Socio-economic assessment of water pollution

This activity involved conducting a health valuation to assess the socio-economic impact of sub-standard water quality, sanitation and hygiene in the Tebbaneh area. This was followed by a cost-benefit analysis (CBA) with the objective to assist decision-makers and planners in justifying the allocation of investment funds for infrastructure interventions and proper service provision.

The socio-economic burden of water pollution on the Tebbaneh residents for the year 2009 was estimated based on the results of the household and dispensary surveys that were conducted in 2009 and that were described in detail in sections 4.2.1 and 4.2.3. The valuation techniques for morbidity and mortality impacts of water pollution that were adopted include the Cost of Illness (COI), the Averted Behavior (AB), and the Disability Adjusted Life Years (DALY) approaches for morbidity valuation, and the Human Capital (HC) and the Willingness to Pay (WTP) approaches for mortality valuation.

<u>Morbidity valuation</u>

Based on the assumption that 88% of the reported diarrheal cases are attributed to unsafe water supply, inadequate sanitation and hygiene (Wilkinson, 2009), and that the cases are distributed uniformly throughout the year, with no seasonal variations, the annual incidence of diarrhea in the Tebbaneh study area for the year 2009 was estimated from the household survey results at 33.1 percent, which amounts to a total of 9,197 cases. The age distribution of the reported cases is presented in Table 11, whereby ~32 percent of the cases are less than 5 years of age and ~34 percent are in the productive age of 18 to 65.

Table 11. Distribution of expected annual diarrheal morbidity cases by age group

Age Group	*Morbidity*	
	Reported cases (%)	*Estimated cases (n)*
1 to 5	32	2,962
6 to 18	30	2,754
19 to 65	34	3,170
66+	4	311
Total	**100**	**9,197**

The COI approach

The direct cost of illness, which consists of all medical expenditures associated with the onset of water-related diarrhea within the study area, was estimated to range between 0.36 and 1.45 million USD in the Tebbaneh area for the year 2009 (Table 12).

Table 12. Direct cost of illness by type of medical service sought in the Tebbaneh area

Type of Medical Service	*Percent distribution of cases*	*Number of cases*	*Cost of Illness per case (USD)*	*Total cost of illness (USD/year)*
Hospital	17	1,577	225.7 – 779[a]	355,929- 1,228,483
Dispensary	26	2,417	0.67 – 50[b]	1,619 - 120,850
Private clinic	11	1,051	1.6 - 59.3[c]	1,682 - 62,324
Pharmacy	19	1,787	1.6 - 22.3[d]	2,859 - 39,850
None	26	2,365	0[e]	0
Total	100	9,197		362,089 - 1,451,507

[a] Based on a survey of hospitals throughout Lebanon conduct as part of a student's MS thesis
[b] Based on the survey of dispensary conducted part of this project
[c] Based on the household social survey
[d] Based on interviews with pharmacists conduct as part of a student's MS thesis

The main assumptions for the above estimations are as follows:

- The type of healthcare sought by all patients in Tebbaneh is reflected in the household survey
- The average hospital stay for the treatment of diarrhea is 3 days

As for indirect cost of illness, which corresponds to lost productivity, or the opportunity cost of days missed from work due to sickness, it was estimated at 0.163 million USD, based on the following assumptions:

- Each clinically reported diarrhea case (i.e. only severe cases are usually reported) aged 18-65 misses 4 days from work, for both treatment and recovery, irrespective of the type of healthcare sought
- Diarrhea cases who are members of the labor force work 26 days per month with an average wage of 332 USD/month, or an equivalent of 13 USD/week
- Lost productivity of caregivers was not accounted for since around 84 percent of them are housewives who are mostly not members of the labor force

Accordingly, the total COI for the year 2009 associated with poor drinking water quality within the study area ranged between 0.525 and 1.614 MUS$/year (Table 13).

Table 13. Total Cost of Illness in Tebbaneh for 2009

Cost of illness	*Cost (MUS$/year)*
Direct cost of Illness	0.362 – 1.451
Lost Productivity	0.163
Total	**0.525 – 1.614**

The Averted Behavior Approach

This approach valuates the costs incurred due to behavioral changes adopted in response to environmental damages, which is water pollution in this case. The main aversive behavior noted in the study area involved the purchase of bottled water as a 'clean', alternative water source. According to the social survey, around 26 percent of the households purchase bottled water as the exclusive source of drinking water, whereas 70 percent of the households reported resorting to bottled water either during sickness or whenever water quality is perceived as polluted. The rate of bottled water consumption was also estimated from the social survey to range from a minimum of 0.58 L/capita/day where bottled water is purchased during the winter season and used only for drinking purposes, to a maximum of 1.52 L/capita/day where bottled water is purchased during summer and used for both drinking and cooking (Table 14).

Table 14. Average bottled water consumption by use and season of the year

Use	*Water consumption (L/capita/day)*	
	Summer	*Winter*
Drinking	0.78	0.58
Cooking	0.74	0.64
Total	1.52	1.22

Given that the cost of bottled water in Tebbaneh ranges between 0.07 and 0.67 USD/Liter, depending on the brand and the volume of the containers, the annual cost of purchasing bottled water by the Tebbaneh population is estimated to range between 0.11 and 7.23 Million USD.

The Disability Adjusted Life Years (DALY) approach

Cost-of-Illness studies do not account for pain and suffering or the value of lost leisure time. Measuring the burden of water-related illnesses, more specifically diarrhea, through the adoption of the Disability Adjusted Life Years (DALY) approach compensates for this inaccuracy. Thus, based on an average duration of 4 days per diarrhea case and a severity weight of 0.11 (Murray and Lopez, 1996), the total number of DALYs lost because of pain and discomfort resulting from diarrhea is estimated at 10.4. For a GDP of 8,175 USD/capita (World Bank, 2011), the estimated cost of years lost due to disability caused by diarrhea is 85,020 USD (number of DALYs $\times$ per capita GDP). Furthermore, in the absence of specific estimates for Tebbaneh, an adjusted GDP of 3,984 USD/capita was used, based on the minimum wage of 332 USD per month. Accordingly, the estimated cost of years lost due to disability caused by diarrhea, using the adjusted GDP, amounted to 41,434 USD.

Based on the above estimations, the yearly total cost of morbidity resulting from diarrhea ranged between 0.72 and 8.93 million USD using the national GDP (Table 5), which constitutes 0.3 to 3.9 percent of the GDP in the Tebbaneh area for the year 2009. Using the adjusted GDP, the yearly total cost of morbidity resulting from diarrhea ranged between 0.68 and 8.88 million USD, thus constituting 0.6 to 8.0 percent of the GDP in the Tebbaneh area for the year 2009.

Table 15. Summary of estimated damage cost from morbidity associated with inadequate water, sanitation and hygiene (base year 2009)

Parameter	*Value*	*Value using adjusted GDP*
Number of cases considered	9,197	9,197
Cost of illness (million USD)	0.525-1.614	0.525-1.614
Cost of avertive behavior (million USD)	0.11-7.23	0.11-7.23
Cost of years lost due to disability (million USD)	0.085	0.041
Total morbidity cost (million USD)	**0.72-8.93**	**0.68-8.88**

Mortality valuation

Regarding child mortality associated with diarrhea, and based on data from the Ministry of Health (1996), a CBS/UNICEF report (2001), and estimates from a World Bank study (2004), it is estimated that about 260 children die (10 percent of all child deaths) every year in Lebanon from diarrhea diseases associated with inadequate potable water, sanitation and hygiene, which would result in an average of 6 child deaths per 100,000. The population in the Tebbaneh area is estimated at around 27,800. This would correspond to 2 child deaths associated with sub-standard water quality, sanitation and hygiene. A United Nations Development Program study (UNDP, 1995) reported that in 1990 each child under five is exposed, on average, to 3.5 incidents of diarrhea each year, causing the death of 750 children per year. This would correspond to 17 child deaths per 100,000 or to 5 cases in the Tebbaneh area. Note that the estimated mortality rates are considered as an underestimation since the study area is one of the poorest in the country and is expected to have a child mortality rate that is higher than the national average child mortality rate.

Human Capital Approach

According to the Global Burden of Disease approach (Murray and Lopez, 1996), the WHO (2004) estimated that the death of a child under five represents the loss of 33 DALYs. Thus, the estimated child deaths in the Tebbaneh area represent an annual loss of 66 to 165 DALYs. Using the human capital approach (HCA), if one year of a person's life is lost, society loses, at the very least, the contribution of this person to production, approximated by the the GDP per capita in Lebanon for the year 2009, for income during the ages of 18 to 65 years. One DALY is the equivalent GDP per capita and is assessed at 8,175 USD, using the national GDP, and 3,984 USD, using the adjusted GDP. Thus, the loss of DALYs due to children mortality ranges between 0.54 and 1.35 million USD using the national GDP and between 0.26 and 0.66 million USD, using the adjusted GDP.

Willingness to Pay Approach

While WTP data for Lebanon are not available, WTP estimated in Europe and North America can be applied by adjusting for GDP per capita differentials. The adjusted WTP in Lebanon for mortality risk reduction of adults was estimated at 31,500[1] for the year 2009. Accordingly, the loss of DALYs due to children mortality, based on the willingness to pay

1 The adjusted WTP was reported at 21,000 USD for the year 2004 (World Bank, 2004) and estimated at 31,500 USD for the year 2009, based on an income ratio of 1.5 between the years 2004 and 2009

approach is estimated to range between 2.08 and 5.20 million USD (Table 16). As such, the damage cost due to infant premature mortality, taking both the HCA and WTP approaches into account is estimated to range between 2.62 and 6.55 million USD, using the national GDP, constituting 1 to 2.6 percent of the GDP in the Tebbaneh area for the year 2009. Using the adjusted GDP, the damage cost due to infant premature mortality was estimated to range between 2.34 and 5.86 million USD, constituting 2 to 5.3 percent of the adjusted GDP in the Tebbaneh area for the year 2009.

Table 16. Summary of estimated damage cost from mortality associated with inadequate water and wastewater management (base year 2009)

Parameter	*Value*	
	Using National GDP	*Using adjusted GDP*
MORBIDITY VALUATION		
Cost of illness (million USD)	0.525-1.614	0.525-1.614
Cost of avertive behavior (million USD)	0.11-7.23	0.11-7.23
Cost of years lost due to disability (million USD)	0.085	0.041
Total morbidity cost (million USD)	**0.72 – 8.93**	**0.68 – 8.88**
% GDP		
MORTALITY VALUATION		
Human Capital Approach	0.54-1.35	0.26-0.66
Willingness to Pay Approach	2.08-5.20	2.08-5.20
Total mortality cost (million USD)	**2.62-6.55**	**2.34-5.86**
% GDP	**1.0 – 2.6**	**2.0 – 5.3**
TOTAL VALUATION		
Total mortality cost (million USD)	**3.34 – 15.48**	**3.02 – 14.74**
% GDP	**1.5 – 6.8**	**2.7 – 14.0**

In total, the socio-economic burden incurred by the population in Tebbaneh due to morbidity and mortality resulting from water-related diarrhea, was estimated using the national GDP to range between 3.34 and 15.48 million USD for the year 2009, thus constituting 1.5 to 6.8 percent of the GDP in the project area. Using the adjusted GDP, the socio-economic burden incurred by the population in Tebbaneh was estimated to range between 3.02 and 14.74 million USD for the year 2009, thus constituting 2.73 to 13.97 percent of the GDP in the project area (Table 6).

4.4.3 Non-structural activity: Cost-Benefit Analysis

Given the results of the health valuation, a cost-benefit analysis (CBA) for relevant interventions defined in this project was conducted with the objective of assisting decision-makers and planners in justifying the allocation of investment funds for infrastructure interventions and proper service provision in Tebbaneh.

Costs

Several types of interventions at the building/household level were identified throughout this study to eliminate pollution sources and improve the quality of water at the point of use in Tebbaneh, including (1) the replacement of tanks in the attic with roof top tanks, (2) the installation of new water piping systems, starting from the pump at the basement, to the

roof top tank and to all taps within the household, and (3) the installation of a new wastewater plumbing system. The capital and operation expenditures (CAPEX) of several alternative options for intervention implementation were examined. It was assumed that 20 % of the households in Tebbaneh are in relatively good condition, and will therefore be excluded from all proposed interventions. The total estimated number of households in Tebbaneh amounts to 4,787. The following alternatives were considered:

Alternative 1: The installation of new plastic roof top storage tank in 50 to 80 percent of the households. This range was considered since around 50 percent of the households in Tebbaneh still have tanks in the attic which need replacement. In addition, it was assumed that 60% of the existing roof top tanks are old and unmaintained and require replacement.

Alternative 2: The installation of a new water piping system in 80 percent of the households within Tebbaneh to eliminate the risk of wastewater infiltration into the water pipes and to protect the supplied water from recontamination.

Alternative 3: The installation of a new wastewater plumbing system in 80 percent of the households within Tebbaneh to eliminate the problems of leakages, clogging, and broken pipes and the associated risk of wastewater infiltration into the water piping system or accumulation in basements.

Alternative 4: The implementation of both Scenarios 1 and 2, thus replacing the whole water piping system along with the storage tanks in 50 to 80 percent of the households.

Alternative 5: The implementation of both, Scenario 3 and 4, thus replacing the water and wastewater plumbing systems in 50 to 80 percent of the households.

Table 17 defines the level of capital investment associated with each alternative, which is a function of the parts required and the number of households involved. As for annual operation and maintenance (O&M) costs of these interventions, they were estimated at 10 percent of the capital costs. An annual discount factor of 4 percent was assumed.

Table 17. Summary costs of interventions according to the five scenarios

Scenario	*Description*	*Unit Capital Cost (USD/ Household)*	*Total Capital Cost for Tebbaneh (million USD)*
Alternative 1	New plastic roof top storage tank	500 – 1,000	1.3 – 3.9
Alternative 2	New water piping system	500 – 1,000	1.9 – 3.9
Alternative 3	New wastewater plumbing system	2,000 – 4,000	7.8 – 15.6
Alternative 4	Scenario 1 + Scenario 2	1,000 – 2,000	3.2 – 7.8
Alternative 5	Scenario 3 + Scenario 4	3,000 – 6,000	11.0– 23.4

Benefits

The health valuation in Tebbaneh defined the socio-economic burden incurred by the population in Tebbaneh due to morbidity and mortality resulting from water-related diarrhea. These costs may be translated into potential benefits associated with improved

water supply and sanitation using the averted cost approach. One option would be to consider that by implementing the above mentioned interventions, 100 percent of the estimated socio-economic costs are averted which is the maximum possible benefit that can be incurred. Another option would be to consider the reduction in the prevalence of water-related diseases associated with water and sanitation interventions examined by several studies and summarized in Table 18. Accordingly, considering the upper-bound value of the first approach and the lower-bound value of the second approach, considerable economic benefits are expected to result from improving the quality of the water supply and sanitation, ranging between 0.51 and 14.75 million USD per year.

Table 18. Estimated incurred and averted damage costs associated with inadequate water supply and sanitation in the Tebbaneh area

Impact	*Damage cost/benefit of water pollution and inadequate sanitation*	*Economic benefit from improved water supply and sanitation*		*Potential range of benefits*
	Cost[a] *(million USD)*	*Percent reduction in cases (%)*	*Benefit (million USD)*	*Benefit (million USD)*
Mortality	2.34-5.86	17-30[b]	0.38-1.76	0.38-5.86
Morbidity	0.57-1.66	6-39[c]	0.07-1.29	0.07-1.66
Avertive behavior	0.11-7.23	50-100[d]	0.06-7.23	0.06-7.23
Total	3.02-14.75	-	0.51-10.28	0.51-7.8-14.75

[a] Using the adjusted GDP in the Tebbaneh area, for a population of 27,804
[b] Cairncross *et al*., 2011; Fewtrell, 2007;
[c] Esrey *et al.*, 1991; WHO, 2004; Wakou, 2005
[d] Assumption

CBA

Each of the five alternatives defined above was analyzed for 6 scenarios based on the range of costs and benefits adopted, including (a) minimum cost vs. minimum benefit, (b) minimum cost vs. average benefit, (c) minimum cost vs. maximum benefit, (d) maximum cost vs. minimum benefit, (e) maximum cost vs. average benefit, and (f) maximum cost vs. maximum benefit (Table 19). The results revealed that for Alternatives 1 and 2, which involve the installation of roof top tanks and water pipes independently, a positive return on investment is achieved the same year, when average and maximum benefits are considered. In the case of minimum benefits, positive return on investment is achieved within 2 to 12 years for Alternative 1, and 2 to 18 years for Alternative 2, depending on the costs. Similarly, regarding Alternative 4, which involves installing water tanks and water pipes simultaneously, a positive return on investment is achieved from 0 to 2 years, when average and maximum benefits are considered. However, when considering minimum benefits, positive return on investment will be achieved after 20 years. As for Alternative 3, which includes changing the plumbing system in the buildings, it involves more capital cost than Alternatives 1 and 2. Accordingly, when average and maximum benefits are considered, a positive return on investment is achieved between 0 and 4 yrs. However, when minimum benefits are considered, positive return on investment will be achieved after more than 20

years. As for Alternative 5, which involves implementing all investments simultaneously, it was found to be economically feasible as well when average and maximum benefits are considered, with a positive return on investment achieved within 0 to 6 years. Thus, in summary, for all alternatives, a positive return on investment will be achieved within a maximum of 6 years, when average and maximum benefits are considered. However, when minimum benefits are considered, return on investment for most alternatives will be achieved in more than 20 years.

Table 19. Return on investment for the five alternatives

Scenarios	Return on investment (yrs)					
	(a) Min. cost vs. Min. benefit	(b) Min. cost vs. Avg. benefit	(c) Min. cost vs. Max. benefit	(d) Max. cost vs. Min. benefit	(e) Max. cost vs. Avg. benefit	(f) Max. cost vs. Max. benefit
Alternative 1 *(Roof top tanks)*	3	0	0	12	0	0
Alternative 2 *(Water piping)*	6	0	0	18	0	0
Alternative 3 *(Wastewater plumbing)*	> 20	2	0	> 20	4	0
Alternative 4 *(Roof top tanks & water piping)*	> 20	0	0	> 20	2	0
Alternative 5 *(Roof top tanks, water piping & wastewater plumbing)*	> 20	3	0	> 20	6	3

Figure 20 illustrates the cumulative benefits 10 years from implementing the alternatives, for the various scenarios listed above. A negative cumulative benefit can be noted for most alternatives when a minimum annual benefit of 0.5 million USD is considered. As for the scenarios considering average and maximum monthly benefits, the cumulative benefits in 120 years were estimated to range from 17.5 to 123.1 million USD. The cumulative benefits for Alternatives 1 and 2 are the highest since they entail the least costly investments.

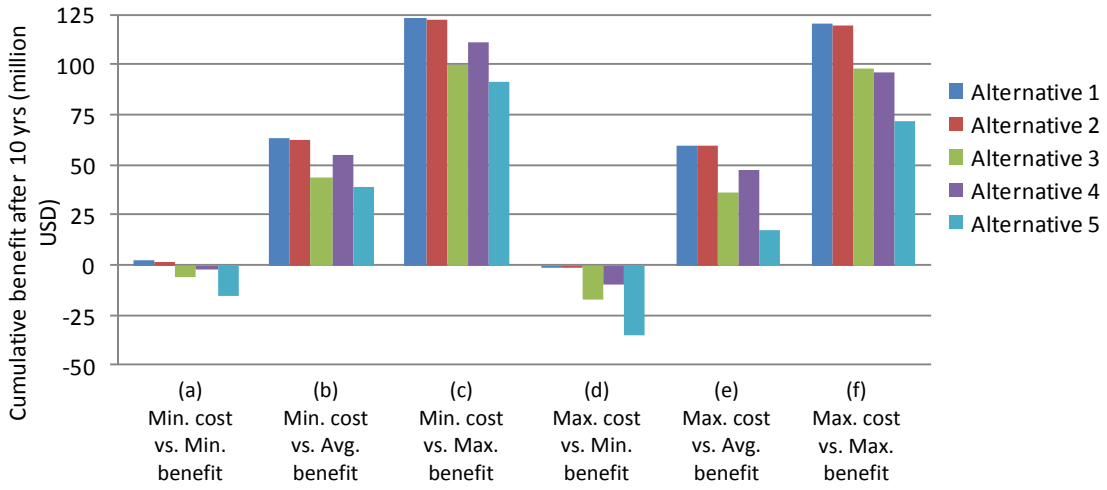


Figure 20. Cumulative benefit after 10 yrs based on CBA for the scenarios under the 5 alternatives

Finally, a reverse approach was used in the CBA, whereby the annual benefit needed to reach a breakeven point 10 years from the implementation of the investment was calculated (Table 20). Accordingly, the estimated annual benefit ranged from 0.2 to 4.61 million USD, which constitute 1.4 to 31.1 percent of the maximum calculated benefit of 14.79 million USD. This is less than the percent range of 17 to 70 percent calculated from ranges of improvement reported in the literature and adapted in Table 18

Table 20. Annual benefit required for a 10 year return on investment

	Scenario 1 *(Roof top tanks)*	Scenario 2 *(Water piping)*	Scenario 3 *(Wastewater plumbing)*	Scenario 4 *(Roof top tanks & water piping)*	Scenario 5 *(Roof top tanks, water piping & wastewater plumbing)*
Capital Cost (MUSD)	1.2-3.9	1.9-3.9	7.8-15.6	3.2-7.8	10.9-23.4
Annual Benefit Required (MUSD)	0.20 - 0.54	0.32 - 1.83	1.25 – 2.54	0.72 - 1.64	2.23 - 4.61
Percent of maximum estimated benefit (%)	1.37 - 3.64	2.164 - 12.35	8.46 - 17.15	4.86 - 11.09	15.05 - 31.15

In conclusion, the implementation of any or all of the proposed investments is economically viable and will result in a positive return on investment with 10 years, at health improvement rates that are conservatively lower than those reported in the literature.

4.5 Sustainable Urban Development Framework

Based on the community surveys and infrastructure mapping coupled with comparative analyses and the pilot interventions monitoring and evaluation, the project's findings were

summarized into a framework that will bring community contribution to urban planning, service provision and local policy making. This framework is intended as a stand alone document that will serve the municipality and/or community organizations as a guide for current and future urban environmental planning specifically in the Tebbaneh region with potential extension to other similar urban areas. Accordingly, the Sustainable Urban Development Framework presented below, was developed to begin with a background section that provides a brief overview of the Tebbaneh slum and the completed study. It then highlights the main environmental problems and needs of the area, followed by action plans that the municipality or other organizations can implement or seek funding for from the central government or donor agencies, to improve the existing situation and alleviate the burden on this poor urban slum.

Sustainable Urban Development Framework

Background

The Tebbaneh area, a disadvantaged urban slum located in the suburbs of the city of Tripoli, North Lebanon, is deemed amid the poorest and most deprived areas in the country. Back in the 1940's, Tebbaneh was known as the trade center between Lebanon and Syria, whereby commercial activities, especially fruits and vegetables trade, were carried out. As a result, the Tebbaneh was referred to as "The Door of Gold", and attracted merchants and rich families for work and residence. Buildings with ancient architectural aspects were constructed and are still testimony of a flourishing past, albeit witnessing severe degradation. Evidently, the situation in Tebbaneh has changed dramatically. The flooding of Abou Ali River in 1955 was the turning point that transformed Tebbaneh into a slum. Furthermore, the civil war (1975-1990), followed by the current unstable political situation contributed to the spread of chaos and deprivation in the area. Tebbaneh today is overcrowded, with a population density reaching 10 times that of any other urban area in the country. Its population is continuously growing within a non-organized urban fabric characterized by small narrow streets and old and deteriorating dwellings, especially in the region surrounding the vegetables market. Table 21 shows selected demographic and socio-economic characteristics of Tebbaneh.

Table 21. General Characteristics of Tebbaneh

Characteristic	*Magnitude*
Overall population (capita)	27,804
Overall area (m^2)	400,000
Population density (capita per Km^2)	69,510
Average family size (capita)	6
Average monthly income (USD)	130
Unemployment rate	12%

A three-year study (2008-2011), funded by the International Development Research Center (IDRC) and implemented by the American University of Beirut (AUB) in coordination with the Municipality of Tripoli and local NGOs, defined priority water and sanitation needs in the region with corresponding social, economic, and cultural barriers contributing to environmental degradation that exacerbates poverty. Pilot interventions were developed and implemented with the participation of the community and formed the basis of a Sustainable Urban Development Framework, highlighting the needs for continuous improvement in Tebbaneh.

Problems and Needs

Several environmental problems were noted in the Tebbaneh region, including inadequate quality water supply, incomplete wastewater infrastructure, excessive solid waste littering, and poor hygiene. At the urban level, a new wastewater network was recently installed in Tebbaneh with connections to most households. While the network has improved sanitation in the area, problems are still commonly encountered, mainly wastewater flooding on streets. Consultations with local NGOs indicated that the main factor hindering the adequate operation of the wastewater network was land ownership, whereby the Municipality at various locations was prevented from completing the connection to some buildings due to the presence of private lands and its inability to excavate in them. At the building level, the main problem encountered is deteriorated plumbing systems (leakages, clogging, broken pipes) and wastewater accumulation in building basements, thus creating foul odors and attracting insects and rodents that promote the spread of diseases.

Similarly, while a new water distribution network has been installed, it remains non-operational because associated appurtenances including water meters and cabinets were vandalized. Accordingly, old worn out and corroded pipes, situated below the new wastewater network continue to be used. The existing water network conveys water at relatively low pressure from three main sources, namely Hab Spring, Rasheen Spring, and Al Mallouli Well. While water from the springs is treated by filtration and chlorination before distribution, water from the Al Mallouli Well is chlorinated as it is pumped into the network, not allowing for adequate contact time for effective disinfection. Water quality monitoring in the Tebbaneh revealed that water supplied to the Tebbaneh area is of relatively acceptable quality, with few pollution incidences. However, this water gets contaminated within the deteriorated distribution network. The most evident instances of pollution are noted immediately following power cutoffs, which occur on a daily basis, when negative pressure in the network allows the seepage of wastewater into the corroded water pipes. Negative pressure is exacerbated by the presence of individual water pumps for every single household at building entrances to pump water to household storage tanks, located either in the attic (45% of tanks) or on roof tops. Most storage tanks are old, corroded, and not covered. Uncovered attic storage tanks, which are usually located below toilet plumbing systems of upper floors, and deteriorated water pipes within the building, are at an increased risk of water contamination from leaking wastewater pipes.

The quality of groundwater was generally found to be poor and unsafe for domestic usage, due to elevated levels of coliform, originating from wastewater contamination. Fortunately, reliance on groundwater is minimal. In addition, around 26 percent of Tebbaneh households supplement their network source with bottled water. Many residents mentioned buying bottled water when the network water seems turbid and when a member of the household is ill. However, water quality analysis of commonly consumed bottled water brands (unlicensed) in Tebbaneh revealed that 24 percent of the analyzed samples were polluted with Total Coliform and were not suitable for drinking.

Finally, poor hygiene at the household level and excessive solid waste littering at the building and slum level, exacerbate an already difficult situation. Lack of awareness and low education levels coupled with poverty are at the core of a negligent and indifferent social behavior.

Sustainable Urban Development Framework

Sub-standard water quality, sanitation and hygiene in the Tebbaneh area were associated with an elevated annual incidence of diarrhea, estimated at 33.1 percent for the year 2009, amounting to a total of 9,197 cases, with around 32 percent of the cases impacting children 5 years of age or less with suspected two diarrhea-related child deaths per year. This incidence rate more than six fold the national annual incidence of diarrhea of 6 percent (IPSOS, 2004), but is comparable with heavily populated poor urban areas in China and India, where waterborne diarrheal incidence rates were estimated at around 35 and 57 percent, respectively (World Bank, 2007; Jadhav et al., 2011). Increased morbidity and mortality impose a socio-economic burden on the population in Tebbaneh, estimated to range between 2.93 and 14.79 million USD for the year 2009, thus constituting 1.3 to 6.5 percent of the GDP in the project area and emphasize the need to adopt a sustainable urban development framework with a clear action plan to improve the existing situation and alleviate the burden on an already impoverished urban slum. The framework encompasses social and physical interventions at the slum level and at the building/household level as outlined below. While the implementation of individual interventions is helpful, the realization of the framework in a holistic manner is expected to maximize its anticipated benefits.

1. At the Tebbaneh level:

Water distribution through the old network should be discontinued as soon as possible. Missing appurtenances should be provided and reinstalled. The new water distribution network should be put into operation, whereby water would be supplied at adequate pressure, eliminating the need for individual pumps in building basements and minimizing the risk of wastewater contamination within the network. The quality of the supplied water needs to be monitored on a regular basis. These activities fall under the jurisdiction of the North Lebanon Water Establishment (NLWE) in coordination with the municipality.

In the case where the new water network cannot be discontinued, it is suggested to eliminate the individual household pumps and install a common compartmentalized water reservoir at the building basement to serve all households within the building. As such, the incoming water for the entire building will be collected in a common reservoir at ground level. Water can then be pumped to the roof-top into individual storage tanks. The installation of such a reservoir requires space at building basement, the consent of the building owner, and approval and proper management by the NLWE and the municipality.

The Al Mallouli Well that is used as a complementary water source for Tebbaneh must be appropriately managed. Well water must be properly treated before supply. This requires the installation of a disinfection tank where water is chlorinated before supply, to ensure adequate chlorine contact time. This activity falls under the jurisdiction of the NLWE.

The private wells scattered around Tebbaneh with no water quality monitoring must be closed, as they are contaminated and represent a serious threat to public health. The NLWE must be able to provide network water to these households as an alternative. This activity should be undertaken in close coordination between the Municipality and the NLWE.

The vending of bottled water in the Tebbaneh area should be controlled by the Municipality of Tripoli. The quality of bottled water brands that are not licensed by the Ministry of Public Health should be continuously monitored by the Municipality of Tripoli and contaminated brands should be banned. A more radical alternative would be the banning of all unlicensed brands as long as an alternative clean source is made available at a reasonable cost.

2. Interventions at the building/household level:

Besides the necessity for interventions at the slum level, which can reduce the risks of pollution at source and during distribution, other interventions are needed in order to minimize risks of water recontamination at the point of use, namely at the building and household levels. These interventions are outlined below by order of priority.

All water storage tanks located in attics should be disconnected and replaced by more hygienic plastic tanks installed on building roof tops. These roof top tanks need to be regularly cleaned and maintained, as well as tightly locked to ensure that the stored water remains protected from irresponsible users who frequent rooftops particularly during the summer. This intervention requires the consent of the household tenant only and may be easily implemented with minimal funding.

A new water piping system needs to be installed in many households within Tebbaneh to eliminate the risk of wastewater infiltration into the water pipes and to protect the supplied

water from recontamination. This intervention requires the consent of the household tenant only and may be easily implemented at a reasonable cost.

A new wastewater plumbing system also needs to be installed in many households within Tebbaneh to eliminate the problems of leakages, clogging, and broken pipes and the associated risk of wastewater infiltration into the water piping system or accumulation in basements. This intervention may require the consent of the household tenant and owner and may be implemented, with some short-term inconvenience to tenants, if funding is available.

3. Awareness and Education:

Intensive and continuous awareness campaigns should be conducted year round to target primarily women and housewives in Tebbaneh, by teaching them basic principles of safe food handling practices, hygiene rituals at households, and sound water usage. Campaigns should focus on simple, practical, and inexpensive techniques that could be easily and sustainably applied by housewives. For instance, women can be shown the basic techniques of food storage, fruits and vegetables washing, domestic cleaning activities using detergents and disinfectants, as well as proper disposal of solid waste. In addition, awareness campaigns should be conducted to sensitize Tebbaneh residents towards civic responsibilities and environmental liabilities such as respecting public property, keeping houses and neighborhoods clean, and informing responsible authorities whenever water or wastewater problems occur. There are several active NGOs in Tebbaneh, with many focusing on women issues that could undertake these campaigns in coordination with the Municipality.

For longer term impact interventions, the younger generation must be targeted through school education starting at the primary level. Topics related to personal hygiene, littering, and environmental protection should be at the core of the educational program. Such involvement at the school level constitutes the main hope for a future conscious generation with a sense of responsibility towards their community.

4. Management and policy approaches:

The authority for managing water supply in Tebbaneh is the NLWE. It is responsible for water treatment and distribution in addition to planning and quality control. The municipality is responsible for managing and maintaining the wastewater network. Therefore, coordination between the two authorities is essential for proper planning and design of water and sanitation activities. A clear division of tasks and distribution of responsibilities are needed to ensure practicality of intervention and sustainability of works.

Many buildings in Tebbaneh are experiencing serious aging and deterioration and are mostly occupied by tenants. The problem of property ownership as well as illegal settlements need to be addressed through fair tenure regulations that keep rights reserved and allow more flexibility in the implementation of proposed interventions, while ensuring that the poor and disadvantaged are protected.

Table 2 presents a summary matrix of the Sustainable Urban Development Framework. This framework favors a hybrid approach that merges “bottom-up” and “top-down” styles for managing environmental problems in Tebbaneh. It sheds the light on the necessity to involve the public in decision-making and action through active community participation targeting the elaboration of a general platform for needed environmental improvements. Accordingly, local residents are to be engaged along with formal authorities in special committees in order to

address and discuss current environmental problems and possible solutions, and to incorporate public needs and values into the planning process. When the dialogue between all stakeholders is adequately pursued, the proposed plan will be capable of integrating community, policy, and management, aiming at promoting the prosperity of people and their environment. It will defeat all bureaucratic and political boundaries by calling for management agreements and public engagement.

The priority level defined in Table 22 for the activities proposed within this framework was determined based on the need to minimize negative health impacts incurred within the community. Accordingly, four indicators were used to prioritize each activity, namely:

1. Urgency of the intervention
2. Extent (in terms of population) of positive impacts expected from the intervention
3. Timeliness of the positive impacts expected from the intervention
4. Magnitude of constraints associated with implementation (the lower the magnitude of constraints, the higher the score), such as consent of building owners, space availability, inconvenience to tenants, governmental bureaucracy, political will, etc.

These indicators were considered to be of equal importance and each activity was allocated a score ranging between 1 and 3 for each indicator, as illustrated in Table 23. The priority of each activity was then assigned based on the total score, whereby:

- an activity scoring between 9 and 12 was deemed of high priority
- an activity scoring between 5 and 8 was deemed of medium priority
- an activity scoring between 1 and 4 was deemed of low priority

Table 22. Sustainable Urban Development Framework Implementation Matrix

Activity		*Priority*	*Responsibility*	*Target*	*Timeline*	*Budget/ Funding*	*Constraints*
At Tebbaneh level	Launching of the new water distribution network	High	▪ NLWE ▪ Municipality	▪ Elimination of pollution risk during distribution ▪ Water supply at adequate pressure ▪ Elimination of the need for individual water pumps	Urgent	2,000 USD / building	▪ Bureaucratic requirements ▪ Protection of public appurtenance
	Installation of compartmentalized water reservoirs	Low	▪ NLWE ▪ Municipality	▪ Elimination of individual water pumps ▪ Decrease of risk of negative pressure in the water network	6 months	3,000 USD / building	▪ Space needed at building basement ▪ Consent of building owner ▪ Approval of NLWE
	Appropriate management of Al Mallouli well	High	▪ NLWE	▪ Provision of quality water with adequate residual chlorine ▪ Elimination of risk of pollution at source	Continuous	5,000 USD for installation	▪ Space availability
	Closure of private wells particularly the mosque well	High	▪ NLWE ▪ Municipality	▪ Control and provision of quality water to few affected households	Urgent	10,000 USD	▪ Connection of few households to the public water network
	Control of bottled water vending	High	▪ Municipality	▪ Assurance of safe drinking water	Continuous	NA[2]	▪ Regular market control
At household /building level	Replacement of water storage tanks on attics by plastic tanks on roof tops	High	▪ Residents	▪ Elimination of pollution risk at point of use	6 months to 1 year	500USD - 1,000USD / household	▪ Consent of household tenant ▪ Regular cleaning and maintenance
	Installment of new water piping systems	Medium	▪ Tenants	▪ Elimination of pollution risk at point of use	1.5 years to 2 years	500USD – 1,000USD / household	▪ Consent of household tenant

[2] Not Applicable

Activity		*Priority*	*Responsibility*	*Target*	*Timeline*	*Budget/ Funding*	*Constraints*
	Installment of new wastewater plumbing systems	Medium	▪ Tenants ▪ Building owner	▪ Elimination of risk of wastewater infiltration and accumulation in basements	2 years	2,000USD-4,000USD / household	▪ Consent of household tenant and owner ▪ Short-term inconvenience to tenant
Awareness and Education	Provision of continuous and intensive awareness campaigns	High	▪ Local NGOs ▪ Municipality	▪ Sensitization of residents towards hygiene principles, environmental liabilities and civic responsibilities	Continuous	500,000USD	▪ Provision of incentives for regular attendance
	Introduction of hygiene and environment related topics into educational programs	High	▪ Local schools	▪ Creation of conscious generation responsible towards the community	Continuous	NA	▪ Availability of knowledgeable educational staff
Management and Policy	Coordination between concerned authorities in water and wastewater	Medium	▪ NLWE ▪ Municipality	▪ Proper planning and design of water and sanitation activities	Continuous	NA	▪ Coping with administrative routine
	Implementation of fair tenure regulations	Medium	▪ Parliament	▪ Flexible implementation of proposed interventions	Varying[3]	NA	▪ Political coordination, harmonization and acceptability

[3] Depending on the political atmosphere in the country

Table 23. Matrix of priorities

Activity	*Indicators*				*Score*	*Priority*
	Urgency of intervention	*Extent of impacts*	*Timeliness of impacts*	*Constraints*		
Launching of the new water distribution network	3	3	3	2	11	High
Installation of compartmentalized water reservoirs	1	1	1	1	4	Low
Appropriate management of Al Mallouli well	3	2	3	2	10	High
Closure of private wells particularly the mosque well	3	2	3	2	10	High
Control of bottled water vending	2	3	2	2	9	High
Replacement of water storage tanks on attics by plastic tanks on roof tops	3	2	2	3	10	High
Installation of new water piping systems	2	2	2	2	8	Medium
Installment of new wastewater plumbing systems	2	2	2	2	8	Medium
Provision of continuous and intensive awareness campaigns	3	2	2	2	9	High
Introduction of hygiene and environment related topics into educational programs	3	2	2	2	9	High
Coordination between concerned authorities in water and wastewater	2	1	1	2	6	Medium
Implementation of fair tenure regulations	2	3	1	1	7	Medium

Ultimately, such a mechanism will enhance a two-way engagement towards sustainable environmental management under a policy frame that fits all parties. It will involve stakeholders starting from the household resident, local community, Non Governmental Organizations (NGOs), the Municipality of Tripoli under the Ministry of Interior and Municipalities (MoIM), the North Lebanon Water Establishment (NLWE) under the Ministry of Energy and Water (MoEW), as well as other concerned ministries such as the Ministry of Public Health (MoPH), and the Ministry of Education and Higher Education (MoEHE). At the higher level, the Council for Development and Reconstruction will be involved in master planning, funding management, and implementation, while the Lebanese Parliament and the Council of Ministers will be involved in legislation. Figure 21 depicts the roles of and linkages between all involved stakeholders in the implementation of the proposed Sustainable Urban Development Framework.

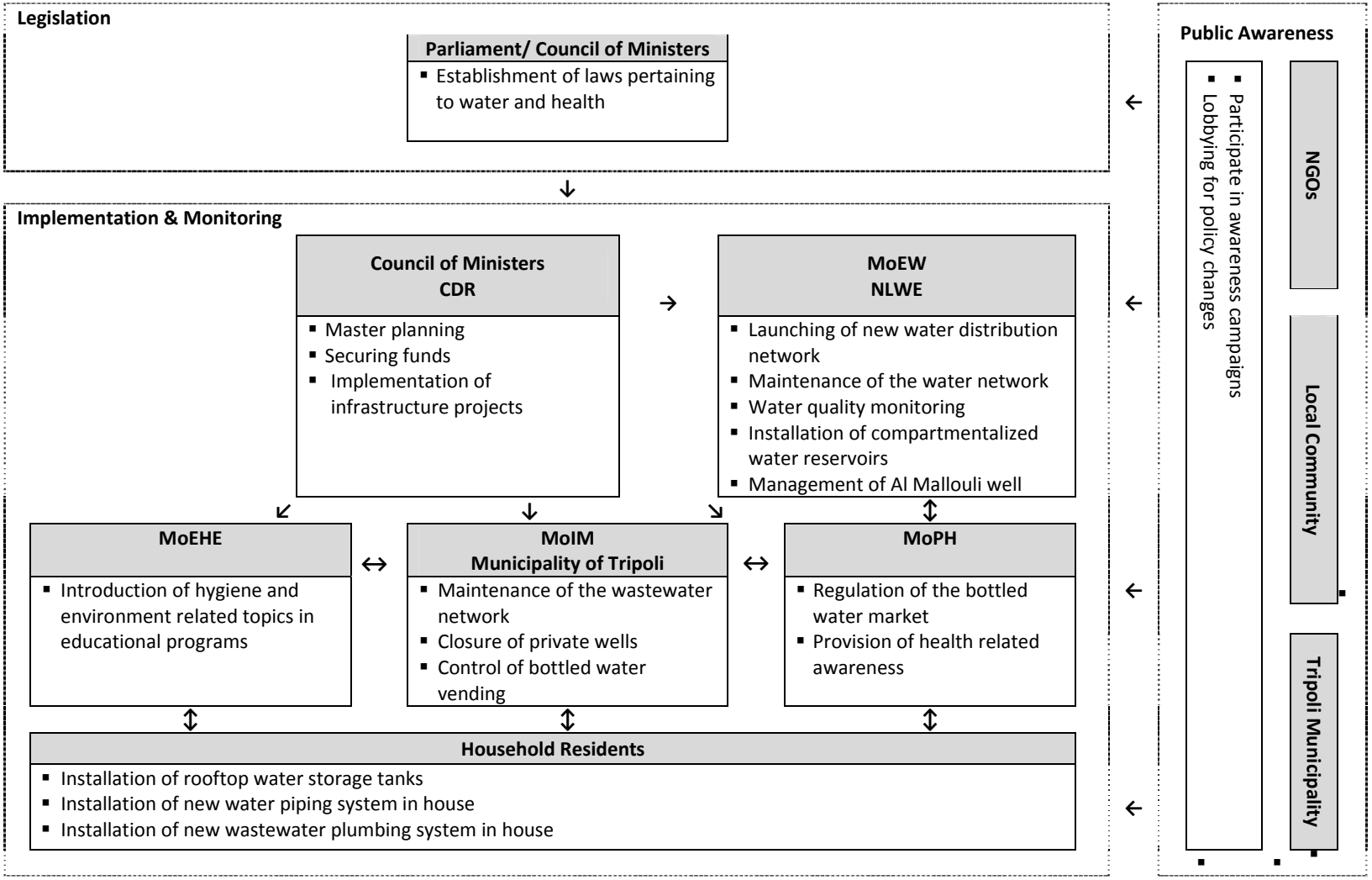


Figure 21. Institutional set-up for the implementation of the proposed framework

4.6 Activities timeline

Throughout the project duration, several constraints delayed project implementation. For instance, in Irbid, there was a delay in survey administration due to the Holy Month of Ramadan as well as a delay in reporting due to commitments of the team at the beginning of the academic year. In Lebanon, the inception of the project as well as all other activities were delayed due to continuous social unrest in Tebbaneh area, where the situation is fragile, and where incidences fueled by political tensions occur continuously. Table 24 outlines the duration of the project activities.

Table 24. Schedule of activities and deliverables

Project year	1						2						3						4		
Year month	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6
Task/activity — Cumulative project month	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
Establishing a comparative framework																					
– Community Consultation including																					
– Field surveys including																					
Needs Assessment Validation and Prioritization																					
– Comprehensive and targeted field surveys																					
– Definition of infrastructure support systems																					
– Community and capacity building needs, priorities, and expectations																					
Infrastructure Mapping and GIS Development																					
– GIS spatial analysis																					
Pilot Interventions: Definition and Implementation																					
– Water, sanitation, drainage and wastewater infrastructure for pilot																					
– Cost-benefit analysis of potential interventions																					
Generating a sustainable urban development framework																					
– Monitoring and evaluation of pilot interventions on improved service provision																					
– Development of Sustainable Urban Development Framework																					
Dissemination																					
– Reporting																					
– Workshops/meetings																					
– Conferences																					

5. PROJECT OUTPUTS

Project activities resulted in various outputs that are of significance at the research, capacity building, and policy and practice levels. At the research level, the main outputs include:

- A social household survey in Irbid (Annasr) area in Jordan (Annex 1) and in Tebbaneh (Tripoli) area in Lebanon (Annex 8)
- A clinical (Hospital and Dispensary) survey in Tripoli (Tebbaneh) area in Lebanon (Annex 11)
- GIS-based zoning and GIS spatial analysis in Tripoli (Tebbaneh) area in Lebanon (Annex 12)
- Water quality monitoring program at the
  Network and household levels in Tripoli (Tebbaneh) area in Lebanon
  Bottled water in Irbid (Annasr) area and in Tripoli (Tebbaneh) area
- Pilot interventions in Tripoli (Tebbaneh) area, which included the installation of new water tanks at roof tops for households in 19 buildings (Annex 17) and the installation of new household water piping systems in 4 households (Annex 18)
- Performance assessment of pilot interventions through a water quality monitoring program
- A master presentation (in English (Annex 20) and Arabic (Annex 5 and Annex 15)) of the overall project that has been developed and is being updated periodically and has been used in all workshops and meetings with the community and stakeholders as well as appraisal missions with IDRC
- Dissemination activities including conferences, workshops, and journal papers are continuing and will extend beyond the project duration

In fact, currently, four papers are being prepared:

1. A comparative assessment of socio-economic characteristics and environmental services provision in two poor suburban areas as a driver for improving environmental services
2. Public perception and economic assessment of bottled water consumption in poor suburban areas
3. Water qualtity assessment and social challenges in poor suburban areas: The case of Tebbaneh, Lebanon
4. Cost benefit Analysis of improving water supply and sanitation in poor suburban areas including the damage cost of waterborne illnesses

Potential peer reviewed journals that are under consideration to publish the papers include:

- Science of the Total Environment
- Journal of Environmental Management
- Environment and Urbanization
- Environmental Management
- Environmental Monitoring and Assessment
- Urban Water Journal
- Management of Environmental Quality: An International Journal

At the capacity level, ouputs include:

- Training of 4 field surveyors in Irbid and 5 in Tripoli on questionnaire administration
- Training of 6 graduate students on water quality monitoring in a poor urban slum
- Awareness of women in the households where the interventions were implemented regarding water quality and the potential sources of pollution within the households
- Training of 3 graduate students on ways to approach and alleviate environmental problems in poor communities like the Tebbaneh region. These students worked tangentially on the project while researching their own thesis topics, which include:

  - Abdel Nabi, H. 2010. *Public Perception and Economic Assessment of Bottled Water Consumption in Poor Suburban Areas.* Masters Thesis Project. Interfaculty Graduate Environmental Sciences Program. American University of Beirut. Beirut, Lebanon.
  - Mawla, D. *Drinking Water Quality and Socio-economics of Waterborne Diarrhea in Poor Suburban Areas*. Masters Thesis. Interfaculty Graduate Environmental Sciences Program. American University of Beirut. Beirut, Lebanon. *Expected in February 2012.*
  - Alameddine, M. *Performance Assessment and Cost-Benefit Analysis of Drinking Water Pollution Mitigation Interventions in Poor Suburban Areas*. Masters Thesis. Interfaculty Graduate Environmental Sciences Program. American University of Beirut. Beirut, Lebanon. *Expected in June 2012.*

At the policy and practice level, ouputs include:

- A Sustainable Urban Development Framework translated to Arabic to be used by community and governmental organizations (Annex 21).
- The establishment of good relationships based on trust and close coordination between researchers at AUB and the North Lebanon Water Establishment in monitoring the quality of the water supplied in the public network and identifying sources of pollution and remediation actions. Additional work is being coordinated with the Establishment beyond the scope of the project.
- A pitch to a panel of journalists at the Dragon's Den panel at the World Conference of Science Journalists in June 2011 (Annex 22).

6. PROJECT OUTCOMES

The project, through lessons learned from An Nasr in Irbid, Jordan, that has similar societal and demographic characteristics coupled with the field surveys and participation of the local community and NGOs in conjunction with the local public sector represented by the municipality in conjunction with consultation with the North Lebanon Water Establishment, was able to identify the major environmental burdens in the Tebbaneh region in Tripoli, Lebanon, to implement relatively effective pilot interventions, and develop a framework for sustainable environmental development. Accordingly, the main outcomes of the project include:

a. A better understanding and documentation of inter-linkages between water, sanitation, and housing problems, and poverty exacerbation in the Tebbaneh region:

- Definition of causes-impacts of service provision and housing problems on environmental degradation and correlation to poverty aggravation, whereby the significance of poor water quality was investigated, the various sources of pollution within the network and within the housing units were identified and their health-based socio-economic impact through water-related morbidity and mortality was assessed.
- Determination of the individual housing units that require rehabilitation of environmental infrastructure, such as houses with tanks in attics and with deteriorating water piping and wastewater plumbing systems,
- Identification of zones where environmental burdens are weighing most heavily, namely the vegetable market zone, where housing conditions are the worst and where problems in environmental quality occur most frequently.
- Identification of stakeholders and creation of a platform for dialogue to ensure efficient problem diagnosis and participatory intervention practices, whereby the municipality and local NGOs as well as the North Lebanon Water Establishement were periodically consulted since the initiation of the project and were directly involved in the project activities.

b. Implementation of pilot interventions to solve water, sanitation, and housing problems:

- Alleviation of environmental degradation towards improved public health through better provision of environmental services and infrastructure, including the installation of new roof top tanks and new water piping systems within buildings.
- Increased awareness among local stakeholders, including marginalized groups, of the nature of environmental degradation and existing means for their prevention and/or remediation.
- Increased capacity of local stakeholders to participate in environmental management by training selected personnel in survey research, and water quality management and monitoring.
- Evaluation of the usefulness of the involvement of the local community in implementation of service rehabilitation interventions, whereby NGO representatives who accompanied the AUB team increased acceptance of the residents to the project team and enhanced their collaboration in identifying and implementing the interventions.
- Diagnosis of policy gaps and institutional weaknesses potentially hindering on-the ground progress in environmental management and urban development projects, and threatening the sustainability of solutions. Identified gaps were related mainly to land tenure, tenancy, bottled water vending, etc. and institutional weaknesses were mainly evident in drinking water quality and sanitation monitoring and management.

c. Definition of a sustainable environmental development framework to be integrated in strategic planning, policies and practices entrenched in scientific findings:

- Increased integration of local perspectives (poor housing conditions) in planning and policy formulation
- Increased influence of voices of marginalized social/gender groups
- Increased capacity of local government to plan efficient intervention
- Scaling-up of lessons learned from successful interventions through integration in local urban planning and practices

The adopted research design and methods were effective in helping the project identify interlinkages between water, sanitation, and housing problems and associated socio-economic burden directly linked to poverty exacerbation. The addition of the water quality assessment and monitoring component allowed a targeted examination of water quality problems in a poor urban slum like Tebbaneh.

7. OVERALL ASSESSMENT AND RECOMMENDATIONS

The project was able to successfully meet its objectives and shed light on the interlinkages between water, sanitation, and environmental services and poverty exacerbation in the poor urban slum of Tebbaneh and identify and implement soft and physical interventions to improve the situation there. The comparative assessment with An-Nasr area, another urban slum in Irbid, Jordan, where environmental services were improved, was beneficial in highlighting the deficiencies in the water supply system in Tebbaneh, as well as the importance of the education of housewives.

In terms of development, the project emphasized the significant impact of housing conditions on the quality of environmental services. It showed that the presence of a water supply network and a wastewater collection network are not adequate to ensure acceptable water supply and sanitation. The water piping and wastewater plumbing systems within buildings have shown to be major sources of water pollution that contribute to negative impacts on the health and the socio-economics of residents. The project identified and implemented physical interventions that are relatively simple that improved the quality of the water at the user level and equally raised awareness of residents regarding sources of pollution within their buildings emphasizing their responsibilities and differentiating them from the public water provider who is not the only party to be blamed. However, what is at stake now is project continuity and the ability of the Municipality and/or community organizations to secure a funding mechanism to implement interventions at a larger scale to achieve long term water quality sustainability.

A major lesson that can be derived for improving future projects is that when environmental services are provided in a poor urban slum, even if these services are not proper, the project should focus initially on housing conditions and sources of pollution within buildings/households. These can often be rectified with minimum institutional and financial constraints and can have good positive impacts. Another lesson is related to water quality monitoring in a poor urban slum whereby a program is deigned to capture peculiarities of the water supply system at both the network and the building-household levels to better understand the non-conventional sources of water pollution.

Given the resources, the project played a beneficial role in highlighting problems and needs in the Tebbaneh region and developing a Sustainable Urban Development Framework, a comprehensive approach to address these problems at various levels. Adpoting this Framework through committed local stakeholders is paramount to obtaining funding for its implementation.

In closure it should be recognized that to date, the politically fragile situation in the project area allowed for limited dissemination of project findings to raise awareness with respect to sources of pollution and hygiene practices at the building/household levels. Efforts in this context will continue after the project duration through various outlets locally and beyond.

8. REFERENCES

APHA (American Public Health Association), AWWA (American Water Works and Protection Association) and Water Environment Federation (WEF), 2005. *Standard Methods for the Examination of Water and Wastewater,* 21st edition, Washington, D.C.

Cairncross, S. Hunt, C. Boisson, S. Bostoen, K. Curtis, V. Fung, I. Schmidt, W-P. 2010. Water, sanitation and hygiene for the prevention of diarrhea. *International Journal of Epidemiology*, 39, 193-205. Online. Available: http://www.hygienecentral.org.uk/pdf/CHERG%20in%20IJE.pdf

CBS/UNICEF. 2001. *Preliminary Report on the Multiple Cluster Survey on the Situation of Children in Lebanon.*

Esrey, S.A., Potash, J.B., Roberst, L., and Shiff, C. (1991). Effects of improved water supply and sanitation on ascariasis, diarrhea, dracunculiasis, hookworm infection, schistosomiasis and trachoma. *Bulletin of the World Health Organization*, 69 (5), 609-621.

Fewtrell, L., Prüss-Üstün, A., Bos, R., Gore, F., and Bartram, J. 2007. Water, sanitation and hygiene: Quantifying the health impact at national and local levels in countries with incomplete water supply and sanitation coverage. *Environmental Burden of Disease Series*, No. 15. World Health Organization, Geneva.

IPSOS. 2004. Enquette sur la quality du service d'eau au liban. Beirut, Lebanon.

Jadhav, J. Ravish, A.S., and Gopinath, D. 2011 A Study of Socio-Cultural Factors, Water Quality And Diarrhea In Bangalore The Internet Journal of Public Health, 1(1).

Murray, J., and A. Lopez. 1996. *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020*. Harvard University Press.

UNDP (United Nations Development Program). 1995. Online. Available: http://www.undp.org.lb/programme/governance/advocacy/hdr97/chp31.pdf.

Wakou, B. 2005. An examination of the combined effects of maternal characteristics, environment and treatment programs on the prevalence of diarrhea amongst infants and children in Uganda. *Population Preview,* 44(2), 50-62.

Wilkinson, P. 2009. *Environmental Epidemiology*. Maidenhead, Berkshire, England. Open University Press.

World Bank 2004. Cost of Environmental Degradation: The Case of Lebanon and Tunisia. Environmental Economics Series. Paper No. 97, prepared by Sarraf, M., Larsen, B., and Owaygen, M.

World Bank. 2007. Cost of Pollution In China - Economic Estimates of Physical Damages. Washington DC.

World Bank. 2011. Online. Available: http://data.worldbank.org/country/lebanon

WHO (World Health Organization), 2004. *Water, Sanitation and Hygiene Links to Health: Facts and Figures*. Online. Available: http://www.who.int/water_sanitation_health/en/factsfigures04.pdf

ANNEXES

Annex 1.
Irbid Field Questionnaire

Participatory Improvement of Water and Sanitation Services in Tripoli through a Comparative Analysis in Irbid, Jordan

Questionnaire Identification					
AI1	**Country**		AI5	**Housing unit number**	|___|___|___|___|
AI2	**Neighbourhood**	|___|___|			
AI3	**Building**	|___|___|___|			|___|___|___|___|
AI4	**Floor**	|___|___|			
Schedule					
AV1	First Visit	DD-MM |___|___|-|___|___|	AT1	Start of interview (time)	hh-mm |___|___|-|___|___|
			AT2	End of Interview (time)	hh-mm |___|___|-|___|___|
AV2	Second Visit	DD-MM |___|___|-|___|___|	AT3	Start of interview	hh-mm |___|___|-|___|___|
			AT4	End of Interview	hh-mm |___|___|-|___|___|
AV3	Third Visit	DD-MM |___|___|-|___|___|	AT5	Start of interview	hh-mm |___|___|-|___|___|
			AT6	End of Interview	hh-mm |___|___|-|___|___|
AV4	Fourth Visit	DD-MM |___|___|-|___|___|	AT7	Start of interview	hh-mm |___|___|-|___|___|
			AT8	End of Interview	hh-mm |___|___|-|___|___|
AV5	Fifth Visit	DD-MM |___|___|-|___|___|	AT9	Start of interview	hh-mm |___|___|-|___|___|
			AT10	End of Interview	hh-mm |___|___|-|___|___|
AV6	**Total visits carried out**				|___|
AV7	**Editing Date**			DD-MM	|___|___|-|___|___|
AV8	**Coding Date**			DD-MM	|___|___|-|___|___|
AV9	**Data entry Date**			DD-MM	|___|___|-|___|___|
Staff					
AS1	**Interviewer**	|___|___|	AS4	**Coder**	|___|___|
AS2	**Supervisor**	|___|___|	AS5	**Data entry operator**	|___|___|
AS3	**Editor**	|___|___|			
Respondent					
Name of household head					
Name of main Respondent					
AR1	**Interview status**				
	1	Interview completed	**COMMENTS:**		
	2	Refusal converted			
	3	Partly completed			
	4	No usable information			
	5	Household unit is vacant			
	6	No contact			
	7	Refusal			

سوف أبدأ بطرح بعض الاسئلة عن العائلة:

معلومات اجتماعية وديموغرافية (socio-demographic)				
SD1	عدد الغرف في المنزل **(دون المطبخ، الحمام، الشرفة والمخزن / موقف السيارة)**			|___|___|
SD2	عدد الافراد الذين يسكنون في المنزل **(الذين يتشاركون الطعام ومدخل البيت)**			|___|___|
SD3	عدد الافراد الذين يسكنون في المنزل بحسب الفئة العمرية			
SD3A1		دون سنة	ذكر	|___|___|
SD3A2			أنثى	|___|___|
SD3B1		من سنة الى 10 سنوات	ذكر	|___|___|
SD3B2			أنثى	|___|___|
SD3C1		من 11 سنة الى 18 سنة	ذكر	|___|___|
SD3C2			أنثى	|___|___|
SD3D1		من 19 سنة الى 30 سنة	ذكر	|___|___|
SD3D2			أنثى	|___|___|
SD3E1		من 31 سنة الى 65 سنة	ذكر	|___|___|
SD3E2			أنثى	|___|___|
SD3F1		أكبر من 65 سنة	ذكر	|___|___|
SD3F2			أنثى	|___|___|
SD4	كم عائلة تسكن في هذا المنزل؟	1	عائلة واحدة	
		2	عائلتان تربطهما قربة	
		3	عائلتان لا تربطهما قربة	
		4	زوج واحد وعدة عوائل	
		5	أكثر من عائلتان	
		6	غير ذلك، حدد:_____	
		98	لا جواب	
		99	لا أعلم	
SD5	تاريخ ميلاد رب المنزل		اليوم الشهر السنة	
			|___|___| - |___|___| - |___|___|	
		98	لا جواب	
		99	لا أعلم	
SD6	عمر رب المنزل		|___|___|	
		98	لا جواب	
		99	لا أعلم	
SD7	تاريخ ميلاد ربة المنزل		اليوم الشهر السنة	
			|___|___| - |___|___| - |___|___|	
		98	لا جواب	
		99	لا أعلم	
SD8	عمر ربة المنزل		|___|___|	
		98	لا جواب	
		99	لا أعلم	
SD9	أعلى مستوى علمي حصّله رب المنزل	1	لا يجيد القراءة والكتابة	
		2	يجيد القراءة والكتابة دون تحصيل أي مستوى	
		3	ابتدائي	
		4	متوسط	
		5	ثانوي	
		6	تقني	
		7	جامعي	
		98	لا جواب	
		99	لا أعلم	

SD10	أعلى مستوى علمي حصّلته ربة المنزل	1	لا تجيد القراءة والكتابة
		2	تجيد القراءة والكتابة دون تحصيل أي مستوى
		3	ابتدائي
		4	متوسط
		5	ثانوي
		6	تقني
		7	جامعي
		98	لا جواب
		99	لا أعلم
SD11	ما هو عدد الذكور في المنزل الذين يتعلّمون في المدرسة؟ |___|___|		
		98	لا جواب
		99	لا أعلم
SD12	أين يتعلّم معظم الاولاد الذكور؟	1	مدرسة خاصة في باب التبانة / إربد؟
		2	مدرسة خاصة خارج باب التبانة / إربد؟
		3	مدرسة حكومية في باب التبانة / إربد؟
		4	مدرسة حكومية خارج باب التبانة / إربد؟
		5	غير ذلك، حدد:_____
		98	لا جواب
		99	لا أعلم
SD13	أعلى مستوى علمي حصّله الابن الأكبر (حتى إذا لم يعد يسكن معك)	1	لا أبناء ذكور
		2	لا يجيد القراءة والكتابة
		3	يجيد القراءة والكتابة دون تحصيل أي مستوى
		4	ابتدائي
		5	متوسط
		6	ثانوي
		7	تقني
		8	جامعي
		98	لا جواب
		99	لا أعلم
SD14	ما هو عدد الإناث في المنزل الذين يتعلّمون في المدرسة؟ |___|___|		
		98	لا جواب
		99	لا أعلم
SD15	أين يتعلّم معظم الاولاد الإناث؟	1	مدرسة خاصة في باب التبانة / إربد؟
		2	مدرسة خاصة خارج باب التبانة / إربد؟
		3	مدرسة حكومية في باب التبانة / إربد؟
		4	مدرسة حكومية خارج باب التبانة / إربد؟
		5	غير ذلك، حدد:_____
		98	لا جواب
		99	لا أعلم
SD16	أعلى مستوى علمي حصّلته البنت الكبرى (حتى إذا لم تعد تسكن معك)	1	لا بنات
		2	لا تجيد القراءة والكتابة
		3	تجيد القراءة والكتابة دون تحصيل أي مستوى
		4	ابتدائي
		5	متوسط
		6	ثانوي
		7	تقني
		8	جامعي
		98	لا جواب
		99	لا أعلم

SD17	هل أحد أفراد المنزل هو عضو أو متطوّع أو على علاقة بأية جمعية إجتماعية، تنموية أو ثقافية في باب التبانة / إربد أو خارجها؟	1 2 98 99	نعم كلا لا جواب لا أعلم	

سوف أطرح عليك بعض الأسئلة حول وضع العمل في منزلك:

العمل (Working Force)				
WF1	ما هو العمل الأساسي لرب المنزل؟		_____	
		98	لا جواب	
		99	لا أعلم	
WF2	أين هو موقع عمله؟		_____	
		98	لا جواب	
		99	لا أعلم	
WF3	ما هو مركزه في العمل؟	1	يعمل لحسابه الخاص	
		2	موظف	
		3	رب عمل	
		4	غير ذلك، حدد	_____
		98	لا جواب	
		99	لا أعلم	
WF4	ما نوع العمل الآخر لرب المنزل؟		_____	
		1	لا عمل آخر	
		98	لا جواب	
		99	لا أعلم	
WF5	ما هو عدد أفراد منزلك الذين يعملون حاليّاً؟		|___|___|	
		98	لا جواب	
		99	لا أعلم	
WF5A1	يعملون مقابل أجر خارج المنزل:	ذكور	≥ 18	|___|___|
WF5A2			≤ 18	|___|___|
WF5A3		إناث	≥ 18	|___|___|
WF5A4			≤ 18	|___|___|
WF5B1	يعملون مقابل أجر من المنزل:	ذكور	≥ 18	|___|___|
WF5B2			≤ 18	|___|___|
WF5B3		إناث	≥ 18	|___|___|
WF5B4			≤ 18	|___|___|
WF5C1	يعملون مع العائلة دون أجر:	ذكور	≥ 18	|___|___|
WF5C2			≤ 18	|___|___|
WF5C3		إناث	≥ 18	|___|___|
WF5C4			≤ 18	|___|___|
WF6	قل لي النسبة المئوية لمساهمة كل مصدر من مصادر الدخل لدخل منزلك الاجمالي:			
WF6A			عمل رب المنزل الأساسي	|___|___|___|
WF6B			عمل رب المنزل الآخر	|___|___|___|
WF6C			عمل أفراد العائلة الآخرين	|___|___|___|
WF6D			إعانات	|___|___|___|
WF6E			غير ذلك، حدد_____	|___|___|___|

سوف أطرح عليك بعض الأسئلة حول الوضع المالي لمنزلك. (لن أسأل عن أرقام محدّدة)

الوضع المالي (Financial status)			
FS1	هل تملك المنزل الذي تسكن فيه؟	1	نعم
		2	كلا
		98	لا جواب
		99	لا أعلم
FS2	هل لديك في المنزل:		
FS2A	غسالة ملابس	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2B	جلاية أواني	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2C	ثلاجة	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2D	سخان ماء	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2E	خط هاتف أرضي ثابت	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2F	خط هاتف خلوي	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2G	تلفاز	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2H	كمبيوتر	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2I	صحن لاقط	1	أمتلك صحن لاقط
		2	لدي اشتراك
		3	لا
		98	لا جواب
		99	لا أعلم
FS3	كيف تقيّم مستوى الدخل في منزلك بالمقارنة مع المنازل الأخرى في اربد (باب التبّانة)	1	أفضل بكثير
		2	أفضل
		3	ذات المستوى
		4	أسوأ
		5	أسوأ بكثير
		98	لا جواب
		99	لا أعلم

FS4	في حال احتاج منزلك فجأةً لمبلغ 150,000 ليرة لبنانيّة (70 دينار)، هل تستطيع تأمينه خلال أسبوع؟	1	نعم	
		2	ربما، لكن ليس بالتأكيد	
		3	لا	Go to HS1
		98	لا جواب	Go to HS1
		99	لا أعلم	Go to HS1
FS5	إذا كان الجواب نعم، كيف تؤمّن المبلغ؟	1	استخدم مدّخراتي	
		2	بمساعدة منظمات	
		3	بمساعدة الأصدقاء	
		4	عن طريق بيع بعض الممتلكات	
		98	لا جواب	
		99	لا أعلم	

سوف أطرح عليك بعض الأسئلة حول الوضع الصحي العام لمنزلك

الوضع الصحّي (Health Status)				
HS1	هل يعاني أحد أفراد المنزل من مرض أو إعاقة مزمنة؟	1	نعم	
		2	لا	
		98	لا جواب	
		99	لا أعلم	
HS2	إذا كان الجواب نعم، ما هو المرض، الجنس، والعمر؟			
HS2A1	الفرد الأول	العمر	|___|___|	
HS2A2		الجنس	1 ذكر	
			2 أنثى	
HS2A3		المرض	_____	
HS2A4		الإعاقة	_____	
HS2B1	الفرد الثاني	العمر	|___|___|	
HS2B2		الجنس	1 ذكر	
			2 أنثى	
HS2B3		المرض	_____	
HS2B4		الإعاقة	_____	
HS2C1	الفرد الثالث	العمر	|___|___|	
HS2C2		الجنس	1 ذكر	
			2 أنثى	
HS2C3		المرض	_____	
HS2C4		الإعاقة	_____	
HS2D1	الفرد الرابع	العمر	|___|___|	
HS2D2		الجنس	1 ذكر	
			2 أنثى	
HS2D3		المرض	_____	
HS2D4		الإعاقة	_____	
HS2E1	الفرد الخامس	العمر	|___|___|	
HS2E2		الجنس	1 ذكر	
			2 أنثى	
HS2E3		المرض	_____	
HS2E4		الإعاقة	_____	
HS3	هل عانى أحد أفراد المنزل من الإسهال في الثلاثة أشهر الماضية؟	1	نعم	
		2	لا	
		98	لا جواب	
		99	لا أعلم	

HS3A	إذا كان الجواب نعم، ما هو المرض، الجنس، والعمر؟			
HS3A1	الفرد الأول	العمر	|___|___|	
HS3A2		الجنس	1 ذكر	
			2 أنثى	
HS3A3		المرض	1 إسهال	
			2 تيفؤيد	
			3 التهاب الكبد (Hepatitis A)	
			4 غير ذلك، حدد _____	
HS3A4		الأعراض	1 إسهال	
			2 استفراغ	
			3 حرارة مرتفعة	
			4 أوجاع في المعدة	
			5 غير ذلك، حدد _____	
HS3A5		كم يوم اضطر المريض البقاء في المنزل بسبب المرض؟	|___|___|	
HS3A6		للعلاج هل تم اللجوء الى	1 المستشفى	
			2 المستوصف	
			3 عيادة خاصة	
			4 الطبيب يزورني في المنزل	
			5 لا أحد	
			6 غير ذلك، حدد _____	
			98 لا جواب	
			99 لا أعلم	
HS3A7a		ما كانت تكلفة العلاج	التكلفة الإجماليّة	|___|___|___|___|___|___|
HS3A7b		باللليرة اللبنانيّة	ثمن الدواء	|___|___|___|___|___|___|
HS3A7c		(الدينارالأردني)؟	أجرة الطبيب في المستوصف	|___|___|___|___|___|___|
HS3A7d			أجرة الطبيب في المنزل	|___|___|___|___|___|___|
HS3A7e			أجرة المستشفى	|___|___|___|___|___|___|
HS3A7f			98 لا جواب	
			99 لا أعلم	
HS3B1	الفرد الثاني	العمر	|___|___|	
HS3B2		الجنس	1 ذكر	
			2 أنثى	
HS3B3		المرض	1 إسهال	
			2 تيفؤيد	
			3 التهاب الكبد (Hepatitis A)	
			4 غير ذلك، حدد _____	
HS3B4		الأعراض	1 إسهال	
			2 استفراغ	
			3 حرارة مرتفعة	
			4 أوجاع في المعدة	
			5 غير ذلك، حدد _____	
HS3B5		كم يوم اضطر المريض البقاء في المنزل بسبب المرض؟	|___|___|	

HS3B6		للعلاج تم اللجوء الى	1	المستشفى
			2	المستوصف
			3	عيادة خاصة
			4	الطبيب يزورني في المنزل
			5	لا أحد
			6	غير ذلك، حدد _____
			98	لا جواب
			99	لا أعلم
HS3B7a		ما كانت تكلفة العلاج		التكلفة الإجماليّة |___|___|___|___|___|___|
HS3B7b		بالليرة اللبنانيّة		ثمن الدواء |___|___|___|___|___|___|
HS3B7c		(الدينارالأردني)؟		أجرة الطبيب في المستوصف |___|___|___|___|___|___|
HS3B7d				أجرة الطبيب في المنزل |___|___|___|___|___|___|
HS3B7e				أجرة المستشفى |___|___|___|___|___|___|
HS3B7f			98	لا جواب
			99	لا أعلم
HS3C1	الفرد الثالث	العمر		|___|___|
HS3C2		الجنس	1	ذكر
			2	أنثى
HS3C3		المرض	1	إسهال
			2	تيفؤيد
			3	التهاب الكبد (Hepatitis A)
			4	غير ذلك، حدد _____
HS3C4		الأعراض	1	إسهال
			2	استفراغ
			3	حرارة مرتفعة
			4	أوجاع في المعدة
			5	غير ذلك، حدد _____
HS3C5		كم يوم اضطر المريض البقاء في المنزل بسبب المرض؟		|___|___|
HS3C6		للعلاج هل تم اللجوء الى	1	المستشفى
			2	المستوصف
			3	عيادة خاصة
			4	الطبيب يزورني في المنزل
			5	لا أحد
			6	غير ذلك، حدد _____
			98	لا جواب
			99	لا أعلم
HS3C7a		ما كانت تكلفة العلاج		التكلفة الإجماليّة |___|___|___|___|___|___|
HS3C7b		بالليرة اللبنانيّة		ثمن الدواء |___|___|___|___|___|___|
HS3C7d		(الدينارالأردني)؟		أجرة الطبيب في المستوصف |___|___|___|___|___|___|
HS3C7e				أجرة الطبيب في المنزل |___|___|___|___|___|___|
HS3C7f				أجرة المستشفى |___|___|___|___|___|___|
HS3C7g			98	لا جواب
			99	لا أعلم
HS3D1	الفرد الرابع	العمر		|___|___|
HS3D2		الجنس	1	ذكر
			2	أنثى

HS3D3	المرض	1	إسهال
		2	تيفؤيد
		3	التهاب الكبد (Hepatitis A)
		4	غير ذلك، حدد _____
HS3D4	الأعراض	1	إسهال
		2	استفراغ
		3	حرارة مرتفعة
		4	أوجاع في المعدة
		5	غير ذلك، حدد _____
HS3D5	كم يوم اضطر المريض البقاء في المنزل بسبب المرض؟	|___|___|	
HS3D6	للعلاج هل تم اللجوء الى	1	المستشفى
		2	المستوصف
		3	عيادة خاصة
		4	الطبيب يزورني في المنزل
		5	لا أحد
		6	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم
HS3D7a HS3D7b HS3D7c HS3D7e HS3D7f HS3D7g	ما كانت تكلفة العلاج بالليرة اللبنانيّة (الدينار الأردني)؟	التكلفة الإجماليّة ثمن الدواء أجرة الطبيب في المستوصف أجرة الطبيب في المنزل أجرة المستشفى 98 99	|___|___|___|___|___|___| |___|___|___|___|___|___| |___|___|___|___|___|___| |___|___|___|___|___|___| |___|___|___|___|___|___| لا جواب لا أعلم
HS4	في العموم، اذا احتاج أحد أفراد منزلك للطبابة، الى أين تلجأ؟	1 2 3 4 5 6 7 98 99	مستوصف عام في باب التبّانة/ اربد مستوصف عام خارج باب التبّانة/ اربد عيادة خاصة في باب التبّانة/ اربد عيادة خاصة خارج باب التبّانة/ اربد مستشفى خارج باب التبّانة/ اربد زيارة منزليّة غير ذلك، حدد_____ لا جواب لا أعلم
HS5	لما فضلت هذا الخيار؟	1 2 3 4 5 6 7 98 99	لأنه الخيار الأوفر لأنه الخيار الأفضل لأنه اكثر راحة من غيره لأني أثق به أكثر لأنه لدينا تأمين عام (ضمان) لأنه لدينا تأمين خاص غير ذلك، حدد لا جواب لا أعلم

الآن سوف أسأل عن المياه في المنزل

مصادر المياه (water sources)				
WS1	ما هي مصادر المياه التي تصل الى المنزل؟			
WS1A		شبكة المياه العامة	1	نعم
			2	كلا
			99	لا أعلم
WS1B		بئر	1	نعم
			2	كلا
			99	لا أعلم
WS1C		صهريج مياه	1	نعم
			2	كلا
			99	لا أعلم
WS1D		مياه منقولة باليد	1	نعم
			2	كلا
			99	لا أعلم
WS1E		مياه معبأة	1	نعم
			2	كلا
			99	لا أعلم
WS1F		غير ذلك، حدد:_____		
WS2A	حدد النسبة المئوية لكل مصدر بحسب الكمية التي تحصل عليها في الشتاء (المجموع يجب أن يكون 100%)	شبكة المياه العامة	|___|___|%	
WS2B		بئر	|___|___|%	
WS2C		صهريج مياه	|___|___|%	
WS2D		مياه منقولة باليد	|___|___|%	
WS2E		مياه معبأة	|___|___|%	
WS2F		غير ذلك	|___|___|%	
WS3A	حدد النسبة المئوية لكل مصدر بحسب الكمية التي تحصل عليها في الصيف (المجموع يجب أن يكون 100%)	شبكة المياه العامة	|___|___|%	
WS3B		بئر	|___|___|%	
WS3C		صهريج مياه	|___|___|%	
WS3D		مياه منقولة باليد	|___|___|%	
WS3E		مياه معبأة	|___|___|%	
WS3F		غير ذلك	|___|___|%	
WS4	كم برميل مياه يستهلك منزلك يومياً في فصل الصيف		|___|___| برميل/يوم	
		99	لا أعلم	
WS5	كم برميل مياه يستهلك منزلك يومياً في فصل الشتاء		|___|___| برميل/يوم	
		99	لا أعلم	
WS6	هل تكفيك كميّة مياه الإستعمال التي تصل الى منزلك في فصل الصيف ؟	1	أكثر من كافية	
		2	كافية	
		3	بالكاد تكفي	
		4	لا تكفي	
		98	لا جواب	
		99	لا أعلم	
WS7	هل تكفيك كميّة مياه الإستعمال التي تصل الى منزلك في فصل الشتاء؟	1	أكثر من كافية	
		2	كافية	
		3	بالكاد تكفي	
		4	لا تكفي	
		98	لا جواب	
		99	لا أعلم	

WS8	هل أنت راضٍ عن نوعيّة مياه الاستعمال التي تصل الى منزلك في فصل الصيف؟	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
WS9	لماذا أنت غير راضٍ؟	1	المياه ليست صافية
		2	هناك رائحة كلور في المياه
		3	المياه ملوّثة
		4	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم
WS10	هل أنت راضٍ عن نوعيّة مياه الاستعمال التي تصل الى منزلك في فصل الشتاء؟	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
WS11	لماذا أنت غير راضٍ؟	1	المياه ليست صافية
		2	هناك رائحة كلور في المياه
		3	المياه ملوّثة
		4	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم

إذا كنت تحصل على المياه من الشبكة العامّة

مياه الشبكة العامة (network water)				
NW1	هل لديك عداد أم عيار بالمتر المكعب؟		1	عداد
			2	عيار بالمتر المكعب
			3	غير ذلك، حدد _____
			99	لا أعلم
NW2A	إذا كان لديك عدّاد	رقم العداد	_____	
NW2B		فاتورة كلّ	|___|___|	شهر
NW2C		الكمية المستهلكة فى آخر فاتورة عداد	|___|___|___|___|	متر مكعب
NW2D		القيمة المدفوعة فى آخر فاتورة	|___|___|___|___|	ليرة / دينار
NW3A	إذا كان لديك عيار بالمتر المكعب	ما قيمة فاتورتك السنويّة؟	|___|___|___|___|	ليرة / دينار
NW3B		ما قياس العيار؟	|___|___|	مم
NW4A	ما هي استخدامات المياه التي تحصل عليها من شبكة المياه العامة	للشرب	1	نعم
			2	كلا
			99	لا أعلم
NW4B		لغسل الأيدي	1	نعم
			2	كلا
			99	لا أعلم
NW4C		للاستحمام	1	نعم
			2	كلا
			99	لا أعلم
NW4D		لغسل الطعام	1	نعم
			2	كلا
			99	لا أعلم

NW4E	للطبخ	1	نعم
		2	كلا
		99	لا أعلم
NW4F	لغسل الصحون	1	نعم
		2	كلا
		99	لا أعلم
NW4G	لتنظيف البيت	1	نعم
		2	كلا
		99	لا أعلم
NW4H	في غرفة الغسيل	1	نعم
		2	كلا
		99	لا أعلم
NW4I	للري	1	نعم
		2	كلا
		99	لا أعلم
NW4J	غير ذلك، حدد:_____		
NW5	ما وتيرة تزويد المياه عبر الشبكة العامّة؟		|___| مرة في الأسبوع
		1	بشكل مستمر
		98	لا جواب
		99	لا أعلم
NW6	كم تبقى المياه مزوّدة حين تأتي؟		|___|___| ساعة
		1	بشكل مستمر
		98	لا جواب
		99	لا أعلم
NW7	كيف تجد نوعية هذه المياه؟	1	جيدة (دون لون، طعم، رائحة، ورواسب)
		2	متوسطة (بعض اللون، طعم، رائحة، ورواسب)
		3	سيئة (ذات لون، طعم، رائحة، ورواسب)
		98	لا جواب
		99	لا أعلم

إذا كنت تحصل على المياه من الآبار

مياه الآبار (Well water)								
WW1	عدد الآبار التي تصل منها مياه الى المنزل |___|							
WW2		A		B		C		D
		البئر 1		**البئر 2**		**البئر 3**		**البئر 4**
1	إسم البئر	_____		_____		_____		_____
		99 لا أعلم		99 لا أعلم		99 لا أعلم		99 لا أعلم
2	نوع البئر	1 خاص للمنزل		1 خاص للمنزل		1 خاص للمنزل		1 خاص للمنزل
		2 مشترك بين عدة منازل		2 مشترك بين عدة منازل		2 مشترك بين عدة منازل		2 مشترك بين عدة منازل
		3 مشترك للحي		3 مشترك للحي		3 مشترك للحي		3 مشترك للحي
		99 لا أعلم		99 لا أعلم		99 لا أعلم		99 لا أعلم
3	حالة البئر	1 مغطّى		1 مغطّى		1 مغطّى		1 مغطّى
		2 مفتوح		2 مفتوح		2 مفتوح		2 مفتوح
		99 لا أعلم		99 لا أعلم		99 لا أعلم		99 لا أعلم
4	طريقة السحب	1 مضخّة		1 مضخّة		1 مضخّة		1 مضخّة
		2 نقل باليد		2 نقل باليد		2 نقل باليد		2 نقل باليد
		3 غير ذلك، حدد: _____		3 غير ذلك، حدد: _____		3 غير ذلك، حدد: _____		3 غير ذلك، حدد: _____
		99 لا أعلم		99 لا أعلم		99 لا أعلم		99 لا أعلم

WW3A	ما هي استخدامات المياه للشرب التي تحصل عليها من البئر	1 2 99	نعم كلا لا أعلم
WW3B	لغسل الأيدي	1 2 99	نعم كلا لا أعلم
WW3C	للاستحمام	1 2 99	نعم كلا لا أعلم
WW3D	لغسل الطعام	1 2 99	نعم كلا لا أعلم
WW3E	للطبخ	1 2 99	نعم كلا لا أعلم
WW3F	لغسل الصحون	1 2 99	نعم كلا لا أعلم
WW3G	لتنظيف البيت	1 2 99	نعم كلا لا أعلم
WW3H	في غرفة الغسيل	1 2 99	نعم كلا لا أعلم
WW3I	للري	1 2 99	نعم كلا لا أعلم
WW3J	غير ذلك، حدد:_____		
WW4	ما وتيرة تزويد المياه عبر الآبار؟	|___|	مرة في الأسبوع
		98	لا جواب
		99	لا أعلم
WW5	كم تبقى المياه مزوّدة حين تأتي؟	|___|___|	ساعة
		98	لا جواب
		99	لا أعلم
WW6	ماذا تدفع مقابل مياه الآبار	1	لا شيء
		|___|___|	ليرة/ دينار شهرياً
		98	لا جواب
		99	لا أعلم
WW7	كيف تجد نوعية هذه المياه؟	1	جيدة (دون لون، طعم، رائحة، ورواسب)
		2	متوسطة (بعض اللون، طعم، رائحة، ورواسب)
		3	سيئة (ذات لون، طعم، رائحة، ورواسب)
		98	لا جواب
		99	لا أعلم

إذا كنت تحصل على المياه من الصهاريج:

صهاريج المياه (Water tankers)			
WT1A	ما هي استخدامات المياه للشرب التي تحصل عليها من صهاريج المياه	1 2 99	نعم كلا لا أعلم

WT1B	لغسل الأيدي	1	نعم
		2	كلا
		99	لا أعلم
WT1C	للاستحمام	1	نعم
		2	كلا
		99	لا أعلم
WT1D	لغسل الطعام	1	نعم
		2	كلا
		99	لا أعلم
WT1E	للطبخ	1	نعم
		2	كلا
		99	لا أعلم
WT1F	لغسل الصحون	1	نعم
		2	كلا
		99	لا أعلم
WT1G	لتنظيف البيت	1	نعم
		2	كلا
		99	لا أعلم
WT1H	في غرفة الغسيل	1	نعم
		2	كلا
		99	لا أعلم
WT1I	للري	1	نعم
		2	كلا
		99	لا أعلم
WT1J	غير ذلك، حدد:_____	1	نعم
WT2	كم مرّة في الاسبوع يحصل المنزل على صهريج؟	|___|___|	
WT3	ما هي سعة الصهريج؟	|___|___|	متر مكعب
WT4	كم تدفع عن كل صهريج؟	|___|___|___|___|	ليرة / دينار
WT5	كيف تجد نوعية هذه المياه؟	1	جيدة (دون لون، طعم، رائحة، ورواسب)
		2	متوسطة (بعض اللون، طعم، رائحة، ورواسب)
		3	سيئة (ذات لون، طعم، رائحة، ورواسب)
		98	لا جواب
		99	لا أعلم

إذا كنت تنقل المياه شخصياً باليد:

المياه المنقولة باليد (Hand-carried)				
HC1	كم مرة تحضر الماء إلى المنزل يومياً؟	|___|___|		مرة
		99	لا أعلم	
HC2	ما كمية الماء في كل مرة؟	|___|___|		ليتر
		99	لا أعلم	
HC3	هل تدفع مقابل هذه المياه؟	1	نعم	
		2	كلا	
		98	لا جواب	
HC4	إذا كان الجواب نعم، كم تدفع؟	|___|___|___|___|		ليرة / دينار
		99	لا أعلم	
HC5	كم دقيقة تستغرق من الوقت لإحضار المياه الى المنزل؟	|___|___|___|		دقيقة
		99	لا أعلم	

HC6A	ما هي استخدامات المياه المنقولة باليد؟	للشرب	1 نعم 2 كلا 99 لا أعلم
HC6B		لغسل الأيدي	1 نعم 2 كلا 99 لا أعلم
HC6C		للاستحمام	1 نعم 2 كلا 99 لا أعلم
HC6D		لغسل الطعام	1 نعم 2 كلا 99 لا أعلم
HC6E		للطبخ	1 نعم 2 كلا 99 لا أعلم
HC6F		لغسل الصحون	1 نعم 2 كلا 99 لا أعلم
HC6G		لتنظيف البيت	1 نعم 2 كلا 99 لا أعلم
HC6H		في غرفة الغسيل	1 نعم 2 كلا 99 لا أعلم
HC6I		للري	1 نعم 2 كلا 99 لا أعلم
HC6J		غير ذلك، حدد:_____	
HC7	كيف تجد نوعية هذه المياه؟	1 جيدة (دون لون، طعم، رائحة، ورواسب) 2 متوسطة (بعض اللون، طعم، رائحة، ورواسب) 3 سيئة (ذات لون، طعم، رائحة، ورواسب) 98 لا جواب 99 لا أعلم	

إذا كنت تشتري المياه المعبأة:

المياه المعبأة (bottled water)			
BW1	كم عبوة يستهلك المنزل في الاسبوع؟		|___|___| 99 لا أعلم
BW2	ما هي سعة العبوة؟		|___|___| ليتر 99 لا أعلم
BW3	إسم العبوة (إذا أمكن)		_____
BW4	كم تدفع عن كل عبوة؟		|___|___|___|___| ليرة / دينار 99 لا أعلم
BW5A	ما هي استخدامات المياه المعبأة؟	للشرب	1 نعم 2 كلا 99 لا أعلم
BW5B		لغسل الأيدي	1 نعم 2 كلا 99 لا أعلم

BW5C	للاستحمام	1	نعم	
		2	كلا	
		99	لا أعلم	
BW5D	لغسل الطعام	1	نعم	
		2	كلا	
		99	لا أعلم	
BW5E	للطبخ	1	نعم	
		2	كلا	
		99	لا أعلم	
BW5F	لغسل الصحون	1	نعم	
		2	كلا	
		99	لا أعلم	
BW5G	لتنظيف البيت	1	نعم	
		2	كلا	
		99	لا أعلم	
BW5H	في غرفة الغسيل	1	نعم	
		2	كلا	
		99	لا أعلم	
BW5I	للري	1	نعم	
		2	كلا	
		99	لا أعلم	
BW5J	غير ذلك، حدد: _____	1	نعم	
BW6	كيف تجد نوعية هذه المياه؟	1	جيدة (دون لون، طعم، رائحة، ورواسب)	
		2	متوسطة (بعض اللون، طعم، رائحة، ورواسب)	
		3	سيئة (ذات لون، طعم، رائحة، ورواسب)	
		98	لا جواب	
		99	لا أعلم	

الآن سوف أسأل عن المياه التي تستخدمها للشرب:

مياه الشرب (drinking water)				
DW1	ما هي كميّة مياه الشرب التي يستهلكها منزلك يومياً في فصل الصيف		|___|___| ليتر	
		99	لا أعلم	
DW2	ما هي كميّة مياه الشرب التي يستهلكها منزلك يومياً في فصل الشتاء		|___|___| ليتر	
		99	لا أعلم	
DW3	هل أنت راضٍ على نوعيّة مياه الشرب التي تستهلك؟	1	نعم	
		2	لا	
		98	لا جواب	
		99	لا أعلم	
DW4	لماذا أنت غير راضٍ؟	1	المياه ليست صافية	
		2	هناك رائحة كلور في المياه	
		3	المياه ملوّثة	
		4	غير ذلك، حدد _____	
		98	لا جواب	
		99	لا أعلم	

DW5	إذا أصبحت غير راضٍ عن نوعية مياه الشرب التي تستهلك حالياً، ماً المصدر البديل الذي قد تلجأ إليه؟	1	لا مصدر بديل
		2	مياه نبع
		3	مياه بئر
		4	أشتري مياه معبأة
		5	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم
DW6	هل تتخذ أي إجراء لتحسين نوعية المياه قبل شربها؟	1	لا
		2	غليها
		3	تركها بضع ساعات تحت أشعة الشمس
		4	ترشيح (فلتر)
		5	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم

الآن سوف أسأل عن تخزين المياه في منزلك:

تخزين المياه (water tanks)			
WT1	هل للمنزل خزان مياه؟	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
WT2	ما نوع هذا الخزان؟	1	خزان معدني فوق المنزل
		2	خزان بلاستيكي فوق المنزل
		3	خزان فايبر جلاس فوق المنزل
		4	خزان إسمنتي فوق المنزل
		5	خزان ارضي معدني
		6	خزان ارضي بلاستيكي
		7	خزان ارضي فايبر جلاس
		8	خزان ارضي إسمنتي
		10	برميل
		98	لا جواب
		99	لا أعلم
WT3	ما سعة هذا الخزان؟		|___|___| برميل
		98	لا جواب
		99	لا أعلم
WT4	هل تمزج المياه الآتية من كافة المصادر في الخزان؟	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
WT5	كم مرة تنظّف خزان المياه؟	1	ولا مرة
		2	مرة كل سنتين
		3	مرة كل ثلاث سنوات
		4	سنوياً
		5	كل ستة اشهر
		6	غير ذلك، حدد_____
		98	لا جواب
		99	لا أعلم

WT6	هل تستخدم أي مادّة لمعالجة المياه في الخزان؟	1	لا
		2	نعم، منتجات الكلور
		3	نعم، منتجات بترولیّة
		4	غير ذلك، حدد_____
		98	لا جواب
		99	لا أعلم
WT7	كيف يتم سحب المياه من الخزان؟	1	دلو
		2	أوعية خاصة
		3	مضخة موصولة بصنابير المنزل
		4	صنبور
		5	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم
WT8	هل تستخدم مياه الخزان للشرب؟	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم

سوف أطرح عليك بعض الأسئلة حول التجهيزات والممارسات الصحيّة

التجهيزات والممارسات الصحيّة (personal hygiene and fixtures)			
PH1	هل يوجد دوش\ حوض استحمام في المنزل؟	1	نعم, خاص بالعائلة
		2	نعم, مشترك مع عوائل أخرى
		3	لا يوجد
		98	لا جواب
		99	لا اعلم
PH2	أين يتم غسل اليدين عادة؟	1	مغسلة داخل الحمام أو قريبة منه
		2	مغسلة ليست داخل الحمام أو قريبة منه
		3	مغسلة في المطبخ
		4	مغسلة في الحديقة
		5	صنبور في فناء المنزل
		6	مكان أخر, حدد _____
		7	نادراً ما تغسل الأيدي
		98	لا جواب
		99	لا اعلم
PH3	ماذا تستخدم عند غسل اليدين؟	1	مياه صنبور مع صابون
		2	مياه صنبور دون صابون
		3	مياه حوض مع صابون
		4	مياه حوض دون صابون
		5	مياه دلو مع صابون
		6	مياه حوض دون صابون
		98	لا جواب
		99	لا اعلم
PH4	هل يوجد ماء ساخن باستمرار؟	1	نعم
		2	لا
		98	لا جواب
		99	لا اعلم

PH5	أين يتم غسل الصحون؟	1	في المطبخ
		2	في الحديقة
		3	مجرى الماء
		98	لا جواب
		99	لا اعلم

سوف أطرح عليك بعض الأسئلة حول التخلص من المياه المبتذلة

التخلص من المياه المبتذلة (wastewater disposal)			
WWD1	هل تشارك احد في الحمام؟	1	لا - مرحاض خاص داخل المنزل
		2	نعم - مع عوائل أخرى
		3	نعم - مرحاض عام
		98	لا جواب
		99	لا أعلم
WWD2	أين يوجد الحمام؟	1	داخل المنزل
		2	داخل البناية - خارج المنزل
		3	خارج البناية
		98	لا جواب
		99	لا أعلم
WWD3	هل يوجد مغسلة بالقرب من أو داخل الحمام؟	1	نعم - داخل الحمام
		2	نعم - بالقرب من الحمام
		3	لا - بعيدة عن الحمام
		98	لا جواب
		99	لا أعلم
WWD4	كيف يتخلص منزلك من المياه المبتذلة؟	1	جورة صحية
		2	شبكة المجاري
		3	في قناة مغطاة
		4	في قناة مفتوحة
		5	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم
WWD5	إذا كان لديك جورة صحيّة، ما وتيرة تفريغها؟		|___|___|
		98	لا جواب
		99	لا أعلم
WWD6	كيف تقوم بتفريغها؟	1	صهريج يضخ المياه المبتذلة للخارج
		2	مواد كيميائية تنظف الجورة
		3	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم

سوف أطرح عليك بعض الأسئلة حول التخلص من النفايات الصلبة

التخلص من النفايات الصلبة (solid waste disposal)				
SWD1	كيف يتم تخزين النفايات في منزلك؟	1	وعاء ـ مفتوح	
		2	وعاء ـ مغلق	
		3	أكياس بلاستيكية	
		4	غير ذلك، حدد	_____
		98	لا جواب	
		99	لا اعلم	
SWD2	كم مرة يتم إخراج النفايات من المنزل؟	1	يومياً	
		2	كل يومين	
		3	مرتين أسبوعيا	
		4	مرة في الأسبوع	
		5	مرات متباعدة	
		6	لا يوجد إمكانية جمع النفايات	
		7	غير ذلك، حدد	_____
		98	لا جواب	
		99	لا اعلم	
SWD3	كيف يتم التخلّص من النفايات؟	1	تجمعها السلطات	
		2	تجمعها المؤسسات المحلية	
		3	تجمعها مؤسسات خاصة	
		4	ترمى داخل حدود البناية	
		5	ترمى على الشارع \ قطعة ارض خالية	
		6	تحرق	
		7	تدفن	
		8	تدوّر	
		9	تطعم للحيوانات	
		10	غير ذلك، حدد	_____
		98	لا جواب	
		99	لا اعلم	
SWD4	كم تبعد حاويات البلدية عن المنزل؟	1	لا يوجد حاويات للبلديّة	
		2	أقل من 50 م	
		3	من 50 - 100 م	
		4	أكثر من 100 م	
		98	لا جواب	
		99	لا اعلم	
SWD5	هل المنزل أو المجمع السكني خالي من النفايات؟	1	نعم	
		2	لا	
		98	لا جواب	
		99	لا اعلم	

تحديد الأولويات (prioritization)		
PR1	ما هما برأيك أهم مشكلتان بيئيتان أساسيتان تعاني منهما اربد/ باب التبانة	
PR2	ما هما برأيك أهم مشكلتان صحيتان أساسيتان تعاني منهما اربد/ باب التبانة	

Annex 2.
Field survey team in An-Nasr Area

Name	*Background/Occupation*
Rajaa Al-Hawari	Architect and Urban Planner Director of An Naser Municipality
Anssam Al Akhras	Graduate Student in Environmental Science at JUST
Dua'a Beny Rusheid	M.S. In Urban Planning Employee at Irbid Greater Municipality
Eman Othman	Architect and urban planner

Annex 3.
Assessment of Water and Sanitation Services in Irbid/An-Nasr Area

PARTICIPATORY IMPROVEMENT OF WATER AND SANITATION SERVICES IN TRIPOLI THROUGH A COMPARATIVE ANALYSIS WITH IRBID

GRANT NO: 104899-001

Assessment of Water and Sanitation Services in Irbid/An-Nasr Area

By: Wa'il Y. Abu-El-Sha'r and Munjed M. Al-Sharif

February 2009

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JORDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY (JUST)

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1 Introduction

Providing water and sanitary services to areas characterized by poverty and high population densities faces extraordinary challenges that have to be overcome to ensure its success. These may include, but not limited to, the lack of the basic infrastructure or the area needed for these services, the inability or the unwillingness to pay for these services, lack of education and health awareness, ethnic or cultural background, administrative or political constraints, and other local conditions. Understanding the nature of these factors and their interactions necessitates a thorough participatory approach that involves all stakeholders with emphasis on local inhabitants, and the identification of a set of impact indicators to characterize the effect of each pertinent factor and decide on the best method for improvement. A comparative assessment with the situations at communities with similar demographic, cultural, and socio-economic conditions is an invaluable means to achieve these objectives.

The current social, economic, and environmental conditions of the Tebbaneh area in Lebanon are characterized by the general lack and/or degradation of basic environmental services provision such as the absence of wastewater collection and treatment, inadequate access to clean water and sanitation, and poor waste management practices. Where it exists, the wastewater collection network suffers from pipe corrosion, insufficient capacity, mixing with storm water, leakage into drinking water supply pipes, clogging, and silting. Collected wastewater is discharged directly without prior treatment into surface water, the nearby Abu-Ali River, the Mediterranean Sea and surrounding range land. A proper drainage system is non-existent with water and wastewater pooling between alleys and preventing or impeding pedestrian movement and increasing the potential exposure to waterborne diseases. In many parts of this region, garbage accumulates in the streets, near and around houses. These conditions, all combined, are directly contributing to the exacerbation of poverty and the environmental degradation of the region.

Better social and environmental conditions prevail in communities with similar cultural and demographic characteristics in Irbid, Jordan because the sanitary services in these communities have been enhanced to acceptable levels by providing a potable water and sewage networks, and improving the solid waste management systems, providing basic health care facilities and awareness programs. These have dramatically improved the health conditions, the livelihood and the environment of these communities. However, a systematic assessment of the impacts of these services on health has not been conducted yet. Furthermore, the tasks or actions that had the most positive impacts on public health or the ones that had the worst impacts are yet to be identified.

Generally, impact indicators for measuring water and sanitation-related program performance include, but are not limited to: the percentage of children under 36 months with diarrhea in the last two weeks; the quantity of water used per capita per day; recurrent costs for water supply services; household income; level of education of mothers; and the percentage of population using hygienic sanitation facilities. Information required for the usage of impact indicators are those related to household characteristics and conditions, and those concerning water supply, sanitation conditions, and hygiene practices. Household details include the number of people living in the household, their ages, occupation, level of education, sex, and the physical characteristics of the house. Additional needed information include, but is not limited to, the main and secondary water supply method (piped water, well, water trucks, springs, etc.), the source and treatment level of drinking water, volumes of water consumed by each household, and the cost paid for this water. Analyzing these

factors will provide a means for evaluating the performance of water and sanitary provision programs by comparing these indicators with established international norms, if available. Lessons learned from past and present experiences of similar communities form a good step to build on.

The lessons learned from Irbid are of great value to all similar communities that need to enhance their sanitary services, such as the Tebbaneh region. Accordingly, the current study was launched in selected parts (An-Nasr) of Irbid, the second largest city in Jordan, that have similar cultural and demographic characteristics as those in Tebbaneh slums of Tripoli, Lebanon. An-Nasr region is characterized by being a poor community with an average monthly income of less than 200 USD per month and with the majority of the population being Sunni Muslims or Christians.

The major tasks conducted for this part of the study included: 1) the interactive preparation of a social questionnaire suitable for the assessment of sanitary services in An-Naser region in Irbid; 2) identification of the field survey team; 3) carrying out a training workshop on how to use the developed questionnaire; 4) conducting a field survey of around 300 households in An Nasr region in Irbid, 5) analyzing the collected data and drawing lessons from Irbid's experience that may be useful to programs of sanitary provision in Tebbaneh slums in Tripoli; and finally 6) reporting.

This report includes background information on water quality, sanitation, and health impacts with a focus on the poor and the need for improved environmental services to alleviate health problems and enhance livelihood. It then describes the scope of work of this study, its objectives, methodology and implementation. This is followed by a description of the study area in terms of infrastructure, demography, land use etc. and an analysis of the results.

2 Literature Review

Water and sanitation improvements, in association with hygiene behavior change, can have significant effects on population and health by reducing a variety of disease conditions such as diarrhea, intestinal helminthes, guinea worm, and skin diseases. These improvements in health can, in turn, lead to reduced morbidity and mortality and improved nutritional status. This occurs through a variety of mechanisms. Of primary importance is the safe disposal of human feces, thereby reducing the pathogen load in the ambient environment.

Increasing the quantity of water allows for better hygiene practices. Raising the quality of drinking water reduces the ingestion of pathogens. With less disease, children can eat and absorb more food, thereby improving their nutritional status. Also, a healthier adult population is a more productive population, and improvements in water and sanitation can improve income and the capacity to acquire food. Other benefits associated with better water delivery include time savings for primary caregivers, which can result in the preparation of more or better food for children.

Improvements in sanitation result in better health, as measured by fewer diarrheal cases, reductions in parasitic infections, increased child growth, and lower morbidity and mortality. The expected reductions in mortality can be substantial, particularly in areas with low levels of education.

It is commonly believed that the main health benefit from improved water supply occurs through better water quality, which reduces the ingestion of pathogens. However, improvements in health associated with better water quality may be smaller than those obtained through increases in the quantity of water, which allows for better personal and domestic hygiene practices (e.g., hand washing, food washing, and household cleaning). Population groups that consistently use more water have better health than groups that use less water.

Another potential benefit from increasing the quantity of water is the use of water for income generating (e.g., local industries) or food producing (e.g., gardening) activities, both of which could result in the intake of more and better food, improving the family's diet as well as the children's anthropometry. A fourth benefit is a reduction in the time spent obtaining water. When women have more time for other activities, they spend much of that time in food-related activities, such as preparing food and feeding young children. Besides, more time for women can also increase women's opportunities for generating income.

Improvements in water and sanitation do not automatically result in improvements in health. Hygiene education is often required to see health impacts materialize. The most important hygiene messages concern the basic issues of hand washing, proper disposal of feces, and protection of drinking water. Frequent hand washing, with and without soap, results in less diarrhea and the proper disposal of feces, which is not guaranteed by the mere presence of latrines, is also critical for the potential benefits of sanitation to materialize.

2.1 Performance indicators for development activities

One or more of the following performance indicators, or equivalent alternatives, are to be used in projects with water and sanitation components and should be collected ideally at baseline, mid-term and final-year evaluations (Billing *et al.* 1999):

1. **Percentage of children under 36 months with diarrhea in the last two weeks,** where diarrhea is defined as more than three loose stools passed in a 24 hour period
2. **Quantity of water used per capita per day,** where all the water collected by or delivered to the household and used for personal purposes is considered
3. **Percentage of child caregivers and food preparers with appropriate hand washing behavior,** where appropriate hand washing includes the time at which it is done and the technique used
4. **Percentage of population using hygienic sanitation facilities,** where sanitation facility is defined as an excreta disposal facility, typically a toilet or latrine; and hygienic means there are no feces on the floor or seat and there are few flies.

2.1.1 Percentage of Children under 36 month with diarrhea in the last two weeks

This indicator is defined as the proportion of children in a given sample who have diarrhea at the time the information is collected or who have had it anytime in the two preceding weeks. Diarrhea is defined as more than three loose stools passed in a twenty-four hour period. Age is calculated in completed months at the time the information is collected from the caretaker. A child who is 20 days old is considered zero months of age, and a child of 50 days is considered one month old.

Calculation is done by dividing the number of children < 36 months of age in the sample with diarrhea in the last two weeks by the total number of children < 36 months of age in the sample.

Water and sanitation-related programs include improvements in facilities as well as hygiene education for behavioral change. Such programs can bring about decreases in the rate of diarrheal disease on the order of 25%. Esrey *et al*. (1991) reviewed 74 studies on the effect of water and sanitation on diarrheal disease morbidity and mortality and nutritional status. The median reduction in diarrheal morbidity calculated for all the studies was 22% and from the more rigorous ones, 26%. Using studies on individual interventions from which morbidity reductions could be calculated, the review showed median reductions of 22% for sanitation alone, 17% for improvements in water quality alone, 27% for improvements in water quantity alone, and 33% for hygiene alone. Handwashing promotion is one of the most effective hygiene interventions. Reductions of 32 to 43% in diarrheal disease have been documented from improvements in handwashing with soap (Feachem 1984).

It can be assumed that greater effects can be achieved when interventions are combined, although the estimated effects of single interventions cannot necessarily be summed. The type of water and sanitation service provided will likely affect the impact as will the level of service before and after the intervention and the environmental conditions in the project area.

2.1.2 Quantity of water used per capita per day

This indicator includes all water collected by or delivered to the household and used there for drinking, cooking, bathing, personal and household hygiene and sanitation by the inhabitants of the household. It does not include water used for gardening or for watering animals. A day is a 24-hour period. All adults and children in the household are counted. It is assumed that the amount collected is the amount used.

Calculation is performed by dividing the volume of water (in liters) collected for domestic use per day by all households in the sample by the total number of persons in the sample households**.** This calculation is more precise if calculated for individual households first and then averaged for the total number of houses sampled. Adding this step helps account for potentially large variations in the number of persons per household.

For water systems in which water is collected or delivered in containers from a community source and brought to the home, data should be collected through random surveys of households. Cluster surveys should not be employed because water sources or availability may be location-related. Collecting data on water use when water is piped directly into the house or compound is very difficult for small-scale systems characteristic of rural and some urban communities. Because these systems are typically not metered either at the source or at the household, it is not possible to calculate total water used in a community. If a central meter were installed, then the per capita consumption would be the amount of water delivered per day by the system divided by the population in the service area. Many problems call into question the reliability of this method. For example, piped water may be used for purposes other than those specified for the indicator; piped systems may have leaks or water may be taken from them by persons outside the service area; and/or it may be difficult to get accurate population figures.

The distance to the water source may be an indirect indicator of water use (Boot and Cairncross 1993). The closer the source of water is to the home, the greater the use. Per capita use per day has been shown to average less than 10 liters when the public standpipe is farther away than one kilometer; at the other extreme, with house connections the average per capita use per day ranges from 150 to 400 liters (also used for gardens) (Gleick 1996).

Esrey *et al.* (1991) concluded that, after excreta disposal, the next most effective intervention for reducing water and sanitation- related diseases is making more water available and accessible to households. Their review showed that increasing water quantity had more of an impact on diarrheal disease than improving water quality.

It is difficult to establish uniform per capita water quantity goals because of local and regional differences in availability of water, climate, and type of water supply. People use water for a wide variety of activities ranging in importance from being essential to sustain life to a luxurious activity. For example, having few liters of water to drink is more vital than washing clothes. However, people will need to wash if skin diseases are to be prevented and physiological needs met. The hierarchy of water requirements arranged in order of decreasing urgency to be satisfied is shown in Figure 1 (Al-Sharif, 2005).

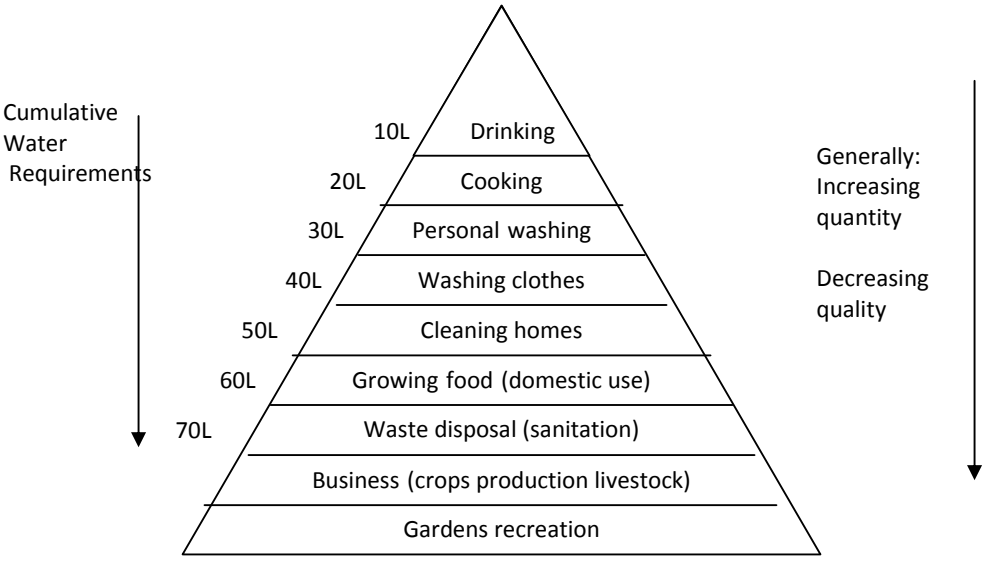

Figure 1. Hierarchy of water requirements

International guidelines or norms for minimum water quantities that domestic water supplies should provide are lacking. A recent review of the different reported values of the minimum water requirements that must be satisfied (Al-Sharif 2005) presented values from 20 to 50 Liters per capita per day (lpcd). However, no evidence is provided that the reported minimum water requirements assure good health. Furthermore, the relative importance of water quantity, water quality, sanitation and hygiene in protecting and improving health remains debatable (Al-Sharif 2005).

The 50 lpcd target may have be to be adjusted downward based on considerations of availability, climate, and technology mentioned above, and on baseline conditions and desired coverage goals. The 50 lpcd target may be used as a guideline in designing a water

supply system when important decisions have to be made about the quantity to be made available per capita. In some projects, a decision may be made to design a system which will provide a smaller quantity of water per capita (for example, 20 lpcd) so that a greater number of persons can have access. In others, the goal may be to assure that all users are provided with 50 lpcd (or a similar "ample" amount) even if fewer households can be connected to the system. Design decisions should be made on the basis of the goals to be achieved by the system with attention to the relationship between quantity of water and reductions in water and sanitation-related diseases.

2.1.3 Percentage of child caregivers and food preparers with appropriate hand washing behavior

Food preparers and child caregivers are persons who prepare most of the food in the household and provide most of the care for young children. Appropriate hand washing behavior includes two dimensions, critical times and technique:

Critical times for hand washing include: after defecation, after cleaning babies' bottoms, before food preparation, before eating, and before feeding children. Handwashing technique uses water, uses soap or ash, washes both hands, rubs hands together at least three times, and dries hands hygienically—by air drying or using a clean cloth.

Calculation is based on the number of food preparers and child caretakers in the sample who report and demonstrate appropriate handwashing behavior divided by the total number of food preparers and child caretakers interviewed in the sample.

Handwashing can be measured by self reporting of critical times and demonstration of technique in a household survey. The interviewer first identifies the main food preparer and principal child caretaker in the household. Usually this is the mother; but it could be two persons. The interviewer asks the person or persons the following two open-ended questions without prompting and checks off all the items mentioned by the interviewee, using a survey form that lists the five critical times and five techniques given above.

Question 1: When do you wash your hands?
Question 2: Would you explain and show me what you do when you wash your hands?

One point is given for each correct time or technique mentioned or observed. A score of 8 points or more (out of a possible 10) qualifies as appropriate handwashing behavior.

Handwashing is one of the most effective ways to break the fecal-oral route of disease transmission. Hand washing behavior is strongly influenced by the presence or absence of a convenient source of water and soap. Studies have shown that, because they facilitate handwashing and other important hygiene behaviors, in-house water supplies are associated with reduced rates of diarrhea (Boot and Cairncross, 1993).

Few studies indicate reasonable targets for improvements in handwashing practices. Instead, most correlate handwashing improvement programs with reduction of diarrheal disease because improved handwashing leads to reductions in diarrheal disease. Considerable improvements in handwashing behavior can be achieved through promotional programs but targets aimed at increasing appropriate handwashing by 50% over the baseline would not be unrealistic. Sustainability of improved handwashing behavior after the

conclusion of promotional programs is an important issue that has not received adequate attention.

2.1.4 Percentage of population using hygienic sanitation facilities

A sanitation facility is defined as a functioning excreta disposal facility, typically a toilet or latrine. Hygienic means that there are no feces on the floor, seat, or walls and that there are few flies. Using sanitation facilities means that a sanitation facility is the predominant means of excreta disposal for household members >12 months of age.

Calculation is performed by dividing the number of people >12 months of age in households in the sample using hygienic sanitation facilities by the total number of people >12 months of age in households in the sample.

Information concerning usage of sanitation facilities can be obtained through a household survey in which the surveyor asks the mother or household head about family latrine use and then inspects the latrine to see if it is (1) is functioning and (2) hygienic and (3) shows signs of use.

Sanitation facility programs might focus on building or improving latrines or other excreta disposal facilities or on improving the maintenance and use of existing facilities. As is clear from the indicator, it is the consistent use of the facility by all family members, not its mere existence that leads to health and environmental improvements. In many cultures, the topic of sanitation use is sensitive and may not lend itself to direct questioning. Interviewers should be well-trained and familiar with the culture, and the survey should attempt to be as unobtrusive and sensitive as possible. In some cultures, female interviewers may be needed to interview female household members.

In urban areas, all residents need to have access to at least 40 liters per capita per day of safe water and 75% of urban dwellers need to have proper sanitation (Warner 1997). These targets mention access but do not mention use, although they assume it. Programs should strive to increase sanitation usage above the baseline to reach 75% usage in the project area.

3 Methodology for Assessment

Jordan is one of the ten poorest countries in the world in the per capita share of water, and yet has relatively good provision of sanitary and water services. It has a low annual per capita income of less than two thousands US dollars, and yet is considered among the most educated countries in the region. Jordan is also a major recipient of millions of refugees from the troubled region, mainly from Palestine and Iraq. Some live on the outskirt of major cities in densely populated areas with fewer services, such as some parts of the city of Irbid (An-Nasr), Jordan. This region is characterized with a high population density, low income, and mainly Sunni Muslims and some Christians.

Jordan has adopted over the years an intermittent water supply policy. This means that water would only be distributed to consumers on a certain day of the week. However, not all areas receive water equally in terms of time and flow rate. These issues might be significant in terms of their impact on the health conditions of water consumers. Another

characteristic of the water supply system in Jordan is the presence of temporary storage water tanks on roofs and underground (this is a response to the intermittent policy for water supply). It is believed that although the piped water supplied by the water authority of Jordan does conform to drinking water quality standards, the risk of contamination do exist because of the water storage practices at the household level. Thus, all kinds of related issues to this matter such as the type, location, size of the storage facility, the frequency of cleansing of such a facility, and the use of chemicals for disinfection were explored.

Sanitary facilities and practices such as the presence of a washing basin and its location, the type of bathing facility, the presence of kitchen sinks, the type of toilets the household has and their locations, and whether the household has running hot water, were all investigated.

One final item considered is the overall solid waste disposal practices and management. This might turn to be of significance in terms of its impact on health conditions. Thus, issues related to the way solid waste is stored at the household, the frequency of disposal, and the presence of solid waste containers near the household were evaluated.

The above mentioned issues will somehow influence the health of people, in particular children under three years of age. Thus, it is important to come out with possible links between the significant conditions and characteristics of the community and certain illnesses and diseases, so that all stakeholders can develop the needed actions, strategies, and tools, to alleviate the negative impacts on the health of the community.

3.1 Study scope of work and objectives

This study is the first part of a major study aimed at improving the water services and sanitation at Tebbaneh Area in Tripoli, Lebanon by using the case of An-Nasr area in Irbid Jordan as a model for the provision of similar services since both areas have similar socio-economic and demographic characteristics. The outcomes of this study will be used by a team of researchers at AUB to achieve this goal.

The main objectives of this part of the research study are: to analyze the current water services and sanitary conditions at An-Nasr area and correlate these conditions to different characteristics of the area; identify the factors (policies, procedures, and projects) that were effective or ineffective in improving these conditions; and ultimately to draw lessons from the experience at An-Nasr area in Irbid and use it in other similar areas in which sanitary conditions need to be improved, particularly the Tebbaneh area, Lebanon.

3.2 Methodology for assessment

The methodology adopted for this study focused on assessing the sanitary conditions at the study area (An-Nasr area) using performance indicators for the implemented policies, procedures, or projects at the study area by conducting a comprehensive survey for about three hundred households using a specially developed questionnaire.

The questionnaire used for the survey was developed by JUST personnel taking into consideration previous knowledge and experiences in conducting similar studies in the region and the feed back from local community and experts. A draft questionnaire was then sent to AUB investigators and was reviewed and updated. The questionnaire covered the

following issues: socio-demographics (17 questions), workforce (6 questions), financial status (5 questions), health status (5 questions), water resources (11 questions), network water (7 questions), well water (7 questions), water tankers (5 questions), hand-carried water (7 questions), bottled water (6 questions), drinking water (6 questions), water tanks (8 questions), personal hygiene and fixtures (5 questions), wastewater disposal (6 questions), solid waste disposal (5 questions), and prioritization (2 questions). A copy of the questionnaire used in this study is included in Annex 1.

The developed questionnaire intended to explore household characteristics and conditions. An investigation of the inhabitants of the household details the number of people living in the household, their ages, occupation, level of education, and sex. Other questions were related to the physical characteristics of the household. This was explored by gathering information about the number of rooms, available furniture, car ownership, electrical equipments, and the availability of water heating facilities. It is very important in this type of research and analysis to get as much information as possible about the income level of the household, thus, the questionnaire has also tried to gather information about the overall income of the household and how much of the income was devoted to different living essentials and requirement. There were questions on how much money has the household spent on food, heating and cooling, electricity and telephone bills, education, etc. However, it is essential that for this type of questions to emphasize to the people the confidentiality of the information that they provide. The research team thinks that such questions are delicate and might cause some uneasiness to the people surveyed. An important section of this questionnaire deals with the general health profiling of the children in the household. There were questions related to the frequency of diarrhea, vomiting, stomachache, coughing, and fever.

Another section of this questionnaire has been designed to survey the main and secondary water supply method (piped water, well, water trucks, springs, etc.), and to identify the source and treatment level of the drinking water, an important parameter that can influence the health conditions for the household inhabitants. This section has also tried to determine the amounts of water consumed by each household, and the cost paid for these waters. It is of great importance to try to correlate the income level of each household with the water consumed at it.

The information derived from the survey study has been carefully analyzed due to some deficiencies resulting from the lack of knowledge of some people regarding some of the required information. Besides, in certain cases, false information were provided on purpose, especially if the respondents felt that some of the information might go to the government or it might be used against them in the future (an example is the income part of the questionnaire). These issues were minimized by explaining to the interviewee the purpose of the research study and the type of information required, and the strict confidentiality of the information provided. Other concerns on the accuracy of the data collected included, but are not limited to, the failure to record all diarrhea cases, and the difficulty in accurately determining the level of per capita consumption of water in each zone.

3.2.1 Teams of surveyors

Two teams of surveyors were identified by the principle investigators to conduct the survey. Each team consisted of two highly qualified female specialists who either work or live in An-Nasr area. The selected team members and their academic background is presented in Table 1.

Table 1. List of surveyors in An-Nasr

Surveyors	*Credentials*
Ms. Rajaa Al-Hawari	Architect and Urban Planner, Director of An Naser Municipality
Ms. Anssam Al Akhras	Graduate Student in Environmental Science at JUST
Ms. Dua'a Beny Rusheid	M. Sc. In Urban Planning and an employee at Irbid Greater Municipality (native of An-Nasr area)
Ms. Eman Othman	An architect and urban planner

Numerous meetings between the principal investigators and the survey teams took place at Queen Rania Al-Abdullah Center for Environmental Science and Technology at JUST. These meetings focused on devising a work plan for the survey study, and on training the surveyors on the use of the questionnaire.

3.2.2 Description of the Study Area in An-Nasr

Irbid is Jordan's second largest city after the capital Amman. It is situated in the north west of the Hashemite Kingdom of Jordan, on a plain land, 65 km to the north of the capital, Amman, surrounded by fertile agricultural lands from the north, east and south (Figure 2). In 2004, the population of the Governorate of Irbid was 926,000 people which constitute about 18% of the country's population. The population density in the governorate is the highest in the country being at 570 persons/km^2 compared to 59.6 persons/km^2 for the whole of Jordan. However, the density varies dramatically within the city itself with a population density at 4,671 persons/km^2 at An-Nasr (Figure 3), which has been selected as the study area. The area of An-Nasr is estimated at about 1.9 km^2.

Figure 2. Location of Irbid in Jordan

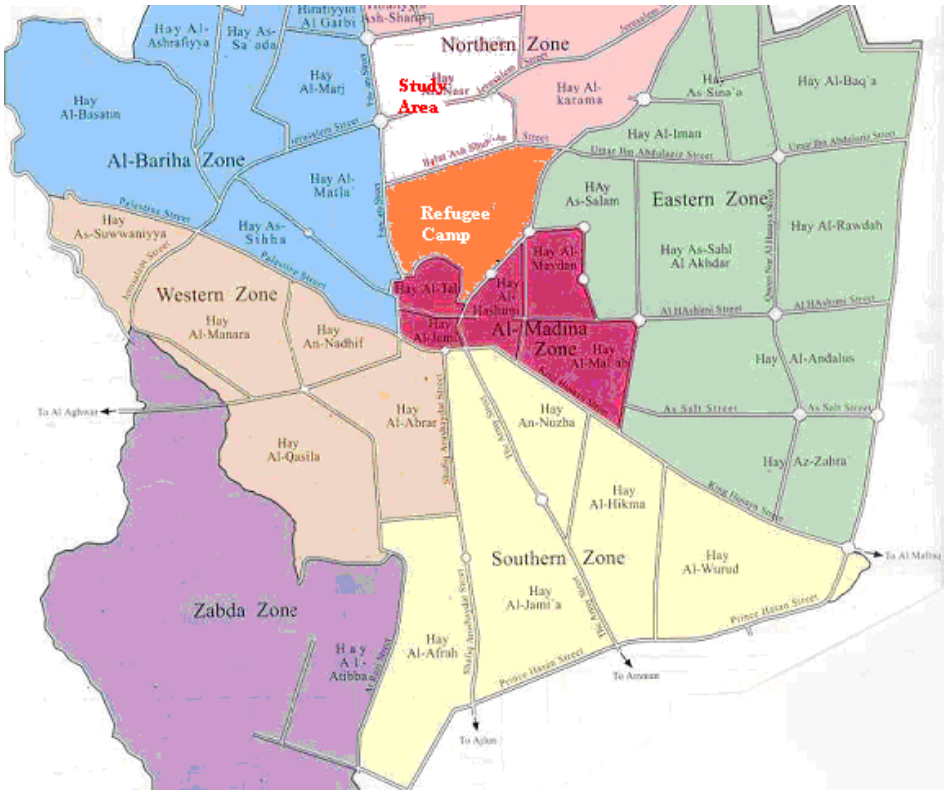

Figure 3. The study area within the city of Irbid

The previous records of the age groups for Irbid region (Table 2) show that 1,299 children are under the age of 5 years, which constitutes about 15% of the total population. In addition, the number of families of An-Nasr area (Table 3) is 1,542 families with a total population of 8,875, thus an average family size of 5.76 persons.

Table 2. Age structure of the population in An-Nasr Area

Age Interval (yrs)	*Males*	*Females*	*Total*
< 1	124	118	242
2 - 4	543	514	1,057
5 - 9	635	649	1,284
10 - 14	591	601	1,192
15 – 19	523	525	1,048
20 – 24	437	455	892
25 – 29	368	338	706
30 – 34	316	320	636
35 – 39	265	243	508
40 – 44	206	189	395
45 – 49	158	130	288
50 – 54	88	78	166
55 – 59	66	70	136
60 – 64	76	59	135
65 – 69	43	47	90
70 – 74	36	26	62
75 – 79	11	10	21
80 +	9	8	17
Total	*4,495*	*4,380*	*8,875*

Table 3. Household information in An-Nasr Area

Parameter	*Value*
Number of houses	1,753
Private families	1,540
Shared families	2
Jordanian males	4,205
Jordanian females	4,191
Non-Jordan males	259
Non-Jordan females	186
Males outside Jordan	31
Females outside Jordan	3

Irbid city has well developed urban characteristics with good infrastructure. An-Nasr area, however, poses a unique set of challenges to the provision of water and sanitation services due to extreme poverty, lack of education, and congestion. Yet, a water supply network is covering the whole area and water is supplied for almost all household units. In 2003, the average per capita per day share of drinking water is 91.6 liters compared to 126.4 liters for the country. Almost all water supplied through this network is abstracted from groundwater wells from areas around Irbid region, after being treated and tested to conform to the Jordanian drinking water standards. Another important fact is that most households in An-Nasr area have storage tanks over the roof made of tin, with some storage tanks made from PVC.

3.2.3 Field Survey for An-Nasr area

A comprehensive survey was launched in An-Nasr area using the prepared questionnaire to collect data on the prevailing relevant conditions and to estimate relevant performance indicators. Around three hundred households in the study area were surveyed by the teams. This is about one fifth of the number of families living in the study area. Pairs of surveyors collected random samples from different parts of the Greater Irbid Municipality. The survey covered the city and some suburban and rural regions.The process was exhaustive and challenging. The teams were faced with extreme sceptics who questioned the motives of this study and urged others not to cooperate. On some days, only few households accepted to participate in the questionnaire. An average of 4 to 5 questionnaires was conducted per day. The team members and the people complained that the survey was very lengthy. In addition, the main portion of the study was conducted during the Holy month of Ramadan (whereby many people were fasting) followed by theEid El-Fitr Holiday.

4 Results and Analysis

Data obtained from the questionnaires were summarized in spreadsheets. Basic statistical analysis was performed on this data. Results are grouped based on the relevant performance indicators as follows.

4.1 Percentage of children under <36 months with diarrhea in the last two weeks

Results indicate that the total number of children less than one year of age in the surveyed families is 71, with 40 males and 31 female. During the last three months before the survey, three diarrhea incidents were reported among males and only one incident among female

children. This represents 75 incidents for every 1,000 males, 32 in a thousand females, and a total of 56 in a thousand children.

For children between one and ten years of age, the total number of children surveyed was 394 out of which 203 are males and 191 are females. The numbers of diarrhea incidents identified during the three months that preceded the survey are 6 males and 7 females. This corresponds to around 30 incidents in 1000 males and 37 in a 1000 females.

4.2 Quantity of water used per capita per day

Results indicated that 97.3% of the houses surveyed (293 houses) receive their water from the public water network and only 8 houses obtain water from other sources. These include: trucks (6 houses, 2.05%), wells (1 house, 0.34%), or hand-carried water from a distant source (1 house, 0.34%) (Figure 4). The average water consumption per capita per day was first estimated for each household by dividing the quantity of water consumed over a 3-months period by the number of inhabitants for each household and 90 days. Then, the obtained averages for all houses studied were averaged. The average water consumption from the water network was found to be 36.5 L/c/d. However, 58.5 % of the surveyed families rely on bottled water for drinking purposes. An estimated average of 9.5 liter of bottled water per capita per day was estimated for the families using bottled water which gives an overall average of 5.5 liter per capita per day. Thus the total consumption rate was around 42 liters per capita per day. Although no specific limit has been established for the minimum water requirements per capita per day, the rate used at An-Nasr may be considered acceptable because the survey occurred during the summer period where the public water supply is usually low.

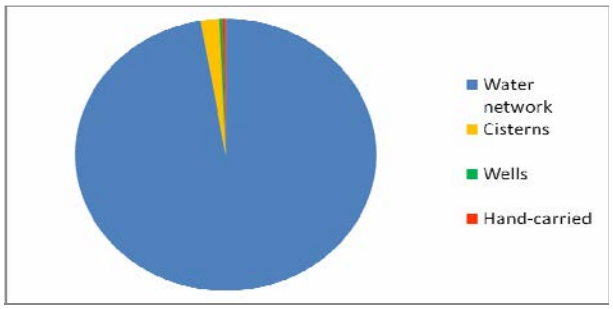

Figure 4. Main water source in An Nasr Area

4.3 Percentage of child caregivers and food preparers with appropriate hand washing behavior

The survey showed that, for hand washing, 96.7% of families surveyed use tap water and soap, 2% use tap water without soap, 0.5% used cistern water with soap, and 0.5% used cistern water without soap (Figure 5). Thus, a total percentage of 97.5% of surveyed families use water and soap for hand washing. The questionnaire, however, lacks specific questions on the techniques and timing of hand washing. The survey also indicated that all families have a kitchen and that all dishwashing occurs in the kitchen. Besides all houses surveyed own a washing machine and a refrigerator.

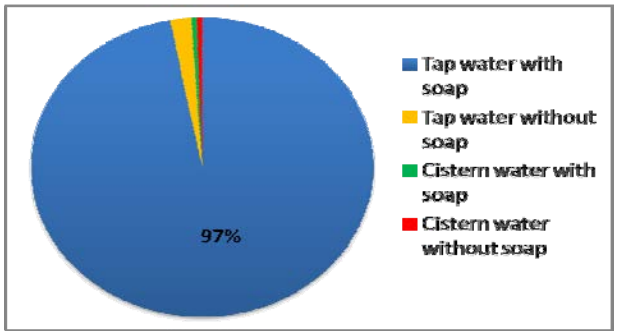

Figure 5. Hand washing behavior in An Nasr Area

4.4 Percentage of population using hygienic sanitation facilities

All houses surveyed are facilitated with toilets, with around 92% of houses having a bathtub and/or shower. Around 87.4% of the families perform hand washing in a sink inside or close to the bathroom, 9.6% of the families do it in a sink far from the toilet, and 4.5% wash hands in a sink in the kitchen. All houses surveyed indicated that they dispose of their wastewater into the sewage network. Around 93.5% of all houses reported that solid waste gets collected by authorities.

4.5 General statistics

The survey indicated that the average family size in the area of study is 6.2 capita per family, and the average number of rooms per house is 3.2. All families surveyed own a cell phone and all except one have a television set and a satellite dish. In addition, all families surveyed have access to a public or private medical clinic or hospital. As can be seen from Figure 6 below, 98% of all housewives can read and write, and about 77% have degrees beyond high school.

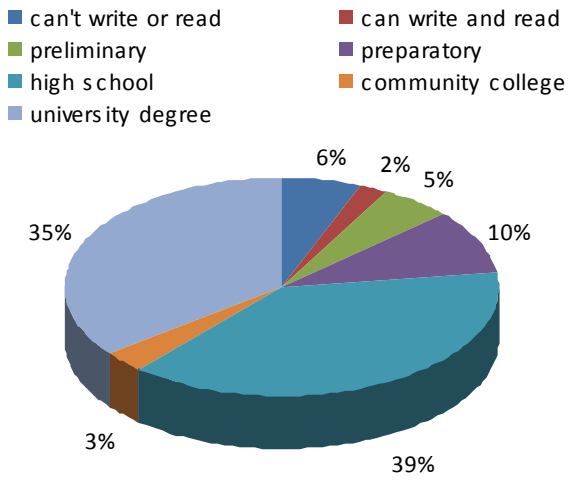

Figure 6. Status of education of housewives in An-Nasr area.

5 Conclusions and Recommendations

The survey of around three hundred families at An-Nasr Area in Irbid revealed that the sanitary and water services at the study area are improved to an acceptable level. This is verified in the following survey findings:

1) Around 97.3% of houses surveyed are provided with water from the public water network
2) All houses surveyed are connected to the wastewater sewage network
3) Solid waste from 93.5 % of houses is collected by authorities
4) The high level of education of housewives and child caregivers since 98% of housewives can read and write;
5) Provision of medical services in clinics at the study area and hospitals; and
6) Provision of a network of access roads and highways

These findings are the result of a set of policies, procedures, or projects that have been adapted by the Government of Jordan and implemented in An-Nasr area for the provision of water and sanitation services. However, the exact effect of each of these measures or their combined effects on improving the sanitary conditions at the study area were extremely difficult to measure. One of the reasons is the lack of information about the prevailing conditions before implementing these measures, not to mention the difficulty in establishing a cause and effect relation between each of these measures and its role in improving the sanitary conditions at An-Nasr area.

Overall, the survey was effective in obtaining the basic information required to estimate the criteria parameters for the provision of sanitary and waste service. However, the following observations were made by the team of field surveyors:

- The questionnaire was lengthy and it took an average of one hour per survey. This led to the decline of many families to do the questionnaire because of the time needed.
- Many people from the surveyed area were very skeptical regarding the real motives of the study despite the fact that all surveyors were provided with official documents from JUST
- Some questions were considered very personal and people surveyed were reluctant to answer such as the date of birth of the housewife. The use of female surveyors, however, helped in this regard.
- The use of some of the collected data was very limited and it would have not affected the general findings of this study.

The following are suggestions to improve the questionnaire:

In general, it is highly recommended to shorten the questionnaire and only emphasize the questions that are relevant to the direct objectives of this study. However, the following points have to be included:

- The questionnaire is to cover the willingness of the people to pay for the provision of better services.
- The questionnaire has to inquire about when the service was provided, and whether the population growth must be taken into consideration.
- The questionnaire has to inquire about the local regulations and authorities in charge of providing water and wastewater collection.

- The questionnaire has to inquire about the heating source.
- The questionnaire has to inquire about who are the child caregivers and their practice of hygienic behavior; whether they have been subjected to any training or awareness programs/ education.
- The questionnaire is to cover the time (before the preparation of food, after changing dippers and using toilets) frequency, and technique used for hand washing.
- The age category for children [article SD3 in the questionnaire] has to be modified to include a new category for age from 1 to 3 years.
- Finally, it is highly recommended to use female surveyors.

REFERENCES

Al-Sharif, M., 2005. Guidance on Household Water Security and Minimum Water Requirements for Health. *Queen Rania Al Abdullah Center for Environmental Sciences and Technology (QRCEST), Jordan.*

Billig, P., D.Bendahmane, A.Swindale. 1999. Water and Sanitation Indicators Measurement Guide. *USAID, Food and Nutrition Technical Assistance.*

Boot, M.., and S. Cairncross, eds. 1993. Actions Speak: The Study of Hygiene Behavior in Water and Sanitation Projects*. IRC International Water and Sanitation Centre and London School of Hygiene and Tropical Medicine: The Hague.*

Esrey, S., J.Potash, L. Roberts, C. Shiff. 1991. Effects of improved water supply and sanitation on ascariasis, diarrhea, drancunculiasis, hookworm infection, schistosomiasis and trachoma. *Bulletin of the World Health Organization* 60:609-621.

Feachem, R. 1984. Interventions for the control of diarrhoeal diseases among young children: promotion of personal and domestic hygiene. *Bulletin of the World Health Organization* 62(3): 467-476.

Gleick, P. 1996. Basic water requirements for human activities: meeting basic needs. *Water International* 21:83-92.

Warner, D. 1997. Environmental sanitation and child health: the missing link in child survival. *A University of Notre Dame conference on the Changing Status of Children in Latin America: Issues in Child Health and Children's Right*, September 26-29.

Annex 4.
List of participants at the inception meeting in Tripoli (October 25, 2008)

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15- Mohammad Kabara	Safadi Foundation	03/931033
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21- Raja Bou Fakher Aldeen	American University of Beirut	01/350000



Selected photos from the inception meeting in Tripoli – October 25, 2008

Annex 5.
Powerpoint presentation at the inception meeting in Tripoli (October 25, 2008)

تحسين خدمات
المياه والصرف الصحي في التبانة عبر التحليل بالمقارنة مع اربد–ألاردن

د. معتصم الفاضل
الجامعة الاميركية في بيروت

الهدف الاساسي

تخفيف الأعباء البيئية في الأحياء الفقيرة من خلال فهم أفضل لكيفية تأثير الخدمات البيئية على الأحوال الإجتماعية، بالإضافة إلى ادخال مشاريع نموذجية لتحسين هذه الخدمات

النشاطات

- إنشاء إطار المقارنة (إربد–ألتبانة)
- تقييم الاحتياجات وتحديد الاولويات
- وضع خرائط للبنى التحتية على نظام المعلومات الجغرافية (GIS)
- المشاريع النموذجية: تحديد وتنفيذ
- وضع إطار التنمية المستدامة
- مشاركة النتائج والخبرات

الاهداف

- تحديد الاولويات تبعا للوضع الاقتصادي–الاجتماعي
- تخطيط وتنفيذ مشاريع نموذجية بإتباع نهج يسمح بمشاركة المجتمع المحلي والبلدية

تقييم الاحتياجات وتحديد الاولويات

- البناء على الخبرات السابقة والحالية
- المسوحات الميدانية (إستمارات،....)
- مقابلات واجتماعات مع أصحاب العلاقة والمعنيين
- فهم النظم الداعمة للبنى التحتية وتحديد مسؤوليات الإدارة
- بناء القدرات المحلية

إنشاء إطار المقارنة (إربد–ألتبانة)

- اربد ، الأردن :
  - خصائص مماثلة للتبانة
  - أداء على نحو كاف لأنظمة المياه والصرف الصحي
- تقييم اجتماعي ميداني
- تحديد وتعريف المؤشرات الرئيسية التي تؤثر على توفير توزيع المياه وخدمات الصرف الصحي

المشاريع النموذجية: تحديد وتنفيذ

- تحديد المشاريع النموذجية المحتملة بالتنسيق مع البلدية والمجتمع المحلي على اسس نتائج المسح الميداني
- مشاريع إنشائية وغير إنشائية تراعي الفوارق الإجتماعية

وضع خرائط للبنى التحتية على نظام المعلومات الجغرافية (GIS)

- المعلومات عن البنى التحتية ستدرج في إطار نظام المعلومات الجغرافية
  - إجراء تحليل للوضع الراهن
  - إتاحة المجال لتطوير نظام دعم بلدي لمنطقة التبانة
- إدراج طبقات بيانات اجتماعية واقتصادية وغيرها متوافقة مع نظم المعلومات الجغرافية القائم حالياً

شكراً...

وضع إطار التنمية المستدامة

- تلخيص نتائج المشاريع في إطار يدفع الى مشاركة ومساهمة المجتمع المحلي في توفير الخدمات ورسم السياسات المحلية
- يستعمل بمثابة دليل في التخطيط البيئي الحالي والمستقبلي في التبانة
- يمكن اعتماده في مناطق أخرى مماثلة
- وضع خطط محددة لإدارة شؤون المجتمع المحلي بوسع البلدية تنفيذها أو السعي إلى الحصول على تمويل لها

Annex 6.
List of participants at the follow up meeting in Tripoli (March 20, 2009)

Name	*Organization*	*Contact information*
1- Sabah Mawloud	جمعية العمل النسوي	06/381112, 03/980547 kmawloud@hotmail.com
2- Dima El Aatal	جمعية العمل النسوي	06/381112
3- Fatima Othman	جمعية العمل النسوي	70/328036
4- Ghina Aaloush	جمعية معكم الخيرية الاجتماعية	03/625698, 06/391992 ghina_osta@hotmail.com
5- Faten Ghanem	جمعية معكم الخيرية الاجتماعية	06/444378 faten.gh82@hotmail.com
6- Sarah EL Khatib	جمعية اللقاء النسائي الخيري	70/145491 zouari_jeddah@yahoo.com
7- Zeina Karameh	جمعية اللقاء النسائي الخيري	03/229973 zeinaka@idm.net.lb
8- Racha Matar	جمعية اللقاء النسائي الخيري	70/690757 missjolie2009@hotmail.com
9- Rabih Omar	Tripoli Municipality	70/843826 rabih_omar@hotmail.com
10- Rabih Mohsen	Tripoli Municipality	03/975511 rbmohsen@yahoo.com
11- Nadia El Ahmad	Tripoli Municipality	70/731751 dia-81@hotmail.com
12- Battoul Assad	Tripoli Municipality	70/802744
13- Alissar Elias	Intern PhD student	03/435206 alissarelias@yahoo.fr
14- Dr. Mutassem El Fadel	American University of Beirut	01/350000 mfadel@aub.edu.lb
15- Raja Bou Fakher Aldeen	American University of Beirut	01/350000 rb20@aub.edu.lb
16- Rania Maroun	American University of Beirut	01/350000 rm27@aub.edu.lb
17- Dany Lichaa El Khoury	American University of Beirut	01/350000 dany.lichaa@aub.edu.lb



Selected photos from the follow up meeting in Tripoli – March 30, 2009

Annex 7.
Field survey team in the Tebbaneh region

Name	*Occupation/Organization*	*Background*	*Project involvement*
Rabih Omar	Social advisor/Tripoli Municipality	MS. Human Resources	Municipality representative
Elissar Elias	Volunteer /intern PhD Student	MS. Geology and Environment	Field coordination of survey team
Nadia El Ahmad	Social worker/Tripoli Municipality	BS. Social Sciences	Field Surveyor
Racha Matar	Social worker/جمعية اللقاء النسائي الخيري	University student/ Arabic education	Field surveyor
Fatima Othman	Social worker/جمعية العمل النسوي	University student/ Social Sciences	Field surveyor
Dima Attal	Social worker/جمعية العمل النسوي	BS. Social Sciences	Field surveyor
Faten Ghanem	Social worker/جمعية معكم الخيرية الاجتماعية	University student/ Psychology	Field surveyor
Rania Maroun	Research Associate/American University of Beirut	MS. Environmental Technology	Social survey coordination and implementation follow up

Annex 8.
Revised Questionnaire for Tebbaneh, Tripoli

Participatory Improvement of Water and Sanitation Services in Tripoli through a Comparative Analysis in Irbid, Jordan

Questionnaire Identification					
AI1	**Country**	**Lebanon**	AI4	**Building**	|___|___|___|___|___|___|___|
AI2	**Zone**	|___|	AI5	**Floor**	|___|___|
AI3	**Neighbourhood**	_____	AI6	**Housing unit number**	(Start from right side) |___|___|
Schedule					
AV1	First Visit	DD-MM |___|___|-|___|___|	AT1	Start of interview (time)	hh-mm |___|___|-|___|___|
			AT2	End of Interview (time)	hh-mm |___|___|-|___|___|
AV2	Second Visit	DD-MM |___|___|-|___|___|	AT3	Start of interview	hh-mm |___|___|-|___|___|
			AT4	End of Interview	hh-mm |___|___|-|___|___|
AV3	Third Visit	DD-MM |___|___|-|___|___|	AT5	Start of interview	hh-mm |___|___|-|___|___|
			AT6	End of Interview	hh-mm |___|___|-|___|___|
AV4	Fourth Visit	DD-MM |___|___|-|___|___|	AT7	Start of interview	hh-mm |___|___|-|___|___|
			AT8	End of Interview	hh-mm |___|___|-|___|___|
AV6	**Total visits carried out**				|___|
AV7	**Editing Date**			DD-MM	|___|___|-|___|___|
AV8	**Coding Date**			DD-MM	|___|___|-|___|___|
AV9	**Data entry Date**			DD-MM	|___|___|-|___|___|
Staff					
AS1	**Interviewer**	|___|___|	AS4	**Coder**	|___|___|
AS2	**Supervisor**	|___|___|	AS5	**Data entry operator**	|___|___|
AS3	**Editor**	|___|___|			
Respondent					
Name of household head					
Name of main Respondent					
AR1	**Interview status**				
	1	Interview completed	**COMMENTS:**		
	2	Refusal converted			
	3	Partly completed			
	4	No usable information			
	5	Household unit is vacant			
	6	No contact			
	7	Refusal			

سوف أبدأ بطرح بعض الاسئلة عن العائلة:

معلومات اجتماعية وديموغرافية (socio-demographic)				
SD1	عدد الغرف في المنزل **(دون المطبخ، الحمام، الشرفة والمخزن/موقف السيارة)**			|___|___|
SD2	عدد الافراد الذين يسكنون في المنزل **(الذين يتشاركون الطعام ومدخل البيت)**			|___|___|
SD3	عدد الافراد الذين يسكنون في المنزل بحسب الفئة العمرية			
SD3A1		دون سنة	ذكر	|___|___|
SD3A2			أنثى	|___|___|
SD3B1		من سنة الى 3 سنوات	ذكر	|___|___|
SD3B2			أنثى	|___|___|
SD3C1		من 3 سنوات الى 10 سنوات	ذكر	|___|___|
SD3C2			أنثى	|___|___|
SD3D1		من 11 سنة الى 18 سنة	ذكر	|___|___|
SD3D2			أنثى	|___|___|
SD3E1		من 19 سنة الى 30 سنة	ذكر	|___|___|
SD3E2			أنثى	|___|___|
SD3F1		من 31 سنة الى 65 سنة	ذكر	|___|___|
SD3F2			أنثى	|___|___|
SD3G1		أكبر من 65 سنة	ذكر	|___|___|
SD3G2			أنثى	|___|___|
SD4	كم عائلة تسكن في هذا المنزل؟	1	عائلة واحدة	
		2	عائلتان تربطهما قربة	
		3	عائلتان لا تربطهما قربة	
		4	زوج واحد وعدة عوائل	
		5	أكثر من عائلتان	
		6	غير ذلك، حدد:_____	
		98	لا جواب	
		99	لا أعلم	
SD5	تاريخ ميلاد رب المنزل		اليوم الشهر السنة	
			|___|___| - |___|___| - |___|___|	
		98	لا جواب	
		99	لا أعلم	
SD6	عمر رب المنزل		|___|___|	
		98	لا جواب	
		99	لا أعلم	
SD7	تاريخ ميلاد ربة المنزل		اليوم الشهر السنة	
			|___|___| - |___|___| - |___|___|	
		98	لا جواب	
		99	لا أعلم	
SD8	عمر ربة المنزل		|___|___|	
		98	لا جواب	
		99	لا أعلم	
SD9	أعلى مستوى علمي حصّله رب المنزل	1	لا يجيد القراءة والكتابة	
		2	يجيد القراءة والكتابة دون تحصيل أي مستوى	
		3	ابتدائي	
		4	متوسط	
		5	ثانوي	
		6	تقني	
		7	جامعي	
		98	لا جواب	
		99	لا أعلم	

SD10	أعلى مستوى علمي حصّلته ربة المنزل	1	لا تجيد القراءة والكتابة
		2	تجيد القراءة والكتابة دون تحصيل أي مستوى
		3	ابتدائي
		4	متوسط
		5	ثانوي
		6	تقني
		7	جامعي
		98	لا جواب
		99	لا أعلم
SD11	ما هو عدد الذكور في المنزل الذين يتعلّمون في المدرسة؟	|___|___|	
		98	لا جواب
		99	لا أعلم
SD12	أين يتعلّم معظم الاولاد الذكور؟	1	مدرسة خاصة في باب التبانة؟
		2	مدرسة خاصة خارج باب التبانة؟
		3	مدرسة حكومية في باب التبانة؟
		4	مدرسة حكومية خارج باب التبانة؟
		5	غير ذلك، حدد:_____
		98	لا جواب
		99	لا أعلم
SD13	أعلى مستوى علمي حصّله الابن الأكبر (حتى إذا لم يعد يسكن معك)	1	لا أبناء ذكور
		2	لا يجيد القراءة والكتابة
		3	يجيد القراءة والكتابة دون تحصيل أي مستوى
		4	ابتدائي
		5	متوسط
		6	ثانوي
		7	تقني
		8	جامعي
		98	لا جواب
		99	لا أعلم
SD14	ما هو عدد الإناث في المنزل الذين يتعلّمون في المدرسة؟	|___|___|	
		98	لا جواب
		99	لا أعلم
SD15	أين يتعلّم معظم الاولاد الإناث؟	1	مدرسة خاصة في باب التبانة؟
		2	مدرسة خاصة خارج باب التبانة؟
		3	مدرسة حكومية في باب التبانة؟
		4	مدرسة حكومية خارج باب التبانة؟
		5	غير ذلك، حدد:_____
		98	لا جواب
		99	لا أعلم
SD16	أعلى مستوى علمي حصّلته البنت الكبرى (حتى إذا لم تعد تسكن معك)	1	لا بنات
		2	لا تجيد القراءة والكتابة
		3	تجيد القراءة والكتابة دون تحصيل أي مستوى
		4	ابتدائي
		5	متوسط
		6	ثانوي
		7	تقني
		8	جامعي
		98	لا جواب
		99	لا أعلم

SD17	هل أحد أفراد المنزل هو عضو أو متطوّع أو على علاقة بأية جمعية إجتماعية، تنموية أو ثقافية في باب التبانة أو خارجها؟	1 2 98 99	نعم كلا لا جواب لا أعلم	

سوف أطرح عليك بعض الأسئلة حول وضع العمل في منزلك:

العمل (Working Force)				
WF1	ما هو العمل الأساسي لرب المنزل؟		_____	
		98	لا جواب	
		99	لا أعلم	
WF2	أين هو موقع عمله؟		_____	
		98	لا جواب	
		99	لا أعلم	
WF3	ما هو مركزه في العمل؟	1	يعمل لحسابه الخاص	
		2	موظف	
		3	رب عمل	
		4	غير ذلك، حدد	_____
		98	لا جواب	
		99	لا أعلم	
WF4	ما نوع العمل الآخر لرب المنزل؟		_____	
		1	لا عمل آخر	
		98	لا جواب	
		99	لا أعلم	
WF5	ما هو عدد أفراد منزلك الآخرين الذين يعملون حاليّاً؟		|___|___|	
		98	لا جواب	
		99	لا أعلم	
WF5A1	يعملون مقابل أجر خارج المنزل:	ذكور	≥ 18	|___|___|
WF5A2			≤ 18	|___|___|
WF5A3		إناث	≥ 18	|___|___|
WF5A4			≤ 18	|___|___|
WF5B1	يعملون مقابل أجر من المنزل:	ذكور	≥ 18	|___|___|
WF5B2			≤ 18	|___|___|
WF5B3		إناث	≥ 18	|___|___|
WF5B4			≤ 18	|___|___|
WF5C1	يعملون مع العائلة دون أجر:	ذكور	≥ 18	|___|___|
WF5C2			≤ 18	|___|___|
WF5C3		إناث	≥ 18	|___|___|
WF5C4			≤ 18	|___|___|
WF6	قل لي النسبة المئوية لمساهمة كل مصدر من مصادر الدخل لدخل منزلك الاجمالي:			
WF6A			عمل رب المنزل الأساسي	|___|___|___|
WF6B			عمل رب المنزل الآخر	|___|___|___|
WF6C			عمل أفراد العائلة الآخرين	|___|___|___|
WF6D			إعانات	|___|___|___|
WF6E			غير ذلك، حدد_____	|___|___|___|

سوف أطرح عليك بعض الأسئلة حول الوضع المالي لمنزلك. (لن أسأل عن أرقام محدّدة)

الوضع المالي (Financial status)			
FS1	هل تملك المنزل الذي تسكن فيه؟	1	نعم
		2	كلا
		98	لا جواب
		99	لا أعلم
FS2	هل لديك في المنزل:		
FS2A	غسالة ملابس	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2B	جلاية أواني	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2C	ثلاجة	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2D	سخان ماء	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2E	خط هاتف أرضي ثابت	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2F	خط هاتف خلوي	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2G	تلفاز	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2H	كمبيوتر	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
FS2I	صحن لاقط	1	أمتلك صحن لاقط
		2	لدي اشتراك
		3	لا
		98	لا جواب
		99	لا أعلم
FS3	كيف تقيّم مستوى الدخل في منزلك بالمقارنة مع المنازل الأخرى في باب التبّانة	1	أفضل بكثير
		2	أفضل
		3	ذات المستوى
		4	أسوأ
		5	أسوأ بكثير
		98	لا جواب
		99	لا أعلم

FS4	في حال احتاج منزلك فجأةً لمبلغ 150,000 ليرة لبنانيّة، هل تستطيع تأمينه خلال أسبوع؟	1 2 3 98 99	نعم ربما، لكن ليس بالتأكيد لا لا جواب لا أعلم
FS5	إذا كان الجواب نعم، كيف تؤمّن المبلغ؟	1 2 3 4 98 99	استخدم مدّخراتي بمساعدة منظمات بمساعدة الأصدقاء عن طريق بيع بعض الممتلكات لا جواب لا أعلم

سوف أطرح عليك بعض الأسئلة حول الوضع الصحي العام لمنزلك

الوضع الصحّي (Health Status)				
HS1	هل يعاني أحد أفراد المنزل من مرض أو إعاقة مزمنة؟	1 2 98 99	نعم لا لا جواب لا أعلم	
HS2	إذا كان الجواب نعم، ما هو المرض، الجنس، والعمر؟			
HS2A1	الفرد الأول	العمر	|___|___|	
HS2A2		الجنس	1 ذكر 2 أنثى	
HS2A3		المرض	_____	
HS2A4		الإعاقة	_____	
HS2B1	الفرد الثاني	العمر	|___|___|	
HS2B2		الجنس	1 ذكر 2 أنثى	
HS2B3		المرض	_____	
HS2B4		الإعاقة	_____	
HS2C1	الفرد الثالث	العمر	|___|___|	
HS2C2		الجنس	1 ذكر 2 أنثى	
HS2C3		المرض	_____	
HS2C4		الإعاقة	_____	
HS2D1	الفرد الرابع	العمر	|___|___|	
HS2D2		الجنس	1 ذكر 2 أنثى	
HS2D3		المرض	_____	
HS2D4		الإعاقة	_____	
HS2E1	الفرد الخامس	العمر	|___|___|	
HS2E2		الجنس	1 ذكر 2 أنثى	
HS2E3		المرض	_____	
HS2E4		الإعاقة	_____	
HS3	هل عانى أحد أفراد المنزل من الإسهال في الثلاثة أشهر الماضية؟	1 2 98 99	نعم لا لا جواب لا أعلم	

HS3A	إذا كان الجواب نعم، ما هو المرض، الجنس، والعمر؟			
HS3A1	الفرد الأول	العمر	|___|___|	
HS3A2		الجنس	1 ذكر	
			2 أنثى	
HS3A3		المرض	1 إسهال	
			2 تيفؤيد	
			3 التهاب الكبد (Hepatitis A)	
			4 غير ذلك، حدد _____	
HS3A4a		الأعراض	1 إسهال	
HS3A4b			2 استفراغ	
HS3A4c			3 حرارة مرتفعة	
HS3A4d			4 أوجاع في المعدة	
HS3A4e			5 غير ذلك، حدد _____	
HS3A5	كم يوم اضطر المريض البقاء في المنزل بسبب المرض؟		|___|___|	
HS3A8	من اهتمّ بالمريض خلال فترة مرضه؟		_____	
HS3A6		للعلاج هل تم اللجوء الى	1 المستشفى	
			2 المستوصف	
			3 عيادة خاصة	
			4 الطبيب يزورني في المنزل	
			5 لا أحد	
			6 غير ذلك، حدد _____	
			98 لا جواب	
			99 لا أعلم	
HS3A7a		ما كانت تكلفة العلاج باللليرة اللبنانيّة؟	التكلفة الإجماليّة |___|___|___|___|___|___|	
HS3A7b			ثمن الدواء |___|___|___|___|___|___|	
HS3A7c			أجرة الطبيب في المستوصف |___|___|___|___|___|___|	
HS3A7d			أجرة الطبيب في المنزل |___|___|___|___|___|___|	
HS3A7e			أجرة المستشفى |___|___|___|___|___|___|	
HS3A7f			98 لا جواب	
			99 لا أعلم	
HS3B1	الفرد الثاني	العمر	|___|___|	
HS3B2		الجنس	1 ذكر	
			2 أنثى	
HS3B3		المرض	1 إسهال	
			2 تيفؤيد	
			3 التهاب الكبد (Hepatitis A)	
			4 غير ذلك، حدد _____	
HS3B4a		الأعراض	1 إسهال	
HS3B4b			2 استفراغ	
HS3B4c			3 حرارة مرتفعة	
HS3B4d			4 أوجاع في المعدة	
HS3B4f			5 غير ذلك، حدد _____	

HS3B5			كم يوم اضطر المريض البقاء في المنزل بسبب المرض؟	|___|___|
HS3B8			من اهتمّ بالمريض خلال فترة مرضه؟	_____
HS3B6		للعلاج هل تم اللجوء الى	1	المستشفى
			2	المستوصف
			3	عيادة خاصة
			4	الطبيب يزورني في المنزل
			5	لا أحد
			6	غير ذلك، حدد _____
			98	لا جواب
			99	لا أعلم
HS3B7a		ما كانت تكلفة العلاج بالليرة اللبنانيّة؟	التكلفة الإجماليّة	|___|___|___|___|___|___|___|
HS3B7b			ثمن الدواء	|___|___|___|___|___|___|___|
HS3B7c			أجرة الطبيب في المستوصف	|___|___|___|___|___|___|___|
HS3B7d			أجرة الطبيب في المنزل	|___|___|___|___|___|___|___|
HS3B7e			أجرة المستشفى	|___|___|___|___|___|___|___|
HS3B7f			98	لا جواب
			99	لا أعلم
HS3C1	الفرد الثالث	العمر	|___|___|	
HS3C2		الجنس	1	ذكر
			2	أنثى
HS3C3		المرض	1	إسهال
			2	تيفؤيد
			3	التهاب الكبد (Hepatitis A)
			4	غير ذلك، حدد _____
HS3C4a		الأعراض	1	إسهال
HS3C4b			2	استفراغ
HS3C4c			3	حرارة مرتفعة
HS3C4d			4	أوجاع في المعدة
HS3C4e			5	غير ذلك، حدد _____
HS3C5		كم يوم اضطر المريض البقاء في المنزل بسبب المرض؟	|___|___|	
HS3C8			من اهتمّ بالمريض خلال فترة مرضه؟	_____
HS3C6		للعلاج هل تم اللجوء الى	1	المستشفى
			2	المستوصف
			3	عيادة خاصة
			4	الطبيب يزورني في المنزل
			5	لا أحد
			6	غير ذلك، حدد _____
			98	لا جواب
			99	لا أعلم

HS3C7a		ما كانت تكلفة العلاج باللیرة اللبنانيّة؟	التكلفة الإجماليّة	|___|___|___|___|___|___|___|
HS3C7b			ثمن الدواء	|___|___|___|___|___|___|___|
HS3C7d			أجرة الطبيب في المستوصف	|___|___|___|___|___|___|___|
HS3C7e			أجرة الطبيب في المنزل	|___|___|___|___|___|___|___|
HS3C7f			أجرة المستشفى	|___|___|___|___|___|___|___|
HS3C7g			98	لا جواب
			99	لا أعلم
HS3D1	الفرد الرابع	العمر	|___|___|	
HS3D2		الجنس	1	ذكر
			2	أنثى
HS3D3		المرض	1	إسهال
			2	تيفؤيد
			3	التهاب الكبد (Hepatitis A)
			4	غير ذلك، حدد _____
HS3D4a		الأعراض	1	إسهال
HS3D4b			2	استفراغ
HS3D4c			3	حرارة مرتفعة
HS3D4e			4	أوجاع في المعدة
HS3D4f			5	غير ذلك، حدد _____
HS3D5		كم يوم اضطر المريض البقاء في المنزل بسبب المرض؟	|___|___|	
HS3D8		من اهتمّ بالمريض خلال فترة مرضه؟ _____		
HS3D6		للعلاج هل تم اللجوء الى	1	المستشفى
			2	المستوصف
			3	عيادة خاصة
			4	الطبيب يزورني في المنزل
			5	لا أحد
			6	غير ذلك، حدد _____
			98	لا جواب
			99	لا أعلم
HS3D7a		ما كانت تكلفة العلاج باللیرة اللبنانيّة؟	التكلفة الإجماليّة	|___|___|___|___|___|___|___|
HS3D7b			ثمن الدواء	|___|___|___|___|___|___|___|
HS3D7c			أجرة الطبيب في المستوصف	|___|___|___|___|___|___|___|
HS3D7e			أجرة الطبيب في المنزل	|___|___|___|___|___|___|___|
HS3D7f			أجرة المستشفى	|___|___|___|___|___|___|___|
HS3D7g			98	لا جواب
			99	لا أعلم

HS4	في العموم، اذا احتاج أحد أفراد منزلك للطبابة، الى أين تلجأ؟	1 2 3 4 5 6 7 98 99	مستوصف عام في باب التبّانة مستوصف عام خارج باب التبّانة عيادة خاصة في باب التبّانة عيادة خاصة خارج باب التبّانة مستشفى خارج باب التبّانة زيارة منزليّة غير ذلك، حدد_____ لا جواب لا أعلم
HS5	لما فضلت هذا الخيار؟	1 2 3 4 5 6 7 98 99	لأنه الخيار الأوفر لأنه الخيار الأفضل لأنه اكثر راحة من غيره لأني أثق به أكثر لأنه لدينا تأمين عام (ضمان) لأنه لدينا تأمين خاص غير ذلك، حدد_____ لا جواب لا أعلم
HS6	هل حصل في منزلك حالة وفاة أطفال بسبب الإسهال	1 2 98 99	نعم كلا لا جواب لا أعلم
HS6A1	إذا الجواب نعم، متى حصلت الوفاة؟		_____ الشهر |___|___|___|___| السنة
HS6A2	ما كان عمر الطفل عند وفاته؟		|___|___| شهر

الآن سوف أسأل عن المياه في المنزل

مصادر المياه (water sources)			
WS1	ما هي مصادر المياه التي تصل الى المنزل؟		
WS1A	شبكة المياه العامة	1 2 99	نعم كلا لا أعلم
WS1B	بئر	1 2 99	نعم كلا لا أعلم
WS1C	صهريج مياه	1 2 99	نعم كلا لا أعلم
WS1D	مياه منقولة باليد	1 2 99	نعم كلا لا أعلم
WS1E	مياه معبأة	1 2 99	نعم كلا لا أعلم
WS1F	غير ذلك، حدد:_____		

WS2A WS2B WS2C WS2D WS2E WS2F	حدد النسبة المئوية لكل مصدر بحسب الكمية التي تحصل عليها في الشتاء (المجموع يجب أن يكون 100%)	شبكة المياه العامة بئر صهريج مياه مياه منقولة باليد مياه معبأة غير ذلك		|___|___|%
WS3A WS3B WS3C WS3D WS3E WS3F	حدد النسبة المئوية لكل مصدر بحسب الكمية التي تحصل عليها في الصيف (المجموع يجب أن يكون 100%)	شبكة المياه العامة بئر صهريج مياه مياه منقولة باليد مياه معبأة غير ذلك		|___|___|% |___|___|% |___|___|% |___|___|% |___|___|% |___|___|%
WS4	كم برميل مياه يستهلك منزلك يومياً في فصل الصيف		99	|___|___| برميل/يوم لا أعلم
WS5	كم برميل مياه يستهلك منزلك يومياً في فصل الشتاء		99	|___|___| برميل/يوم لا أعلم
WS6	هل تكفيك كميّة مياه الإستعمال التي تصل الى منزلك في فصل الصيف ؟		1 2 3 4 98 99	أكثر من كافية كافية بالكاد تكفي لا تكفي لا جواب لا أعلم
WS7	هل تكفيك كميّة مياه الإستعمال التي تصل الى منزلك في فصل الشتاء؟		1 2 3 4 98 99	أكثر من كافية كافية بالكاد تكفي لا تكفي لا جواب لا أعلم
WS8	هل أنت راضٍ عن نوعيّة مياه الاستعمال التي تصل الى منزلك فيً فصل الصيف؟		1 2 98 99	نعم لا لا جواب لا أعلم
WS9	لماذا أنت غير راضٍ؟		1 2 3 4 98 99	المياه ليست صافية هناك رائحة كلور في المياه المياه ملوّثة غير ذلك، حدد _____ لا جواب لا أعلم
WS10	هل أنت راضٍ عن نوعيّة مياه الاستعمال التي تصل الى منزلك فيً فصل الشتاء؟		1 2 98 99	نعم لا لا جواب لا أعلم
WS11	لماذا أنت غير راضٍ؟		1 2 3 4 98 99	المياه ليست صافية هناك رائحة كلور في المياه المياه ملوّثة غير ذلك، حدد _____ لا جواب لا أعلم

إذا كنت تحصل على المياه من الشبكة العامّة

مياه الشبكة العامة (network water)				
NW1	هل لديك عداد أم عيار بالمتر المكعب؟		1	عداد
			2	عيار بالمتر المكعب
			3	لا عداد ولا عيار
			4	غير ذلك، حدد _____
			99	لا أعلم
NW2A	إذا كان لديك عدّاد	رقم العداد	_____	
NW2B		فاتورة كلّ	|___|___|	شهر
NW2C		الكمية المستهلكة فى آخر فاتورة عداد	|___|___|___|___|	متر مكعب
NW2D		القيمة المدفوعة فى آخر فاتورة	|___|___|___|___|	ليرة
NW3A	إذا كان لديك عيار بالمتر المكعب	ما قيمة فاتورتك السنويّة؟	|___|___|___|___|	ليرة
NW3B		ما قياس العيار؟	|___|___|	مم
NW4A	ما هي استخدامات المياه التي تحصل عليها من شبكة المياه العامة	للشرب	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
NW4B		لغسل الأيدي	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
NW4C		للاستحمام	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
NW4D		لغسل الطعام	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
NW4E		للطبخ	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
NW4F		لغسل الصحون	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
NW4G		لتنظيف البيت	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
NW4H		في غرفة الغسيل	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
NW4I		للري	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم

NW4J	غير ذلك، حدد:_____		
NW5	ما وتيرة تزويد المياه عبر الشبكة العامّة؟		|___| مرة في الأسبوع 2 متقطّع لكن لا يمكن تحديد الوتيرة 1 بشكل مستمر 98 لا جواب 99 لا أعلم
NW6	كم تبقى المياه مزوّدة حين تأتي؟		|___|___| ساعة 2 متقطّع لكن لا يمكن التحديد 1 بشكل مستمر 98 لا جواب 99 لا أعلم
NW7	كيف تجد نوعية هذه المياه؟	1 جيدة (دون لون، طعم، رائحة، ورواسب) 2 متوسطة (بعض اللون، طعم، رائحة، ورواسب) 3 سيئة (ذات لون، طعم، رائحة، ورواسب) 98 لا جواب 99 لا أعلم	

إذا كنت تحصل على المياه من الآبار

مياه الآبار (Well water)					
WW1	عدد الآبار التي تصل منها مياه الى المنزل |___|				
WW2		A	B	C	D
		البئر 1	**البئر 2**	**البئر 3**	**البئر 4**
1	إسم البئر (إذا أمكن)	_____ 99 لا أعلم	_____ 99 لا أعلم	_____ 99 لا أعلم	_____ 99 لا أعلم
2	نوع البئر	1 خاص للمنزل 2 مشترك بين عدة منازل 3 مشترك للحي 99 لا أعلم	1 خاص للمنزل 2 مشترك بين عدة منازل 3 مشترك للحي 99 لا أعلم	1 خاص للمنزل 2 مشترك بين عدة منازل 3 مشترك للحي 99 لا أعلم	1 خاص للمنزل 2 مشترك بين عدة منازل 3 مشترك للحي 99 لا أعلم
3	حالة البئر	1 مغطّى 2 مفتوح 99 لا أعلم	1 مغطّى 2 مفتوح 99 لا أعلم	1 مغطّى 2 مفتوح 99 لا أعلم	1 مغطّى 2 مفتوح 99 لا أعلم
4	طريقة السحب	1 مضخّة 2 نقل باليد 3 غير ذلك، حدد: _____ 99 لا أعلم	1 مضخّة 2 نقل باليد 3 غير ذلك، حدد: _____ 99 لا أعلم	1 مضخّة 2 نقل باليد 3 غير ذلك، حدد: _____ 99 لا أعلم	1 مضخّة 2 نقل باليد 3 غير ذلك، حدد: _____ 99 لا أعلم
WW3A	ما هي استخدامات المياه التي تحصل عليها من البئر	للشرب	1 نعم 2 كلا 3 أحياناً 99 لا أعلم		
WW3B		لغسل الأيدي	1 نعم 2 كلا 3 أحياناً 99 لا أعلم		
WW3C		للاستحمام	1 نعم 2 كلا 3 أحياناً 99 لا أعلم		

WW3D	لغسل الطعام	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WW3E	للطبخ	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WW3F	لغسل الصحون	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WW3G	لتنظيف البيت	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WW3H	في غرفة الغسيل	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WW3I	للري	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WW3J	غير ذلك، حدد:_____		
WW4	ما وتيرة تزويد المياه عبر الآبار؟		|___| مرة في الأسبوع
		98	لا جواب
		99	لا أعلم
WW5	كم تبقى المياه مزوّدة حين تأتي؟		|___|___| ساعة
		98	لا جواب
		99	لا أعلم
WW6	ماذا تدفع مقابل مياه الآبار	1	لا شيء
			|___|___| ليرة شهرياً
		98	لا جواب
		99	لا أعلم
WW7	كيف تجد نوعية هذه المياه؟	1	جيدة (دون لون، طعم، رائحة، ورواسب)
		2	متوسطة (بعض اللون، طعم، رائحة، ورواسب)
		3	سيئة (ذات لون، طعم، رائحة، ورواسب)
		98	لا جواب
		99	لا أعلم

إذا كنت تحصل على المياه من الصهاريج:

صهاريج المياه (Water tankers)			
WT1A	ما هي استخدامات المياه التي تحصل عليها من صهاريج المياه	للشرب	1 نعم
			2 كلا
			3 أحياناً
			99 لا أعلم

WT1B	لغسل الأيدي	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WT1C	للاستحمام	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WT1D	لغسل الطعام	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WT1E	للطبخ	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WT1F	لغسل الصحون	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WT1G	لتنظيف البيت	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WT1H	في غرفة الغسيل	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WT1I	للري	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
WT1J	غير ذلك، حدد:_____		
WT2	كم مرّة في الاسبوع يحصل المنزل على صهريج؟	|___|___|	
WT3	ما هي سعة الصهريج؟	|___|___|	متر مكعب
WT4	كم تدفع عن كل صهريج؟	|___|___|___|___|	ليرة
WT5	كيف تجد نوعية هذه المياه؟	1	جيدة (دون لون، طعم، رائحة، ورواسب)
		2	متوسطة (بعض اللون، طعم، رائحة، ورواسب)
		3	سيئة (ذات لون، طعم، رائحة، ورواسب)
		98	لا جواب
		99	لا أعلم

إذا كنت تنقل المياه شخصياً باليد:

المياه المنقولة باليد (Hand-carried)			
HC1	كم مرة تحضر الماء إلى المنزل يومياً؟	|___|___|	مرة
		99 لا أعلم	
HC2	ما كمية الماء في كل مرة؟	|___|___|	ليتر
		99 لا أعلم	

HC3	هل تدفع مقابل هذه المياه؟		1	نعم
			2	كلا
			98	لا جواب
HC4	إذا كان الجواب نعم، كم تدفع؟		|___|___|___|___|	ليرة
			99	لا أعلم
HC5	كم دقيقة تستغرق من الوقت لإحضار المياه الى المنزل؟		|___|___|___|	دقيقة
			99	لا أعلم
HC6A	ما هي استخدامات المياه المنقولة باليد؟	للشرب	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
HC6B		لغسل الأيدي	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
HC6C		للاستحمام	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
HC6D		لغسل الطعام	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
HC6E		للطبخ	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
HC6F		لغسل الصحون	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
HC6G		لتنظيف البيت	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
HC6H		في غرفة الغسيل	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
HC6I		للري	1	نعم
			2	كلا
			3	أحياناً
			99	لا أعلم
HC6J		غير ذلك، حدد:_____		

HC7	كيف تجد نوعية هذه المياه؟	1	جيدة (دون لون، طعم، رائحة، ورواسب)
		2	متوسطة (بعض اللون، طعم، رائحة، ورواسب)
		3	سيئة (ذات لون، طعم، رائحة، ورواسب)
		98	لا جواب
		99	لا أعلم

إذا كنت تشتري المياه المعبأة:

المياه المعبأة (bottled water)			
BW1	كم عبوة يستهلك المنزل في الاسبوع؟		|___|___|
		99	لا أعلم
BW2	ما هي سعة العبوة؟		|___|___| ليتر
		99	لا أعلم
BW3	إسم العبوة (إذا أمكن)		_____
BW4	كم تدفع عن كل عبوة؟		|___|___|___|___| ليرة
		99	لا أعلم
BW5A	ما هي استخدامات المياه المعبأة؟ للشرب	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
BW5B	لغسل الأيدي	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
BW5C	للاستحمام	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
BW5D	لغسل الطعام	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
BW5E	للطبخ	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
BW5F	لغسل الصحون	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
BW5G	لتنظيف البيت	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
BW5H	في غرفة الغسيل	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم

BW5I	للري	1	نعم
		2	كلا
		3	أحياناً
		99	لا أعلم
BW5J	غير ذلك، حدد:_____		
BW6	كيف تجد نوعية هذه المياه؟	1	جيدة (دون لون، طعم، رائحة، ورواسب)
		2	متوسطة (بعض اللون، طعم، رائحة، ورواسب)
		3	سيئة (ذات لون، طعم، رائحة، ورواسب)
		98	لا جواب
		99	لا أعلم

الآن سوف أسأل عن المياه التي تستخدمها للشرب:

مياه الشرب (drinking water)			
DW1	ما هي كميّة مياه الشرب التي يستهلكها منزلك يومياً في فصل الصيف		|___|___| ليتر
		99	لا أعلم
DW2	ما هي كميّة مياه الشرب التي يستهلكها منزلك يومياً في فصل الشتاء		|___|___| ليتر
		99	لا أعلم
DW3	هل أنت راضٍ على نوعيّة مياه الشرب التي تستهلك؟	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
DW4	لماذا أنت غير راضٍ؟	1	المياه ليست صافية
		2	هناك رائحة كلور في المياه
		3	المياه ملوّثة
		4	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم
DW5	إذا أصبحت غير راضٍ عن نوعية مياه الشرب التي تستهلك حالياً، ما المصدر البديل الذي قد تلجأ إليه؟	1	لا مصدر بديل
		2	مياه نبع
		3	مياه بئر
		4	أشتري مياه معبأة
		5	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم
DW6	هل تتخذ أي إجراء لتحسين نوعية المياه قبل شربها؟	1	لا
		2	غليها
		3	تركها بضع ساعات تحت أشعة الشمس
		4	ترشيح (فلتر)
		5	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم

الآن سوف أسأل عن تخزين المياه في منزلك:

تخزين المياه (water tanks)			
WT1	هل للمنزل خزان مياه؟	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
WT2A	ما نوع هذه الخزانات؟	1	خزان معدني فوق المنزل
WT2B		2	خزان بلاستيكي فوق المنزل
WT2C		3	خزان فايبر جلاس فوق المنزل
WT2D		4	خزان إسمنتي فوق المنزل
WT2E		5	خزان ارضي معدني
WT2F		6	خزان ارضي بلاستيكي
WT2G		7	خزان ارضي فايبر جلاس
WT2H		8	خزان ارضي إسمنتي
WT2I		10	برميل
WT2J		98	لا جواب
WT2K		99	لا أعلم
WT3	ما سعة هذا الخزان؟		|___|___| برميل
		98	لا جواب
		99	لا أعلم
WT4	هل تمزج المياه الآتية من كافة المصادر في الخزان؟	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم
WT5	كم مرة تنظّف خزان المياه؟	1	ولا مرة
		2	مرة كل سنتين
		3	مرة كل ثلاث سنوات
		4	سنوياً
		5	كل ستة اشهر
		6	غير ذلك، حدد_____
		98	لا جواب
		99	لا أعلم
WT6	هل تستخدم أي مادّة لمعالجة المياه في الخزان؟	1	لا
		2	نعم، منتجات الكلور
		3	نعم، منتجات بترولّية
		4	غير ذلك، حدد_____
		98	لا جواب
		99	لا أعلم
WT7	كيف يتم سحب المياه من الخزان؟	1	دلو
		2	أوعية خاصة
		3	مضخة موصولة بصنابير المنزل
		4	صنبور
		5	غير ذلك، حدد_____
		98	لا جواب
		99	لا أعلم
WT8	هل تستخدم مياه الخزان للشرب؟	1	نعم
		2	لا
		98	لا جواب
		99	لا أعلم

سوف أطرح عليك بعض الأسئلة حول التجهيزات والممارسات الصحيّة

التجهيزات والممارسات الصحيّة (personal hygiene and fixtures)			
PH1	هل يوجد دوش\ حوض استحمام في المنزل؟	1	نعم, خاص بالعائلة
		2	نعم, مشترك مع عوائل أخرى
		3	لا يوجد
		98	لا جواب
		99	لا اعلم
PH2	أين يتم غسل اليدين عادة؟	1	مغسلة داخل الحمام أو قريبة منه
		2	مغسلة ليست داخل الحمام أو قريبة منه
		3	مغسلة في المطبخ
		4	مغسلة في الحديقة
		5	صنبور في فناء المنزل
		6	مكان أخر, حدد _____
		7	نادراً ما تغسل الأيدي
		98	لا جواب
		99	لا اعلم
PH4	هل يوجد ماء ساخن باستمرار؟	1	نعم
		2	لا
		98	لا جواب
		99	لا اعلم
PH5	أين يتم غسل الصحون؟	1	في المطبخ
		2	في الحديقة
		3	مجرى الماء
		98	لا جواب
		99	لا اعلم
وجّهي هذه الأسئلة الى الشخص الذي يحضّر الطعام ويعتني بالأطفال:			
PH6A	متى تغسل يديك؟ عّددِ	1	بعد الدخول الى الحمام
PH6B		2	بعد تغيير حفاضات الأطفال
PH6C		3	قبل تحضير الطعام
PH6D		4	قبل الأكل
PH6E		5	قبل إطعام الأطفال
PH6F		98	لا جواب
PH6G		99	لا اعلم
PH7A	هل يمكنكِ ان تريني كيف تغسل يديك عادةً؟ **(راقب طريقة غسل اليدين ودوّر الطرق المعتمدة)**	1	تستعمل المياه فقط
PH7B		2	تستعمل الياه والصابون
PH7C		3	تغسل اليدين الاثنين
PH7D		4	تفرك اليدين معا أقّله ثلاث مرات
PH7E		5	تجفّفين يديك بإستعمال فوطة نظيفة
PH7F		98	لا جواب
PH7G		99	لا اعلم

سوف أطرح عليك بعض الأسئلة حول التخلص من المياه المبتذلة

التخلص من المياه المبتذلة (wastewater disposal)			
WWD1	هل تشارك احد في الحمام؟	1	لا ـ مرحاض خاص داخل المنزل
		2	نعم ـ مع عوائل أخرى
		3	نعم ـ مرحاض عام
		98	لا جواب
		99	لا أعلم
WWD2	أين يوجد الحمام؟	1	داخل المنزل
		2	داخل البناية ـ خارج المنزل
		3	خارج البناية
		98	لا جواب
		99	لا أعلم
WWD3	هل يوجد مغسلة بالقرب من أو داخل الحمام؟	1	نعم ـ داخل الحمام
		2	نعم ـ بالقرب من الحمام
		3	لا ـ بعيدة عن الحمام
		98	لا جواب
		99	لا أعلم
WWD4	كيف يتخلص منزلك من المياه المبتذلة؟	1	جورة صحية
		2	شبكة المجاري
		3	في قناة مغطاة
		4	في قناة مفتوحة
		5	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم
WWD5	إذا كان لديك جورة صحيّة، ما وتيرة تفريغها؟		|___|___|
		98	لا جواب
		99	لا أعلم
WWD6	كيف تقوم بتفريغها؟	1	صهريج يضخ المياه المبتذلة للخارج
		2	مواد كيميائية تنظف الجورة
		3	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم
WWD7	هل يعاني المبنى/المسكن الذي تقطنه من أي مشكلة في نظام صرف المياه المبتذلة؟	1	غير موصول بشبكة التصريف العامة
		2	تجمّع المياه المبتذلة في الطابق السفلي/الملجأ
		3	إنسدادات
		4	روائح
		5	تشققات وتسرب
		6	غير ذلك، حدد _____
		98	لا جواب
		99	لا أعلم

سوف أطرح عليك بعض الأسئلة حول التخلص من النفايات الصلبة

التخلص من النفايات الصلبة (solid waste disposal)				
SWD1	كيف يتم تخزين النفايات في منزلك؟	1	وعاء ـ مفتوح	
		2	وعاء ـ مغلق	
		3	أكياس بلاستيكية	
		4	غير ذلك، حدد	_____
		98	لا جواب	
		99	لا اعلم	
SWD2	كم مرة يتم إخراج النفايات من المنزل؟	1	يومياً	
		2	كل يومين	
		3	مرتين أسبوعيا	
		4	مرة في الأسبوع	
		5	مرات متباعدة	
		6	لا يوجد إمكانية جمع النفايات	
		7	غير ذلك، حدد	_____
		98	لا جواب	
		99	لا اعلم	
SWD3	كيف يتم التخلّص من النفايات؟	1	تجمعها السلطات	
		2	تجمعها المؤسسات المحلية	
		3	تجمعها مؤسسات خاصة	
		4	ترمى داخل حدود البناية	
		5	ترمى على الشارع \ قطعة ارض خالية	
		6	تحرق	
		7	تدفن	
		8	تدوّر	
		9	تطعم للحيوانات	
		10	غير ذلك، حدد	_____
		98	لا جواب	
		99	لا اعلم	
SWD4	كم تبعد حاويات البلدية عن المنزل؟	1	لا يوجد حاويات للبلديّة	
		2	أقل من 50 م	
		3	من 50 - 100 م	
		4	أكثر من 100 م	
		98	لا جواب	
		99	لا اعلم	
SWD5	هل المنزل أو المجمع السكني خالي من النفايات؟	1	نعم	
		2	لا	
		98	لا جواب	
		99	لا اعلم	

تحديد الأولويات (prioritization)		
PR1	ما هما برأيك أهم مشكلتان بيئيتان أساسيتان تعاني منهما باب التبانة	_____ _____
PR2	ما هما برأيك أهم مشكلتان صحيتان أساسيتان تعاني منهما باب التبانة	_____ _____

الإستعداد للدفع (willingness to pay)		
WTP1	في حال تأمّنت لك المياه بنوعية وكمّية أفضل ما هو المبلغ الشهري الذي تستطيع تأمينه للإشتراك في هذه الخدمة (الليرة اللبنانيّة)	|___|___|___|___|___|___|___|___|___|___|
WTP2	في حال تأمّن لك تحسين إمدادات الصرف الصحّي ما هو المبلغ الشهري الذي تستطيع تأمينه للإستفادة من هذه الخدمة (الليرة اللبنانيّة)	|___|___|___|___|___|___|___|___|___|___|

ملاحظات:

_____
_____
_____
_____
_____
_____
_____
_____
_____

Annex 9.
Detailed results of microbiological and physicochemical analysis of water samples collected as part of the Water Sampling Program

Results of microbiological and physicochemical analysis of water samples collected from the drinking water network

Sample ID	Fecal coliform (CFU/ 100 ml after 24 hrs)	Fecal coliform (CFU/ 100 ml after 48 hrs)	Total coliform (CFU/ 100 ml)	Nitrate (mg/L NO_3^-)	Residual Chlorine (mg/L Cl_2)	pH	TDS (mg/L)	Color (PtCo APHA)	Turbidity (NTU)
1. TA0034-1	0	0	0	15.6	0.04	7.11	365	12	2.36
2. TA0045-1	0	0	0	21.6	0.15	6.96	831	4	1.9
3. TA0046-1	0	0	0	25.8	0.23	6.92	839	6	1.6
4. TA0058-1	0	0	0	16.2	0.06	7.15	368	5	4.1
5. TA0074-1	0	0	0	19.6	0.21	7.12	364	7	2.4
6. TA0085-1	0	0	0	25	0.22	6.82	812	5	1.24
7. TA0090-1	0	0	0	22.9	0.25	6.83	784	5	0.25
8. TA0097-1	0	0	0	23.9	0.13	7.1	514	4	1.27
9. TA0102-1	0	0	0	16.1	0.08	7.24	328	9	1.34
10. TA0106-1	0	0	0	22.4	0.05	7.21	520	6	1.44
11. TA0113-1	0	0	0	16.1	0.06	7.26	393	58	1.95
12. TA0127-1	0	0	0	19.3	0.23	7.84	804	10	3
13. TA0143-1	0	0	0	22	0.2	6.78	855	8	1.14
14. TB0039-1	0	0	10	16.1	0.06	7.12	314	11	NA
15. TB0072-1	0	0	0	18	0.05	6.8	310	6	NA
16. TB0102-1	0	0	0	20.6	0.06	6.92	706	0	NA
17. TB0110-1	1	0	2	19.1	0.07	6.99	567	6	NA[2]
18. TB0122-1	0	0	0	16.7	0.04	6.97	396	21	NA
19. TB0129-1	0	0	1	16	0.12	6.98	299	20	NA
20. TB0132-1	0	0	5	19.2	0.03	7.03	298	22	NA
21. TB0161-1	0	0	0	17.8	0.06	7.05	278	10	NA
22. TB0178-1	0	0	0	14.7	0.01	7.22	315	4	NA
23. TB0183-1	0	0	0	15.1	0.05	6.77	316	6	NA
24. TB0536-1	0	0	1 (154 non TC)	20.9	0.06	7.31	311	11	NA
25. TB0539-1	0	0	0 (120 non TC)	19.1	0.05	6.93	361	UR	NA
26. TB0615-1	0	0	(TNTC non TC)	17	0.06	6.88	818	UR	NA
27. TB0623-1	0	0	(68 non TC)	15.9	0.03	7.03	647	UR	NA
28. TB0631-1	0	0	(2 non TC)	20	0.13	6.74	294	UR	NA
29. TB0642-1	0	0	1 (TNTC non TC)	17.2	0.17	7.07	832	UR	NA

Sample ID	Fecal coliform (CFU/ 100 ml after 24 hrs)	Fecal coliform (CFU/ 100 ml after 48 hrs)	Total coliform (CFU/ 100 ml)	Nitrate (mg/L NO_3^-)	Residual Chlorine (mg/L Cl_2)	pH	TDS (mg/L)	Color (PtCo APHA)	Turbidity (NTU)
30. TB0645-1	0	0	0	21.7	0.24	7.05	744	UR	NA
31. TB0646-1	0	0	0	18.6	0.08	7.01	846	UR	NA
32. TB0649-1	0	0	0	17.7	0.23	7.26	465	UR	NA
33. TB0664-1	0	0	0	13.4	0.15	7.15	455	UR	NA
34. TJ0002-1	0	0	0	23.9	0.06	6.83	291	1	NA
35. TJ0008-1	0	0	0 (3 non TC)	19.2	0.05	6.82	290	2	NA
36. TJ0018-1	0	0	500 (TNTC non TC)	19.1	0.18	7.11	860	19	NA
37. TJ0021-1	0	0	0	18.3	0.09	7.1	390	11	NA
38. TJ0023-1	0	0	(7 non TC)	16.5	0.03	6.94	306	5	NA
39. TJ0045-1	0	0	0	9.2	0.07	6.8	295	6	NA
40. TJ0052-1	0	0	0	19.1	0.07	6.69	308	10	NA
41. TJ0062-1	0	0	(15 non TC)	19.6	0.04	7.01	304	7	NA
42. TJ0066-1	0	0	0 (2 non TC)	19.2	0.1	6.81	283	1	NA
43. TJ0072-1	0	0	1 (20 non TC)	17	0.09	7.07	301	25	NA
44. TJ0080-1	0	0	0	17.4	0.11	6.66	279	3	NA
45. TJ0091-1	0	0	1 (20 non TC)	20.1	0.13	6.94	859	12	NA
46. TJ0102-1	0	0	0 (2 non TC)	13.1	0.16	6.85	297	51	NA
47. TJ0103-1	0	0	0 (6 non TC)	18.2	0.12	6.86	287	18	NA
48. TJ0104-1	0	0	0	18.9	0.12	6.69	319	4	NA
49. TJ0252-1	0	0	0	18.8	0.22	6.92	857	53	NA
50. TJ0286-1	0	0	0 (19 non TC)	12.6	0.15	6.85	277	8	NA
51. TJ0493-1	0	0	0	16.4	0.11	6.69	208	UR	NA
52. TJ1100-1	0	0	0	17.4	0.07	6.82	315	2	NA
53. TJ1103-1	0	0	0	16.2	0.03	7	289	UR	NA
54. TJ1106-1	0	0	0	20.2	0.18	6.84	322	UR	NA
55. TJ1111-1	0	0	1	17.1	0.1	6.45	217	UR	NA
56. TJ1127-1	0	0	4	12.4	0.05	7.38	493	15	NA
57. TJ1132-1	0	0	2	21.1	0.17	6.82	315	2	NA
58. TJ1136-1	0	0	0	16.6	0.25	6.87	855	49	NA
59. TJ1148-1	0	0	0	21.3	0.3	6.7	862	0	NA

Sample ID	Fecal coliform (CFU/ 100 ml after 24 hrs)	Fecal coliform (CFU/ 100 ml after 48 hrs)	Total coliform (CFU/ 100 ml)	Nitrate (mg/L NO_3^-)	Residual Chlorine (mg/L Cl_2)	pH	TDS (mg/L)	Color (PtCo APHA)	Turbidity (NTU)
60. TJ1151-1	0	0	0	18.5	0.01	7.17	306	2	NA
61. TJ1152-1	0	0	2	14.6	0.05	7.25	317	4	NA
62. TJ1154-1	3	0	43	14.7	0.02	7.38	493	15	NA
63. TJ1158-1	0	0	0	13.8	0.04	7.09	310	22	NA
64. TJ1166-1	0	0	0	17.1	0.1	7.16	670	8	NA
65. TJ1169-1	0	0	(10 non TC)	20.5	0.19	6.9	832	UR	NA
66. TJ1182-1	0	0	0	18.4	0.27	6.95	853	1	NA
67. TJ1187-1	0	0	0	6.1	0.12	7.12	301	46	NA
68. TJ1189-1	0	0	0	27.8	0.09	7.08	307	16	NA
69. TJ1207-1	0	0	133	18.7	0.15	6.99	310	UR	NA
70. TJ1216-1	0	0	0	15.6	0.09	6.63	209	UR	NA
71. TJ1221-1	0	0	174	16.4	0.06	6.73	217	UR	NA
72. TJ1227-1	0	0	0	15.9	0.05	6.49	215	UR	NA
73. TJ1228-1	0	0	0	16.1	0.07	6.96	656	9	NA
74. TJ1229-1	0	0	2	14.9	0.02	7.04	317	11	NA
75. TJ1231-1	2	0	210	14.8	0.13	6.04	215	7	NA
76. TK0484-1	0	0	0	17.2	0.12	7.27	370	34	8.6

Results of microbiological and physicochemical analysis of water samples collected from the storage tanks

Sample ID	Location of Tank	Fecal coliform CFU/ 100 ml after 24 hrs)	Fecal coliform (CFU/ 100 ml after 48 hrs)	Total coliform (CFU/ 100 ml)	Nitrate (mg/L NO_3^-)	pH	TDS (mg/L)	Color (PtCo APHA)	Turbidity (NTU)
1. TA0034-2	Roof Top	0	0	0	20.8	7.36	400	13	1.44
2. TA0045-2	Attic	0	0	0	24.1	7.29	841	12	1.39
3. TA0085-2	Attic	0	0	0	24.4	7.09	851	9	1.46
4. TA0090-2	Attic	0	0	0	20.4	7.01	808	5	1.6
5. TA0106-2	Roof Top	0	0	0	18.1	7.32	381	10	1.2
6. TA0113-2	Roof Top	0	0	0	18.4	7.48	392	13	NA
7. TA0143-2	Attic	0	0	0	23	7.15	838	15	0.98
8. TB0039-2	Roof Top	0	0	0	14	7.21	420	23	NA
9. TB0072-2	Attic	0	0	0	18.8	6.9	395	9	NA
10. TB0102-2	Roof Top	0	0	21	19.1	6.85	369	11	1.55
11. TB0110-2	Attic	0	0	13	18.6	7.00	495	7	NA
12. TB0122-2	Other	9	0	177	18.2	6.95	578	8	NA
13. TB0129-2	Roof Top	0	0	9	23.2	6.98	643	6	NA
14. TB0132-2	Attic	0	0	0	17.8	7.07	319	15	NA
15. TB0161-2	Attic	0	0	0	19.5	7.00	350	14	NA
16. TB0178-2	Attic	0	0	0	15	7.22	304	7	NA
17. TB0183-2	Attic	0	0	0	19	7.16	377	11	NA
18. TB0536-2	Roof Top	0	0	1 (112 non TC)	14.5	7.09	350	17	NA
19. TB0539-2	Attic	0	0	3 (TNTC non TC)	23.7	7.17	356	UR	NA
20. TB0615-2	Roof Top	0	0	8 (few non TC)	17.1	7.15	806	UR	NA
21. TB0623-2	Roof Top	0	0	(60 non TC)	16.3	7.08	712	24	NA
22. TB0631-2	Roof Top	0	0	(150 non TC)	13.3	6.36	307	UR	NA
23. TB0642-2	Roof Top	0	0	2 (120 non TC)	21.1	7.09	813	UR	NA
24. TB0645-2	Roof Top	0	0	1	21.5	7.05	769	UR	NA
25. TB0646-2	Roof Top	0	0	3 (TNTC non TC)	16.6	6.86	655	UR	NA
26. TB0649-2	Roof Top	0	0	1 (140 non TC)	18.2	7.12	355	UR	NA
27. TB0664-2	Roof Top	0	0	0	18.9	6.75	345	7	NA
28. TJ0002-2	Attic	0	0	13 (TNTC non TC)	17.1	6.85	321	4	NA

Sample ID	Location of Tank	Fecal coliform CFU/ 100 ml after 24 hrs)	Fecal coliform (CFU/ 100 ml after 48 hrs)	Total coliform (CFU/ 100 ml)	Nitrate (mg/L NO_3^-)	pH	TDS (mg/L)	Color (PtCo APHA)	Turbidity (NTU)
29. TJ0021-2	Attic	0	0	(3 non TC)	19.4	6.98	833	6	NA
30. TJ0023-2	Attic	0	0	(15 non TC)	23.1	7.02	762	6	NA
31. TJ0052-2	Attic	0	0	(10 non TC)	27.7	6.68	768	UR	NA
32. TJ0066-2	Attic	0	0	0 (13 non TC)	19.9	6.84	409	16	NA
33. TJ0072-2	Roof Top	0	0	(TNTC non TC)	18.3	7.02	758	26	NA
34. TJ0091-2		0	0	0	17.2	7.03	689	27	NA
35. TJ0103-2	Attic	0	0	3 (2 non TC)	31.1	6.87	280	4	NA
36. TJ0104-2	Attic	4 (TNTC non FC)	0	10 (TNTC non TC)	15	6.95	308	23	NA
37. TJ0252-2	Attic	0	0	(10 non TC)	20.2	6.92	810	2	NA
38. TJ0286-2	Attic	4	9	85 (TNTC non TC)	17.7	6.95	278	39	NA
39. TJ1100-2	Attic	0	0	0	17.5	7.29	314	UR	NA
40. TJ1103-2	Attic	0	0	0	15.7	7.02	320	2	NA
41. TJ1106-2	Roof Top	0	0	0	15.5	7.02	317	8	NA
42. TJ1111-2	Attic	0	0	0	13.4	6.82	322	3	NA
43. TJ1127-2	Attic	0	0	0	19.6	7.21	897	62	NA
44. TJ1132-2	Roof Top	0	0	0	18.4	7.29	314	UR	NA
45. TJ1136-2	Attic	0	0	(24 Non TC)	24.7	6.71	802	1	NA
46. TJ1148-2	Attic	0	0	(24 Non TC)	21.6	6.92	741	2	NA
47. TJ1151-2	Roof Top	0	0	3	13.7	7.21	303	8	NA
48. TJ1152-2	Roof Top	0	0	8	14.3	7.13	313	61	NA
49. TJ1154-2	Attic	0	0	3	12	7.09	587	10	NA
50. TJ1158-2	Attic	2	0	3	17.5	8	300	10	NA
51. TJ1166-2	Roof Top	0	0	0	17.1	7.11	315	9	NA
52. TJ1169-2	Attic	0	0	0	21	6.97	832	1	NA
53. TJ1182-2	Attic	0	0	0	20.2	6.96	804	UR	NA
54. TJ1187-2	Roof Top	0	0	5	13.5	7.12	302	8	NA
55. TJ1189-2	Attic	2	0	3	31.8	7.13	341	25	NA
56. TJ1207-2	Roof Top	0	0	124	17.5	6.84	214	UR	NA
57. TJ1216-2	Roof Top	0	0	6	18.9	7.18	642	3	NA
58. TJ1221-2	Roof Top	0	0	1	17.4	7.18	648	4	NA

Sample ID	Location of Tank	Fecal coliform CFU/ 100 ml after 24 hrs)	Fecal coliform (CFU/ 100 ml after 48 hrs)	Total coliform (CFU/ 100 ml)	Nitrate (mg/L NO_3^-)	pH	TDS (mg/L)	Color (PtCo APHA)	Turbidity (NTU)
59. TJ1227-2	Attic	1	0	35	15.3	7.12	313	7	NA
60. TJ1228-2	Roof Top	0	0	0	17.3	7.04	315	20	NA
61. TJ1229-2	Roof Top	0	0	2	16.5	7.14	328	5	NA
62. TJ1231-2	Roof Top	0	0	0	12.3	7.18	656	67	NA
63. TK0484-2	Attic	0	0	0	20.5	7.37	381	17	NA

Results of microbiological and physicochemical analysis of bottled water samples collected from Tebbaneh and Irbid

Brand name	FC(CFU/100mL)					TC (CFU/100mL)					Nitrate (mg/L)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
TEBBANNEH, LEBANON															
Brand T1	0	0	0	0	0	0	0	0	0	0	13.6	14.2	12.1	11.8	10.7
Brand T2	0	0	0	0	0	0	1	0	2	147	14.3	7.6	7.9	7.9	6.3
Brand T3	0	0	0	0	0	24	30	0	0	38	10.4	10.5	12.1	12.3	10.2
Brand T4	0	0	0	0	0	0	0	2	0	0	11.3	11.7	15.5	12	14.2
Brand T5	0					1					27				
Brand T6	207	0	2	0	0	48	0	53	9	8	29.6	31.1	39.1	49.5	42.3
Brand T7	0	0	0	0	0	0	0	0	0	0	13.3	13.9	15.5	13.5	18.9
Brand T8	0	0	0	0	0	0	0	0	0	0	13.8	11.9	13.4	13	11.5
Brand T9	1	0	0			3	0	2			11.7	9.7	10.1		
Brand T10	0	0	0	0	0	2	0	0	0	0	6.8	4.6	8.5	4.6	5
Brand T11	0					0					17.9				
Brand T12	0	0	0	0	0	0	0	0	0	0	2.3	6.4	10.7	9.3	7.5
Brand T13	0	0	0	0	0	0	2	84	0	0	28	29.4	29.8	34.6	22.6
Brand T14	0	0	0	0	0	0	0	10	0	0	12.4	9.6	8.6	9.8	8.6
Brand T15	0	0	0	0	0	0	0	0	0	0	2.2	5.6	5.8	8.5	8.4
Brand T16	0	0	0	0	0	0	0	0	0	0	8.7	6.2	6.1	7.8	5.5
Brand T17	0					0					7.7				
Brand T18	0	0	0	0	0	0	0	0	0	0	6.6	6.9	6.2	4.4	3.6
AN-NASR JORDAN															
Brand A1	0	0	0	-	-	0	0	0	-	-	9.6	4.9	11.7	-	-
Brand A2	0	0	0	-	-	0	0	0	-	-	15.7	8.4	13.7	-	-
Brand A3	0	0	0	-	-	0	0	0	-	-	16.2	20.7	18.5	-	-
Brand A4	0	0	0	-	-	0	0	0	-	-	5.2	10.9	4.5	-	-
Brand A5	0	0	0	-	-	0	0	0	-	-	7	11.1	11.6	-	-
Brand A6	0	0	0	-	-	0	0	0	-	-	14.9	15.2	12.7	-	-

Annex 10.
Detailed results of microbiological and physicochemical analysis of water samples collected in August 2010

Results of microbiological and physico-chemical analysis of water samples collected from the drinking water network

Sample ID	Fecal coliform (CFU/ 100 ml after 24 hrs)	Fecal coliform (CFU/ 100 ml after 48 hrs)	Total coliform (CFU/ 100 ml)	Free residual chlorine (mg/L Cl^-)
64. TJ0006 D	0	0	1	
65. TJ0014 D	0	0	0	0.16
66. TJ0024 D	0	0	1	0.17
67. TJ0094 D	0	0	0	0.25
68. TJ1137 D	0	0	5	0.09
69. TJ1150 D	0	0	0	0.16
70. TJ1183 D	0	0	0	0.12
71. Sabeel (TJ0033/ 34/70)	0	0	0	0.22
72. TA0054 D	0	0	6	0.18
73. TA0064 D	0	0	0	0.17
74. TA0089 D	0	0	7	0.17
75. TB0553 D	0	0	2	0.1
76. TK0408 D	0	0	2	0.16
77. TK0437 D	0	0	4	0.08
78. TK0439 D	0	0	0	0.08
79. TB0070 D	0	0	1	0.09
80. TB0080 D	0	0	0	0.13
81. TB0085 D	0	0	160	0.09
82. TB0105 D	0	0	1	0.19
83. TB0112 D	0	0	0	0.15
84. TB0126 D	0	0	1	0.22
85. TJ1128 D	0	0	0	0.22
86. TB0016 D	0	0	0	0.28
87. TB0073 D	0	0	0	0.34
88. TB0139 D	0	0	0	0.26
89. TB0174 D	0	0	0	0.17
90. TB0177 D	0	0	3	0.15
91. TB0652 D	0	0	2	0.28
92. TB0678 D	1	3	TNTC	0.18
93. TJ0280 D	0	0	0	0.13
94. TJ0495 D	0	0	0	0.33
95. TJ1107 D	0	1	1	?
96. TJ1156 D	0	0	0	0.13
97. TJ1190 D	0	0	1	0.31

Results of microbiological and physico-chemical analysis of water samples collected from the storage tanks

Sample ID	Location of Tank	Fecal coliform (CFU/ 100 ml after 24 hrs)	Fecal coliform (CFU/ 100 ml after 48 hrs)	Total coliform (CFU/ 100 ml)
1. TJ0006 T	attic	0	0	0
2. TJ0014 T	attic	0	0	0
3. TJ0024 T	attic	0	0	0
4. TJ0033 T	roof	0	0	0
5. TJ0034 T	roof	0	0	1
6. TJ0070 T	roof	0	0	0
7. TJ0093 T	attic	0	0	2
8. TJ0094 T	attic	0	0	0
9. TJ1137 T	attic	0	0	1
10. TJ1150 T	roof	0	0	0
11. TJ1183 T	attic	0	0	0
12. TA0048 T	roof	0	0	0
13. TA0054 T	roof	0	0	9
14. TA0064 T	roof	0	0	101 in 75 ml
15. TA0089 T	attic	0	0	32
16. TB0553 T	roof	0	0	2
17. TK0408 T	attic	0	0	5
18. TK0437 T	attic	21	28	183
19. TK0439 T	attic	0	0	3 non TC
20. TB0070 T	attic	0	0	200
21. TB0073 T	roof	0	0	0
22. TB0080 T	attic	0	0	150
23. TB0085 T	attic	0	0	18
24. TB0105 T	attic	0	0	7
25. TB0112 T	roof	0	0	3
26. TB0126 T	roof	1	2	TNTC
27. TJ1128 T	attic	0	0	140
28. TB0016 T	Roof	0	0	1
29. TB0139 T	Attic	0	39 yellow	TNTC
30. TB0174 T	Roof	0	0	0
31. TB0177 T	Roof	0	0	0
32. TB0652 T	Attic	0	0	0
33. TB0678 T	Attic	80	80	TNTC
34. TJ0280 T	attic	0	0	0
35. TJ0280 T	roof	0	0	0
36. TJ0495 T	Attic	0	0	1
37. TJ0504 T	Attic	0	0	0
38. TJ1107 T	Attic	0	13	5
39. TJ1156 T	Attic	0	0	4
40. TJ1190 T	Attic	0	0	20

Annex 11.
Questionnaire used for the Survey of Dispensaries

المسح الصحّي للمستوصفات في التبّانة

1. **إسم الباحث:** _____
2. **تاريخ البحث:** _____

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3. **إسم وموقع المستوصف:** _____
   - 3.1 إسم الطبيب: _____
   - 3.2 رقم الهاتف: _____

4. **عدد إصابات الإسهال التي سجّلت في المستوصف خلال الفترة الممتدّة ما بين أيلول 2008 وأيلول 2009:** _____

4.1 ما هي كلفة معالجة إصابة الإسهال الواحدة (الليرة اللبنانيّة):

	الحد الأدنى:	الحد الأقصى:
اجرة المستوصف:	_____	_____
ثمن الدواء:	_____	_____
تكاليف أخرى:	_____	_____
التكلفة الإجماليّة:	_____	_____

4.2 ما هي الأدوية الأكثر شيوعاً لمعالجة حالات الإسهال:

إسم الدواء:	عدد الوحدات:
_____	_____
_____	_____
_____	_____

5. **عدد إصابات التيفوئيد التي سجّلت في المستوصف خلال الفترة الممتدّة ما بين <u>أيلول 2008</u> <u>وأيلول 2009</u>:**

5.1 ما هي كلفة علاج حالة التيفوئيد الواحدة (الليرة اللبنانيّة):

	الحد الأدنى:	الحد الأقصى:
اجرة المستوصف:	_____	_____
ثمن الدواء:	_____	_____
تكاليف أخرى:	_____	_____
التكلفة الإجماليّة:	_____	_____

5.2 ما هي الأدوية الأكثر شيوعاً لمعالجة حالات التيفوئيد:

إسم الدواء:	عدد الوحدات:
_____	_____
_____	_____

6. **يعتبر عدد إصابات الإسهال والتيفوئيد الذي سجّل في المستوصف المعني خلال الفترة الواقعة ما بين أيلول 2008 وأيلول 2009:**
   - ❑ دون المعدّل السنوي للحالات المسجلة خلال الثلاث إلى خمس سنوات السابقة
   - ❑ فوق المعدّل السنوي للحالات المسجلة خلال الثلاث إلى خمس سنوات السابقة
   - ❑ ضمن المعدّل السنوي للحالات المسجلة خلال الثلاث إلى خمس سنوات السابقة

إن كان الجواب <u>دون</u> أو <u>فوق</u> المعدّل السنوي، ما هي الأسباب المحتملة لذلك؟

_____

_____

ملاحظات عامة:

هل مجمل الإصابات من الأطفال أو البالغين؟ _____

هل حصل أي إنتشار وبائي في الفترة الأخيرة؟ _____

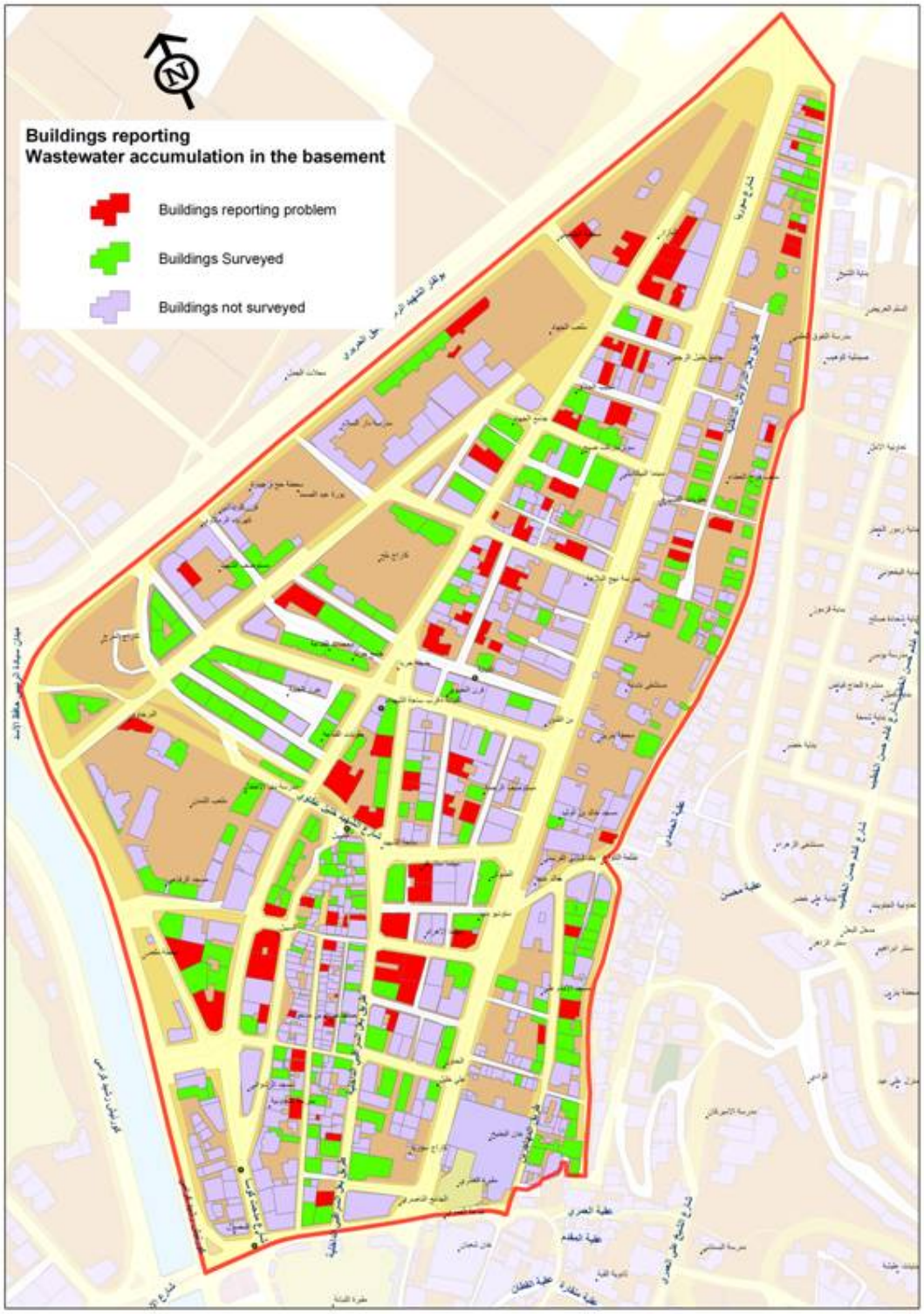
ملاحظات أخرى: _____

_____

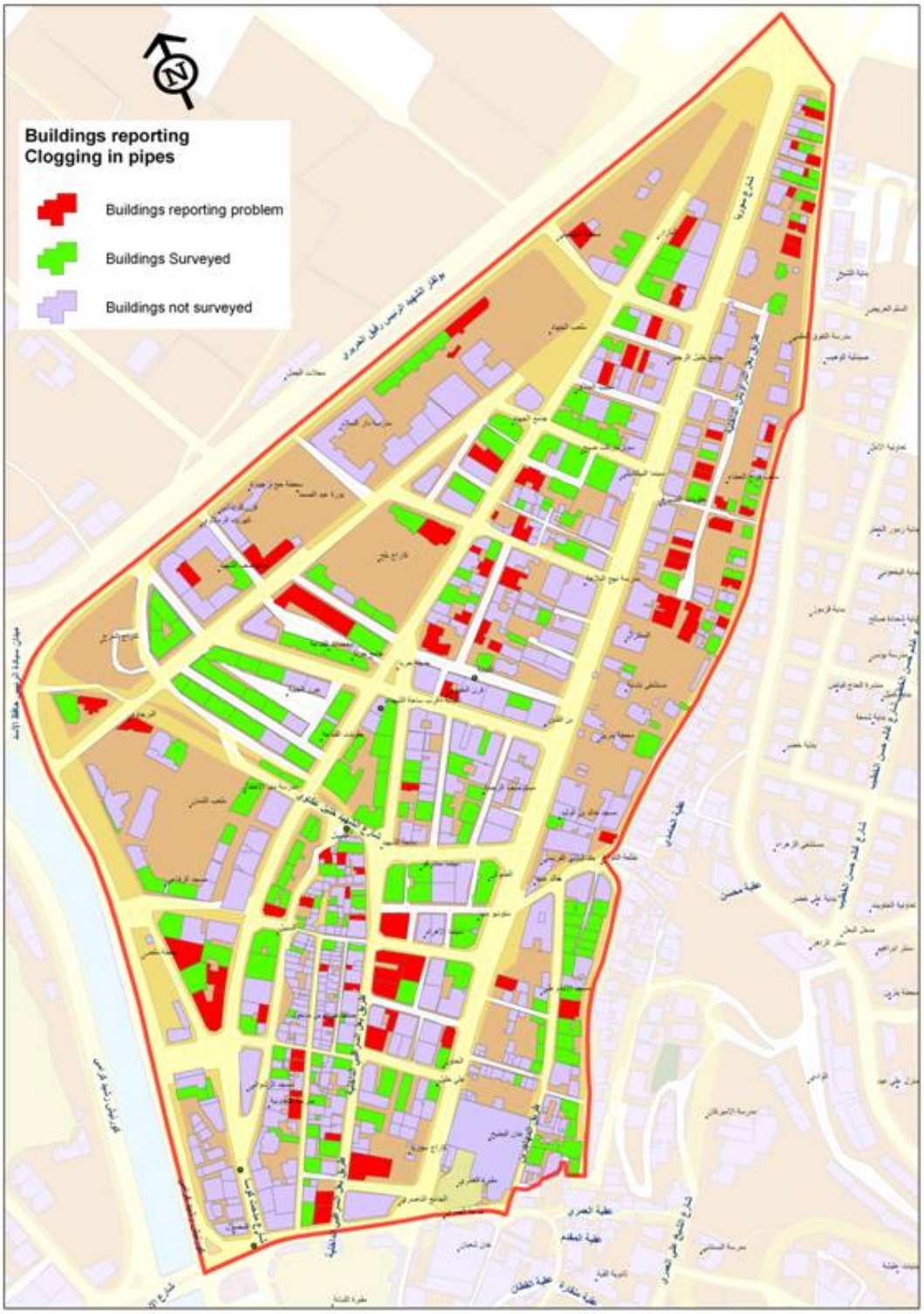
_____

Annex 12.
Sample GIS Spatial Analysis Output

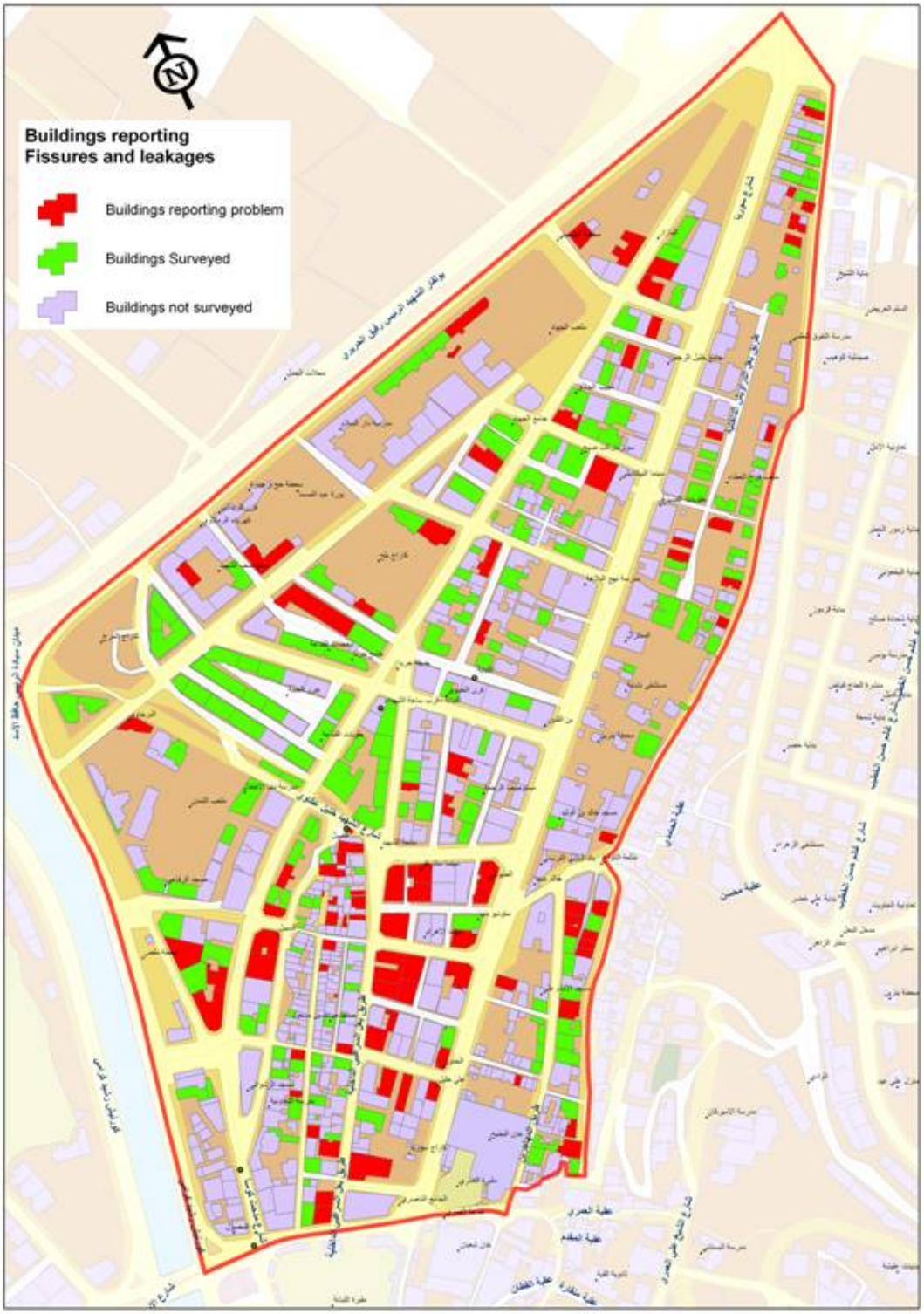
Map showing distribution of buildings within which households were surveyed during the Social Survey



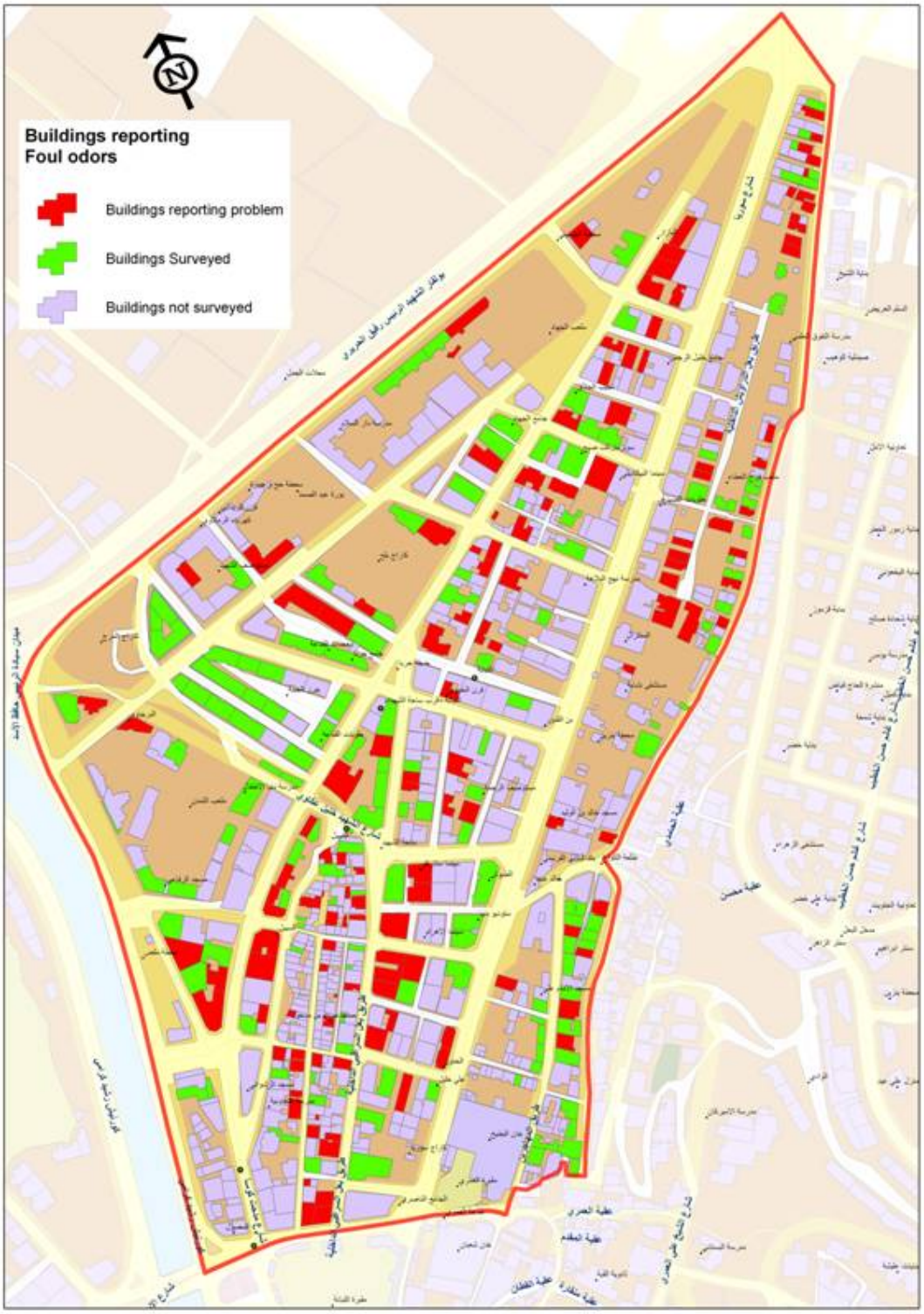
Map showing the distribution of buildings reporting wastewater accumulation in the basement (buildings in red) during the Social Survey



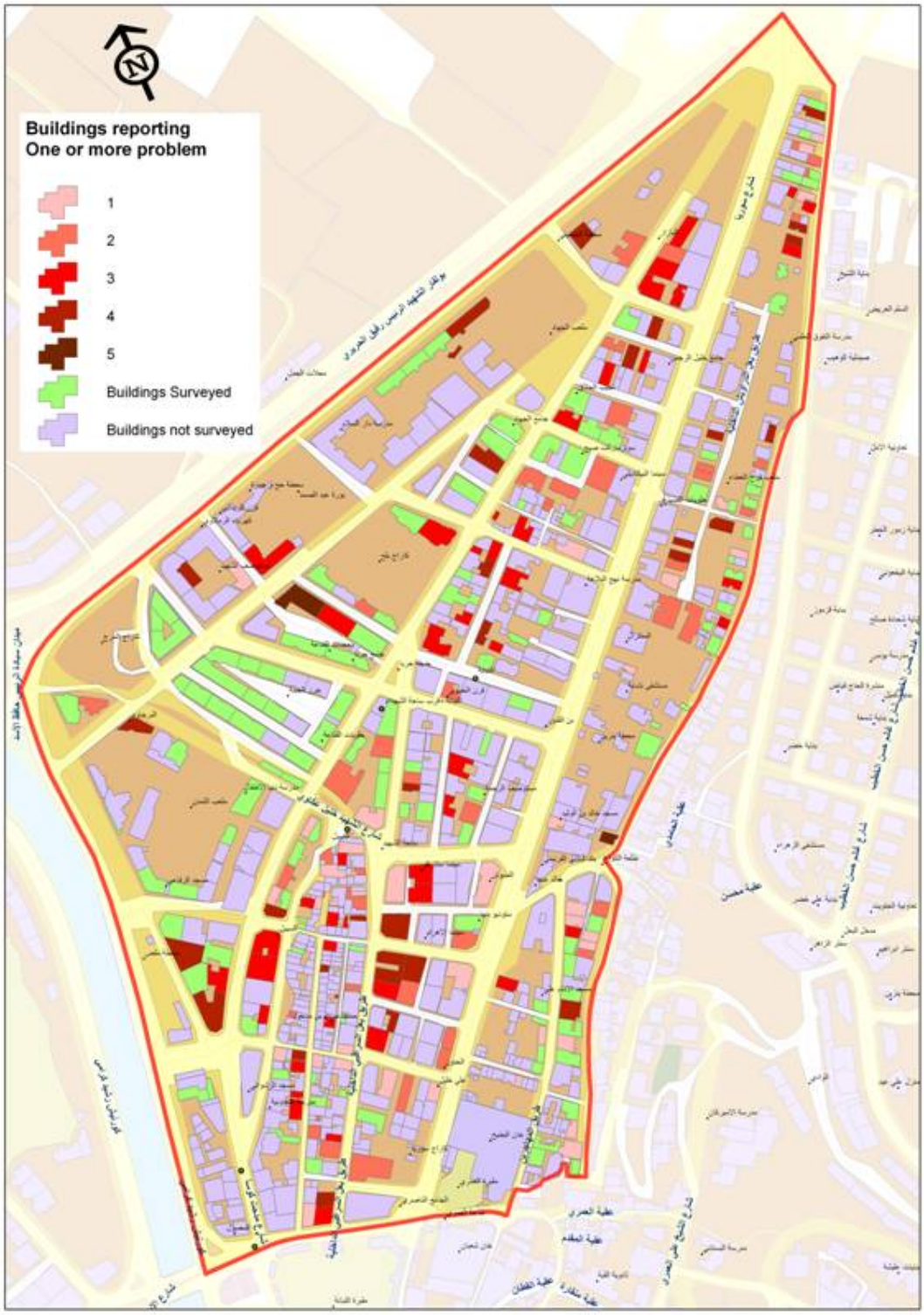
Map showing the distribution of buildings reporting clogging in wastewater pipes (buildings in red) during the Social Survey



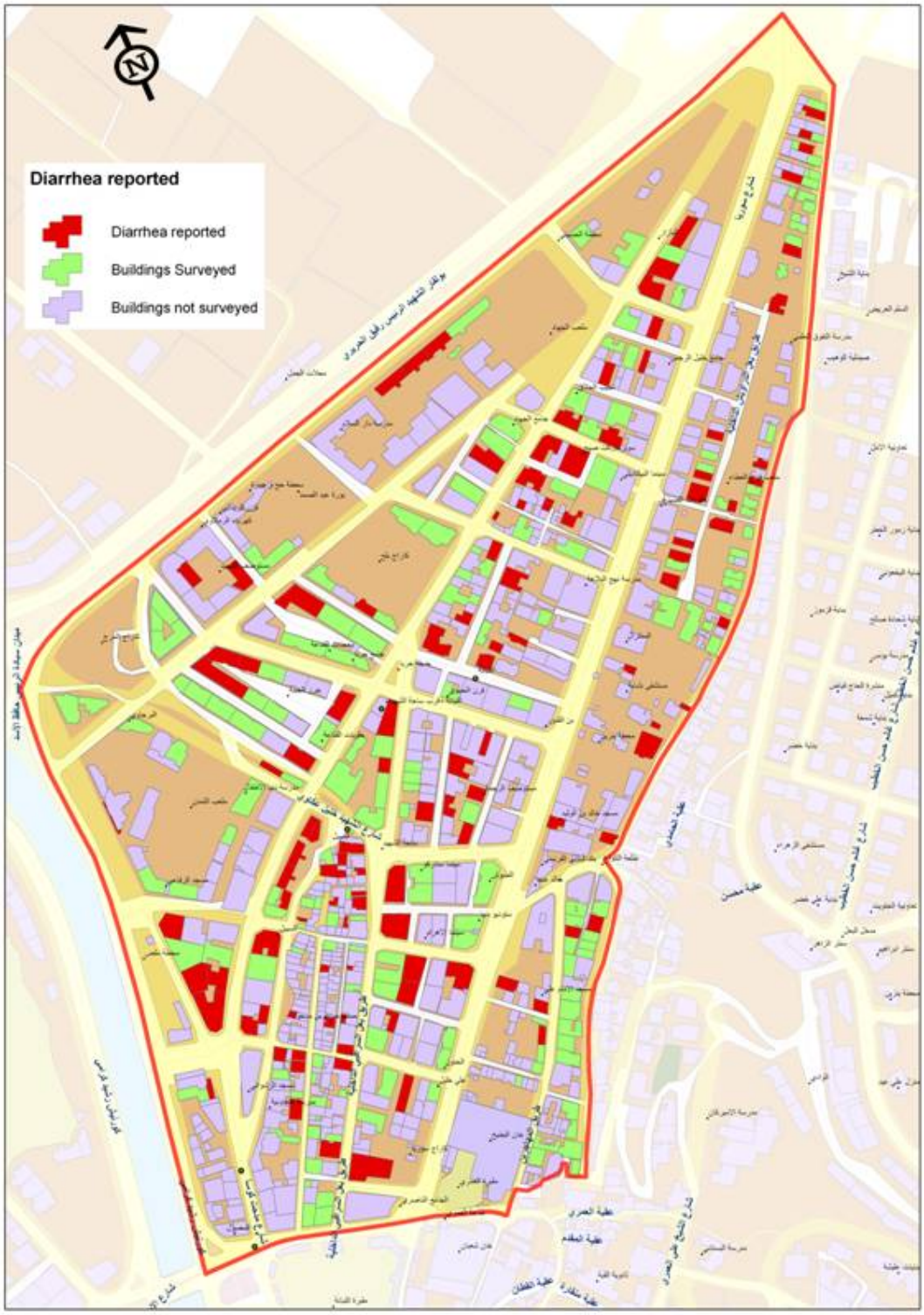
Map showing the distribution of buildings reporting fissures and leakages in the sanitary piping (buildings in red) during the Social Survey



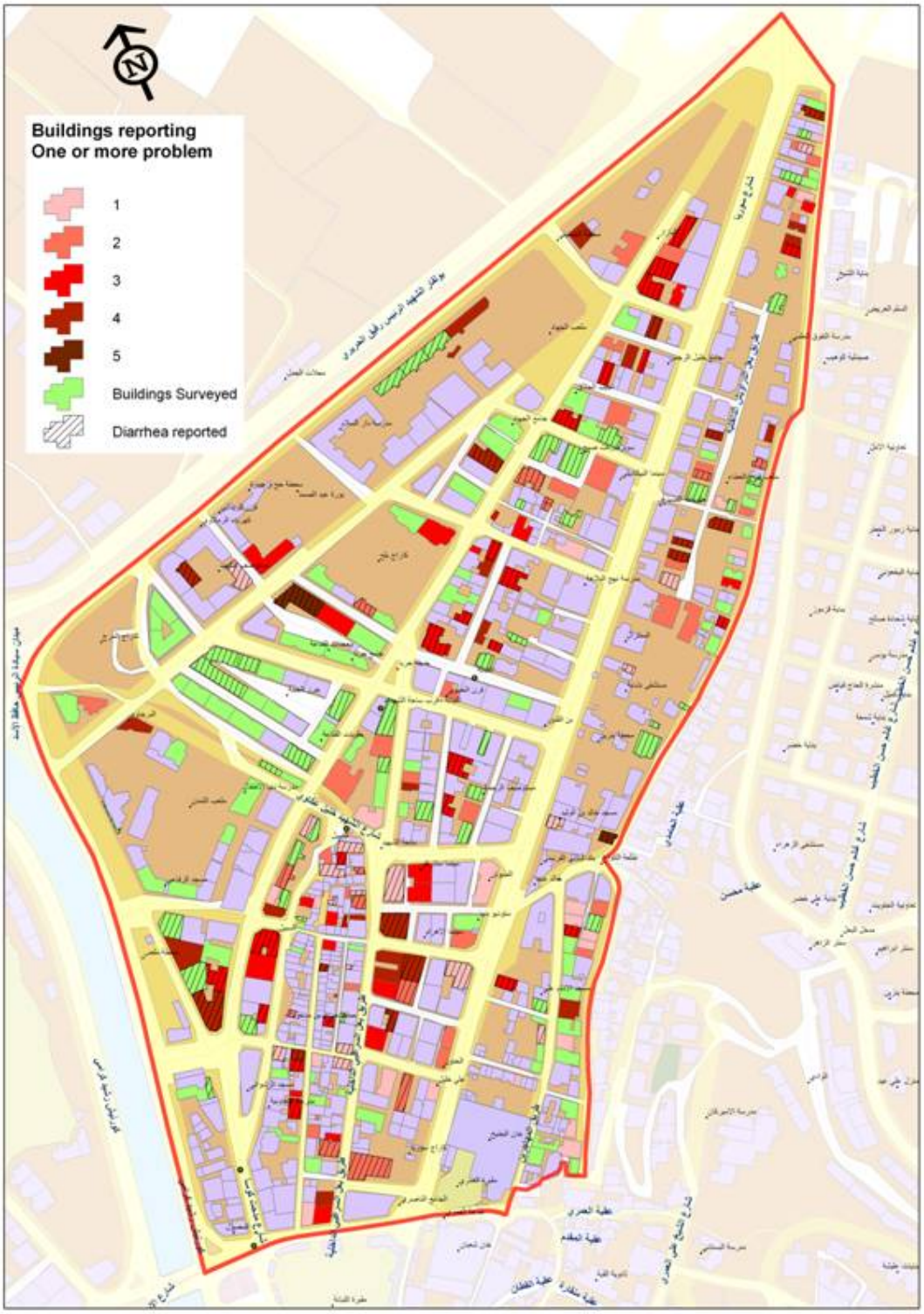
Map showing the distribution of buildings reporting foul wastewater-related odors (buildings in red) during the Social Survey



Map showing the distribution of buildings reporting one or more wastewater-related problem (buildings in red) during the Social Survey



Map showing the distribution of buildings where diarrhea cases were reported during the three months (buildings in red) preceding the the Social Survey



Map showing the distribution of buildings reporting one or more wastewater-related problem (buildings in increasing shades of red) along with buildings reporting diarrhea cases (buildings hatched)

Annex 13.
Detailed results of the tested associations using SPSS

Testing of Associations

1. **Association between 'Tank Type' and 'Total Coliform' concentration in tap water from tank:**

   Result: At 90% confidence, p-value = 0.734 > 0.10. Therefore there is NO association between tank type and total coliform levels in tank water.

Group Statistics

	Tank types recoded	N	Mean	Std. Deviation	Std. Error Mean
Storage Tank Total Coliform Concentrations Elimination of Duplicate Bldgs	Tanks on roof	28	6.96	23.380	4.418
	Tanks in attic	33	5.18	15.858	2.760

2. **Association between 'Tank Type' and 'Fecal Coliform' concentration in tap water from tank:**

   Result: At 85% confidence, p-value = 0.142 < 0.15. Therefore there is **borderline** association between tank type and fecal coliform levels in tank water.

Group Statistics

	Tank types recoded	N	Mean	Std. Deviation	Std. Error Mean
Storage Tank Fecal Coliform Concentrations Elimination of Duplicate Bldgs	Tanks on roof	28	.00	.000	.000
	Tanks in attic	33	.67	2.367	.412

3. **Association between 'Tank Type' and presence/absence of 'Total Coliform' in tap water from tank:**

   Result: At 90% confidence, p-value = 0.07 < 0.10. Therefore there is association between tank type and total coliform levels in tank water.

Pollution status based on TC in tank after duplicate elimination * Tank types recoded Crosstabulation

			Tank types recoded			
			Tanks on roof	Tanks in attic	Other	Total
Pollution status based on TC in tank after duplicate elimination	Not polluted	Count	13	23	0	36
		% within Tank types recoded	46.4%	69.7%	.0%	58.1%
	Polluted	Count	15	10	1	26
		% within Tank types recoded	53.6%	30.3%	100.0%	41.9%
Total		Count	28	33	1	62
		% within Tank types recoded	100.0%	100.0%	100.0%	100.0%

4. **Association between 'Tank Type' and presence/absence of 'Fecal Coliform' in tap water from tank:**

   Result: At 95% confidence, p-value = 0.005 < 0.05 Therefore there is association between tank type and fecal coliform contamination of tank water.

Pollution status based on FC in tank after duplicate elimination * Tank types recoded Crosstabulation

			Tank types recoded			
			Tanks on roof	Tanks in attic	Other	Total
Pollution status based on FC in tank after duplicate elimination	Not polluted	Count	28	28	0	56
		% within Tank types recoded	100.0%	84.8%	.0%	90.3%
	Polluted	Count	0	5	1	6
		% within Tank types recoded	.0%	15.2%	100.0%	9.7%
Total		Count	28	33	1	62
		% within Tank types recoded	100.0%	100.0%	100.0%	100.0%

5. **Association between 'diarrhea cases' and 'water quality'**

   Result: Cannot be tested since all water samples were collected from households exhibiting diarrhea cases.

6. **Association between 'diarrhea cases' and 'tank type'**

   Result: At 90% confidence, p-value = 0.067 < 0.10 There is association between diarrhea cases and tank type.

Tank types recoded * Diarrhea among members in the past three months Crosstabulation

			Diarrhea among members in the past three months		
			Yes	No	Total
Tank types recoded	Tanks on roof	Count	58	112	170
		% within Diarrhea among members in the past three months	48.3%	58.6%	54.7%
	Tanks in attic	Count	61	79	140
		% within Diarrhea among members in the past three months	50.8%	41.4%	45.0%
	Other	Count	1	0	1
		% within Diarrhea among members in the past three months	.8%	.0%	.3%
Total		Count	120	191	311
		% within Diarrhea among members in the past three months	100.0%	100.0%	100.0%

7. Association between 'wastewater problems' and 'diarrhea cases'

Result: At 90% confidence, p-value = 0.246 > 0.10 There is NO association between presence of wastewater problems and diarrhea cases.

Problems in wastewater network and fixtures * Diarrhea among members in the past three months Crosstabulation

			Diarrhea among members in the past three months		
			Yes	No	Total
Problems in wastewater network and fixtures	Yes	Count	77	109	186
		% within Diarrhea among members in the past three months	61.6%	55.1%	57.6%
	No	Count	48	89	137
		% within Diarrhea among members in the past three months	38.4%	44.9%	42.4%
Total		Count	125	198	323
		% within Diarrhea among members in the past three months	100.0%	100.0%	100.0%

8. Association between 'wastewater problems' and 'water quality'

Result: At α = 0.10, p-value = 0.122 for TC and 0.391 for FC. Therefore there is no association between wastewater problems and water quality.

In summary, an association was found between tank type and water quality (for both TC and FC as indicators). An association was also found between diarrhea cases and tank type, while no association was found between diarrhea cases and reporting of wastewater problems.

Annex 14.
Details of the building selection process

List of buildings where diarrhea cases were reported

1. Deeb Abou Shama
2. Koja Building
3. TA0034
4. TA0045
5. TA0046
6. TA0048
7. TA0054
8. TA0058
9. TA0064
10. TA0074
11. TA0085
12. TA0089
13. TA0090
14. TA0097
15. TA0102
16. TA0106
17. TA0113
18. TA0127
19. TA0143
20. TB0016
21. TB0039
22. TB0070
23. TB0072
24. TB0073
25. TB0080
26. TB0085
27. TB0102
28. TB0105
29. TB0110
30. TB0112
31. TB0122
32. TB0126
33. TB0129
34. TB0132
35. TB0139
36. TB0161
37. TB0174
38. TB0177
39. TB0178
40. TB0183
41. TB0536
42. TB0539
43. TB0553
44. TB0615
45. TB0623
46. TB0631
47. TB0642
48. TB0645
49. TB0646
50. TB0649
51. TB0652
52. TB0658
53. TB0664
54. TB0678
55. TJ0002
56. TJ0006
57. TJ0008
58. TJ0014
59. TJ0018
60. TJ0021
61. TJ0023
62. TJ0024
63. TJ0033
64. TJ0034
65. TJ0045
66. TJ0052
67. TJ0062
68. TJ0066
69. TJ0070
70. TJ0072
71. TJ0080
72. TJ0093
73. TJ0094
74. TJ0102
75. TJ0103
76. TJ0104
77. TJ0252
78. TJ0280
79. TJ0286
80. TJ0493
81. TJ0495
82. TJ0504
83. TJ0528
84. TJ0531
85. TJ1100
86. TJ1103
87. TJ1106
88. TJ1107
89. TJ1111
90. TJ1127
91. TJ1128
92. TJ1132
93. TJ1136
94. TJ1137
95. TJ1148
96. TJ1150
97. TJ1151
98. TJ1152
99. TJ1154
100. TJ1156
101. TJ1158
102. TJ1166
103. TJ1169
104. TJ1182
105. TJ1183
106. TJ1187
107. TJ1189
108. TJ1190
109. TJ1207
110. TJ1216
111. TJ1221
112. TJ1227
113. TJ1228
114. TJ1229
115. TJ1231
116. TK0408
117. TK0437
118. TK0439
119. TK0449
120. TK0451
121. TK0484

List of buildings where diarrhea was reported and total coliform was detected in the water of the storage tanks

1. TB0102
2. TB0110
3. TB0122
4. TB0129
5. TB0536
6. TB0539
7. TB0615
8. TB0642
9. TB0645
10. TB0646
11. TB0649
12. TJ0002
13. TJ0103
14. TJ0104
15. TJ0286
16. TJ1151
17. TJ1152
18. TJ1154
19. TJ1158
20. TJ1187
21. TJ1189
22. TJ1207
23. TJ1216
24. TJ1221
25. TJ1227
26. TJ1229

List of buildings where diarrhea was reported and total coliforms detected in the water of the storage tanks located on the attic

1. TB0110
2. TB0539
3. TJ0002
4. TJ0103
5. TJ0104
6. TJ0286
7. TJ1154
8. TJ1158
9. TJ1189
10. TJ1227

Annex 15.
Powerpoint presentation at the meeting with NGOs in Tripoli (March 3, 2010)

الهدف الأساسي

تخفيف الأعباء البيئية في الأحياء الفقيرة من خلال فهم أفضل لكيفية تأثير الخدمات البيئية على الأحوال الإجتماعية.
بالإضافة إلى ادخال مشروع/مشاريع نموذجية لتحسين هذه الخدمات

تحسين خدمات
المياه والصرف الصحي في التبانة

مركز الموارد المائية
كلية الهندسة والعمارة
الجامعة الأميركية في بيروت

المسح الميداني في التبّانة

- تحديد منطقة العمل وتقسيمها إلى خمسة مناطق بالتعاون مع البلدية والجمعيّات الأهليّة
  - جمعية القاء النسائي الخيري
  - جمعية العمل النسوي
  - جمعية معالم الغربية الاجتماعية
- تأهيل المسح خلال شهري تموز وآب بالتعاون مع البلدية والجمعيّات الأهليّة
- تجنيد حوالي 332 استمارة
  - حوالي 60-70 استمارة في كل قسم من منطقة الدراسة
- تحليل المعلومات التي تمّ جمعها

النشاطات المنفذة حتى الآن

- مسح ميداني في إربد
- مسح ميداني في التبانة
- مسح صحّي ميداني في التبانة
- تقييم نوعيّة المياه في التبانة
- تحديد المشروع/ المشاريع النموذجيّة

بعض نتائج المسح الميداني في التبّانة

- حالات الإسهال:

أطفال دون السنة	1,000 نسمة 201	1,000 نسمة 55
أطفال بين السنة والخامسة	1,000 نسمة 113	1,000 نسمة 34

- توزيع حالات الإسهال في منطقة الدراسة

بعض نتائج المسح الميداني في التبّانة

مصادر المياه


بعض نتائج المسح الميداني في التبّانة
• نظرة السكان لنوعيّة مياه الشبكة العامّة


بعض نتائج المسح الميداني في التبّانة
• مواقع خزانات المياه


بعض نتائج المسح الميداني في التبّانة
ملاحظات عامّة
• تختلف الأبنية بحسب المناطق
– الحالات الأسوأ في سوق الخضار (المنطقة 1)
– الحالات "الأفضل" في منطقة 5


بعض نتائج المسح الميداني في التبّانة
• التخلّص من مياه المجارير
– إثنين فقط يستعملون الجورة الصحيّة
مشاكل في شبكة الصرف الصحّي


بعض نتائج المسح الميداني في التبّانة
ملاحظات عامّة
• التخلّص من المياه المبتذلة
– شبكة التصريف العام جديدة في التبّانة
– أبرز المشاكل المتعلّقة بالمياه المبتذلة هي ضمن المباني
– لا يعتبر سكّان التبّانة التخلّص من المياه المبتذلة لمشكلة بيئيّة أساسيّة في التبّانة


بعض نتائج المسح الميداني في التبّانة
ملاحظات عامّة

المسح الصحّي في النبّانة

- حوالي 70 بالمئة يتجهون إلى المستوصفات الخاصة الطبية
- أشر من 90 بالمئة يذهبون الى خمس مستوصفات عامة وهي:
  - الرحمة، العزو والصحة، الدعوة، العزيزي، الصيدلي
- تم جمع المعلومات حول
  - عدد حالات الإسهال والتقرئة عند الأقل 5 سنوات من يناير 2008 الى يناير 2009
  - البرك المائية التي يتم وضعها في هذه المنازل
  - ثمن الاستخدام

نتائج المسح الصحّي في النبّانة

			156	146		306
			100	79	18	197
					442	442
					352	352
			35	126		161
			21	40		61

Total reported annual diarrhea cases = 61 per 1,000 population

نتائج المسح الصحّي في النبّانة

ثمن الماء بريال المستوصف

المستوصف	رسم المستوصف	ثمن الأدوية لعائلة (ريال يمني)	ثمن الأدوية لعائلة (منخفض الدخل)
الجزيرة للصداقة	1,000	0 (Free)	0 (Free)
الرحمة	3,000	10,000-15,000	-
الرحمة (عائلات العمل)	0	10,000-75,000	45,000
العزيزي	5,000	8,000-36,000	34,000
الدعوة	0-5,000	4,500-20,000	4,000-25,000
الصيدلي	6,000-9,000	22,000-55,000	17,500

تقييم نوعيّة المياه في النبّانة

- تم تقييم نوعيّة المياه في
  - الشبكة العامّة للمياه
  - الخزّانات المنزليّة
  - المياه المعبّأة
- تم فحص مؤشّرات فيزيائيّة، كيميائيّة، وبيولوجيّة

تقييم نوعيّة المياه في النبّانة

نتائج تقييم نوعيّة المياه في النبّانة

مياه الشبكة العامة

Parameter	Range	Standard (EPA/ EU/ WHO)	Non-conformance N	Non-conformance (%)
Fecal coliform (CFU/100 ml)	1-3	0	3	(4)
Total coliform (CFU/100 ml)	1-500	0	18	(26)
Nitrate (mg/L NO3)	6.1-27.8	40-50	0	(0)
pH	6.04-7.84	6.5-8.5	0	(0)
Residual chlorine (mg/L Cl2)	0.01-0.3	>0.5	70	(100)
TDS (mg/L)	208-862	500	24	(35)
Color (PtCo APHA)	0-67	15	14	(20)
Turbidity (NTU)	0.98-1.6	1	6	(9)

Total number of samples = 70

نتائج تقييم نوعيّة المياه في التبّانة
مياه الخزان

Parameter	Range	Standard (EPA/ EU/ WHO)	Standard Exceedance N	(%)
Fecal coliform (CFU/100 ml)	1-9	0	6	(10)
Total coliform (CFU/100 ml)	1-177	0	26	(41)
Nitrate (mg/L NO3⁻)	13-33.0	40-50	0	(0)
pH	6.36-8	6.5-8.5	1	(0)
TDS (mg/L)	214-697	500	28	(44)
Color (PtCo APHA)	0-67	15	34	(54)
Turbidity (NTU)	0.99-14	1	6	(10)

Total number of samples = 63

نتائج تقييم نوعيّة المياه في التبّانة
المياه المعبّأة

Parameter	Range	Standard (EPA/ EU/ WHO)	Standard Exceedance N brands	(%)
Fecal coliform (CFU/100 ml)	0-317	0	1	(6)
Total coliform (CFU/100 ml)	0-147	0	4	(24)
Nitrate (mg/L NO3⁻)	2.3-49.5	40-50	0	(0)

Total number of brands = 18

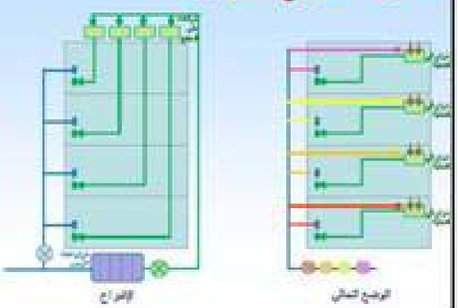
نتائج تقييم نوعيّة المياه في التبّانة

- مياه الشبكة العامة
  - تشكل كثافة المياه في بعض المناطق [illegible] من خلال [illegible] على صعيد [illegible]
  - تم رصد لون وعكارة في المياه وفقاً لما أفاد به السكان
  - نسبة التلوث [illegible] في حالة [illegible] دون معايير مياه الشرب
- خزانات المياه
  - تلوث مياه الخزان بالميكروبات
  - أحد مصادر التلوث إمدادات الصرف الصحي داخل المباني
- المياه المعبأة
  - 1 من 18 نوع مياه ملوّثة بالكوليفورم الغائطة
  - 4 من 18 نوع مياه ملوّثة بمجموع الكوليفورم
  - المياه المعبأة تستخدم في [illegible] الرضع والمرضى
  - السكان لا يثقون المياه المعبأة من [illegible] في السوق

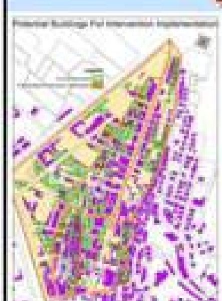
تحديد المشاريع النموذجية

- المشاريع النموذجية في مجال المياه
  - استبدال المضخات الصغيرة داخل المباني بخزّان مياه مشترك على مستوى الأرض، بحيث يتم ضخ المياه من هذا الخزّان الى السطح / الخفيّة
  - استبدال خزّانات المياه في الخفيّة بخزانات على سطح المباني

تحديد المشاريع النموذجية



تحديد المشاريع النموذجية



- تحديد الأبنية

مستوى الأبنية	عدد الأبنية
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

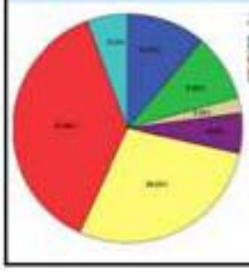
بعض نتائج المسح الميداني في التبّانة

- مشاكل في نظام صرف المياه المبتذلة
  - مبانٍ تعاني من مشكلة تو الكثير ورصدت فيها حالات إسهال

بعض نتائج المسح الميداني في التبّانة

- مشاكل في نظام صرف المياه المبتذلة
  - مبانٍ تعاني من مشكلة تو

بعض نتائج المسح الميداني في التبّانة
تحديد الأولويّات بالنسبة للمشاكل البيئيّة



- 38 بالمئة يعتبرون القوارض والحشرات كمشكلة بيئية أساسية في التبّانة
- 28 بالمئة يعتبرون النفايات المنزليّة كمشكلة بيئية أساسية في التبّانة

بعض نتائج المسح الميداني في التبّانة
النفايات المنزليّة الصلبة

- 96 بالمئة يخرجون النفايات يوميّاً من المنزل
- 61 بالمئة أفادوا بوجود مستوعبات لجمع النفايات على مسافة قريبة (أقل من 50 متر)
- 60 بالمئة تذمّروا من قلّة النظافة في محيط المنزل

بعض نتائج المسح الميداني في التبّانة
ملاحظات عامّة

- ممارسات صحية
  - ضعف ملحوظ بالممارسات الصحية ضمن المنازل وعلى الشوارع

بعض نتائج المسح الميداني في التبّانة
ملاحظات عامّة

- إدارة النفايات المنزليّة
  - توفر مستوعبات لجمع النفايات على مسافة قريبة (أقل من 50 متر)
  - المساكة هي سلوك السكان والرمي العشوائي للنفايات في سكانهم الضيقة وفي الأراضي المتروكة
  - يعتبر السكان إدارة النفايات الصلبة مسألة بيئية أساسية كما تقلقهم الحشرات والقوارض المرتبطة بها

تحديد المشاريع النموذجية

- التوعية / التثقيف الصحي لتشجيع التغييرات السلوكية المتعلقة بـ
  - النظافة الشخصية
  - الرعي العشوائي للنفايات
- حملات التوعية تستهدف
  - ربات المنزل
  - تلامذة المدارس
- حملات التوعية تتضمّن
  - ورشات عمل عامة بالتنسيق مع الجمعيات الأهلية المحلية
  - زيارات منزلية
  - يوم نظافة عام

Annex 16.
Field Inspection of Selected Buildings

Characteristics of selected buildings

Building Number	*Zone*	*Street Name*	*Landmark*	*No. of floors*	*No. of housing units per bldg*	*Space availability around the bldg*	*Notes*
TB0110	1	Baal Al Sarakibi Street		3	3	None	Very old building, directly on the main street with shops on the ground floor
TJ1154	1		Next to Sabil and Meat Palace	6	24	Limited space on building entrance	Very old building, bad condition
TJ1158	1		In front of Masjad Al Rashwani	5	15	Space inside the building entrance	The building is in relatively good condition, located in the middle of the vegetables retail market
TJ1189	1		Al Sabil	5	35	Very limited space around or inside building.	In the middle of the vegetables retail market. Shops on ground floor
TB0539	2	Mouhajireen street	Directly next to Al Imam Ali Mosque	4	12	A lot of space outside the building.	Building in very good condition
TJ0002	4		Across the street from Jihad Mosque	3	7	There is some space ($4X4m^2$)	Car body repair workshop at ground level
TJ0103	4	Bazar Street		6	12	Some space available	
TJ0104	4		Next to Forn Al Hamawi	2	4	No space available	
TJ0286	4		In front of Khalil Al Rahman Mosque	6	12	Space on 1^{st} floor ($5x5m^2$)	
TJ1227	5		3 buildings away from Al Jihad Mosque	6	21	No space available	

Photos of selected buildings

Building Number	*Photos of buildings*
TB0110	 
TJ1154	  
TJ1158	  

Building Number	*Photos of buildings*
TJ1189	  
TB0539	  
TJ0002	   

Building Number	*Photos of buildings*
TJ0103	   
TJ0104	  
TJ0286	 x   

Building Number	*Photos of buildings*
TJ1227	 

Annex 17.
Location and Photos of Storage Tank Installation

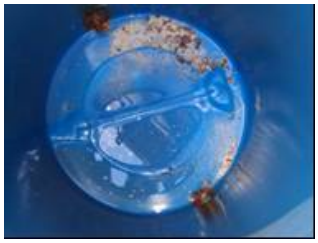
Date, location, and owner of households were tanks were replaced

Date	*Zone*	*Bldg Id*	*Floor*	*Owner*
08/02/2011	4	TJ0002	1	Mohammad Shoumra
	4	TJ0104	2	Abdel Nasser Naaman
	4	TJ0104	1	Talal Sahyouni
10/02/ 2011	4	TJ0103	4	Hussein Al Mawla
	3	TA0089	1	Hadla Jandal
	5	TJ1107	2	Rabih El Naddaf
11/02/2011	3	TK0437	1	Haitham Mohammad
	1	TJ1154	1	Rahjat Ibrahim
	1	TB0110	1	Riad Khodor
	3	TK0408	2	Nahla Alayan
15/02/2011	4	TJ0002	2	Mohammad Matar
	4	TJ0002	4	Mostafa Matar
	1	TJ1128	6	Noujoud Abdel Karim Fayad
	1	TJ1158	1	Emm Omar Shaabo
17/02/2011	4	TJ0104	1	Aiicha El Sayed
	4	TJ0104	2	Mohammad Abdo Tafeh
	1	TB0070	2	Salwa Hazzouri
	2	TB0678	1	Bilal Sahyouni
18/02/2011	3	TK0408	3	Samar Mostafa
	1	TB0113	2	Ahmad Ibrahim
	1	TB0029	1	Khadijeh El Ali Kabalan
	1	TJ1154	2	Rabih El Kurdi
23/02/2011	4	TJ0002'	3	Manal Nayouf
	5	TJ1236	5	Abdel Kader Harraz
	1	TB0113	3	Khaled Ibrahim
	1	TB0113	1	Akram Ibrahim
24/02/2011	1	TB0118	1	Walid Ibrahim
	1	TB0115	0	Rabih Ibrahim
	1	TB0119	1	Mohammad Ibrahim
	1	TB0034	0	Khouloud El Khaled

Photos of new and replaced of storage tanks

Bldg Id	*Owner*	*Old tank*	*New tank*
TJ0002	Mohammad Shoumra		
TJ0104	Abdel Nasser Naaman		
TJ0104	Talal Sahyouni		
TJ0103	Hussein Al Mawla		
TA0089	Hadla Jandal		
TJ1107	Rabih El Naddaf	-	

Bldg Id	*Owner*	*Old tank*	*New tank*
TK0437	Haitham Mohammad		
TJ1154	Rahjat Ibrahim		
TB0110 Riad Khodor			
TK0408	Nahla Alayan		
TJ0002	Mohammad Matar		

Bldg Id	*Owner*	*Old tank*	*New tank*
TJ0002	Mostafa Matar		
TJ1128	Noujoud Abdel Karim Fayad		
TJ1158	Emm Omar Shaabo		
TJ0104	Aiicha El Sayed		
TJ0104	Mohammad Abdo Tafeh		
TB0070	Salwa Hazzouri		

Bldg Id	*Owner*	*Old tank*	*New tank*
TB0678	Bilal Sahyouni		
TK0408	Samar Mostafa		
TB0113	Ahmad Ibrahim		
TB0029	Khadijeh El Ali Kabalan		
TJ1154	Rabih El Kurdi		
TB0118	Walid Ibrahim		

Bldg Id	*Owner*	*Old tank*	*New tank*
TB0115	Rabih Ibrahim		
TB0119	Mohammad Ibrahim		
TB0034	Khouloud El Khaled		

Annex 18.
Photos of replaced of water pipes

Bldg Id	*Owner*	*New water pipes*
TJ0002	Mohammad Matar	 
TJ0002	Mostafa Matar	 
TB0070	Salwa Hazzouri	 
TJ0103	Hussein Al Mawla	 

Annex 19.
Results of Water Quality Monitoring Program from March to October 2011

Results of microbiological and physicochemical analysis of water samples collected from the **drinking water tap** from March 27 till July 10

Date	*March 27, April 3*			*April 10, April 17*			*May 1, May 8*			*May 15, May 22*			*June 5, June 26*			*July 3, July 10*		
Building Id	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*
TJ1154-1	0.52	0	0	0.39	27	2	0.28	0	0	0.35	1	0	-	-	-	-	-	-
TJ1154-2	0.52	0	0	0.39	27	2	0.28	0	0	0.33	0	0	0.42	11	0	-	-	-
TB0110	0.24	0	0	0.35	0	0	0.31	0	0	0.31	0	0	0.28	0	0	0.24	0	0
TJ1128	-	-	-	-	-	-	0.32	0	0	-	-	-	-	-	-	0.28	11	0
TJ1158	0.21	0	0	0.26	0	0	0.31	2	0	0.24	0	0	0.28	175	0	0.16	2	0
TB0070	0.46	0	0	0.26	0	0	0.3	1	0	0.32	0	0	0.3	0	0	0.10	3	0
TB0113-1	0.12	0	0	0.28	TNTC	38	0.3	0	0	-	-	-	0.34	TNTC	3	0.22	47	0
TB0113-2	0.12	0	0	0.28	TNTC	38	0.3	0	0	-	-	-	-	-	-	-	-	-
TB0113-3	0.12	0	0	0.28	TNTC	38	0.3	0	0	-	-	-	0.31	TNTC	2	-	-	-
TB0029	0.4	TNTC	0	0.3	0	0	0.33	2	0	0.31	0	0	0.28	TNTC	0	0.26	7	2
TB0118	0.13	0	0	0.34	0	0	0.3	0	0	-	-	-	-	-	-	-	-	-
TB0115	0.29	0	0	0.27	0	0	0.3	0	0	0.33	TNTC	0	0.33	0	0	0.10	0	0
TB0119	0.12	0	0	0.31	0	0	0.38	0	0	-	-	-	0.32	TNTC	0	-	0	0
TB0034	0.35	18	0	0.27	0	0	0.46	0	0	0.38	0	0	0.29	167	0	0.20	0	0
TB0678	0.42	77	74	-	-	-	0.25	TNTC	TNTC	0.37	TNTC	32	-	-	-	0.12	TNTC	92
TA0089	0.27	1	0	0.39	10	0	0.29	0	0	0.50	1	0	0.29	55	0	-	-	-
TK0437	0.22	1	0	0.38	0	0	-	1	0	0.28	0	0	0.27	0	0	0.11	0	0
TK0408-2	0.33	1	0	0.35	61	0	0.33	1	0	0.40	TNTC	0	0.40	0	0	-	-	-
TK0408-3	0.33	1	0	0.35	61	0	0.33	1	0	0.27	17	0	0.40	2	0	-	-	-
TJ0002-1	0.28	0	0	0.28	88	0	0.35	TNTC	0	0.28	0	1	0.25	6	0	0.24	74	0
TJ0002-2	0.28	0	0	0.28	88	0	0.35	TNTC	0	0.32	TNTC	0	-	-	-	-	-	-
TJ0002-3	0.28	0	0	0.28	88	0	0.35	TNTC	0	0.27	0	0	0.26	0	0	0.39	TNTC	0
TJ0002'	0.28	0	0	0.26	1	0	0.21	32	0	0.3	8	0	-	-	-	-	-	-
TJ0104-1A	0.33	10	0	0.35	TNTC	0	-	0	0	0.26	TNTC	0	0.34	0	0	0.38	50	0
TJ0104-1B	0.33	10	0	0.35	TNTC	0	-	0	0	0.31	TNTC	0	0.37	27	0	-	-	-

Date	*March 27, April 3*			*April 10, April 17*			*May 1, May 8*			*May 15, May 22*			*June 5, June 26*			*July 3, July 10*		
Building Id	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]
TJ0104-2A	0.33	10	0	0.35	TNTC	0	-	0	0	0.36	TNTC	0	0.36	TNTC	1	0.19	TNTC	0
TJ0104-2B	0.33	10	0	0.35	TNTC	0	-	0	0	0.29	112	0	0.39	55	0	0.29	11	0
TJ0103	0.2	44	0	0.27	4	0	-	0	0	0.27	0	0	0.33	0	0	-	-	-
TJ1107	0.35	0	0	0.35	0	0	0.27	1	0	0.30	0	0	0.22	4	0	0.29	0	0
TJ1236	0.28	0	0	0.33	0	0	0.28	0	0	0.27	0	0	-	-	-	0.19	0	0

[1] Free residual chlorine (mg/L Cl^-)

[2] Total Coliform (CFU/100 ml)

[3] Fecal Coliform (CFU/100 ml)

Results of microbiological and physicochemical analysis of water samples collected from the **drinking water tap** from July 17 till October 30

Date	*July 17, July 24*			*Aug 7-14, Sept 4*			*Sept 11, Sept 18*			*Sept 25, Oct 2*			*Oct 9, Oct 16*			*Oct 23, Oct 30*		
Building Id	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]
TJ1154-1	0.21	0	0	-	-	-	0.09	54	0	0.12	0	0	0.22	156	0	0.20	0	0
TJ1154-2	-	-	-	0.10	142	0	0.08	0	0	-	-	-	-	-	-	0.12	0	0
TB0110	-	-	-	-	-	-	-	-	-	0.02	0	0	-	-	-	-	-	-
TJ1128	-	-	-	-	-	-	-	-	-	0.07	TNTC	0	0.17	188	0	-	-	-
TJ1158	0.12	1	0	0.14	0	0	-	-	-	-	-	-	0.09	0	0	0.03	0	0
TB0070	0.09	8	0	-	-	-	0.42	0	0	0.03	TNTC	0	0.09	1	0	0.13	0	0
TB0113-1	0.20	34	0	-	-	-	0.22	0	0	0.19	0	0	0.25	0	0	-	-	-
TB0113-2	-	-	-	-	-	-	-	-	-	-	-	-	0.07	1	0	-	-	-
TB0113-3	-	-	-	-	-	-	0.24	0	0	-	-	-	0.11	2	0	-	-	-
TB0029	0.21	TNTC	TNTC	0.08	0	0	-	-	-	-	-	-	0.23	2	0	0.13	0	0
TB0118	-	-	-	-	-	-	0.16	0	0	-	-	-	-	-	-	-	-	-
TB0115	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TB0119	-	-	-	-	-	-	-	-	-	-	-	-	0.30	0	0	-	-	-
TB0034	0.18	0	0	-	-	-	0.10	0	0	0.31	0	0	0.18	0	0	0.21	0	0
TB0678	0.16	34	17	-	-	-	-	-	-	0.14	TNTC	123	0.13	15	10	-	-	-
TA0089	0.18	0	0	-	-	-	0.37	0	0	0.10	81	0	0.14	29	0	0.19	0	0
TK0437	0.36	0	0	0.15	0	0	0.20	0	0	0.19	0	0	0.10	0	0	0.14	0	0
TK0408-2	0.17	TNTC	0	0.19	0	0	-	-	-	0.03	0	0	0.04	20	0	-	13	0
TK0408-3	-	TNTC	0	0.14	1	0	0.16	0	0	0.04	0	0	0.08	0	0	0.04	TNTC	0
TJ0002-1	0.09	8	0	0.21	0	0	0.13	0	0	0.24	0	0	0.05	0	0	0.21	47	0
TJ0002-2	0.07	0	0	0.19	0	0	0.03	0	0	-	-	-	0.14	TNTC	0	0.21	0	0
TJ0002-3	-	-	-	-	-	-	0.37	12	-	0.13	0	0	0.17	0	0	0.19	0	0
TJ0002'	0.14	33	0	0.15	66	0	-	-	-	-	-	-	0.06	44	0	0.08	0	0
TJ0104-1A	0.20	0	0	0.19	0	0	0.16	0	0	0.20	106	0	0.17	0	0	0.40	0	0
TJ0104-1B	0.12	0	0	0.18	0	1	0.16	0	0	0.17	TNTC	0	-	-	-	0.22	0	0

Date	*July 17, July 24*			*Aug 7-14, Sept 4*			*Sept 11, Sept 18*			*Sept 25, Oct 2*			*Oct 9, Oct 16*			*Oct 23, Oct 30*		
Building Id	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]
TJ0104-2A	0.27	25	0	-	0	0	0.16	0	0	0.22	159	0	0.20	92	0	0.29	0	0
TJ0104-2B	0.27	0	0	-	0	0	-	-	-	0.19	0	0	0.12	0	0	0.39	0	0
TJ0103	0.24	0	0	0.11	0	0	-	-	-	0.19	0	0	-	-	-	0.13	0	0
TJ1107	0.17	0	0	-	-	-	-	-	-	0.28	0	0	-	-	-	-	-	-
TJ1236	0.16	0	0	-	-	-	0.12	0	0	0.17	0	0	0.10	TNTC	0	0.17	0	0

[1] Free residual chlorine (mg/L Cl^-)

[2] Total Coliform (CFU/100 ml)

[3] Fecal Coliform (CFU/100 ml)

Results of microbiological and physicochemical analysis of water samples collected from the **tap connected to tank** from March 27 till July 10

Date	*March 27, April 3*			*April 10, April 17*			*May 1, May 8*			*May 15, May 22*			*June 5, June 26*			*July 3, July 10*		
Building Id	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]
TJ1154-1	0.43	0	0	0.26	0	0	0.25	0	0	0.29	0	0	-	-	-	-	-	-
TJ1154-2	0.33	0	0	0.29	0	0	0.29	0	0	0.32	TNTC	0	0.32	11	0	-	-	-
TB0110	0.17	0	0	0.26	1	0	0.35	1	0	0.25	72	0	0.29	0	0	0.22	0	0
TJ1128	0.25	6	0	0.3	0	0	0.39	0	0	0.29	0	0	0.34	TNTC	0	-	-	-
TJ1158	0.33	0	0	0.26	0	0	0.26	1	0	0.24	0	0	0.30	247	0	0.15	0	0
TB0070	0.28	1	0	0.36	0	0	0.32	1	0	0.25	15	0	0.37	TNTC	0	0.18	1	0
TB0113-1	0.12	35	30	0.27	1	0	0.31	2	0	0.32	5	0	0.30	103	0	0.17	TNTC	0
TB0113-2	0.13	TNTC	0	0.33	TNTC	0	0.32	TNTC	0	0.27	70	0	0.27	0	0	-	-	-
TB0113-3	0.11	16	0	0.26	0	0	0.24	0	0	0.35	TNTC	0	0.30	33	4	0.29	13	0
TB0029	-	35	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TB0118	0.09	0	0	0.31	0	0	0.27	0	0	0.22	9	0	-	-	-	-	-	-
TB0115	0.33	0	0	0.29	0	0	0.28	60	0	0.28	26	0	0.28	TNTC	61	0.20	0	0
TB0119	0.13	18	0	0.28	0	0	0.25	32	0	0.24	1	0	0.30	TNTC	0	-	0	0
TB0034	-	-	-	0.34	28	0	0.3	102	0	0.22	18	0	0.28	225	TNTC	0.16	TNTC	0
TB0678	0.36	112	15	0.34	0	0	0.26	TNTC	88	0.33	31	17	0.29	1	0	0.07	TNTC	21
TA0089	0.38	55	37	0.24	27	16	0.29	TNTC	0	0.29	TNTC	TNTC	0.25	TNTC	68	0.36	TNTC	0
TK0437	0.14	1	0	0.32	25	0	-	14	0	0.24	6	0	0.28	0	0	0.13	0	0
TK0408-2	0.33	13	0	0.33	TNTC	0	0.28	TNTC	0	0.28	14	1	0.36	0	0	0.36	TNTC	0
TK0408-3	-	-	-	0.32	1	0	0.26	23	1	0.32	TNTC	0	0.36	TNTC	0	-	-	-
TJ0002-1	0.26	3	0	0.32	27	0	0.27	1	0	0.26	1	0	0.24	21	0	0.32	0	0
TJ0002-2	0.27	9	0	0.26	150	0	0.28	50	0	0.32	0	0	0.29	1	0	0.30	TNTC	13
TJ0002-3	0.32	0	0	0.24	0	0	0.25	0	0	0.22	TNTC	0	0.28	4	0	0.31	TNTC	0
TJ0002'	0.24	TNTC	0	0.27	1	0	0.35	27	0	0.21	110	0	0.23	0	0	-	-	-
TJ0104-1A	-	-	-	0.33	0	0	-	1	0	-	-	-	0.26	45	0	0.29	TNTC	0
TJ0104-1B	0.28	TNTC	0	0.39	2	0	-	0	0	0.28	140	0	0.40	33	0	-	-	-

Date	*March 27, April 3*			*April 10, April 17*			*May 1, May 8*			*May 15, May 22*			*June 5, June 26*			*July 3, July 10*		
Building Id	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*	*Free Cl[1]*	*TC[2]*	*FC[3]*
TJ0104-2A	0.27	12	1	0.35	0	0	-	4	0	0.33	163	0	0.32	51	0	0.22	38	0
TJ0104-2B	0.33	0	0	0.28	2	0	-	2	0	0.31	TNTC	0	0.26	0	0	0.38	2	0
TJ0103	0.26	34	1	0.3	4	0	-	1	0	0.21	1	0	0.27	5	0	0.30	0	0
TJ1107	-	-	-	0.35	0	0	0.27	1	0	0.25	0	0	0.25	28	0	0.30	0	0
TJ1236	0.25	0	0	0.26	TNTC	0	0.29	TNTC	0	0.35	0	0	0.27	0	0	0.14	25	0

[1] Free residual chlorine (mg/L Cl^-)

[2] Total Coliform (CFU/100 ml)

[3] Fecal Coliform (CFU/100 ml)

Results of microbiological and physicochemical analysis of water samples collected from the **tap connected to tank** from July 17 till October 30

Date	*July 17, July 24*			*Aug 7-14, Sept 4*			*Sept 11, Sept 18*			*Sept 25, Oct 2*			*Oct 9, Oct 16*			*Oct 23, Oct 30*		
Building Id	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]
TJ1154-1	0.22	TNTC	0	0.07	1	0	0.11	0	0	0.14	35	0	0.13	TNTC	0	0.12	TNTC	0
TJ1154-2	-	-	-	0.29	2	0	0.11	0	0	-	-	-	-	-	-	0.21	1	0
TB0110	0.16	0	0	0.21	1	0	-	-	-	0.15	0	0	-	-	-	-	-	-
TJ1128	0.16	TNTC	1	0.24	0	0	0.03	0	4	0.17	0	0	0.26	1	0	0.25	0	0
TJ1158	0.10	4	0	0.02	0	0	-	-	-	-	-	-	0.09	0	0	0.11	0	0
TB0070	0.15	45	0	0.16	0	0	0.16	49	0	0.01	110	0	0.19	0	0	0.05	0	0
TB0113-1	0.21	19	0	0.20	15	0	0.20	TNTC	0	0.14	TNTC	0	0.09	2	0	-	-	-
TB0113-2	-	-	-	0.26	TNTC	1	-	-	-	-	-	-	0.07	110	14	-	-	-
TB0113-3	0.26	72	0	0.25	TNTC	15	0.15	2	0	0.15	TNTC	0	0.19	88	10	-	-	-
TB0029	0.12	0	0	0.24	TNTC	0	0.12	5	0	-	-	-	0.32	TNTC	0	0.19	0	0
TB0118	-	-	-	-	-	-	0.12	25	0	0.11	0	0	-	-	-	-	-	-
TB0115	-	-	-	0.13	0	0	-	-	-	-	-	-	-	-	-	-	-	-
TB0119	-	-	-	-	-	-	-	-	-	0.03	TNTC	0	0.14	38	0	-	-	-
TB0034	0.15	TNTC	0	0.24	24	0	0.04	TNTC	0	0.11	TNTC	70	0.17	2	0	0.06	0	0
TB0678	0.15	TNTC	3	-	-	-	-	-	-	0.18	TNTC	92	0.11	116	2	-	-	0
TA0089	0.22	130	0	0.16	0	0	0.23	0	0	0.21	28	0	0.15	68	0	0.29	0	0
TK0437	0.17	0	0	0.23	0	0	0.25	0	0	0.11	0	0	0.01	26	0	0.08	0	0
TK0408-2	0.19	TNTC	0	0.15	0	0	-	-	-	0.02	TNTC	0	0.02	TNTC	0	-	TNTC	0
TK0408-3	0.08	TNTC	0	0.18	0	0	0.13	0	0	0.08	2	0	0.03	86	0	0.02	0	0
TJ0002-1	0.28	0	0	0.21	0	0	0.06	0	0	0.15	0	0	0.13	0	0	0.13	0	0
TJ0002-2	0.17	1	0	0.19	0	0	0.10	0	0	-	-	-	0.14	72	0	0.20	0	0
TJ0002-3	0.18	12	0	0.12	12	0	0.10	0	0	0.11	0	0	0.09	8	0	0.11	0	0
TJ0002'	0.11	0	0	0.23	2	0	-	-	-	-	-	-	0.08	TNTC	0	0.01	6	0
TJ0104-1A	0.23	1	0	0.23	TNTC	0	0.28	51	0	0.25	TNTC	0	0.20	0	0	0.31	0	0
TJ0104-1B	0.23	1	0	0.18	7	6	0.26	0	0	0.17	15	0	-	-	-	0.35	1	0

Date	*July 17, July 24*			*Aug 7-14, Sept 4*			*Sept 11, Sept 18*			*Sept 25, Oct 2*			*Oct 9, Oct 16*			*Oct 23, Oct 30*		
Building Id	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]
TJ0104-2A	0.13	TNTC	0	-	9	0	0.12	0	0	0.16	1	0	0.20	1	0	0.20	0	0
TJ0104-2B	0.21	9	1	0.23	0	0	-	-	-	0.25	13	0	0.18	2	0	0.21	0	0
TJ0103	0.17	TNTC	0	0.08	0	0	-	-		0.20	0	0	-	-	-	0.08	0	0
TJ1107	0.17	0	0	-	-	-	-	-	-	0.18	TNTC	0	0.01	3	0	-	-	-
TJ1236	0.16	27	0	0.23	0	0	0.15	0	0	0.18	0	0	0.14	0	0	0.17	0	0

[1] Free residual chlorine (mg/L Cl^-)

[2] Total Coliform (CFU/100 ml)

[3] Fecal Coliform (CFU/100 ml)

Results of microbiological and physicochemical analysis of water samples collected from the **storage tanks** from May 1 till October 2

Date	*May1, May 8*			*July 3, July 10*			*July 17, July 24*			*Aug 7-14, Sept 4*			*Sept 11, Sept 18*			*Sept 25, Oct 2*		
Building Id	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]
TJ1154-1	0.31	0	0	-	-	-	0.14	TNTC	17	0.24	0	0	0.16	0	0	0.11	0	0
TJ1154-2	-	-	-	-	-	-	0.12	6	0	0.25	0	0	0.11	TNTC	0	-	-	-
TB0110	-	-	-	0.25	0	0	0.17	0	0	0.18	0	0	-	-	-	0.14	0	0
TJ1128	-	-	-	0.32	39	0	0.16	TNTC	1	0.34	0	0	-	-	-	0.10	0	0
TJ1158	-	-	-	0.16	0	0	0.12	1	0	-	-	-	-	-	-	-	-	-
TB0070	-	-	-	0.13	0	0	0.09	0	0	0.08	0	0	0.15	3	0	0.05	6	0
TB0113-1	0.35	2	0	0.11	0	0	0.19	30	0	0.24	TNTC	0	0.18	0	0	0.18	0	0
TB0113-2	-	-	-	0.08	83	0	-	-	-	0.30	100	140	0.12	TNTC	0	-	-	-
TB0113-3	-	-	-	0.19	0	0	0.18	131	0	0.31	TNTC	0	0.10	0		0.13	TNTC	0
TB0029	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TB0118	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TB0115	-	-	-	0.15	TNTC	0	-	-	-	0.13	0	0	-	-	-	-	-	-
TB0119	-	-	-	0.15	TNTC	0	-	-	-	-	-	-	-	-	-	-	-	-
TB0034	-	-	-	0.18	0	0	-	-	-	-	-	-	-	-	-	-	-	-
TB0678	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TA0089	0.35	5	0	0.48	TNTC	0	0.19	84	0	0.25	0	0	0.40	0	0	0.15	TNTC	0
TK0437	-	-	-	0.17	0	0	0.10	0	0	-	-	-	0.15	0	0	0.20	0	0
TK0408-2	-	-	-	0.34	TNTC	0	0.18	13	0	0.19	2	0	0.15	0	0	0.02	0	0
TK0408-3	-	-	-	-	-	-	0.22	TNTC	0	0.20	0	0	0.10	0	0	0.04	33	0
TJ0002-1	-	-	-	0.32	TNTC	0	0.15	0	0	0.15	0	0	0.08	0	0	0.15	0	0
TJ0002-2	0.28	50	0	0.34	19	0	0.15	0	0	0.12	0	0	0.05	0	0	-	-	-
TJ0002-3	-	-	-	0.35	0	0	0.12	0	0	0.16	1	0	0.14	0	0	0.18	0	0
TJ0002'	-	-	-	0.30	0	0	0.12	0	0	0.16	5	0	-	-	-	-	-	-
TJ0104-1A	-	-	-	0.31	3	0	0.16	0	0	-	0	0	0.06	0	0	0.04	24	0
TJ0104-1B	-	-	-	0.20	TNTC	0	0.17	TNTC	0	-	0	0	0.24	0	0	0.21	8	0

Date	*May1, May 8*			*July 3, July 10*			*July 17, July 24*			*Aug 7-14, Sept 4*			*Sept 11, Sept 18*			*Sept 25, Oct 2*		
Building Id	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]	*Free Cl*[1]	*TC*[2]	*FC*[3]
TJ0104-2A	-	-	-	0.29	38	0	0.15	0	0	-	0	0	0.33	0	0	0.26	0	0
TJ0104-2B	-	-	-	0.33	63	0	0.19	0	0	-	0	0	-	-	-	0.22	2	0
TJ0103	-	-	-	-	-	-	-	-	-	0.22	0	0	-	-	-	0.14	0	0
TJ1107	-	-	-	0.28	0	0	0.13	0	0	-	-	-	-	-	-	0.18	0	0
TJ1236	-	-	-	0.27	0	0	0.16	0	0	0.13	0	0	0.11	0	0	0.17	0	0

[1] Free residual chlorine (mg/L Cl^-)

[2] Total Coliform (CFU/100 ml)

[3] Fecal Coliform (CFU/100 ml)

Results of microbiological and physicochemical analysis of water samples collected from the **storage tanks** from October 9 till October 30

Date	*Oct 9, Oct 16*			*Oct 23, Oct 30*		
Building Id	*Free residual chlorine (mg/L Cl⁻)*	*TC (CFU/ 100 ml)*	*FC (CFU/ 100 ml)*	*Free residual chlorine (mg/L Cl⁻)*	*TC (CFU/ 100 ml)*	*FC (CFU/ 100 ml)*
TJ1154-1	0.10	0	0	0.19	1	0
TJ1154-2	-	-	-	0.14	0	0
TB0110	-	-	-	-	-	-
TJ1128	0.22	53	0	0.21	0	0
TJ1158	0.10	10	0	0.18	0	0
TB0070	0.05	1	0	0.05	0	0
TB0113-1	0.16	5	0	-	-	-
TB0113-2	0.03	31	0	-	-	-
TB0113-3	0.07	0	0	-	-	-
TB0029	-	-	-	-	-	-
TB0118	-	-	-	-	-	-
TB0115	-	-	-	-	-	-
TB0119	0.20	0	0	-	-	-
TB0034	-	-	-	-	-	-
TB0678	-	-	-	-	-	-
TA0089	0.26	50	0	0.24	0	0
TK0437	0.03	5	0	0.15	0	0
TK0408-2	0.03	28	0	0.03	0	0
TK0408-3	0.11	TNTC	0	0.04	1	0
TJ0002-1	-	44	0	0.16	0	0
TJ0002-2	0.06	15	0	0.06	0	0
TJ0002-3	0.03	4	0	0.18	0	0
TJ0002'	0.10	10	0	0.15	0	0
TJ0104-1A	0.22	3	0	0.19	0	0

Date	*Oct 9, Oct 16*			*Oct 23, Oct 30*		
Building Id	*Free residual chlorine (mg/L Cl⁻)*	*TC (CFU/ 100 ml)*	*FC (CFU/ 100 ml)*	*Free residual chlorine (mg/L Cl⁻)*	*TC (CFU/ 100 ml)*	*FC (CFU/ 100 ml)*
TJ0104-1B	0.11	TNTC	0	0.30	0	0
TJ0104-2A	0.12	25	0	0.11	0	0
TJ0104-2B	0.29	10	0	0.36	0	0
TJ0103	-	-	-	0.10	0	0
TJ1107	0.05	0	0	-	-	-
TJ1236	-	-	-	-	-	-

Annex 20.
Powerpoint presentation at the appraisal meeting with
Mr. Mark Redwood (May 13, 2011)

Participatory Improvement of Water and Sanitation Services in Tripoli through a Comparative Analysis with Irbid

Project Progress
May 2008 to present

American University of Beirut

Main Goal

Easing environmental burdens in an urban area through a better understanding of how poor environmental services exacerbate poverty as well as piloting interventions that improve such services

Outline

- Background, goals and objectives
- Scope of work
- Progress to date
- Next steps

Study Area

- Tebbaneh, Tripoli
  - One of the poorest urban areas in Lebanon
  - Transformed into a slum in 1955 by the flooding of the nearby Abu-Ali River
  - Dwellings miserable and underserved
  - More than 50% live below the poverty line
  - Average monthly household income USD130
  - Unemployment rate reaches 12% in comparison to 6% for the rest of the city

Background

Poor Urban Area

Study Area

An-Nasr	Tebbaneh
1.9 Km² area	0.4 Km² area
Highest population density in the country	Highest population density in the country
4,671 persons/km²	69,510 persons/km²
Poor community	Poor community
Average monthly income < 200 USD per month	Average monthly income < 200 USD per month
Majority of the population Sunni Muslim and a minority of Christians	Majority of the population Sunni Muslim and a minority of Christians

Objectives

- Draw on lessons from Irbid, Jordan
- Define priority needs
- Develop and implement pilot intervention(s) with the participation of the community and the municipality
- Develop a sustainable environmental management framework
- Disseminate the experience with the pilot intervention(s)

Needs Assessment Validation and Prioritization

- Build on previous and on-going experiences
- Field surveys
- Stakeholders' interviews and meetings
- Understand the infrastructure support systems and the responsibilities
- Community capacity building needs, priorities, and expectations

Scope of Work

- Establishing a comparative framework
- Needs assessment validation and prioritization
- Infrastructure mapping and GIS development
- Pilot intervention(s): Definition and implementation
- Sustainable urban development framework
- Dissemination

Infrastructure Mapping and GIS Development

- The infrastructure inventory will be integrated in a GIS framework
  - Conduct a situational analysis
  - Allow the development of a municipal support system for the Tebbaneh region
- Include social, economic and other data layers
- Compatible with existing GIS system

Establishing a Comparative Framework

- Irbid, Jordan:
  - Similar characteristics to Tebbaneh
  - Adequately functioning water and sanitation system
- Social field assessment
- Definition of key indicators affecting the provision of water distribution and sanitary services

Pilot Intervention(s): Definition and Implementation

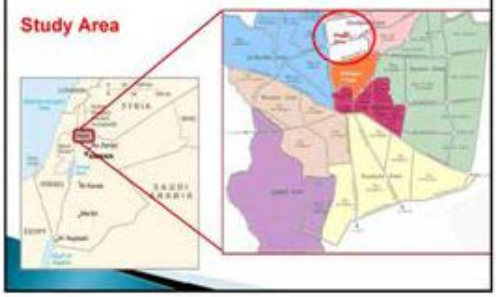
- Potential intervention(s) will be defined in coordination with the community and the municipality
- Structural and non-structural
- Gender-sensitive

Sustainable Urban Development Framework

- Solicitation of community feedback about pilot interventions and feasibility to expand throughout the Tebbaneh
- Summarize project's findings into a framework that will serve as a guide for the community and municipality to seek funding for expansion of similar pilot interventions throughout the Tebbaneh or similar regions

Social Field Assessment in Irbid

Study Area



Progress to date

- Needs assessment validation and prioritization
  - Social field assessment in Irbid
  - Social field assessment in Tebbaneh
  - Main results of field assessment
  - Health survey in Tebbaneh
  - Socio-economic assessment of water pollution
  - Water quality assessment
- GIS spatial analysis
- Definition of pilot interventions
- Implementation of pilot interventions
- Monitoring of intervention impacts

Social Field Assessment in Irbid
Issues covered by the Questionnaire

- Socio-demographic
  - (Age, household members, education)
- Work force
- Financial status
- Health status
  - Chronic illnesses
  - Water-related illnesses (incidence, treatment, costs)
- Personal hygiene and fixtures
- Water sources (quantity, use, quality)
  - Network water
  - Well water
  - Water tankers
  - Hand-carried water
  - Bottled water
  - Drinking water
  - Water tanks
- Wastewater disposal
- Solid waste disposal
- Willingness to pay
- Prioritization of environmental and health problems

Social Field Assessment in Irbid

1. Several meetings between AUB representative and the JUST Team in Jordan
2. Selection of survey area
3. Preparation of social questionnaire
4. Identification of field survey team
5. Training on questionnaire use
6. Conducting field survey of 300 households
7. Data analysis
8. Drawing lessons useful for Tebbaneh study
9. Reporting

Social field assessment in Tebbaneh
Inception Meeting

- A representative appointed by the Tripoli Municipality for coordination and sharing views and plans
- Local stakeholders in the Tebbaneh region invited for an inception meeting

Social field assessment in Tebbaneh
NGO Team Formation

- Interested local NGOs called for a follow-up meeting at the Tripoli Municipality
- A team of NGOs that will participate in the implementation of the various project activities was formed

NGO Team Members

1. Women's Work Organization
2. With You Charitable Organization
3. Women's Group Charitable Organization

Establishing a comparative framework

- Survey data from Tebbaneh analyzed and compared to those from Irbid
  - strong similarities in selected socio-demographic indicators
  - a striking difference in the level of education of housewives
  - levels of diarrhea among children in the Tebbaneh region were found to be 3 to 5 times higher
  - new sewage network in both areas
  - differences in the water supply system
  - Buildings in An-Nasr do not exceed 3 stories while buildings in Tebbaneh are higher
  - Other results and general observations

Social field assessment in Tebbaneh
Survey design and implementation

- Questionnaire revised based on
  - Recommendations from the Irbid team
  - Pilot-testing in Tebbaneh
- Study area divided into 5 zones containing almost equal numbers of buildings
  - 60 to 70 households randomly selected from each zone
- Survey implemented during July and August 2009

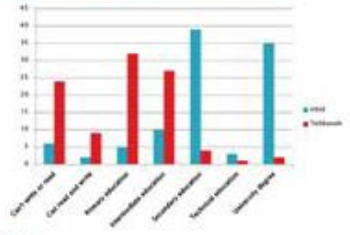
Establishing a comparative framework
General socio-demographics

	Tebbaneh Mean (Range)	Irbid Mean (Range)
Number of rooms in household	3.2 (1-12)	3.4 (1-8)
Number of household members	5.7 (1-14)	6.1 (2-15)
Number of families within the household	1.2 (1-5)	1.1 (1-3)
Age of male household head	45.0 (22-88)	44.2 (23-96)
Age of female household head	41.4 (16-79)	38.7 (17-67)

Social field assessment in Tebbaneh
Survey Implementation

- The AUB team accompanied local surveyors during their household visits
- A total of 332 questionnaires were administered over a period of 6 weeks
- Respondents very cooperative with a response rate of 86 percent
- Collected data entered on SPSS by the AUB Team
- Data cleaned and analyzed

Establishing a comparative framework
Education level of housewives



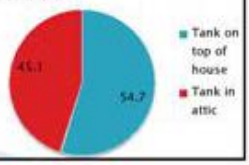
Establishing a comparative framework
Waterborne diseases

	Irbid	Tebbaneh
Children < 1yr	56 per 1,000	281 per 1,000
Children 1-10 yrs	34 per 1,000	113 per 1,000

The wastewater infrastructure has been improved in Tebbaneh similar to An-Nasr area, hence the difference in diarrheal incidence can be attributed more to:
- **water sources**
- **water supply system**
- **hygienic practices**

Social field assessment in Tebbaneh
Results: Water tanks

- 96% of households store their water in tanks
- Stored water not used for drinking but used for household cores and washing fruits and vegetables, etc.
- Household storage tanks located
  - in the attic
  - on the building's roof
- Storage tanks are not well covered and often not covered at all



Establishing a comparative framework
Water supply

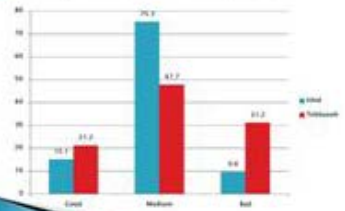
An-Nasr, Irbid
- Intermittent supply but good pressure
- Incoming water stored in a common/ compartmentalized reservoir
- Water from reservoir pumped to roof-top tanks
- OR incoming water fills roof-top tanks directly

Tebbaneh, Tripoli
- Continuous supply but low pressure
- No storage reservoirs in building basements
- Individual water pumps installed in the basement on incoming water pipe
- Many apartments still use old storage tanks located in attics

Increased risk of water pollution in Tebbaneh

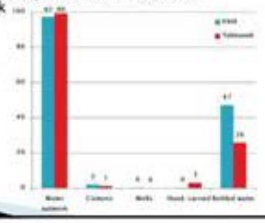
Social field assessment in Tebbaneh
Results: Perception of water quality

- Quality rating of network water



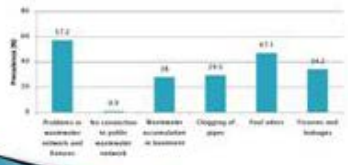
Social field assessment in Tebbaneh
Results: Water supply

- Nearly 99 percent of respondents in Tebbaneh use water from the public water supply network
- Around 26 percent of respondents in Tebbaneh supplement network water with bottled water especially when:
  - Network water seems turbid
  - A household member is ill



Social field assessment in Tebbaneh
Results: Wastewater disposal

- Wastewater infrastructure lately improved in Tebbaneh
- 99.4 % are connected to the wastewater network
- **Main wastewater problems reported were within the buildings (57 %):**



Social field assessment in Tebbaneh
Results: Water tanks

Social field assessment in Tebbaneh
Results: Willingness to Pay

Improved water supply services	Improved wastewater network services
Mean WTP ~ 7,000 LL/ month	Mean WTP ~ 4,000 LL / month
Range: 0 to 150,000/ month	Range: 0 to 50,000 LL/ month
S.D.: 14,000 LL/ month	S.D.: 9,000 LL/ month
58 % were willing to pay ZERO LL	71 % were willing to pay ZERO LL

Social field assessment in Tebbaneh
Results: Solid waste management

- 96% remove their solid waste daily from the household
- 100% reported solid waste collection by private establishments (Lavajet)
- 61% reported that solid waste collection bins were less than 50 m away
- 60% complained from lack of cleanliness of surroundings

Health survey in Tebbaneh
Methodology

- Lebanese Ministry of Health contacted for official data on diarrhea and typhoid
  - Significant under-reporting
- Data collected directly from the health facilities in the Tebbaneh Study Area
- Nearly 77 percent of surveyed households resorted to dispensaries for medical care
  - More than 90 percent of these households frequented five main dispensaries
    - Al Rahmah, Al Azm Wal Saadah, Al Dawah, Al Hariri, and Al Hamidi dispensaries
- Questionnaire prepared to collect data on
  - Number of diarrhea and typhoid cases during the period extending between September 2008 and September 2009
  - Common medications prescribed for diarrhea and typhoid cases
  - Average cost of treatment

Social field assessment in Tebbaneh
Hygiene

- Significantly low hygiene practices were noted both within households and on the streets

Health survey in Tebbaneh
Methodology

- Location of surveyed dispensaries
  - Al Hariri and Al Hamidi dispensaries are outside Tebbaneh

Health survey in Tebbaneh
Results

- Data sources:
  - physicians' daily log books
  - patients' medical files
  - dispensary's admittance records
- Data from some dispensaries contained some gaps
- Data was used to calculate the socio-economic impact of water-related diarrhea in Tebbaneh

Socio-economic assessment
Methodology

- Water-related morbidity
  1. Cost of illness (COI) approach
  2. Aversive behavior approach
  3. Disability Adjusted Life Years (DALY) approach
- Main assumptions
  - 88 % of diarrheal disease is attributed to unsafe water supply, inadequate sanitation and hygiene (Wilkinson 2010)
  - The diarrheal cases distribution by age group and type of disease is uniform throughout the year
  - Since typhoid and other non specified diarrheal illnesses are of insignificant occurrence, only the cost of treatment of diarrhea was considered in the calculations

Health survey in Tebbaneh
Results

Number of diarrheal cases as reported by the top five dispensaries

Dispensary	Types of investigated records	Reported Period	Number of Diarrheal Cases				Notes
			< 5 yrs	> 5 yrs	Un-specified	Total	
Al Azem wal Saadah	Patients files	01/09/08 to 01/09/09	194	196		390	
Al Rahmeh	Physicians log books	01/03/08 to 08/09/09	100	76	19	197	Data over a 6 months period
Al Rahmeh (Cases requiring IVF)	Entrance log books	02/09/08 to 31/08/09			442	442	
Al Hariri	Computer database	01/09/08 to 01/09/09			202	202	
Al Daawah	Entrance log books	01/09/08 to 01/09/09	50	131		181	Calculated as the annual average of reported cases for the past 3 years
Al Hamidi	Patients files	01/01/09 to 28/02/09 and 01/07/09 to 21/08/09	25	40		65	Data over 2 2-months period

Estimated annual diarrhea cases = 61 per 1,000 population

Socio-economic assessment
Methodology

- Water-related mortality
  1. Human Capital Approach
  2. Willingness to Pay (Value of a Statistical Life) approach
- Main issues/ assumptions
  - Health survey indicated zero mortality due to diarrhea
  - National mortality rate (750 cases per year) adopted
    - 6 cases per year in Tebbaneh
  - Adopted rate is conservative given that Tebbaneh is one of the poorest areas in the country

Health survey in Tebbaneh
Results

Medication and dispensary costs

Dispensary	Dispensary fees (LL)	Medication costs for Diarrhea cases (LL)	Medication costs for Typhoid cases (LL)
Al Azem wal Saadah	1,000	0 (Free)	0 (Free)
Al Rahmeh	3,000	10,000-15,000	-
Al Rahmeh (Cases requiring IVF)	0	10,000-75,000	45,000
Al Hariri	5,000	6,000-36,000	24,000
Al Daawah	0-5,000	4,500-20,000	4,000-25,000
Al Hamidi	6,000-9,000	22,000-55,000	17,500

Socio-economic assessment
Results

- COI approach- Morbidity

Data Type	Value (MUS$/year)
Direct cost of illness	0.360 – 1.444
Lost Productivity	0.163
Total	0.523 – 1.607

- Aversive behavior approach- Morbidity

(purchase of bottled water)

Type of Data	Value
Total Number of Study Population	27,804
Proportion of Households Purchasing Bottled Water (%)	25.8 – 70
Number of People Consuming Bottled Water	7,173.6 - 19,462.8
Average consumption of water (L/Capita/day)	0.58 – 1.52
Total bottled water consumption (L/day)	4,161 – 29,583
Cost of bottled water in US$/L	0.07 – 0.67
Total cost of purchasing bottled water (USD/day)	291 – 19,821
Total cost of purchasing bottled water (USD/yr)	106,215 – 7,234,523

Socio-economic assessment
Results

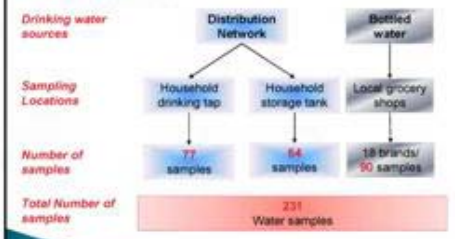
- DALY approach- Morbidity

Indicator	Value	Variables
DALY (Lower bound estimate)	55,213	YLD = 10.2 GDP = 5,413 (USD/Capita for the year 2004)
DALY (Higher bound estimate)	1,148,438	YLD = 10.2 WTP = 112,592 (USD/Case for the year 2004)
DALY (in 2009)	82,820 – 1,723,660	Applying the Benefit Transfer Methodology

- Total cost of morbidity

Type of Expenditures	Value (MUS$/year)
Cost of illness	0.523 – 1.607
Cost of Aversive Behavior	0.106 – 7.235
Cost of years lost due to disability	0.082 – 1.723
Total	0.711 – 10.565

Water quality assessment in Tebbaneh
Methodology



Socio-economic assessment
Results

- Human Capital approach- Mortality
  - 1.12 MUS$ per year
- WTP approach- Mortality

Data Type	Value (MUS$/year)
Range of WTP estimates in the US	0.6 – 13.5
Value of Statistical Life in Lebanon	0.11-2.43
Total Cost of Mortality	0.55 – 12.15

- *Total socio-economic burden*

Outcome	Value (MUS$/year)	Percent of GDP (%)
Morbidity	0.71 – 10.57	0.3 – 4.6
Mortality	0.55 – 12.15	0.2 – 5.3
Total	1.83 – 22.72	0.5 – 9.9

Water quality assessment in Tebbaneh
Results: Network water

Parameter	Range	Standard (EPA/ EU/ WHO)	Standard Exceedance N	Standard Exceedance (%)
Fecal coliform (CFU/100 ml)	1-3	0	3	(4)
Total coliform (CFU/100 ml)	1-500	0	18	(24)
Nitrate (mg/L NO_3^-)	6.1-27.8	40-50	0	(0)
pH	6.04-7.84	6.5-8.5	0	(0)
Residual chlorine (mg/L Cl_2)	0.01-0.3	> 0.5	76	(100)
TDS (mg/L)	208-862	500	24	(32)
Color (PtCo APHA)	0-67	15	14	(22)
Turbidity (NTU)	0.98-1.6	1	6	(10)

Total number of samples = 77

Water quality assessment in Tebbaneh
Methodology

- Drinking water quality assessed in
  - Water distribution network
    - Sampling points based on distribution network and detected diarrheal cases
  - Household storage tanks
  - Vended bottled water
    - 3 batches of different water brands consumed were collected from the area
- The water samples were tested for
  - Nitrates, Residual Chlorine, pH, TDS, Turbidity and Color
  - Fecal and Total Coliform

Water quality assessment in Tebbaneh
Results: Storage tanks

Parameter	Range	Standard (EPA/ EU/ WHO)	Standard Exceedance N	Standard Exceedance (%)
Fecal coliform (CFU/100 ml)	1-9	0	6	(10)
Total coliform (CFU/100 ml)	1-177	0	26	(41)
Nitrate (mg/L NO_3^-)	12-31.8	40-50	0	(0)
pH	6.36-8	6.5-8.5	1	(0)
TDS (mg/L)	214-897	500	26	(44)
Color (PtCo APHA)	0-67	15	14	(24)
Turbidity (NTU)	0.98-1.6	1	6	(10)

Total number of samples = 64

Water quality assessment in Tebbaneh
Results: Bottled water

Parameter	Range	Standard (EPA/ EU/ WHO)	Standard Exceedance N brands	/ %
Fecal coliform (CFU/100 ml)	0-207	0	2	(11)
Total coliform (CFU/100 ml)	0-147	0	6	(33)
Nitrate (mg/L NO3)	2.2-49.5	40-50	1	(5.5)

Total number of brands = 18

GIS Spatial Analysis

- Distribution of diarrhea cases in study area

Water quality assessment in Tebbaneh
Results: Summary

- Network water
  - Inefficient chlorination of drinking water
  - Potential contamination of the drinking water within the network
  - Color and turbidity detected as reported by residents
- Storage tanks
  - Fecal and total contamination of storage tanks
  - Potential contamination from wastewater plumbing within the buildings/house
- Bottled water
  - 2 of 12 brands was fecally contaminated
  - 6 of 12 brands were contaminated with Total Coliform
  - Bottled water is mostly used for infants and sick residents
  - Residents do not purchase brands selectively but whatever is available in the market

GIS Spatial Analysis

- Problems in wastewater network and fixtures
  - Clogging of pipes

Infrastructure mapping & GIS Development

- New sewage and water networks have been recently installed in the Tebbaneh area
- Developing a GIS Municipal Support System not beneficial for locating potential pilot interventions
- GIS use focused on spatial analysis to identify priority areas for pilot interventions
- Main parameters:
  - distribution of diarrhea cases
  - distribution of buildings reporting wastewater related problems
  - buildings where water pollution was detected

GIS Spatial Analysis

- Problems in wastewater network and fixtures
  - Fissures and leakages

GIS Spatial Analysis

- Problems in wastewater network and fixtures
  - Foul odors

GIS Spatial Analysis

- Problems in wastewater network and fixtures
  - Buildings reporting one or more problems

GIS Spatial Analysis

- Problems in wastewater network and fixtures
  - Wastewater accumulation in basement

GIS Spatial Analysis

- Problems in wastewater network and fixtures
  - Buildings with problems and diarrhea cases

GIS Spatial Analysis

- Problems in wastewater network and fixtures
  - Buildings not connected to the wastewater network

GIS Spatial Analysis Results

- 5 zones suffered almost equally from wastewater related problems and from the incidence of diarrhea
  - No clustering of environmental problems discerned
- Selected buildings for intervention
  - 8 buildings are located in Zones 1 and 4, which are at the heart of Tebbaneh and where building conditions are the worst
  - 1 building is located in Zone 5 characterized by relatively newer buildings
  - 1 building located in zones 2 and 3 in Jabal Mohsen
  - Where more space and empty land parcels are available
  - *The selection process of the 10 buildings is detailed later*

Definition of pilot interventions

Definition of Pilot Intervention
Testing associations

- Associations between selected variables were tested using SPSS
- Variables of interest
  - reported incidence of diarrhea in the three months preceding data collection
  - type of household storage tank (roof top vs attic)
  - presence/absence of fecal and total coliforms in the analyzed water samples
- Chi Square Test and ANOVA
- Significant associations found between:
  - type of storage tank used (attic vs. roof top) and the presence of total ($p = 0.07$) and fecal ($p = 0.005$) coliforms in the water
  - type of storage tank and the reporting of diarrhea cases ($p = 0.067$)
- No association between diarrhea cases and reporting of wastewater problems

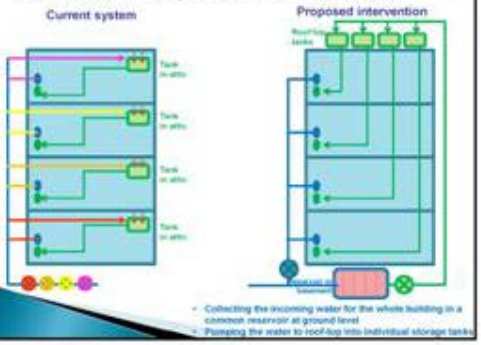
Definition of pilot interventions

- Intervention description
- Testing associations using SPSS
- Building short listing using SPSS
- Building selection through public consultations
- Building inspection
- Newly proposed intervention

Definition of Pilot Intervention
Building selection via SPSS

- Variables showing association in SPSS were used to shortlist buildings
  - diarrhea cases detected in 121 of the total 330 surveyed buildings
  - Tank water samples collected from 64 buildingsreporting diarrhea
  - Total coliforms detected in 26 surveyed buildings
  - 10 of these buildings have storage tanks in attic

Definition of pilot interventions



Definition of Pilot Intervention
Public consultations

- Meeting held at the Tripoli Municipality
  - representatives from the municipality
  - local NGOs
    - Women's Work Organization (جمعية العمل النسوي)
    - *With You* Charitable Organization (جمعية معكم الخيرية الاجتماعية)
    - Women's Group Charitable Organization (جمعية اللقاء النسائي الخيري)
  - Results of the social surveys and comparative assessment were presented
  - Proposed type of pilot intervention discussed
- Participants communicated their interest in the survey results and their willingness to assist in the implementation of the pilot intervention.

Definition of Pilot Intervention
Building selection via field inspection

- Field visits
  - Buildings inspected in the field by the AUB team to explore the possibility of implementing the proposed intervention
    - number of floors per building
    - the presence of space in the basement for the water reservoir
    - social acceptability
- Several constraints were faced:
  - Obtaining consent of all tenants in building
  - Obtaining consent of building owner
  - Obtaining approval of Water authorities

Definition of Pilot Intervention
Building selection via field inspection

- Field visit 3
  - 6 of the previously visited buildings re-visited
    - Building ownership investigated
    - 3 buildings short-listed
      - Building TJ0002
        - Owners of the second interconnected building actually lived in the building and showed enthusiasm to the project
      - Building TJ0104
        - Lawyer managing the building
        - Lawyer currently being contacted to investigate his jurisdiction and ability to give consent for pilot implementation
      - Building TB0539
        - Owner not liked by tenants
        - Contact being sought
- Details of field investigation of 10 buildings

Definition of Pilot Intervention
Building selection via field inspection

- Field visit 1:
  - Buildings inspected in the field by the AUB team to explore the possibility of implementing the proposed intervention
    - number of storeys per building
    - the presence of space in the basement for the water reservoir
    - social acceptability
  - 2 buildings first found to meet the above mentioned selection criteria, particularly in terms of space availability
    - Building TJ0002
    - Building TB0539
      - Located in Jabal Mohsen, although geographically it appears to be part of Tebbaneh
- Field visit 2
  - Detailed field exploration for implementing the pilot project in building TJ0002
    - building has a space of around 4X4m² at ground level as well as a basement
    - ground level space was filled with solid waste
    - basement was full of water leaking from deteriorated pipelines
  - Meeting was held with the residents of the building and the proposed pilot project was presented

Definition of Pilot Intervention
Building selection

1. TB0110
2. TJ1154
3. TJ1158
4. TJ1189
5. TB0539
6. TJ0002
7. TJ0103
8. TJ0104
9. TJ0286
10. TJ1227

Definition of Pilot Intervention
Building selection via field inspection

- Field visit 2 (cont'd)
  - Constraints:
    - Building TJ0002 system is connected to an adjoining building rendering the total number of apartments to be rehabilitated to 13
    - Building owned by someone who recently passed away
      - inheritance consists of seven individuals who may have different plans about the building
    - The AUB team agreed with the building residents to first explore with the building new owners and seek their permission before proceeding with the pilot project design and implementation
    - After two weeks, two of the owners did not agree to implement the pilot intervention

Definition of Pilot Intervention
Building selection

1. TB0110
   - Zone: 1
   - Number of floors: 3
   - Total number of housing units: 3
   - Space availability around building: None
   - Notes:
     - Very old building with lots of fissures and cracks
     - Includes one residential unit only and the remaining floors are for a grocery shop

- *Building option discarded*

Definition of Pilot Intervention
Building selection

2. TJ1154

- **Zone** :1
- **Number of floors**: 6
- **Total number of housing units**: 24
- **Space availability around building**: Limited at building entrance
- **Notes**:
  - Very old building in bad condition
  - Difficulty in reaching consensus regarding pilot project implementation due to large number of households

- *Building option discarded*

Building entrance

Definition of Pilot Intervention
Building selection

5. TB05 39

- **Zone** :2
- **Number of floors**: 4
- **Total number of housing units**: 5
- **Space availability around building**: A lot of space around the building
- **Notes**:
  - Building located in Jabal Mokseh
  - Space around the building is for different owners
  - 1st and 2nd floors have no pumps
  - Last floor has tank on roof
  - Not ideal option since the building's condition and water supply system is much better than other buildings in Tebbaneh

- *Building option still under consideration ranked 3*
  - *Phone number of owner is currently being sought*

Definition of Pilot Intervention
Building selection

3. TJ1158

- **Zone** :1
- **Number of floors**: 5
- **Total number of housing units**: 15
- **Space availability around building**: Space at building entrance
- **Notes**:
  - Building in relatively good condition in the middle of the vegetable market
  - Difficulty in reaching consensus regarding pilot project implementation due to large number of households

- *Building option discarded*

Building entrance

Definition of Pilot Intervention
Building selection

6. TJ0002

- **Zone** :4
- **Number of floors**: 3
- **Total number of housing units**: 7 + 3
- **Space availability around building**: Some space available (4X4 m²)
- **Notes**:
  - Consists of 2 interconnected bldgs
  - Underground space available but is full full of water
  - Ground level space available but is full of solid waste
  - The two bldgs were first selected but owners of only one building agreed to implement the pilot intervention

- *One building option discarded and the other is still under consideration and ranked 1*

Space between 2 buildings

Definition of Pilot Intervention
Building selection

4. TJ1189

- **Zone** :1
- **Number of floors**: 5
- **Total number of housing units**: 35
- **Space availability around building**: Very limited space around or inside the building
- **Notes**:
  - Building located in the middle of the vegetable market with shops on the ground floor
  - Difficulty in reaching consensus regarding pilot project implementation due to the very large number of households

- *Building option discarded*

Building entrance

Definition of Pilot Intervention
Building selection

7. TJ0103

- **Zone** :4
- **Number of floors**: 6
- **Total number of housing units**: 12
- **Space availability around building**: Some space available between two bldgs
- **Notes**:
  - All apartments are
  - Difficulty in reaching consensus regarding pilot project implementation due to the large number of households and the fact that different apartments have different owners

- *Building option discarded*

Building entrance

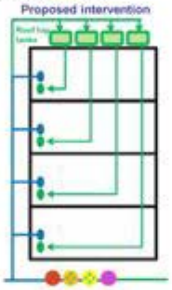
Definition of Pilot Intervention
Building selection

8. TJ0104
   - Zone :4
   - **Number of floors**: 2
   - **Total number of housing units**: 4
   - **Space availability around building**: Some space available at ground level
   - **Notes**:
     - There is a basement underground but it is closed
     - Only last floor has tank on roof
     - Building managed by a lawyer since the owner is dead

- *Building option still under consideration and ranked 2*
  - *Phone number of lawyer is currently being sought to discuss possibility of*

Definition of Pilot Intervention
New proposition

- Newly proposed intervention
  - Replace old water tanks located in the attic with rooftop water tanks (500 L capacity)
  - Install the needed pipes connecting the basement pump to the water tank and the water tank to the various taps in the buildings



Definition of Pilot Intervention
Building selection

9. TJ0286
   - Zone :4
   - **Number of floors**: 6
   - **Total number of housing units**: 12
   - **Space availability around building**: Space on first floor (5X5 m²)
   - **Notes**:
     - Difficulty in reaching consensus regarding pilot project implementation due to the large number of households
     - Available space on first floor

- *Building option discarded*

Space on first floor

Definition of Pilot Intervention
New proposition

- Additional water sampling and analysis was conducted
  - 35 drinking water samples
  - 45 tank water samples
- 19 buildings were selected for the intervention

Definition of Pilot Intervention
Building selection

10. TJ1227
    - Zone :5
    - **Number of floors**: 6
    - **Total number of housing units**: 21
    - **Space availability around building**: None
    - **Notes**:
      - Difficulty in reaching consensus regarding pilot project implementation due to the very large number of households

- *Building option discarded*

Building entrance

Implementation of Pilot Intervention

- Selection of contractor following a bidding process by AUB
- Installation of new plastic tanks
  - February – March 2011
  - A total of 20 buildings

Implementation of Pilot Intervention

Old tanks

Implementation of Pilot Intervention

Selected newly installed tanks

Implementation of Pilot Intervention

Old tanks (cont'd)

Monitoring of intervention impact

- Water quality monitoring
  - Samples collected where intervention took place:
    - Water samples from drinking tap
    - Water samples from tap connected to storage tank
  - Samples analyzed for:
    - Total coliform
    - Fecal coliform
    - Free residual chlorine

Implementation of Pilot Intervention

Existing fixtures and interior of some old tanks

Monitoring of intervention impact

Summary of results

Building ID	Total Coliform: Tank		Total Coliform: Network		Fecal Coliform: Tank		Fecal Coliform: Network	
	Before	After	After		Before	After	After	
TI1154-1	3	0	9		0	0	0	
TI1154-2	1	0	9		0	0	0	
TB0110	13	0	1		0	0	0	
TI1128	140	2	0		0	0	0	
TI1158	3	0	0		0	0	0	
TB0070	200	1	0		0	0	0	
TB0113-1	0	13	0		0	1	13	
TB0113-3	TNTC	3	0		6	0	13	
TB0029	TNTC	35	TNTC		45	0	0	
TB0115	4	20	0		0	0	0	
TI1236	0	TNTC	0		0	0	0	

Building ID	Total Coliform: Tank		Total Coliform: Network		Fecal Coliform: Tank		Fecal Coliform: Network	
	Before	After	After		Before	After	After	
TB0139	0	4	0		0	0	0	
TB0034	0	46	6		0	0	0	
TN0089	32	TNTC	4		0	18	0	
TK0437	165	13	1		28	0	0	
TK0408-2	5	TNTC	21		0	0	0	
TK0408-3	1	13	21		0	1	0	
TB0001-2	14	70	TNTC		0	0	0	
TB0104-2	10	1	TNTC		0	0	0	
TB0103	5	13	16		0	0	0	
TI1107	5	0	0		19	0	0	

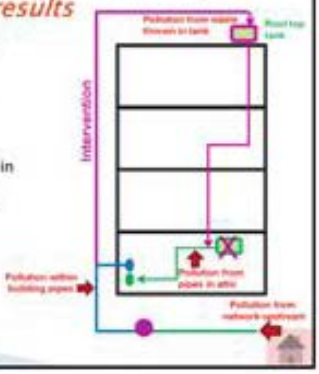
Values in red and bold require further investigation: Abuse of water tanks

Values highlighted in yellow: piping vs water source

Monitoring of intervention impact

Interpretation of results

- Improvement noted in around 55% of the buildings
- Potential sources of pollution currently being investigated
  - Leakage into pipes within the building
  - People throwing waste into the water tanks
- Monitoring ongoing



Next steps

1. Continue pilot interventions and monitoring of performance assessment
2. Sustainable urban development framework
3. Disseminate the experience with pilot interventions

End of Presentation

Annex 21.
Sustainable Urban Development Framework (in Arabic)

الإطار المستدام للتنمية الحضريّة

الخلفيّة:

تعتبر منطقة التبانة، والتي تقع في ضواحي مدينة طرابلس شمال لبنان، واحدة من الأحياء الأكثر فقراً وحرماناً في البلاد. عُرفت التبانة في الأربعينات كمركز للتجارة بين لبنان وسوريا، حيث كانت تتمّ فيها عدّة صفقات تجاريّة خاصّةً تلك الّتي تختصّ بالخضار والفاكهة. نتيجةً لذلك، لُقّبت التبانة بـ "باب الذهب"، واجتذبت التجار والعديد من الأُسر الغنيّة للعمل والإقامة فيها. كذلك، شيّدت المباني ذات الطّابع المعماري القديم وهي لازالت شهادة حتّى اليوم على ماضٍ مزدهر، وإن كان هذا الماضي قد شهد تدهوراً شديداً. أمّا اليوم، فمن الواضح أنّ الوضع في التبانة قد تغيّر بشكل كبير. كان فيضان نهر أبو علي في العام 1955 نقطة التحول التي جعلت التبانة مجموعة أحياء شديدة الفقر. وعلاوةً على ذلك، ساهمت الحرب الأهليّة (1975-1990)، كما الوضع السياسي الغير مستقرّ في انتشار الفوضى والحرمان في المنطقة. باتت التبانة اليوم مكتظة جدّاً، بكثافة سكانية بلغت عشرة أضعاف كثافة أيّ ضاحية مدينة أخرى في البلاد، مع تزايد مستمرّ في عدد السكّان. وهي تتميّز حاليّاًبنسيج حضريّ غير منظّم، وشوارع صغيرة وضيّقة، ومساكن قديمة في حالة متدهورة، خصوصاً في المنطقة المحيطة بسوق الخضار. يبيّن الجدول 1 الخصائص الديموغرافية والاجتماعية والاقتصادية للتّبانة.

جدول 1 الخصائص العامّة للتّبانة

الخاصّية	الحجم
إجمالي السكان (فرد)	27,804
إجمالي المساحة ($م^2$)	400,000
الكثافة السكانية (فرد / $كم^2$)	69,510
متوسط حجم الاسرة (فرد)	6
متوسط الدخل الشهري (دولار أمريكي)	130
معدّل البطالة	12%

في دراسة لمدة ثلاث سنوات (2008-2011) مموّلة من قبل مركز البحوث للتنمية الدولية (IDRC) ومنفّذة من الجامعة الأميركية في بيروت (AUB) بالتنسيق مع بلدية طرابلس والمنظمات غير الحكومية المحلية، تم تحديد الحاجات الأوّلية في قطاعيّ المياه والصرف الصحي في المنطقة، مع العوائق الاجتماعية والاقتصادية والثقافية التي تسهم في التدهور البيئي المؤدّي إلى تفاقم الفقر. وعلى إثر هذه الدراسة، تمّ اقتراح وتنفيذ بعض المشاريع النموذجية بمشاركة المجتمع المدني والتي شكّلت أساسًا لإطار التنمية المدنية المستدامة، مسلّطة الضوء على الحاجة للتحسين المستمر في التبانة.

المشاكل والاحتياجات:

لوحظت مشاكل بيئية عديدة في منطقة التبانة، منها إمدادات مياه غير ملائمة من ناحية النوعية، بنية تحتية غير مكتملة لمياه الصرف الصحي، تناثر مفرط للنفايات الصلبة، وقلة النظافة. على مستوى المدينة، تم حديثاً تركيب شبكة مياه صرف صحي جديدة وتمّ وصلها بمعظم المنازل. ومع أنّ تغيير الشبكة قد حسّن وضع الصرف الصحي في المنطقة، إلّا أنّ بعض المشاكل ما تزال تعترض المنطقة، لا سيما فيضان المياه الآسنة في الشوارع . وأشارت المشاورات مع المنظمات غير الحكومية المحلية أنّ العامل الرئيسي الذي يعوق حسن تشغيل شبكة مياه الصرف الصحي هوملكية الأرض، حيث تم منع بلدية طرابلس في مواقع مختلفة من إكمال الوصلات مع بعض المباني بسبب وجود أراض خاصة وبالتالي عدم قدرتها على الحفر فيها. أمّا على مستوى المباني، فتكمن المشكلة الأساسية في تدهور نظام السباكة (تسربات، انسدادات، وأنابيب مكسورة) بالإضافة إلى تراكم مياه الصرف الصحي في أقبية المباني، وبالتالي إنبعاث الروائح الكريهة التي تجذب الحشرات والقوارض المشجّعة على انتشارالأمراض.

كذلك، وفي حين تمّ تركيب شبكة جديدة لتوزيع مياه الشفة، إلا أنّه لم يتمّ العمل بها حتى الآن بسبب أعمال التخريب لملحقاتها كالخزائن والعدّادات. أمّا الشبكة المستخدمة حاليّاً، فهي مهترئة، تقوم على أنابيب جرّ مياه قديمة بالية ومتآكلة، وتقع تحت شبكة الصرف الصحّي الجديدة. تنقل هذه الشبكة المياه بضغط منخفض نسبيّاً من ثلاث مصادر رئيسية هي نبع هاب، نبع رشعين وبئر الملّولة. في حين يتمّ معالجة مياه الينابيع قبل التوزيع من خلال الترشيح والكلور، تتمّ معالجة مياه بئر الملّولة بالكلور مباشرةً قبل ضخّها في الشبكة، بدون تأمين الوقت الكافي لتطهير المياه. رغم ذلك، تبيّن من خلال مراقبة نوعية المياه في التبانة، أنّ المياه التي تزوّد بها المنطقة هي ذات نوعية مقبولة نسبياً، مع حوادث تلوّث قليلة. لكنّ هذه المياه تتعرّض للتّلوّث داخل شبكة التوزيع المهترئة. يشار إلى أنّ حوادث التلوّث تعود إلى الحالات التالية مباشرةً لانقطاع التيّارالكهربائي، والّتي تحدث بشكل يوميّ، بحيث يشجّع الضغط السلبيّ في الشبكة على تسرّب مياه الصرف الصحي إلى أنابيب المياه الصّدئة. والجدير بالذّكر أنّ الضغط السلبي في الشبكة يكون من جرّاء وجود مضخات مياه فردية لكلّ أسرة في مدخل المبنى الواحد والّتي تستخدم لضخّ المياه إلى الخزانات الواقعة إمّا على العلّية (45% من الخزانات) أو على الأسطح. كما أنّ أغلب خزّانات المياه المستخدمة قديمة، متآكلة، ومكشوفة. تقع خزانات العلّية المكشوفة عادةً تحت أنظمة سباكة المرحاض للطوابق العليا وأنابيب المياه المهترئة داخل الطابق، وهي بالتالي معرّضة لخطر تلوّث متزايد ناتج عن احتمال تسرّب مياه الصرف الصحّي إليها.

أمّا بالنسبة إلى المياه الجوفية، فقد وجدت نوعيتها غير صالحة للاستخدام المنزلي نظراً لمستويات البكتيريا القولونية المرتفعة الناتجة عن التلوث بمياه الصرف الصحي. لحسن الحظ، أنّ الاعتماد على المياه الجوفية محدود. بالإضافة إلى ذلك، يعتمد حوالي 26 في المائة من أسر التبانة على المياه المعبّأة كمصدر مكمّل لمصدر الشبكة. وقد ذكر العديد من السكان شراء المياه المعبأة للاستخدام عندما تبدو مياه الشبكة عكرة وعندما يكون أحد أفراد الأسرة مريض. ومع ذلك، كشف تحليل نوعية المياه المعبّأة من مختلف الماركات المستهلكة عموماً في التبانة (الغير مرخصة) أنّ 24 في المئة من العينات التي تمّ تحليلها ملوّث بإجمالي البكتيريا القولونية وهي بالتالي لا تصلح للشرب.

أخيراً، إنّ قلّة النظافة على مستوى الأسرة والإفراط بنثرالنفايات الصلبة على مستوى المبنى والأحياء الفقيرة، أدّيا إلى تفاقم الوضع الصعب في التبانة. كذلك، فقلّة الوعي وتدنّي مستويات التعليم، مقرونة بحالات الفقر الشديد هي في صميم سلوك اجتماعي منتشر في التبانة قوامه الإهمال واللامبالاة.

الإطار المستدام للتنمية الحضريّة:

ترتبط نوعية المياه والصرف الصحي والنظافة الصحية في منطقة التبانة، والتي هي دون المقاييس المقبولة، بمعدّل سنوي مرتفع لحالات الإسهال يقدر بحوالي 33.1 بالمئة للعام 2009، بما يعادل ما مجموعه 9197 حالة. تجدر الإشارة الى أنّ حوالي 32 في المئة من الحالات هم من الأطفال دون الخامسة من العمر وأنّ حالتي وفاة سنوياً تحصل بين الأطفال من جرّاء أمراض مرتبطة بالإسهال. هذا

المعدّل يساوي أكثر من ستة أضعاف معدل الإصابة السنوية الوطنية للإسهال والّذي يساوي 6 في المئة (ايبسوس، 2004)، ولكنّه يقارن مع المناطق الحضرية الفقيرة المكتظّة بالسكان في الصين والهند، حيث قدرت معدّلات الإصابة بالإسهال بسبب المياه بنحو 35 و57 في المئة، على التوالي (البنك الدولي 2007، جادهاف وآخرون،2011). إنّ زيادة معدلات الأمراض والوفيات تفرض عبئاً اجتماعياً واقتصادياً على السكان في التبانة يقدّر بما يتراوح بين 2.93 و14.79 مليون دولار لعام 2009، و هو يشكّل بالتالي 1.3 إلى 6.5 في المئة من إجمالي الناتج المحلي في منطقة المشروع. يؤكّد ذلك على ضرورة اعتماد إطار التنمية الحضرية المستدامة مع خطة عمل واضحة لتحسين الوضع القائم وتخفيف العبء على الأحياء الفقيرة في المناطق الحضرية الفقيرة. ويشمل الإطار التدخلات الاجتماعية والمادية على مستوى الأحياء الفقيرة وعلى مستوى المبنى/ الوحدة السكنية على النحو المبين أدناه. وفي حين أنّ تنفيذ التدخلات الفردية مفيد، إلّا أنّه من المتوقع أن يؤدّي تنفيذ الإطار المقترح بطريقة شاملة إلى أوسع تحقيق واستفادة من النتائج المنظورة.

1. تدخلات على مستوى التبانة

على مستوى التبانة، ينبغي وقف توزيع المياه من خلال الشبكة القديمة في أقرب وقت ممكن. كما ينبغي توفير الملحقات المفقودة للشبكة الجديدة كي يبدأ تشغيل الشبكة الجديدة لتوزيع المياه، حيث يتم بموجبها تزويد المياه بالضغط الكافي، ممّا يلغي الحاجة لمضخات فردية في أقبية المباني ويقلّل من خطر التلوّث بمياه الصرف الصحي. بالإضافة إلى ذلك، هناك حاجة إلى رصد نوعية المياه المزوّدة على أساس منتظم. هذه الأنشطة تقع تحت السلطة القانونية لمؤسّسة مياه لبنان الشمالي بالتنسيق مع البلديّة.

إذا لم يمكن تشغيل شبكة المياه الجديدة، يقترح استبدال الحاجة إلى مضخات منزلية فردية بخزّان مياه مشترك في الطابق الأرضي للمبنى لتلبية حاجات جميع الوحدات السكنية. بذلك، يتمّ جمع المياه للمبنى بأكمله في خزان مشترك على مستوى الأرض، ويمكن عندئذ ضخّ المياه إلى خزّانات مياه فردية على السطح. الجدير بالذكر أنّ تركيب خزان مشترك من هذا القبيل يتطلب مساحة في قبو المبنى، وموافقة مالك المبنى، بالإضافة إلى الموافقة والإدارة السليمة من قبل مؤسّسة مياه لبنان الشمالي والبلدية.

بالنسبة إلى بئر الملّولة الّذي يتمّ استخدام مياهه كمصدر تكميلي لمنطقة التّبانة، فيتوجّب حسن إدارته بحيث يجب معالجة مياه البئر بشكل صحيح قبل التوزيع. يتطلّب ذلك إنشاء خزّان لتعقيم المياه بالكلور وبالتّالي السماح للوقت الكافي للاتّصال بالكلور. يندرج هذا النشاط تحت سلطة مؤسّسة مياه لبنان الشمالي.

كذلك، يتوجّب إغلاق الآبار الخاصة التي لا تراقب نوعية مياهها والمنتشرة في جميع أنحاء التبانة، علماً أنّ معظمها ملوّث ويمثّل تهديداً خطيراً للصّحة العامّة. كما يجب أن تكون مؤسّسة مياه لبنان الشمالي قادرةً على وصل شبكة المياه بالمباني الّتي تعتمد على الآبار الخاصة كبديل، ممّا يتطلّب التنسيق الوثيق بين البلدية ومؤسّسة مياه لبنان الشمالي.

بالإضافة إلى السابق ذكره، ينبغي على بلديّة طرابلس مراقبة بيع المياه المعبّأة في منطقة التبانة، بحيث تتولّى المراقبة المستمرّة لنوعية المياه المعبأة المندرجة ضمن العلامات الغير مرخّصة من قبل وزارة الصحة العامة، كما يتوجّب حظرالعلامات التجارية الملوثة. وثمة بديل أكثر راديكالية وهو يتضمّن حظر جميع العلامات التجارية الغير مرخّصة طالما هناك مصادر بديلة آمنة ومتاحة بتكلفة معقولة.

2. تدخّلات على مستوى المبنى / الوحدة السكنية:

إلى جانب ضرورة التدخل على مستوى الأحياء الفقيرة، ممّا يمكّن من تقليل مخاطر التلوّث عند المصدر وخلال التوزيع، هناك حاجة لتدخّلات أخرى من أجل تقليل مخاطر إعادة التلوث المياه عند

نقطة الاستخدام، وهذه التدخّلات تختصر على صعيدي البناء و الوحدة السكنية. وترد هذه التدخلات تالياً حسب ترتيب الأولويات.

يجب فصل جميع خزّانات المياه الموجودة في العلّيات والاستعاضة عنها بخزّانات بلاستيكية صحية مثبّتة على أسطح الأبنية. تحتاج هذه الخزّانات إلى تنظيف بشكل منتظم للحفاظ عليها، فضلاً عن قفل للإغلاق وضمان أن تظلّ المياه المخزّنة محمية من المستخدمين غير المسؤولين الذين يستخدمون أسطح المنازل ولا سيما خلال فصل الصيف. هذا التدخل يتطلب موافقة المستأجر فقط، ويمكن تنفيذه بسهولة مع الحد الأدنى من التمويل.

تحتاج العديد من الوحدات السكنية في التبانة إلى نظام مواسير مياه جديد للقضاء على خطر تسرّب مياه الصرف الصحي في أنابيب المياه وحماية إمدادات المياه من إعادة التلوث. هذا التدخّل يتطلب موافقة المستأجر فقط، ويمكن تنفيذه بسهولة وتكلفة معقولة.

أمّا في ما يخصّ مياه الصرف الصحي، فيحتاج نظام السباكة في الكثير من الوحدات السكنية في التبانة إلى التجديد للقضاء على مشاكل التسرب، والانسداد، والأنابيب المكسورة وما يصحب ذلك من مخاطر تسرّب مياه الصرف الصحي إلى منظومة مواسير مياه الشرب أو تراكم المياه المبتذلة في الطوابق السفلية. قد يتطلب هذا التدخّل موافقة المستأجر والمالك، ويمكن تنفيذه، إذا ما توفر التمويل، رغم احتمال التسبّب ببعض الإزعاج على المدى القصير للمستأجرين.

3. التوعية والتعليم

ينبغي تنظيم حملات توعية مكثفة ومستمرة على مدار السنة تستهدف في المقام الأوّل النساء وربّات المنازل في التبانة، من خلال تعليمهم المبادئ الأساسية للممارسات الآمنة لتداول الغذاء، وطقوس النظافة في المنزل، وترشيد استخدام المياه عل أن تركّز هذه الحملات على تقنيات بسيطة، عمليّة وغير مكلفة يمكن لربّات المنزل تطبيقها بسهولة وعلى نحو مستدام. فعلى سبيل المثال، يمكن تعليم النساء التقنيات الأساسية والسليمة لغسل الخضار والفاكهة وتخزينها، بالإضافة إلى التنظيف المنزلي باستخدام المنظفات والمطهرات، والتخلص السليم من النفايات الصلبة. كما ينبغي القيام بحملات توعية لسكان التبانة تجاه المسؤوليات المدنية والبيئية مثل احترام الممتلكات العامة، الحفاظ على نظافة البيوت والأحياء، إبلاغ السلطات المسؤولة في حال حدوث مشاكل في المياه والصرف الصحّي. هناك العديد من المنظمات غير الحكومية الناشطة في التبانة، والمعنية بقضايا المرأة والتي يمكن أن تضطلع بهذه الحملات بالتنسيق مع البلدية.

لكي يكون لهذه الحملات الأثر على المدى الطويل، يجب استهداف الأطفال من المرحلة الابتدائية من خلال دمج المواضيع المتعلقة بالنظافة الشخصية، ورمي النفايات وحماية البيئة في المناهج المدرسية حتّى تصبح في صلب البرنامج التعليمي. تشكّل هذه المشاركة على مستوى المدارس أملاً رئيسيّاً لجيل المستقبل الواعي والمسؤولتجاه المجتمع.

4. نهج الإدارة والسياسة

تتولّى مؤسّسة مياه لبنان الشمالي سلطة إدارة إمدادات المياه في التبانة وهي مسؤولة عن معالجة المياه وتوزيعها، بالإضافة إلى تنظيم القطاع ومراقبة الجودة. أمّا البلدية فهي المسؤولة عن إدارة وصيانة شبكة مياه الصرف الصحي. ولذلك، فإنّ التنسيق بين السلطتين ضروري جدّاً من أجل التخطيط والتصميم السليمين لكلّ ما يختصّ بقطاعي المياه والصرف الصحي. وعليه، فثمّة حاجة إلى تقسيم واضح للمهام وتوزيع للمسؤوليات لضمان استدامة الأعمال وتطبيقها العملي.

يعاني العديد من المباني في التبانة، حيث معظم السكان من المستأجرين، من الاهتراء والتدهور الخطير. أمّا مشكلتي الملكية والمساكن غير المشروعة، فيتعين معالجتهما من خلال قوانين الملكية العادلة التي تحافظ على الحقوق وتسمح بمزيد من المرونة في تنفيذ التدخلات المقترحة، مع ضمان حماية الفقراء والمحرومين.

يعرض الجدول 2 أدناه القالب المختصر لإطار التنمية المدنية المستدامة. يفضّل هذا الإطار اتّباع نهجاً مختلطاً يجمع بين نمطي "من أسفل إلى أعلى" و "من أعلى إلى أسفل" لمعالجة المشاكل البيئية في التبانة. وهو يسلّط الضوء على ضرورة إشراك العامّة في صنع القرار والعمل من خلال المشاركة الناشطة في المجتمع والتي تهدف إلى وضع برنامجاً عامّاً للتحسينات البيئية اللازمة. تبعاً لذلك، على السكان المحليين أن يشاركوا جنباً إلى جنب مع السلطات الرسمية في لجان خاصة لمعالجة ومناقشة المشكلات البيئية الراهنة والحلول الممكنة، وإدراج قيم السكان واحتياجاتهم في عملية التخطيط. عندما تتم متابعة الحوار بين جميع أصحاب المصلحة على النحو الصائب، فإن الخطة المقترحة ستكون قادرةً على دمج المجتمع والسياسة والإدارة، وتأمين الرخاء للناس والبيئة، وتخطّي كل الحدود السياسية والبيروقراطية من خلال الدعوة إلى اتّفاقات إدارية والمشاركة العامّة

تم تحديد مستوى الأولوية للأنشطة المقترحة في الجدول رقم 2 على أساس الحاجة إلى التقليل من الآثار الصحية السلبية المترتبة داخل المجتمع. تبعاً لذلك، تم استخدام أربع مؤشرات لتحديد أولويات كل نشاط، وهي :

1. الحاجة الملحّة للتدخل

2. مدى (من حيث عدد السكان) الآثار الإيجابية المتوقعة من التدخل
3. توقيت الآثار الايجابية المتوقعة من التدخل
4. حجم القيود المرتبطة بتنفيذ النشاطات، مثل موافقة مالكي المبنى، وتوافر المساحة، وإزعاج للمستأجرين، والبيروقراطية الحكومية، والإرادة السياسية ، الخ.

وقد اعتبرت هذه المؤشرات متساوية في الأهمية، وخصص لكل نشاط نقاط تتراوح بين 1 و 3 لكل مؤشر، كما هو موضح في الجدول رقم 3. ثم تم تعيين أولوية كل نشاط على أساس مجموع النقاط. واعتبر النشاط الذي يسجل مجموع نقاط بين 9 و 12 ذو أولوية عالية؛ والنشاط الذي يسجل مجموع نقاط بين 5 و 8 ذو أولوية متوسطة، في حين النشاط الذي يسجل مجموع نقاط بين 1 و 4 من أولوية منخفضة.

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جدول 2. جدول تنفيذ الإطار المستدام للتنمية الحضريّة

	النشاط	*الأولويّة*	*المسؤوليّة*	*الهدف*	*الجدول الزمني*	*الميزانية / التمويل*	*القيود*
على مستوى التّبانة	تدشين شبكة توزيع المياه الجديدة	مرتفعة	▪ مؤسسة مياه لبنان الشمالي ▪ بلديّة طرابلس	▪ القضاء على مخاطر التلوث خلال التوزيع ▪ إمداد المياه تحت ضغط كاف ▪ إلغاء الحاجة لمضخات المياه الفردية	عاجل	2,000 دولار أميريكي /مبنى	▪ متطلبات بيروقراطية ▪ حماية الأملاك العامة
	تركيب خزانات مياه على مستوى المباني	متدنّية	▪ مؤسسة مياه لبنان الشمالي ▪ بلديّة طرابلس	▪ إلغاء الحاجة لمضخات المياه الفردية ▪ تقليل من مخاطر الضغط السلبي في شبكة مياه الشفة	ستة أشهر	3,000 دولار أميريكي /مبنى	▪ الحاجة إلى مساحة في قبو المبنى ▪ موافقة مالك المبنى ▪ موافقة مؤسسة مياه لبنان الشمالي
	إدارة أفضل لبئر الملّولة	مرتفعة	▪ مؤسسة مياه لبنان الشمالي ▪	▪ توفير مياه غير ملوّثة مع كميّة كافية من الكلور المتبقي ▪ القضاء على مخاطر التلوث عند المصدر	متواصل	5,000 دولار أميريكي /تركيب	▪ توافر المساحة
	إغلاق الآبار الخاصة، وبئر الجامع بالتحديد	مرتفعة	▪ مؤسسة مياه لبنان الشمالي ▪ بلديّة طرابلس	▪ الرقابة وتوفير مياه غير ملوّثة للأسر القليلة المتضررة	عاجل	10,000 دولار أميريكي	▪ وصل الأسر القليلة على شبكة المياه العامة
	تنظيم بيع المياه المعبأة	مرتفعة	▪ بلديّة طرابلس	▪ ضمان مياه آمنة للشرب	متواصل	-	▪ مراقبة دائمةللسوق
على مستوى المنزل/ المبنى	استبدال خزانات المياه على علية المنازل بخزانات بلاستيكية على أسطح المباني	مرتفعة	▪ المستأجرين	▪ القضاء على مخاطر التلوث عند نقطة الاستخدام	ستة أشهر لسنة	500-1,000 دولار أميريكي /منزل	▪ موافقة المستأجر ▪ التنظيف والصيانة المنتظمين
	تركيب نظام جديد لمواسير المياه في المنازل	متوسّطة	▪ المستأجرين	▪ القضاء على مخاطر التلوث عند نقطة الاستخدام	سنة ونصف لسنتان	500-1,000 دولار أميريكي /منزل	▪ موافقة المستأجر
	تركيب نظام سباكة جديد في المنازل	متوسّطة	▪ المستأجرين	▪ القضاء على خطر تسرّب مياه الصرف الصحي وتراكمها في الأقبية	سنتان	2,000-4000 دولار أميريكي /منزل	▪ موافقة المستأجر والمالك ▪ إزعاج المستأجر على المدى القصير

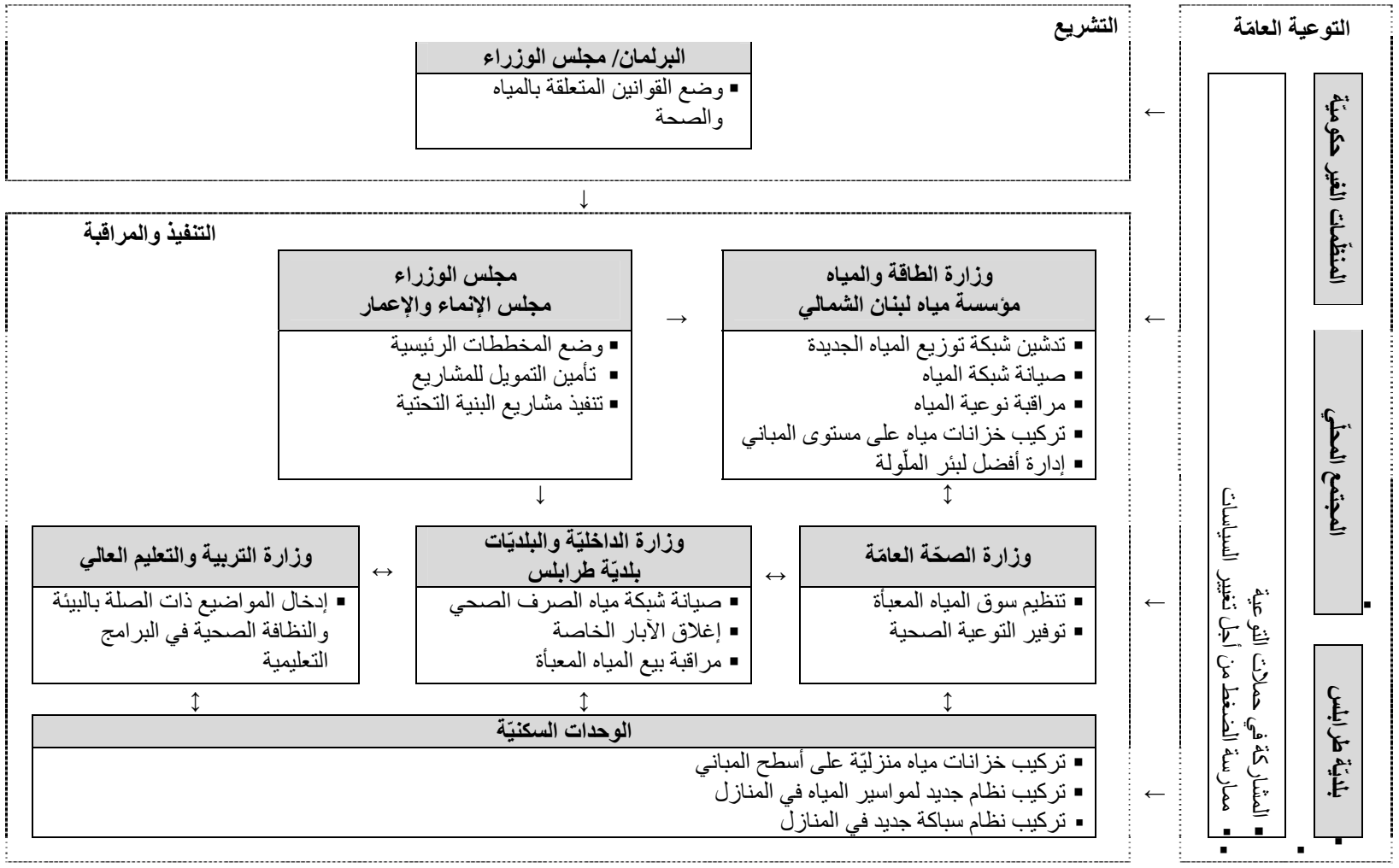
	النشاط	*الأولويّة*	*المسؤوليّة*	*الهدف*	*الجدول الزمني*	*الميزانية / التمويل*	*القيود*
توعية وتثقيف	توفير حملات توعية مستمرة ومكثفة	مرتفعة	▪ المنظمات غير الحكوميّة المحلّية ▪ بلديّة طرابلس	▪ توعية السكان على مبادئ النظافة، والالتزامات البيئية، والمسؤوليات المدنية	متواصل	500,000 دولار أميريكي	▪ توفير حوافز للحضور المنتظم
	إدخال المواضيع ذات الصلة بالبيئة والنظافة الصحية في البرامج التعليمية	مرتفعة	▪ المدارس المحلّية	▪ خلق جيل واعٍ ومسؤول تجاه المجتمع	متواصل	-	▪ توافر كادر تعليمي مؤهّل
إدارة وسياسة	التنسيق بين السلطات المعنية في مجال المياه والصرف الصحي	متوسّطة	▪ مؤسسة مياه لبنان الشمالي ▪ بلديّة طرابلس	▪ تخطيط وتصميم سليم للأنشطة المتعلّقة بالمياه والصرف الصحي	متواصل	-	▪ التعامل مع الروتين الاداري
	تنفيذ أنظمة عادلة للملكية	متوسّطة	▪ البرلمان	▪ تنفيذ مرن للتدخلات المقترحة	متفاوت[1]	-	▪ التنسيق والقبول السياسي

[1] *حسب المناخ السياسي في البلد*

الجدول 3. نمط احتساب الأولويات

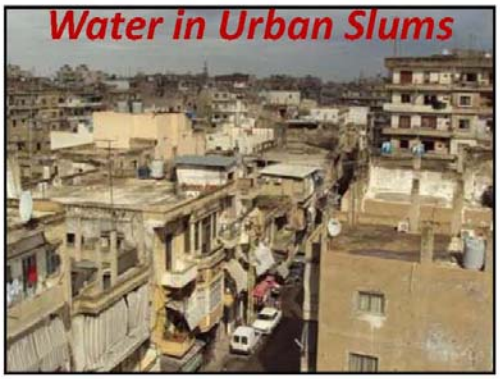
النشاط	*المؤشرات*				*مجموع النقاط*	*أولويّة*
	الحاجة الملحة للتدخل	*مدى التأثيرات*	*توقيت التأثيرات*	*القيود*		
تدشين شبكة توزيع المياه الجديدة	3	3	3	2	11	مرتفعة
تركيب خزانات مياه على مستوى المباني	1	1	1	1	4	متدنّية
إدارة أفضل لبئر الملّولة	3	2	3	2	10	مرتفعة
إغلاق الآبار الخاصة، وبئر الجامع بالتحديد	3	2	3	2	10	مرتفعة
تنظيم بيع المياه المعبأة	2	3	2	2	9	مرتفعة
استبدال خزانات المياه على علية المنازل بخزانات بلاستيكية على أسطح المباني	3	2	2	3	10	مرتفعة
تركيب نظام جديد لمواسير المياه في المنازل	2	2	2	2	8	متوسطة
تركيب نظام سباكة جديد في المنازل	2	2	2	2	8	متوسطة
توفير حملات توعية مستمرة ومكثفة	3	2	2	2	9	مرتفعة
إدخال المواضيع ذات الصلة بالبيئة والنظافة الصحية في البرامج التعليمية	3	2	2	2	9	مرتفعة
التنسيق بين السلطات المعنية في مجال المياه والصرف الصحي	2	1	1	2	6	متوسطة
تنفيذ أنظمة عادلة للملكية	2	3	1	1	7	متوسطة

في نهاية المطاف، تعزّز هذه الآلية المقترحة نظرةً ثنائيّة الأبعاد نحو الإدارة البيئية المستدامة ضمن إطار سياسي يناسب جميع الأطراف ويتمّ من خلاله إشراك أصحاب المصالح جميعاً من أسر ومجتمع محلي ومنظمات غير حكومية إلى بلدية طرابلس تحت إشراف وزارة الداخلية والبلديات، ومؤسّسة مياه لبنان الشمالي تحت إشراف وزارة الطاقة والمياه، فضلاً عن الوزارات المعنية الأخرى مثل وزارة الصحة العامة ووزارة التربية والتعليم العالي. على المستوى الأعلى، يتولّى مجلس الإنماء والإعمار التخطيط الرئيسي وإدارة التمويل والتنفيذ، بينما يتولّى البرلمان اللبناني ومجلس الوزراء التشريع. الشكل 1 أدناه يصوّر الأدوار والروابط بين جميع أصحاب المصلحة المعنيين في تنفيذ إطار التنمية المدنية المستدامة المقترح.



الشكل 1. النظام المؤسساتي لتنفيذ الإطار المقترح

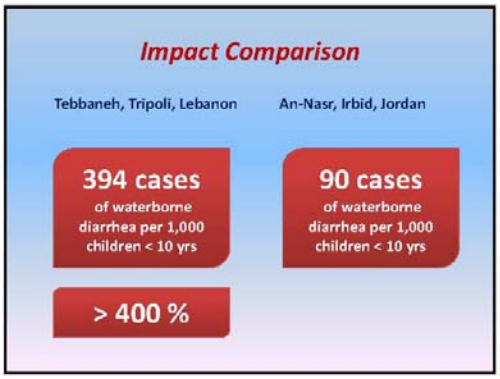
Annex 22.
Pitch at the Dragon's Den Panel at the World Conference of Science Journalists
(June 29, 2011)

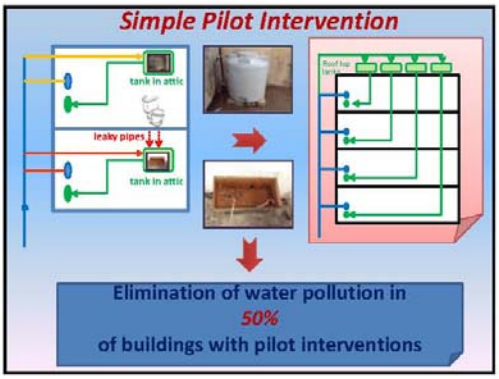

Water in Urban Slums

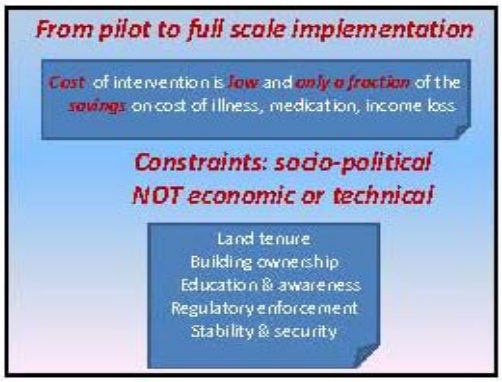

What if this was your water tank?


Poor Urban Slums
Lack of safe drinking water
(diarrhea, typhoid, etc)
Livelihoods
Health
Income
Cost of illness, medication
Cost of bottled water, loss of work days
Poverty exacerbation


Challenges
•Socio-political instability
•Lack of regulatory enforcement
•92% of housewives without secondary education
•130 USD month


Impact Comparison
Tebbaneh, Tripoli, Lebanon
An-Nasr, Irbid, Jordan
394 cases
of waterborne diarrhea per 1,000 children < 10 yrs
90 cases
of waterborne diarrhea per 1,000 children < 10 yrs
> 400 %


Simple Pilot Intervention
tank in attic
leaky pipes
tank in attic
Elimination of water pollution in
50%
of buildings with pilot interventions


From pilot to full scale implementation
Cost of intervention is low and only a fraction of the savings on cost of illness, medication, income loss
Constraints: socio-political
NOT economic or technical
Land tenure
Building ownership
Education & awareness
Regulatory enforcement
Stability & security


THANK YOU