018530 - SWITCH

Sustainable Water Management in the City of the Future

Integrated Project

Global Change and Ecosystems

D3.1.5 Benefits Achieved from the Ma'awa el Sayadeen water Demand Demonstration

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The SWITCH Drainage & Sanitation Improvement Demonstration Project, Alexandria, Egypt:

Rationale, Design and Results.

Benefits Achieved from the Ma'awa el Sayadeen water Demand Demonstration

1. Introduction:

One fifth of Alexandria's population live in rural areas. These areas have a mixed rural and Bedouin societal structure which contributes to the large rural life style in many districts.

By 1996, there were about 36 informal areas, covering a total area of about 34.11 km2. Such areas were occupied by about 84.8062 inhabitants, representing about one-quarter of the total population of Alexandria Governorate. This high concentration of population has led to an overall population density of about 24,864 person/ km2.

By 2005 these informal settlements had expanded to around 50 in number and they now account for about 9.7% of the total area of the Alexandria Governorate. These informal areas accommodate as many as 1.4 million inhabitants, representing 42% of the total population of the Governorate and putting the existing social and urban infrastructure under great pressure. Such informal or un-planned settlements seriously limit the abilities of residents in obtaining basic infrastructure and public services.

2. Rationale:

Sustainable Water Management Improves Tomorrow's Cities' Health (SWITCH) has been introduced to the city of Alexandria to set the stage for Alexandria to be among the leading cities in implementing the principles of Integrated Urban Water Management (IUWM). An IUWM long term plan has been developed which mainly addresses current and future problems of urban water management in Alexandria including challenges facing the supply of water to a city that is located at the very end of the Nile River distribution system, which is the main renewable water resource in Egypt that supplies more than 95% of the county's overall demand.

SWITCH had initially introduced the concept of a Learning Alliance (LA) process to the Alexandrian stakeholders, which provided network in the form of a multiple stakeholder platform Group that aimed to bring together a wide variety of stakeholders with different interests, at different times and at different levels within the community – to better ensure that the research effort in Urban Water Management was indeed "demand-driven", and one that would eventually lead to the delivery of integrated water management solutions. (Pels and Bury, 2006).

One of the objectives of the Learning Alliance was to undertake a number of key activities such as "Visioning" (a common consensus of what they wanted their city to look like in the year 2037) and a Scenario Building exercises to try and ascertain the likely issues and strategies that needed to be considered in order that this vision could become a reality.

During one of these LA workshops when a Resources, Infrastructure, Demand and Access (RIDA) Framework process approach was adopted it became apparent that there were areas of Alexandria where inequitable distribution of water resources and infrastructure where very prevalent. This tended to be manifest in the poorer and so-called informal areas of the city. It was determined by the LA, therefore, that a physical demonstration should be carried out in one of these areas to study how infrastructure could be expanded/augmented in a manner that best addressed these issues. Ma'awa El Sayadeen, (referred to as The Fisherman's Village) was eventually selected as the location of the demonstrations to be carried out.

3. Pre-Demonstration Activities:

a. Consultations – Political and Community Groups

The Ma'awa El Sayadeen demonstration site was selected primarily based upon the concept that the demonstration site should be firstly a peri-urban informally developed (slum) area, be of definable boundaries, inhabited predominately by the poorer members of Alexandrian society and be amenable to access by researchers and the water utility organizations. In addition it was considered important that such a neighborhood could also serve as a suitable site in which to conduct a Social Inclusion survey, a water use audit and provide both water and sanitary elements suitable for a physical demonstrated to be carried out in. Ma'awa El Sayadeen was considered to have all of these elements and was therefore selected as the SWITCH Demonstration sites accordingly following contacts and discussions with "community leaders" in the neighbourhood. The Social Inclusion component embedded in the SWITCH project emphasizes a pro-poor, equitable and participatory approach in

bringing about improved planning, management and delivery of water and sanitation services. The demonstration site at Ma'awa El Sayadeen was seen as a suitable platform for practical integration of these social inclusion objectives. It was intended to be an example of consultative and inclusive planning processes between the community and city authorities with regard to water and sanitation needs and provision (Abdrabo, 2008). In that sense, the area has the conditions that apply to the thematic approach of the SWITCH project. The demonstration site is an impoverished area of a former fishing village on the side of Lake Maryout. This village encompasses an area of some 114,000 m2 and has approximately 1000 households.

The Alexandria Learning Alliance which included a number of political figures as well as national and local decision makers endorsed the proposal to undertake the demonstration in Ma'awa El-Sayadeen in order that they may be able to evaluate the processes and intervention strategies adopted by the LA for potential use in other similar areas of the city.

FIG. 1. LOCATION OF MAAWA AL-SAYADEEN

The Ma'awa El Sayadeen area, which had received no proper development of the infrastructure since 1962 was suffering from the following conditions prior to the start of the SWITCH demonstration project:

- Frequent blockage of the sanitation network which causes repetitive flooding of the street with sewage.

- Frequent flooding of streets and homes during the rainy season.
- Offensive odour all year round.
- Only 75% of the houses were covered by drinking water services with officially installed meters.
- The remaining 25% of the houses were not connected to the drinking water network at all and the residents of these houses generally relied on receiving their water from neighbours.

There had been public stand-pipes taps but these had been removed some years earlier.

The community involvement in the process was initiated through a series of meetings that were organized by CEDARE and held on the demonstration site in different locations so as to enable most of the residents to be able to attend or air their views. CEDARE facilitated the participation of the area's residents by identifying influential figures within the community and encouraging them to spread the word about SWITCH and its potential interventions in the area. In all seven meetings were held so as to consider all income categories in the area as it was considered to be very important that no part of the community felt disenfranchised in any way.

Fig.2 shows the distribution of different meetings held in the area.

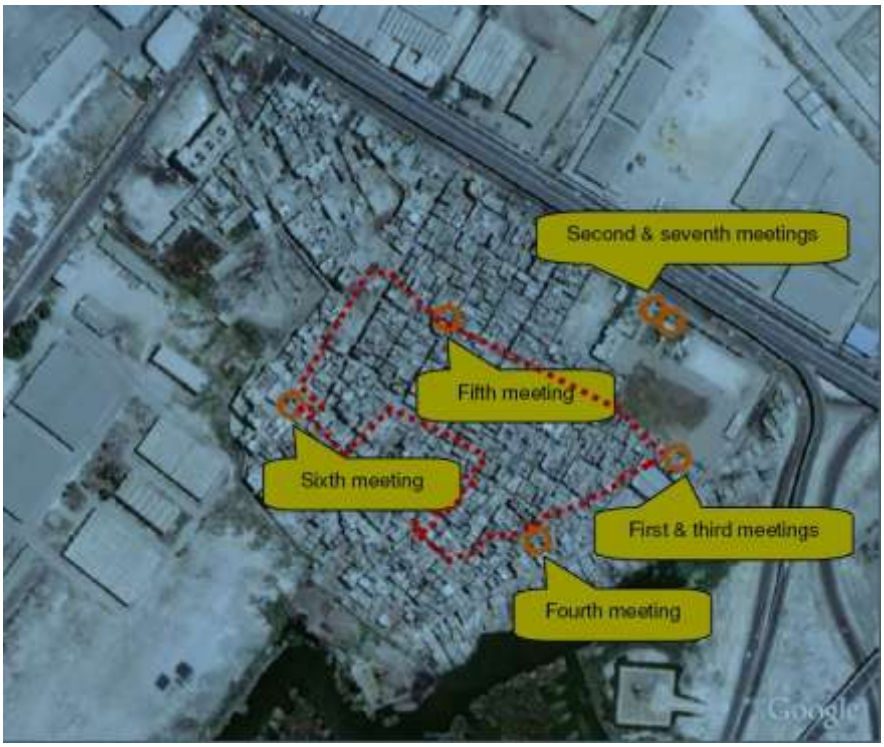


FIG.2 Community involvement in Demonstration site

b. Advocacy and Partnering

The Alexandria Water Company (AWCO) had identified closely with the SWITCH initiative from a very early phase in the project due to their concerns for the well being of the residents and the difficulties they faced in providing water services into such un-planned neighbourhoods of the city.

Through its representatives, AWCO has been actively participating in the SWITCH Learning Alliance process leading up to the selection of the Ma'awa El Sayadeen location for the demonstration site and were keen to enter into a third party agreement with CEDARE in order to to use this opportunity to enable them to try new approaches that were otherwise less likely to be applied in such an informal settlement.. As the Learning Alliance process progressed, members became more familiar with globally used terms such as "right to water" and "lifeline water consumption" which enabled the Stakeholders to better understands the issues and hence looks at some common shared objectives other than just one of augmenting water services within the area.

4. Demonstration Activities:

a. Household Surveys:

To fully understand and appreciate the complexity and the characteristics of the demonstration area, a household water use survey was planned to be able to understand how the residents used water in an area which, based upon the water consumption records, showed that residents had access to less than 50 L/C/D. The sampling strategy was formulated so as to encompass all parts of the area and was focused at the household level so that it included a reasonable demographic balance.

The household survey included 200 samples were conducted by AWCO personnel and Fig. 3 shows some of the results obtained. The full results and analysis are shown in Appendix A.

In summary, the survey showed that:

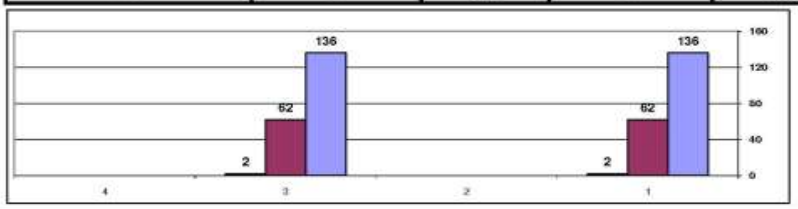
- The average number of inhabitants per household was found to be 4.74 which correlated with the National Statistical inhabitants per household in urban areas of 4.1.
- Of these 11% are children under the age of 5, while 19 % are children and youths between the ages of 5 and 17.
- 88% of the households surveyed possess or have use of a washing machine. These machines are generally used 5 times a week or less and at least 68% of machine owners use cold water in washing.
- Almost all households surveyed had one toilet, 24% of all toilets require excessive flushing water.
- 85.5 % of households were separate apartments.

Below is a sample of the type of questions used in the Water Use Audit. Full results are shown in Appendices below:

The Holding Company for Water and Waste Water
Alexandria Drinking Water Company

Third question: How many times do you shower every day?

	Winter		Summer	
Between Once and Three Times	136	68.0%	136	68.0%
More than three times	62	31.0%	62	31.0%
No response	2	1.0%	2	1.0%
Total	200	100.0%	200	100.0%



Fourth Question: How many times during the day is the bathtub filled?

	Number	Percentage
Not used	0	0%
Once a week	17	8.5%
Twice a week	12	6.0%
More than twice a week	20	10.0%
No response	151	75.5%
Total	200	100%

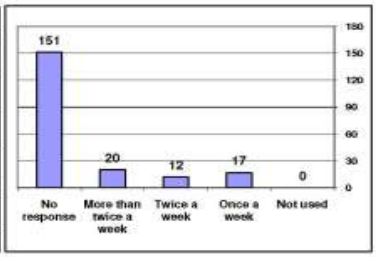


Fig.3 Household survey results

b. Reduction in Non-Revenue water by adopting a District-Metering Area (DMA) approach::

Part of the intervention was to look at ways of reducing non-revenue water as it was clear from a preliminary mass-balance analysis that there were significant leakage losses. After several inspection visits and reference to water company records, it was found that the network had 4 entrance points represented by 3x4 inch diameter pipes and one 6 inch pipe. A so-called Zero Test is a test usually performed to either identify the source of a water flow or to assure isolation or operability of the valves

in a network by attaching manometers to all potential water sources. A successful zero would be identified by a zero reading on all of the corresponding manometers.

The zero tests were performed in the study area by closing the valves that corresponded to the three 4 inch pipes to ensure that the area was only supplied through the 6 inch pipeline.

Fig.4 shows the pipelines serving the area and their respective valves.

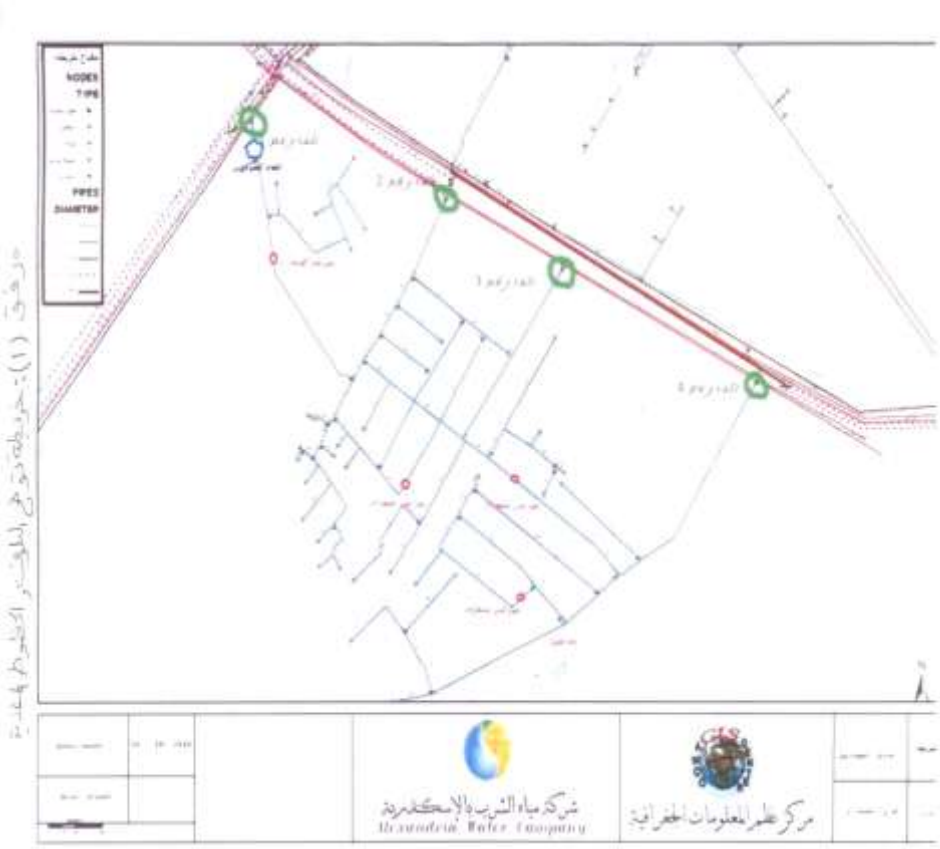


Fig. 4 pipelines serving the demonstration area and the main control valves (in green)

The test was unsuccessful at the first attempt and therefore two of the 4inch valves were inspected and repaired and the remaining valves were replaced. The test was repeated and was successful.

Fig.5 shows the locations of manometers deployed.

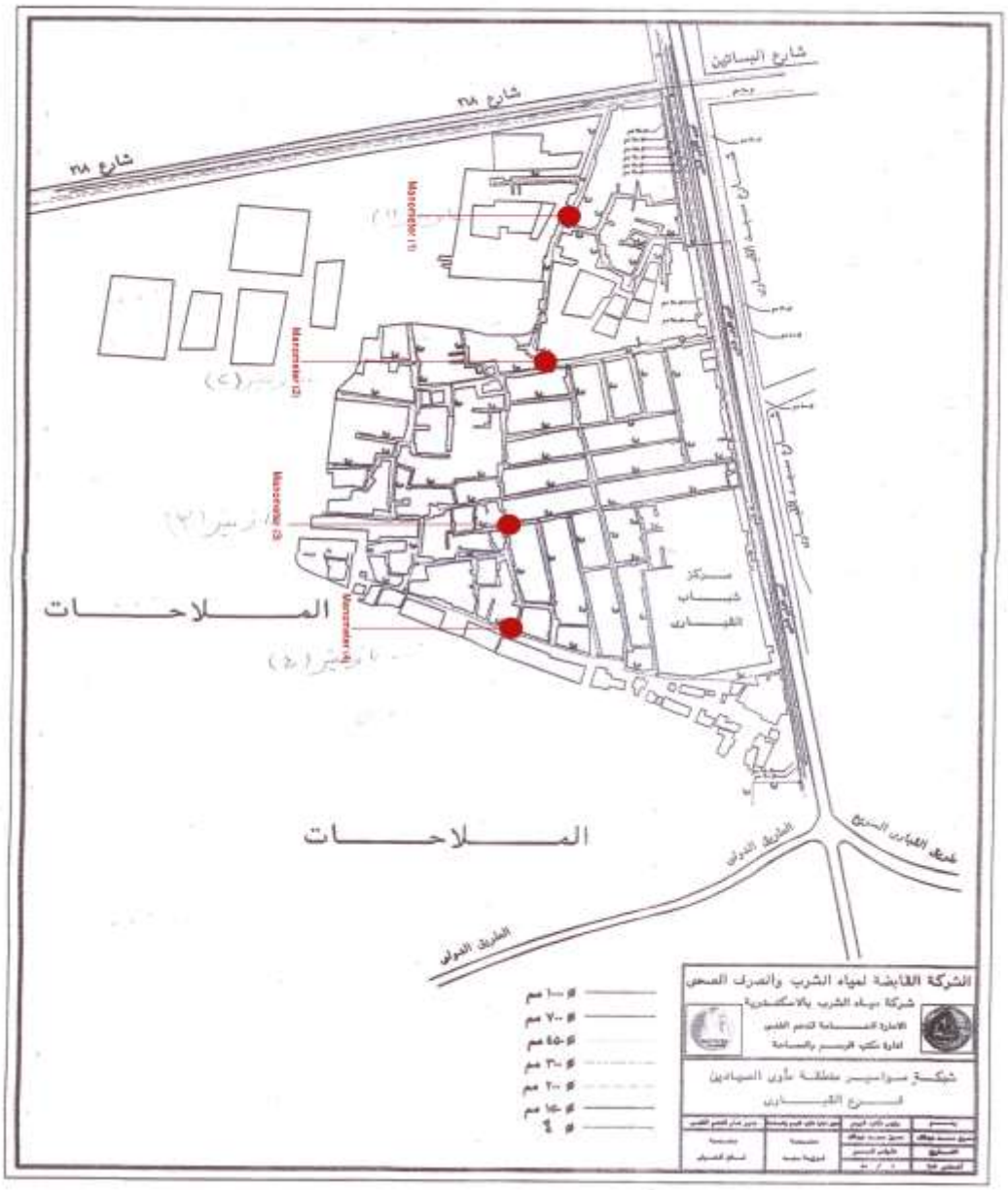


Fig.5 Location of Manometers

A concrete chamber was then constructed as shown in Fig.6, and a 6 inch mechanical meter was installed along with a pressure recorder, which was purchased and installed in order to measure the maximum and minimum flows and pressures in the area.

Fig. 7 shows the flows and pressures outputs and analysis over a period of 24 hours.

Fig. 6 Construction of the concrete Flow Meter chamber

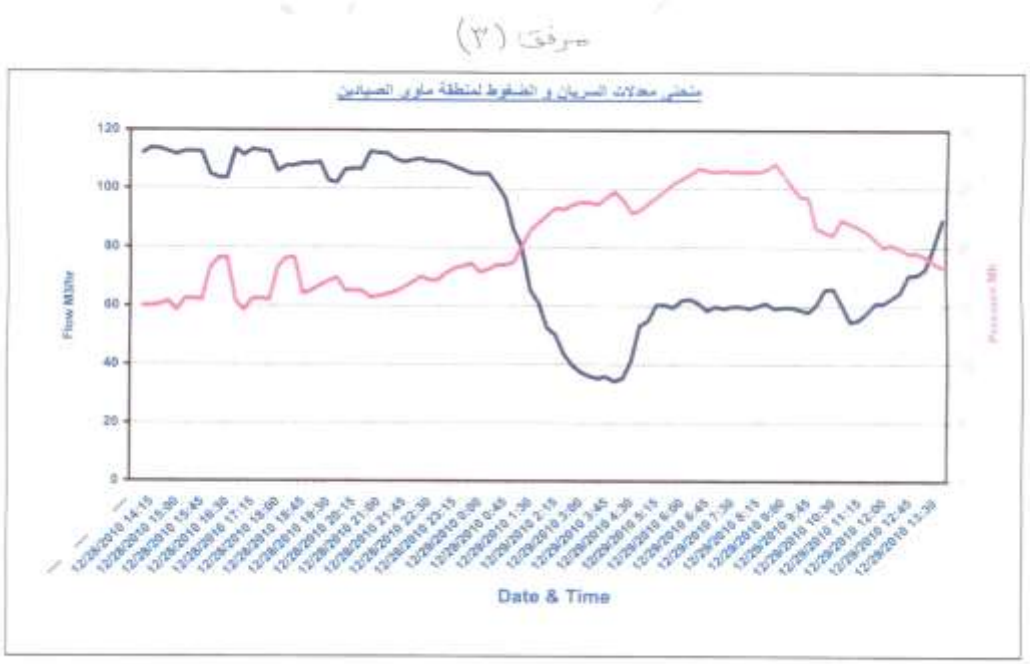


Fig. 7 Flow and pressure trends in the demo site

c. Procurement of Leakage Detection Equipment, Leakage Detection exercise, and Pipe Repairs:

Although some degree of Leakage Detection is practiced by almost all water service providers in Egypt the practice of establishing DMA's and then following these up

with a Leakage Detection and Mains Rehabilitation Programme is not well established.

In order to be able to arrive at a reasonable assessment of the level of unmetered water losses in the Ma'awa El Sayadeen supply network it was agreed that part of the demonstration would be to examine, by using conventional, portable leakage detection equipment, the actual level of leakage losses in the system. Leakage detection equipment was therefore specified, advertised in the national newspaper and procured in order to illustrate that this type of technology is in fact locally available. The equipment included an electromagnetic flow meter as well as a mobile digital leakage detection set.

Following on from the Leakage Detection Survey where Night-Time Flow readings showed that X% of the total supply into the neighbourhood was being lost to pipeline leakage (See Fig.7). After carrying out a rigorous inspection of high-leakage areas in the network the following actions were taken, which also included repairing and replacing main feeder pipelines immediately lying outside the Ma'awa El Sayadeen network (Fig.8):

- A 250 meter 12 "pipe line was fully replaced along with its corresponding house connections.
- A 6 meter pipeline of 700 mm diameter which fed all the 6 inch lines was replaced along with a 700 mm isolating valve.
- A 28.7 meter 700 mm pipeline with a diameter of 700 mm was replaced and a 700 mm isolating valve installed.

Fig.8 - Pipe replacement

d. Meter Installation:

Through AWCO Metering teams investigations it was found that there were 181 malfunctioning meters which needed to be replaced (see fig.9). The locations of installed meters are shown in Fig.11.

Fig.9 Meter Installation

e. Installation and testing of Water Saving Devices:

Again as part of the Demand Management investigations the LA considered that by providing and installing 'water efficient' devices - such as shower-heads, etc. - in the demonstration site these devices would be seen as significant contribution towards effective Demand Management. Whereas, much of the demonstration had looked at the physical and revenue losses in the form of leakage and unmetered water from the supply system, AWCO was very interested to see what effect the widespread use of such water efficient devices could potentially have within the demonstration area.

Fig.10 Installation of water saving devices

To this effect, and with consultations and the permission of the householders concerned some 2000 water efficient devices were purchased and were planned to be installed as follows:

- 100 showerhead saving devices
- 950 tap saving devices
- 500 3 litres mixer saving devices
- 500 6 litres mixer saving devices

It was also considered essential that such devices should be both affordable and available in Egypt so that the ability to adopt a “roll-out” a program for encouraging customers to install these devices could be considered in the future by AWCo as part of their WDM policy.

Unfortunately only some 320 of these water saving devices were eventually installed by AWCO in houses and mosques as well as the local youth centre within the demonstration site and this was due to the severe security conditions that accompanied the political events that took place in Egypt in the early part of 2011, it was not possible to install all of the remaining devices in the area. Nevertheless, since then all of these devices have been installed in public places in other areas of Alexandria and are being monitored by AWCo as part of their program.

Fig.7 shows the locations of the installed water efficiency devices in addition to the installed meters.

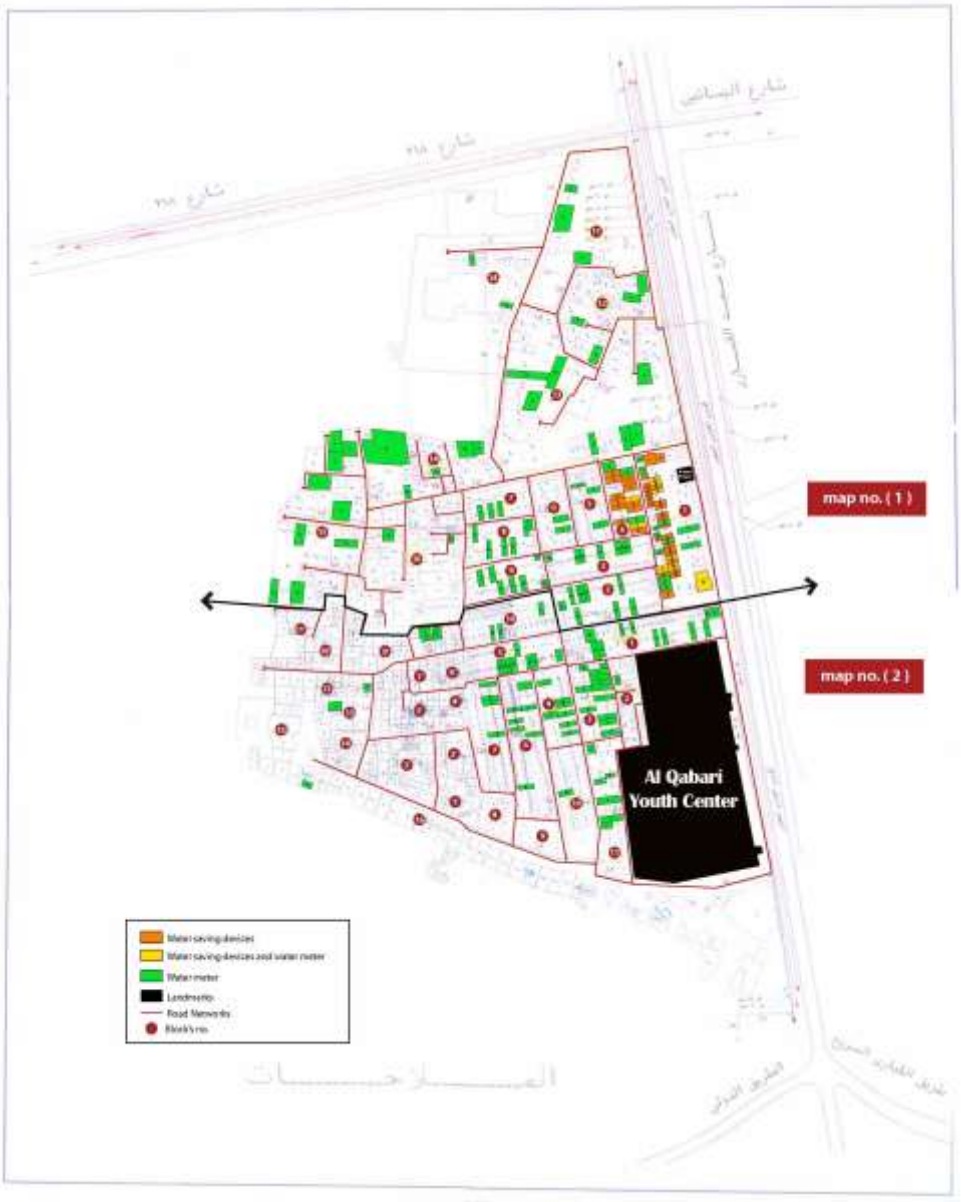


Fig.11 - Locations of Installed meters and water saving devices

f. Alternative Water Resource:

As part of the initial intervention strategy where it was found that the local sport centre was consuming significant quantities of drinking water in order to irrigate their grass pitches, the Demonstration included for a study of and implementation of alternative supplies for this irrigation water. Examination of the annual water demand for the irrigation of the football pitches showed that about 75 cubic meters was being consumed on average each month giving rise to the possibility that this

amount of potable water could otherwise be diverted into domestic supplies within what is a highly water stressed area of the city.

Of the alternatives supplies investigated, such as final effluent, local desalination, rainwater harvesting and ground water sources it was considered that the only feasible solution was a ground water supply.

A specialist hydrological team visited the Youth Centre and identified potential locations for a groundwater abstraction well that could be drilled based upon a series of electrical resistivity logs showing the ground water table in the area.

After carrying out these geophysical tests the team eventually identified the optimum location for a test well. The locations of the electrical loggers are shown in fig. 12.

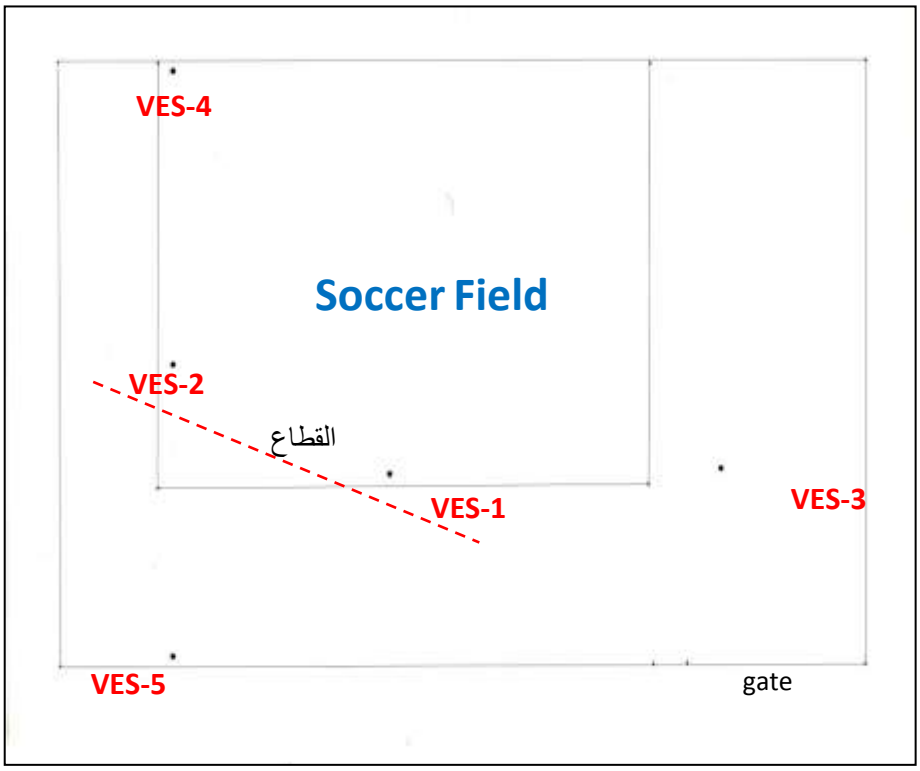


Fig.12 Locations of electrical logger readings

Figure.13 shows the final results of the geo-electrical study of the Youth Centre area, where the study area was divided into four categories with respect to electrical resistivity.

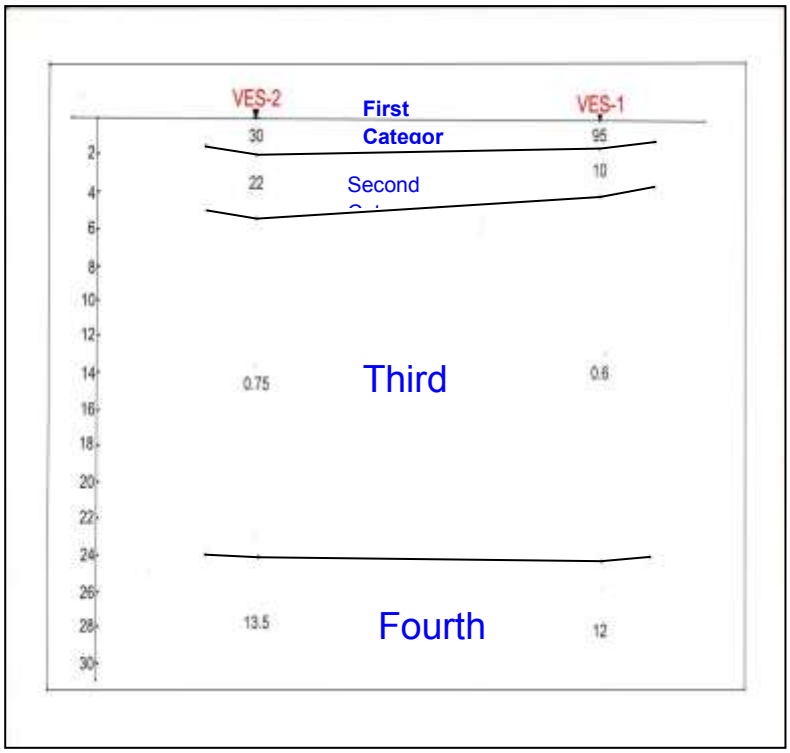


Fig. 13 Geo-electrical study results.

The first category in Fig 13 above represents a non-water bearing layer as the electrical resistivity ranged between 30 to 95 Ohm/meter, while the third category represents a highly saline water zone where the low electrical resistivity ranged between from 0.6 to 0.75 ohm /meter. The second and fourth categories were shown to have mildly saline water where the electrical resistivity ranged between 10 to 22 ohm/meter.

It was therefore predicted that the best quality ground water was likely to be encountered in test location VRS-5 Where a trial borehole drilled as illustrated on the map in Fig 12.

Fig.14 shows the well general outline design.

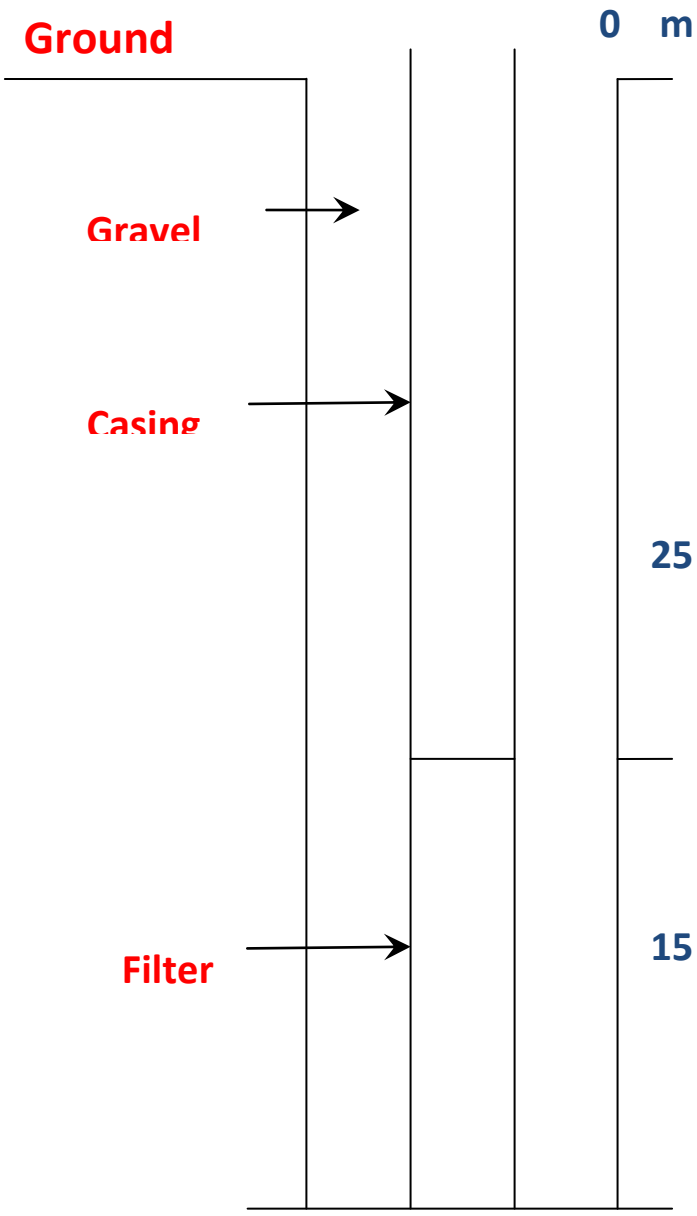


Fig.14 Well design

When the trial borehole was finished and initial sufficient water samples taken, initial testing showed salinity values ranging from between 11,000 and 12,000 ppm. Under a short continuous pumping test the groundwater salinity reaches up to 33,000 ppm.

In an effort to get reduced the salinity an investigation was conducted into whether placing a screening material in the upper layer would improve the quality of the water abstracted. However the water quality showed that this generally did not improve salinity significantly.

A three day continuous pumping trial was scheduled to be performed in order to collect sufficient samples so that the consistency of the quality testing methodology could be ascertained. The three days pumping schedule was however was actually conducted over a discontinuous 7 day period due to the instability of the local electric supplies. The total volume of water pumped in the 7 days was 840 cubic meters and the total operation time during the 7 days period was approximately 20 hours with a maximum daily continuous operational period of 3 hours with an average discharge rate of 42 m3/ hr.

The subsequent salinity test results showed an average of 28,000 ppm which is of course, still very high for the purpose of irrigating a grassed area such as a sports field, but it was considered that this was probably not fully representative of the actual water quality due to the pumping schedule not having been performed under optimum conditions. As the ground water is fed from Lake Maryout three samples were taken from the eastern edge, middle and the western edge and the average salinities were 10,000, 4,000 and 11,000 respectively which suggests that the ground water in the test well is highly likely to reduce with time to that of the main body of the lake.

The main objective of the intervention to replace the use of potable water for irrigation of the pitches was intended to allow the saved additional volume to be put into feeding the domestic supply deficit in the Ma'awa El Sayadeen area. However it was also very much supported by the Sport Club management as the cost to their water bills was significantly increased as a direct result of using potable water for irrigation. In addition this was being exacerbated by a recent retraction of the Holding Company for Water & Wastewater's (HCWW) 50% discount on water supplies provided to Sports Facilities which was removed in an effort to reduce this non-potable demand. The Sports Club have now installed a fixed, controlled sprinkler

system which now regulates the amount of water consumed with each irrigation cycle.

Due to time constraints and the difficulties resulting from the national political disturbances on-going at the time of the demonstration the Sports Club are nevertheless continuing to investigate the potential for using ground water and may also be combining this with blending ground water and potable water in order to obtain a more effective and sustainable irrigation system. To this effect they will continue to liaise with AWCO in order to arrive at the most sustainable outcome. AWCO are also keen to follow this demonstration in order that they may take the lessons learned to other Sports Clubs in Alexandria who are currently using potable water for irrigation of their grounds.

Fig. 15 Borehole Drilling

5. Analysis and Impacts

a. Commercial and external physical losses:

As the main objective of the demonstration project was to make a tangible and positive impact on the lives of the residents in Ma'awa El Sayadeen, it was important to evaluate the significance of the changes brought about by the demonstration project.

One such impact was non-revenue water losses reduction and this was carried out using a phased loss reduction approach which comprised in all seven specific phases.

In each of the first six phases a number of faulty meters were identified and replaced and by the final phase 7, a number of leaking pipelines had been replaced following the leakage detection survey work.

At the start of Phase 1 the percentage of losses in the DMA was shown to be 62% of all water supplied, which included pre-rehabilitation commercial and physical losses. At the completion of Phase 7 works however, this percentage was apparently reduced to 37% which is equal to the average net water losses for the City of Alexandria at some 36%.

Whereas the Ma'awa El Sayadeen network is now typical of and it could be argued, no better, than the general network throughout the city of Alexandria the demonstration has shown that Ma'awa El Sayadeen was not only disadvantaged by an inadequate water infrastructure but that this was exacerbated by uncontrolled leakages further reducing the availability of water into the neighbourhood.

Table.1 and Fig. 16 show exact details of the seven phases discussed.

	(1) Phase	(2) Phase	(3) Phase	(4) Phase	(5) Phase	(6) Phase	Phase(7)
Meter readings in households (m^3)	2118	2298	3490	2977	3936	2932	3094
Meter reading in chamber (m^3)	5707	5393	7587	5782	7569	5380	4950
Difference in readings (m^3)	3689	3095	4097	2804	3633	2448	1856
Meters replaced	–	56	36	29	24	15	After Leakage reduction
Losses (%)	62.90	57.40	54	51.50	48	45.50	%37.50

Table.1 - Steps taken to reduce commercial and physical losses

It is however important to stress that it is highly unlikely that by implementing a similar DMA approach to all of the city's networks will or could result in loss reductions of the same magnitude there is an indication that conducting similar approaches in other poor neighbourhoods could well yield similar results and significantly improve water availability in these areas. No doubt the reduction seen in Ma'awa El Sayadeen is reflective of the very poor state of the network which is not considered to be typical of the majority of networks within the city. Nevertheless the demonstration has provided information, a methodology and an approach to encourage AWCO to press ahead with their planned DMA Program for the whole of the governorate.

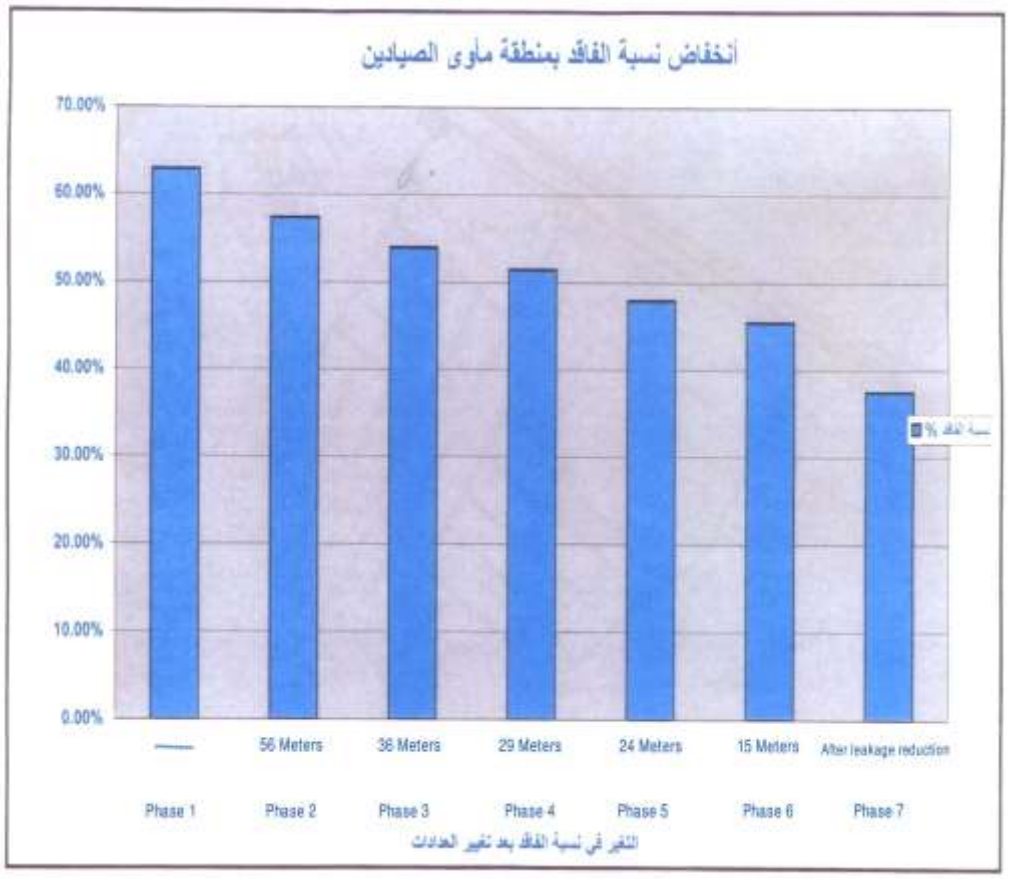


Fig. 16 – The different phases of commercial and physical losses reduction

b. Householdlosses and Water Saving Devices:

The daily consumption was measured and recorded in selected households 4 to 11 days before and after applying the water saving devices as shown in table.2.

sample	Consumption before (CM/day)	Consumption after (CM/day)	Reduction (%)
1	1.273	0.677	47
2	0.597	0.333	44
3	0.5	0.333	33
4	0.409	0.333	19
5	1.455	0.677	53
6	0.865	0.333	62
7	1.455	0.677	53
8	3	0.677	77
9	0.409	0.333	19
10	1	0.677	32

11	0.5	0.333	33
12	1	0.333	67
		Average Reduction (%)	**45**

Table.2 Daily Consumption before and after installing the water saving devices

From table.2 it is clear that on average, the daily consumption has dropped to almost half what it was before installing the water saving devices which if correct would count as a great success for this particular intervention. However in order for this result to be verified continuous sampling of the selected households fitted with water efficient devices would need to be carried out over a much longer period and these would need to be compared against a control group of similar households that had not been fitted with such devices.

Nevertheless the results of this are sufficiently encouraging so far to suggest that fitting such water saving devices should be given serious consideration by the Water Company and this should give them the confidence to include such an approach in their mix of measure for an overall Strategy for Water Demand Management in Alexandria.

Fig.17 shows the meter readings on 20-10-2010 and 10-1-2011 to reflect the difference in consumption in the youth centre before and after the installation of the water saving devices. The 225 cubic meters consumption that could be indicated from the figure will be set as a baseline for future savings on drilling water.

Fig.17 Meter Readings in the youth centre

Although this cannot, due to the various constraints both physical and political, be considered to have been a rigorous trial it nevertheless indicates that under more controlled circumstances there is a significant potential for reducing water demand in such institutions as the Sports Club that could possibly be applied to other similar establishments. AWCO are therefore continuing to monitor the Sports Club to obtain more reliable data over a longer period so that they can be in a position to use this approach in other Sports and Social Clubs in the City with more confidence.

c. Community perception:

Whilst despite a number of community consultations and awareness events prior to installing the water efficient devices in an effort to introduce the concept and potential benefits to the people of Ma'awa El Sayadeen it has to be said that there was a degree of suspicion which probably reflects something of the previous lack of interest in their infrastructure related plight. The early contacts and meetings held in various parts of the community did nevertheless proved to be very helpful in facilitating the work carried out in Ma'awa El Sayadeen. In addition the installation of new water meters also had a mixed reception depending on whether this raised or reduced the level of the recipient's water bills. Nevertheless the overall impression was one of acceptance and cooperation and the fact that the demonstration as a whole has delivered greatly improved water (and sanitation) infrastructure to the people was seen as a well worthwhile benefit to the community.

The youth centre management on the other hand were extremely enthusiastic about the water saving devices and the alternative water resource trails. Being the largest establishment in the area and having the largest water bill based on their volumetric consumption; any way of reducing that consumption was potentially of great interest to them. Moreover, switching to groundwater for irrigation was seen as an even bigger benefit, if this does prove to be fully implementable, to them in light of the new Holding Company decree to remove the 50% discount on water bill that used to be given to sports clubs.

As the Water Compoany continues to monitor these demonstration activites more and more information will be collected and will hopefully provide even greater confidence amongst the company and the community as a whole of the mutual benefits to be derived from implementing a well thought out Water Demand Management approach over the whole urban network as a contribution to a more sustainable future for Alexandria.

6. Recommendations and Scaling up (Lessons learnt).

It is considered that the most important lesson(s) learnt in this demonstration was that in informal housing areas such as Ma'awa El Sayadeen, in spite of the fact that legislation prevents formalisation of the area by bestowing a public water and drainage system on them, that by working directly with all of the stakeholders and developing shared objectives, the social impacts of being deprived of such infrastructure can largely be overcome. It has been recognised that integration of informal settlements like Ma'awa El Sayadeen is more likely to be the way forward as it recognises the 'reality of the ground' and therefore seeking to upgrade these to the same sort of level as the formal developments in the urban landscape has to be an approach that needs to be adopted. Otherwise there will continue to be the social and physical gap between the formal and informal communities of Alexandria. This demonstration, along with the parallel sanitary infrastructure intervention

demonstration, has shown that in order to be able to develop a medium to long-term Urban Plan such informal areas have to be seen as part of an integrated plan that involves all areas of development rather than attempting to deal with these in isolation.

By intervening in Ma'awa El Sayadeen together with the Water and Sanitary Drainage Companies, the planners and the community stakeholders, the demonstrations have pointed to the possibility of providing basic (water) infrastructure whilst at the same time stimulating amongst the inhabitants a firmer sense of belonging to the community as a whole and thereby increasing the chances of them accepting greater degrees of formalisation of their neighbourhoods going forwards.

The Water Company has now been able to trial leakage detection technologies, undertake - albeit a relatively small District Metering Area exercise and gauge the potential outcome of the leakage and water demand reduction trials so that this can, after further verification, be rolled-out over the whole urban area. AWCO has a plan for a ten year DMA Programme for all of their networks that will benefit greatly from the learning gained in the Ma'awa El Sayadeen demonstration project.

The initial results from the alternative supply sources investigation for the Sports Club has provided the first real local examination of the ground water potential for such irrigation requirements and as Alexandria contains a large number of such clubs and public open spaces the results of the trials carried out under the demonstration have been very encouraging and have enabled AWCO to be able to continue to investigate this in more detail.

In addition, although the evidence for achieving a positive social impact in Ma'awa El Sayadeen is largely anecdotal, there is a clear impression that this has been the case and that this demonstration has made a difference to the lives of a large number of people living in the community.

7. References

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Annexes

Appendix 1

Results of AWCO Household Water Use Surveys

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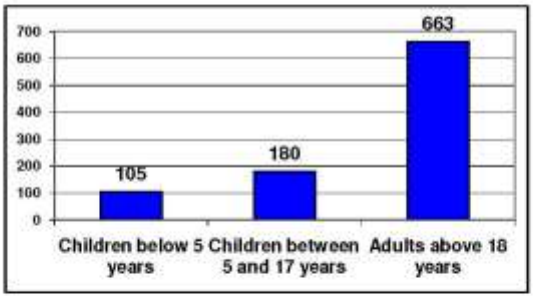
Questionnaire Results of the Analysis of Water Uses within the Residential Units (Fishermen's Shelter)

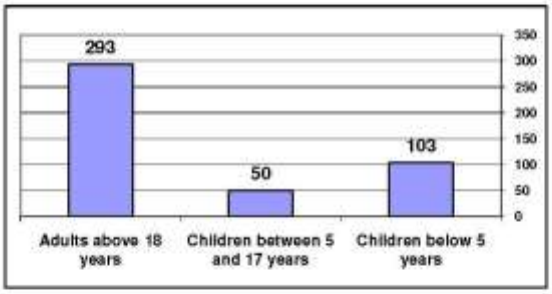
First Question: How many people are living within the residential unit (including children)?

	Number
Children below 5 years	105
Children between 5 and 17 years	180
Adults above 18 years	663



Second question: How many people are present at home during the day (including children)?

	Number
Children below 5 years	103
Children between 5 and 17 years	50
Adults above 18 years	293



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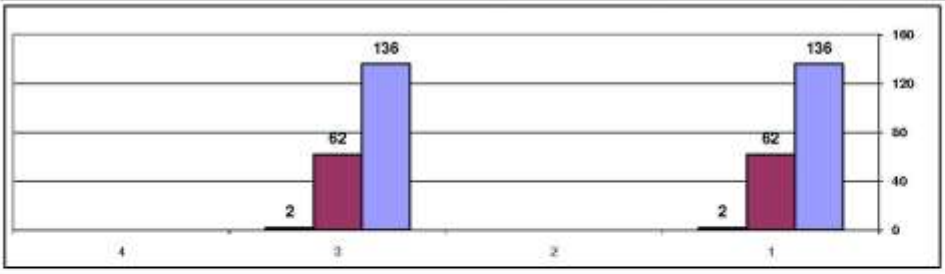
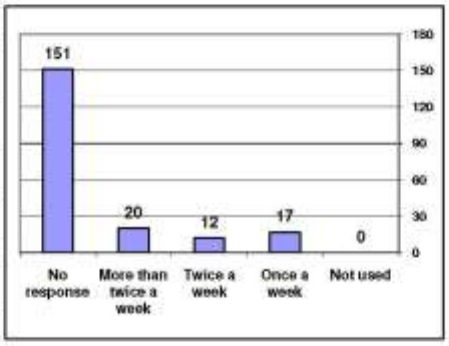
Third question: How many times do you shower every day?

	Winter		Summer	
Between Once and Three Times	136	68.0%	136	68.0%
More than three times	62	31.0%	62	31.0%
No response	2	1.0%	2	1.0%
Total	200	100.0%	200	100.0%



Fourth Question: How many times during the day is the bathtub filled?

	Number	Percentage
Not used	0	0%
Once a week	17	8.5%
Twice a week	12	6.0%
More than twice a week	20	10.0%
No response	151	75.5%
Total	200	100%



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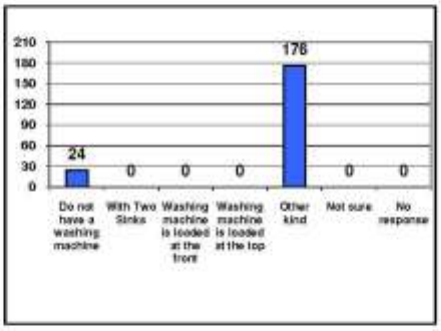
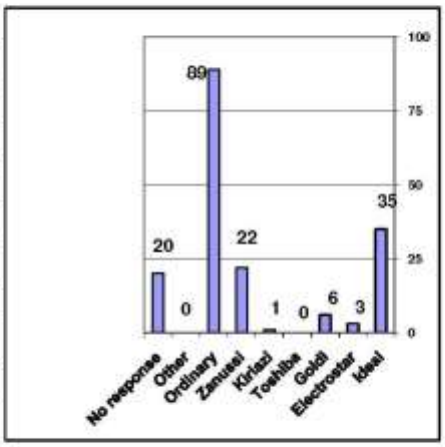
Fifth Question: Do you have a washing machine and what kind is it?

	Number	Percentage
Do not have a washing machine	24	12.0%
With Two Sinks	0	0.0%
Washing machine is loaded at the front	0	0.0%
Washing machine is loaded at the top	0	0.0%
Other kind	176	88.0%
Not sure	0	0.0%
No response	0	0.0%
Total	200	100.0%



Sixth Question: What is the model and type (brand name) of the washing machine?

Type	Number	Percentage
Ideal	35	19.9%
Electrostar	3	1.7%
Goldi	6	3.4%
Toshiba	0	0.0%
Kiriazi	1	0.6%
Zanussi	22	12.5%
Ordinary	89	50.6%
Other	0	0.0%
No response	20	11.4%
Total	176	100.0%



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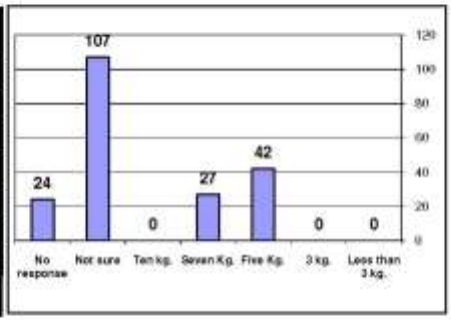
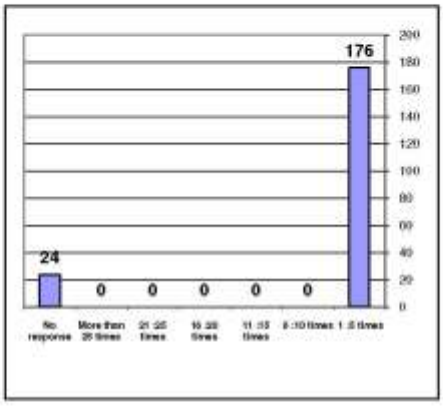
Seventh question: What is the capacity of the washing machine?

	Number	Percentage
Less than 3 kg.	0	0.0%
3 kg.	0	0.0%
Five Kg.	42	21.0%
Seven Kg.	27	13.5%
Ten kg.	0	0.0%
Not sure	107	53.5%
No response	24	12.0%
Total	200	100.0%



Eighth question: How many times is the washing machine used per week?

	Number	Percentage
1 :5 times	176	88.0%
6 :10 times	0	0.0%
11 :15 times	0	0.0%
16 :20 times	0	0.0%
21 :25 times	0	0.0%
More than 25 times	0	0.0%
No response	24	12.0%
Total	200	100.0%



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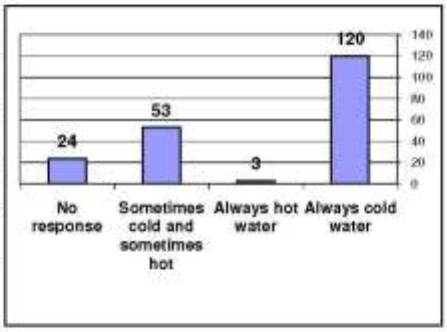
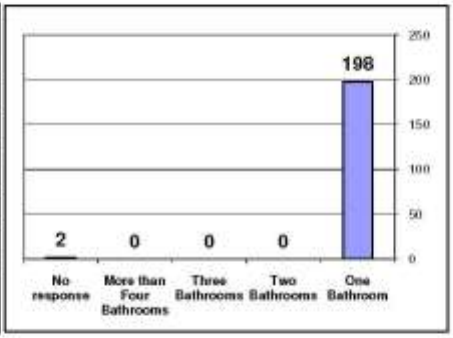
Ninth Question : What is the temperature of water used in washing clothes?

	Number	Percentage
Always cold water	120	60.0%
Always hot water	3	1.5%
Sometimes cold and sometimes hot	53	26.5%
No response	24	12.0%
Total	200	100.0%



Tenth Question: How many bathrooms (toilet) are there in the house?

	Number	Percentage
One Bathroom	198	99.0%
Two Bathrooms	0	0.0%
Three Bathrooms	0	0.0%
More than Four Bathrooms	0	0.0%
No response	2	1.0%
Total	200	100%



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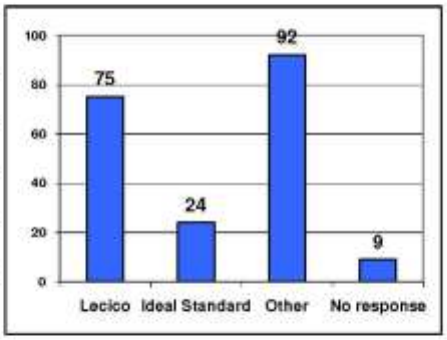
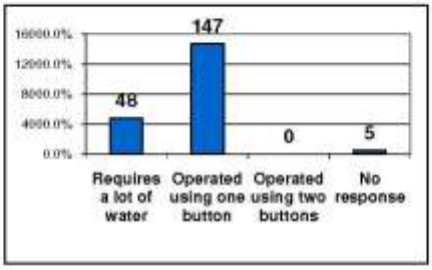
Eleventh Question: What is the brand name of the toilet?

	Number	Percentage
Lecico	75	37.5%
Ideal Standard	24	12.0%
Other	92	46.0%
No response	9	4.5%
Total	200	100.0%



Twelfth Question: How many toilets within the residential unit are of the following types?

	Number	Percentage
Requires a lot of water	48	24.0%
Operated using one button	147	73.5%
Operated using two buttons	0	0.0%
No response	5	2.5%
Total	200	100.0%



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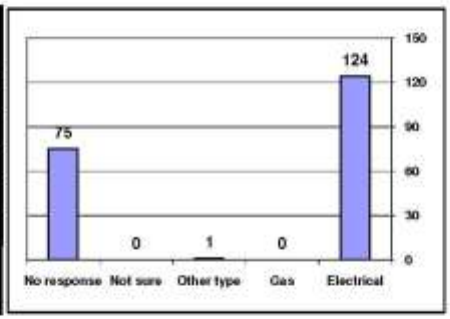
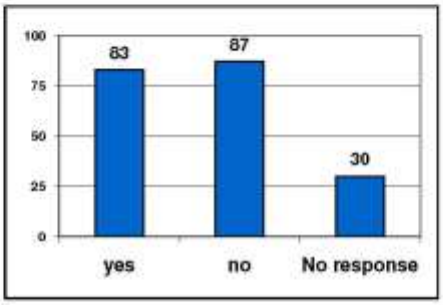
Thirteenth Question : What is the type of heater used?

	Number	Percentage
Electrical	124	62.0%
Gas	0	0.0%
Other type	1	0.5%
Not sure	0	0.0%
No response	75	37.5%
Total	200	100.0%



Fourteenth Question: Do you have any objection to the figures in the questionnaire?

yes	83	41.5%
no	87	43.5%
No response	30	15.0%
Total	200	100.0%



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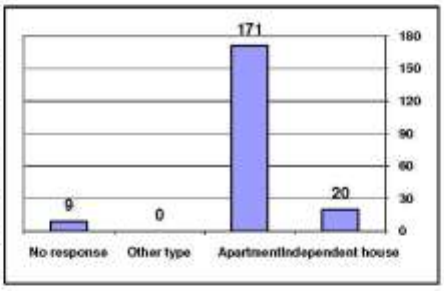
Fifteenth Question : What type is the residential unit that you live in?

	Number	Percentage
Independent house	20	10.0%
Apartment	171	85.5%
Other type	0	0.0%
No response	9	4.5%
Total	200	100.0%



Sixteenth Question: What is the approximate value for the monthly water consumption bill?

		Number	Percentage
During the summer Season	Below 10 pounds	1	0.5%
	From 10 to 20 pounds	95	47.5%
	More than 20 pounds	101	50.5%
During the Winter Season	Below 10 pounds	1	0.5%
	From 10 to 20 pounds	95	47.5%
	More than 20 pounds	101	50.5%
No response		3	1.5%
Total		200	100%

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Seventeenth Question : When breakage occurs in the water taps, what is the period taken to call technicians?

	Number	Percentage
During the same day	59	29.5%
Within two days	137	68.5%
More than two days	0	0%
No Response	4	2%
Total	200	100%