The Hashemite Kingdom of Jordan

Ministry of Water and Irrigation
Ministry of Planning and International Cooperation

High Level Conference on Jordan's Water Crisis

December 2, 2013



"This major conference heralds the beginning of a new phase of cooperation in donor participation in Jordan. I hope the discussions and final recommendations made at this event will be instrumental in solving the impact the Syrian refugee crisis is having on the water sector in Jordan."

H.E. Minister, Ministry of Water and Irrigation



High Level Conference on Jordan's Water Crisis

The following organizations provided data and information are hereby acknowledged with appreciation:

1. Ministry of Water and Irrigation and Water Authority of Jordan

2. Ministry of Planning and International Cooperation

3. Ministry of the Interior

4. UNICEF

5. UNHCR

6. Public Security Directorate

7. Department of Statistics

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1. CONFERENCE AGENDA

9:00 Registration & Coffee

10:00 Opening Session

Minster of Ministry of Water and Irrigation

Minister of Ministry of Planning and International Cooperation

Welcome and Aims and Objectives of the Conference

10:15 Technical Presentations

- Background Paper – the challenges "H.E. Eng. Basem Telfah, Secretary General MWI / Dr. Tarek Al Tarawneh – id:rc"
- Looking Forward - how will it be possible to cluster projects? "Eng. Malek Al Rawashdeh- Secretary General Assistant for Technical Affairs"
- Response Plan – the proposed interventions– "Eng. Eyad Dhayyat, Director of Project Management Unit – PMU"
- UNICEF – current interventions in the camps and host communities – "Mr. Jamal Shah"

12:00 Coffee Break

12:15 Breakout Sessions

Technical Discussions on the Challenges
- Inside the camps – drinking water and waste water
- Host communities – drinking water
- Host communities – waste water

13:30 Lunch

14:15 Breakout Groups Present their Findings to Plenary

15:00 Round Table Discussion - "Facilitator, Dr. Tarek Al Tarawneh"

16:00 Summary of Findings and Next Steps, "H.E. Eng. Basem Telfah, Secretary General MWI / HE. Dr. Saleh Al Kharabsheh, Secretary General MoPIC.

2. FINAL CONFERENCE RECOMMENDATIONS

Conference Recommendations for Next Steps

• All attendees agreed that the Syrian refugee crisis had resulted in extreme pressure seriously impacting water infrastructure and services in the country, and that without immediate major interventions and infusion of capital, Jordan would experience a serious degradation in services, increased levels of water-borne diseases and an inability of a large proportion of the population of the country to lead healthy and productive lives. It was emphasized that although the pressure on the water system was most acute in the north of the country, other parts of Jordan have also experienced increased numbers of refugees and as a result the situation was serious throughout many of the other governorates.

• The Conference agreed that Jordan on its own could not and should not be left responsible for alleviating the impact on the water sector of the Syrian crisis, It is the responsibility of the international community as a whole to help provide planned and sustainable investment to ensure the country could deal with the extraordinary pressures now facing the water sector.



• It was agreed that although there was an urgent need for capital investment in the camps and host communities there was equally a critical requirement that funds be available for operations and maintenance over the long term. It was agreed that planning to ensure an effective operations and maintenance strategy should be a priority in future and should be an area of priority support by donors.

• The speakers emphasized that the international community should aim to align their funding of the water sector in Jordan in harmony with Ministry of Water and Irrigation's own strategic plan and that MWI would need to prioritize interventions and present these to donors in the near future. This prioritization process would necessitate clear explication and background as well as concrete results.

• The conference discussed the long term issues of what would happen to the Syrian refugee camps following the resolution of the present political crisis in Syria. Although no recommendations could have been made at the conference, it was agreed that this was a critical issue and further discussions and planning would be required to ensure an effective plan was in place to deal with the camps, including but not restricted to scaling down camps in due course of time.

• All agreed that the host community platform (organized by MoPIC) and the Task Force led by the MWI is critically important in ensuring a coordinated and sustained response to the crisis.

• The conference believed that all major NGO's that currently work on issues related to the Syrian refugee crisis should be allowed to have an active role and must be committed to take part in and attend Task Force, to be chaired by the MWI Secretary General, and other technical/coordination meetings where appropriate.

• Investment in additional water resources and rehabilitation of existing systems was also judged critical to alleviate the crisis and donors should be prepared to invest additional funding in these areas.

• The conference plenary discussed how each of the donors has its own evaluation mechanism for financing. The plenary determined that there is a need for a common financing evaluation mechanism; and further discussions on this element is critical.

• There were wide ranging discussions on how to cluster projects effectively and it was agreed that the Task Force would be charged with undertaking this important role for the water sector.

• Interventions to support MWI to cope with the deficits in the wastewater collection, and wastewater treatment sectors are urgently needed, especially because of the risk of contamination of groundwater aquifers.

• It was agreed that the office of the MWI Secretary General will coordinate with donors to identify needs, priorities and program investments and interventions.



Breakout session on "Inside the camp - drinking water and waste water"

3. QUANTIFICATION OF THE IMPACT OF SYRIAN REFUGEES ON THE WATER SECTOR IN JORDAN



3.1 EXECUTIVE SUMMARY

The growing Syrian conflict has caused a massive influx of both Syrian immigrants and refugees into Jordan starting from 2011 and accelerating over 2012 and 2013. This dramatic population increase has impacted Jordan's water and sanitization sectors and heavily strained both the Jordanian economy and resources. Massive water loss through system inefficiencies and population increase are straining the overall supply sources, especially in the northern areas of Jordan where Syrian refugees demand on water services are increasing day by day. Additionally, sanitation services have become an issue of major concern; many cities require expansion in sanitation capabilities to handle the increase in waste generated.

This report analyzes the numbers and spatial distribution of Syrian refugees, and quantifies the impact the refugees have on water supply, waste generation and sanitation services, and overall quality of water in specific areas.

Data were collected in partnership with several government ministries and NGO's working with Syrian refugees and within the water sector. This study focuses on the overall impact of Syrian in-migration to Jordan due to the conflict between 2009 and 2013 in addition to those with a specific refugee status. The prevailing methodology used was collecting data before and after the influx of Syrian immigrants and refugees and comparing this data within each district.

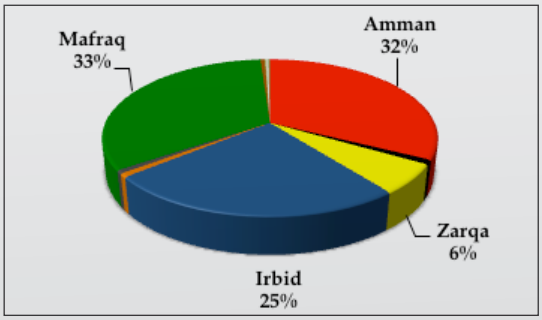


Figure A. Syrian Concentration in Jordan

Results of this report reveal where Syrians are most concentrated in Jordan (Figure A), and the districts most impacted by the influx of Syrians. Additionally, in-depth analysis has determined how each district has coped with strains on water supply and dealt with sanitation service issues. Some areas are experiencing twice the demand on water than before the inflow of Syrian refugees, and are proving unable to adequately provide sanitation network services to both incipient Jordanian nationals and Syrian refugees.

This background paper was prepared by Interdisciplinary Research Consultants (id:rc) under assistance from the USAID Public Action for Water, Energy and Environment Project (PAP).

Prevailing water losses are attributed to the absence of reliable water supply network in some locations, accompanied by a high percentage of systemic leakage. Areas such as Ramtha in Irbid that are most affected by the Syrian influx illustrate well the considerable impact that Syrian refugees have had on local water availability and service reliability. Results also show that Jordan's twelve groundwater basins are overexploited, and the current model of water withdrawal is dangerously unsustainable. The overall water deficit in Jordan has sharply risen with the rise in numbers of Syrians, as well as due to the high costs of maintaining the status quo (Figures B.1 and B.2 below).

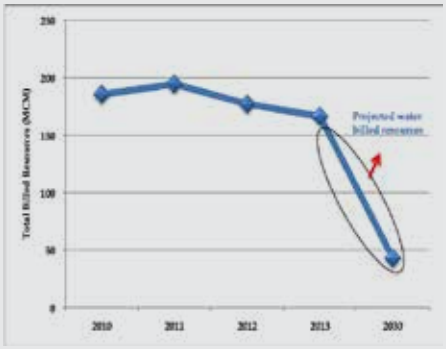


Figure B.1 Total Billed Resources

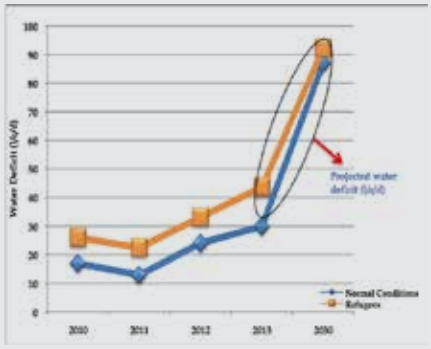


Figure B.2 Water Deficit

Data tables such as these highlight the current and expected strain on water supply from the Syrian influx

Water loss and deficit data reveal a clear need to restructure existing water transport systems and to take major steps in reducing the demand on water while increasing supply in the northern districts.

With regard to water treatment and waste management, the results indicate the degradation in water quality presently well below minimum acceptable international water quality standards for countries like Jordan. Additionally, sanitation service networks reaching the Jordan and Syrian population have fallen short of demand, as reported in Table A.

The current sanitation systems are unable to accommodate the majority of the Syrian refugee population, and even more distressingly, some sectors of the Jordanian population as well study results demonstrate a compelling need for sanitation sector restructuring and new interventions aimed towards improving both existing treatment/sanitation plants and overall water quality.

This report concludes with recommended activities and interventions based on the current study findings.

Governorate	Decrease in Efficiency of One Meter Serving Households 2013
Mafraq	51.62%
Irbid	30.29%
Zarqa	12.85%
Amman	5.09%
Jarash	4.69%
Ajloun	4.44%
Karak	3.58%
Ma'an	3.04%
Salt	2.38%
Tafila	1.99%
Aqaba	1.48%
Madaba	0.00%
Country average	15.30%

Table A. Decrease in Sanitation Efficiency

These recommendations focus on increasing wastewater treatment capacity, wastewater treatment networks, water distribution, and increased-capacity pumping facilities .

These findings will be used to form actions and interventions to mitigate the Syrian refugee impact on Jordan's water supply and capabilities. The Ministry of Water and Irrigation's Quantification of the Impact of Syrian Refugees on the Water Sector in Jordan Donor Conference in December 2013 will focus on this report to assist donor organization in prioritizing future interventions.



3.2 BACKGROUND

The conflict in Syria initially began as a civil uprising, evolved from initially minor protests, beginning as early as January 2011, as a response to the regional Arab Spring, rampant incipient government corruption, and massive human rights abuses. Large-scale unrest began on 15 March 2011 in the southern city of Daraa, sometimes called the "Cradle of the Revolution", and later spread across the country. The government of Syria responded to the protests with large scale of arrests, censorship of events, accompanied by some token concessions to the protestors. However, the protests continued to grow. In late April 2011, the Syrian regime began launching large-scale military operations against restive towns and cities.

The violence in Syria has caused millions to flee their homes. In August 2012, the United Nations said more than one million people were internally displaced, and in September 2013, the UN reported that more than 6.5 million Syrians had been displaced, of whom 2 million were reported to have fled to neighboring countries. One in 3 of those refugees (= 667,000 people) sought safe-haven in Lebanon (with a population of 48 million). Others fled to Jordan, Turkey, and Iraq. Turkey has accepted 400,000 Syrian refugees, half of whom are spread around a dozen camps placed under the direct authority of the Turkish Government. On 9 October 2012, the United Nations High Commissioner for Refugees (UNHCR) reported that the number of external Syrian refugees stood at between 355,000 up to 500,000. In September 2013, the UN stated that the number of Syrian refugees had swollen to in-excess-of 2 million persons, a significant proportion of which had fled into Jordan.

In response to the waves of refugees entering the country, Jordan began construction of a 30,000 square meter refugee camp in March 2012 outside the city of Mafraq. Jordan agreed to create camps to house the increasing numbers of refugees, including one camp already in the works in northern Jordan that could hold up to 113,000 people. Reports indicated that Jordan has absorbed some 500,000 Syrian refugees.

The economics behind Jordan's refugee program have also been a subject of significant domestic contention and anxiety. The Jordanian Ministry of Planning & International Cooperation estimated the cost of refugee accommodation to be $851.1 million, or roughly 2 percent of the country's $40 billion GDP. Though much international aid has been promised, thus far it has come up several hundreds of millions of dollars short of the total cost.

Already a water scarce country, Jordan's water resources and services were overstretched before the arrival of Syrian refugees, and in need of immediate rehabilitative actions. In certain areas such as Mafraq, before refugees arrived there were already high levels of communal tension over water and the public water services. Northern governorates

where 84% of the refugees are located are particularly strained. All water resources in the northern governorates covered by the Yarmouk Water Company are currently at full capacity pumping 24/7 with no seasonal modulation. This level can not be sustained over the long term. The system also has massive inefficiencies, losing up to 75% of water through technical breaches in some areas. The networks are aging, with the average water supply network being 35 years old, and the average sewage line around 30 years old. One serious gap is in rehabilitation of municipal water infrastructure to increase water quality and accessibility.

Also severely affected by the increased demand for water supply is the sanitation sector. Several cities require expansion of sewerage networks for collection of wastewater in main urban areas, and the wastewater treatment plants are in need of major expansion in order to handle the increased quantities of waste generation.

Despite the limited resources and economic challenges in Jordan, the country has been doing all that is in its power to meet the urgent needs of Syrian refugees since the beginning of the crisis. The government has estimated that accommodating the 1.1 million Syrians currently in Jordan requires a budget allocation of $389.2 million annually to provide basic items and services.



3.3 OBJECTIVE

Already water-stretched, the Jordanian water sector has been heavily impacted by the influx of refugees in massive numbers. The strategic objectives of the Technical Affairs Department of the Ministry of Water and Irrigation is to implement projects and interventions that target significant increases in the percentage of people served by and connected to the water network, as well as increasing the number of households connected to the sewerage networks. Under those efforts, a number of interventions have been implemented across the Kingdom covering network rehabilitation and non-revenue water; improvements in the water supply system, rehabilitation of water conveyor system to the northern governorates, and upgrading of water networks, reservoirs, pumping stations, and household connections across the country. Efforts are also aimed at reducing technical and commercial water losses (e.g. theft and poor billing, etc.), and increasing the efficiency of energy usage in pumping and conveyance of water nation-wide.

Similarly, efforts are currently on the drawing board for planned wastewater improvement and rehabilitation. This covers expansion in wastewater services, establishment of treatment plants and wastewater networks, and increasing the efficiency of treatment plants and waste disposal. The following are a number of water and wastewater programs, currently under implementation. These were designed around furtherance of the strategic objectives of MWI:

- Non-revenue water reduction project for areas occupied by Iraqi refugees in Zarqa governorate (to be completed in 2016);
- Water and energy efficiency project in Zarqa governorate (to be completed in November 2013);
- Rehabilitation and improvement of water utilities in Tafileh governorate (to be completed in 2013);
- Expansion of Mafraq wastewater treatment plant project (to be completed in 2015); and,
- Rehabilitation of wastewater infrastructure project across the country (to be competed in 2015).

In addition, there are a number on-going donor-funded activities specifically related to the refugees crisis. These include the following:

- Activities funded by the KfW for water sector projects in the north covering wells, transmission lines, and distribution networks with an estimated cost of US $18 million.
- Activities funded by the World Bank working with the municipalities and the MWI for water projects in municipalities in the amount of $50 million, of which $8 million will be dedicated to the MWI.
- A $20 million grant by JICA for water projects in the northern governorates, and
- An upcoming EU fact-finding mission to identify areas of EU intervention.

Despite the above efforts, there are still significant needs for further support for the sector from the international donor community. This current assessment aims to undertake the following:

A. Analysis in detail of the numbers of Syrian refugees and their geographic distribution in Jordan;
B. Quantification of the impact of the increased population on the water sector in terms of:
- water supply
- wastewater sanitation and treatment

C. Identification and quantification of the gaps in the water and wastewater sector,
D. Formulation of actions and interventions needed to rectify the gaps and shortages



3.4 OVERALL METHODOLOGY AND APPROACH

3.4.1 Distribution of Refugees

Data on the distribution of the Syrian refugees were obtained from a number of reliable sources. Those sources included the Ministry of Interior, Ministry of Planning and International Cooperation, UNHCR, Unicef and other UN Agencies. The study team extensively met with those organizations to obtain and confirm the veracity of the reported data. As a result of the investigations, the following categories of data were identified:

- Data on Syrian nationals that have entered Jordan before, during, and after the crisis, but are not classified as refugees
- Data on Syrian refugees that have official refugee status
- Data on Syrian refugees that do not have official refugee status

The data for the above data categories were obtained, to the extent possible, for the years 2009 through 2013. Furthermore, the data were categorized by governorate, and by district, in order to enable the study team to conduct water demand analysis at the district level. Details on the findings of those data are presented in Section 3.4.

3.4.2 Water Supply

According to the MWI (2013), the rapid rise in the number of Syrian refugees caused a severe stress on public water supply systems, serving twice as many people than originally served in certain areas. Moreover, in some locations, water availability is reaching such low levels that competition and social tension between refugees and Jordanians are rising.

The main indicator used by the study team to assess the impact of Syrians on the limited water resources before and after Syrian crisis was the per capita water deficit, per district, and per year. Based on the total billed water consumption data obtained from the MWI for the period of 2010 to 2013, the per capita billed water consumption was calculated and compared to an agreed upon per capita daily water amount specified by the MWI of 100 l/c/d. The difference between the two numbers (i.e., the billed amount and the specified target amount) represents the per capita water deficit, which is attributed to, among other factors, the increasing refugee population. Specifically, the following analytical approach was undertaken:

The study team conducted the analysis based on two scenarios. First, the per capita water deficit under normal conditions (before the Syrian refugee influx) was calculated. This amount was calculated using the total Jordanian population, with data obtained from the Department of Statistics for the period from 2010 through 2013.

Second, the per capita water deficit after weighing-in the number of Syrian refugees was calculated for the same period of time between 2010 and 2013. The total population used represents the total Jordanian population in addition to the total Syrian population (refugees and non-refugees), before and after the crisis situation began.

Upon finding the deficit value under normal and post crisis conditions, the study team compared the two values on a district-level to highlight the critical locations in terms of water deficit, and where interventions are highest priority.

3.4.3 Sanitation

To gauge the impacts of Syrian refugees living in Jordan on the sanitation services, analysis of the services was divided into two components: a) the first component looks into the capacity of each treatment plant in Jordan in relation to the actual influent inflows; and b) the second component looks into the sewer network connecting the households to the treatment facility.

Each of the component reviews display both the quantitative and the qualitative aspects of the problem. Although it is clear that the larger impact of the refugees has occured since the crisis, it was demonstrated that Syrians even before the crisis are shown to have had a significant impact on the efficiency of the sewer networks and treatment plants for a number of governorates adjacent to the border areas.

A. Wastewater Treatment Capacity

This assessment exercise included all the wastewater treatment plants that have been constructed or expanded and operated during the period 2000 through 2012. The treatment plants comprise the following types: extended aeration, trickling filter, active sludge, oxidation ditch, and waste stabilization ponds. The treatment plants included are not categorized based on their type, but rather considered in terms of their average design flows. The exercise also includes the five treatment plants which are currently under construction or are planned. These five treatment plants are Kufranja, Mafraq, Mu'tha, North Shouneh and Shalalah.

The indicator looks at each treatment plant capacity in comparison to the inflow. The capacity for each treatment plant is provided by the Water Authority of Jordan (WAJ). The inflow for each treatment plant is also given by WAJ for the total population including Syrian refugees and non-refugees. The comparison was done as follows:

For each of the treatment plants, the study team delineated the districts served by the plant in order to identify the serviced population.
For each plant, WAJ provided the inflow for the years 2009 through 2012. For the purposes of this assessment, the same inflow rates for 2012 were assumed for 2013. Those inflows account for the Jordanians and non-Jordanians (i.e., refugees) living in the serviced districts.

For those years (i.e., 2009 through 2013), Jordanian population level data were obtained from the Department of Statistics. When analyzed with the refugee statistics obtained as described above, those populations were used to calculate the proportional inflow that could be attributed to only Jordanians after the onset of the political crisis.
Inflow to capacity ratios was calculated for those years under two scenarios: 1)For Jordanians only; and 2) For Jordanians augmented by the non-Jordanians.
Increases in the ratio of inflow to capacity for each plant were calculated for comparison purposes.

The wastewater treatment plants were then analyzed from a quality perspective where key water quality indicators as provided by WAJ for the various treatment plants were benchmarked against international water quality parameters. To ascertain an overview of the direct impact Syrians (refugees and non-refugees) have over the efficiency of wastewater treatment plants, a number of key parameters were selected. The selection of these parameters was based on the importance of the parameters to wastewater treatment facilities, in addition to the data availability for the selected governorates, for the year 2012 after the Syrian crisis.

The population distribution before the Syrian crisis included those Jordanians and Syrians (non-refugees) that are served by centralized treatment plants. It was assumed that all Syrians before the crisis were served by treatment plants. This is based on the fact that Syrians who moved before the crisis settled in locations having developed infrastructure (including, but not limited to, electricity, clean water access, and sanitation). It is very unlikely that many Syrian non-refugees moved into rural areas in Jordan, specifically those areas un-served by a treatment plant.

B. Sanitation and Sewerage

For each of the districts serviced by the various treatment plants, the population was converted to be expressed in terms of households. The average household size is estimated at about 5.2 persons, according to the Department of Statistics Report: Jordan Population and Family Health Survey 2009. Due to unavailability of verifiable statistical data, the analysis assumed a similar average household number for Syrians (refugees and non-refugees) for the years 2009 through 2013.

The sewer length provided by WAJ was used in parallel with the number of households to provide the indicator used for the sewer network.

The indicator compares the efficiency of one meter length serving households between Jordanians and Syrians, and Jordanians only. The scenario compares the efficiency of one meter length in the sewer network between Jordanian community only and Jordanian and Syrian communities.

The influx of Syrian refugees and non-refugees has led to decreased efficiency per unit length of sanitation sewer, as shown in Table 4.



3.5 RESULTS AND KEY FINDINGS

3.5.1 Distribution of Refugees

According to the UNHCR data, the total number of Syrian refugees was officially recorded as 120,321 in 2012. In addition to the UNHCR figures, the total number of Syrians in Jordan based on the Ministry of Interior (MoI) figures were gathered for this study. According to the MoI figures, there are almost 1.3 million Syrians in Jordan distributed across the twelve governorate. That is nearly 24% of the total population of Jordan. Figure 1 shows the spatial breakdown and distribution of refugees at the end of 2013. Of the total number of Syrians, around 83% are residing in host communities (i.e. outside refugee camps), mainly in the northern governorates, with the highest percentage of them settled in Mafraq, Amman, Irbid and Zarqa governorates, respectively. In addition, more than 60% of Syrians (both refugees and non-refugees) are situated in the northern governorates that have already been suffering from critical conditions in terms of water and sanitation services. This large number of Syrians will certainly increase pressures on the environment and on the limited water resources, especially groundwater aquifers, which are under severe pressure of over abstraction, exceeding the annual safe yield, and deterioration in water quality and resulting in major undesirable environmental impacts.

The Syrians residing in Jordan before the crisis are Syrian national/citizens that have been entering Jordan since 2006. Their total number is estimated based on an average family size as the official statistics only show a total of 476,000 passports, which include individual and family passports (Syria still uses a system where an entire family can be listed in one passport). The bulk of the refugees (i.e., recipients of refugee card, and/or registered with UNHCR) entered in 2013. The data, however, had the following limitations:

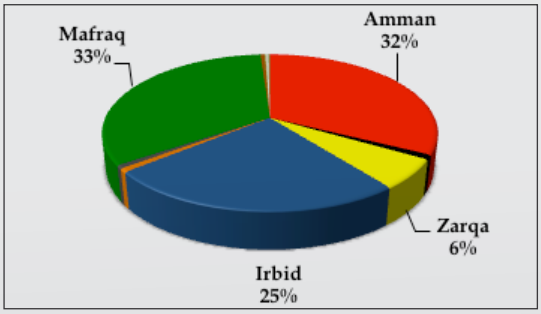


Figure 1. Syrian Concentration in Jordan

- A detailed breakdown on cumulative data of the influx of Syrians between the start of the crisis in Syria and the current day could not be accurately determined.
- A detailed breakdown of the refugees by governorate and district could be found only for the year 2013. The total numbers of refugees by the end of 2011 and 2012 were only available for the entire country un-disaggregated by governorate. Therefore, the study team used the 2013 geographic distribution on districts for those two years.

No data are available on the cumulative number and geographic distribution of the non-refugee Syrians. The Ministry of Interior only indicated that they resided in main urban centers. For this reason, the study team estimated their breakdowns as follows:

- 50% in Amman and its surrounding areas,
- 30% in Mafraq's main cities,
- 15% in Irbid, and
- 5% in Zarqa.

While the focus of this study is to assess the impacts of refugees on host communities, it will also shed light on potential water interventions that aim at managing the decline in water quantity and quality in the country as a result of increased demands from refugees, and where in some district locations refugees far exceed the number of local Jordanian residents.

To more succinctly determine the impact of the Syrians on water and sanitation sector in Jordan, the analysis was carried out on a district level. In this context, for each governorate, the total number of Syrians was calculated in addition to the numbers of refugees in camps (Zaatri in Mafraq and Mrejeb Fhoud in Zarqa). Based on the total number of Syrians across the country, and the number of Syrians per governorate, the percentage of Syrians per governorate was calculated. Consequently, taking the percentage of Syrian population in each district as per the MoI figures, to the total number of Syrians in each governorate, the total number of Syrians per district could be accurately estimated.

The following table shows the distribution of the Syrian nationals (refugees and non- refugees) in the various governorates.

Table 1. Distribution of Syrians (1000's)

Governorate	2010			2011			2012			2013		
	Jordanian	Syrians		Jordanian	Syrians		Jordanian	Syrians		Jordanian	Syrians	
		Refugees	Non Refugees		Refugees	Non Refugees		Refugees	Non Refugees		Refugees	Non Refugees
Amman	2,367.0	-	375.0	2,419.6	0.5	375.0	2,473.4	19.5	375.0	2,504.5	119.2	375.0
Balqa	409.5	-	-	418.6	0.1	-	428.0	2.1	-	437.4	12.6	-
Zarqa	910.8	-	37.5	931.1	0.2	37.5	951.8	8.2	37.5	965.1	49.8	37.5
Madaba	152.9	-	-	156.3	0.0	-	159.7	0.1	-	163.3	0.4	-
Irbid	1,088.1	-	112.5	1,112.3	1.0	112.5	1,137.1	39.2	112.5	1,158.4	239.8	112.5
Mafraq	287.3	-	225.0	293.7	1.1	225.0	300.3	42.7	225.0	305.9	260.7	225.0
Jarash	183.4	-	-	187.5	0.0	-	191.7	1.7	-	195.5	10.2	-
Ajloun	140.6	-	-	143.7	0.0	-	146.9	1.5	-	150.3	9.1	-
Karak	238.4	-	-	243.7	0.0	-	249.1	1.1	-	256.3	6.9	-
Tafiela	85.6	-	-	87.5	0.0	-	89.4	0.2	-	92.2	1.3	-
Ma`an	116.2	-	-	118.8	0.0	-	121.4	0.7	-	125.1	4.4	-
Aqaba	133.2	-	-	136.2	0.0	-	139.2	0.4	-	142.4	2.4	-
Total	6,113		750	6,249	3	750	6,388	117	750	6,496	717	750

3.5.2 Water Supply

Figure 2 below presents the total billed resources, and the per capita water deficit trends from 2010 through 2013. As Figure 2.a shows, the total billed water resources across the country demonstrate a decreasing trend from 2010 through 2013. The trend is further expected to decline significantly by 2030, when the total billed resources are anticipated to amount to nearly 42 MCM per year. This trend is attributed to many factors including the increase in population and demand, and the decrease in the available per capita water resources.

Likewise, Figure 2.b presents the per capita water deficit. The figure shows an increasing trend through the years, which is projected to rise notably in 2030. Moreover, the figure depicts a noticeable difference between the water deficit calculated under normal conditions (i.e., due to increasing population of Jordanians), and under post-crisis conditions (i.e., with the inclusion of Syrian refugees). As can be seen, the growing number of refugees is adversely impacting the available per capita water amount, where deficit value under the refugee scenario almost doubles compared to the normal conditions scenario for 2013. This latest development is due in large measure to the substantial influx of Syrian refugees into the country, which if allowed to continue, will only further exacerbate the shortage of potable water, and is forecasted to yield a water deficit of up to 92 l/c/d in 2030.

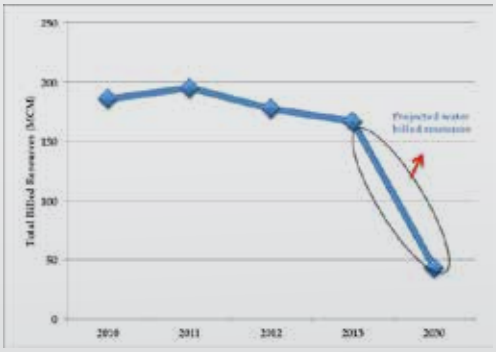


Figure 2.a. Total billed water resources

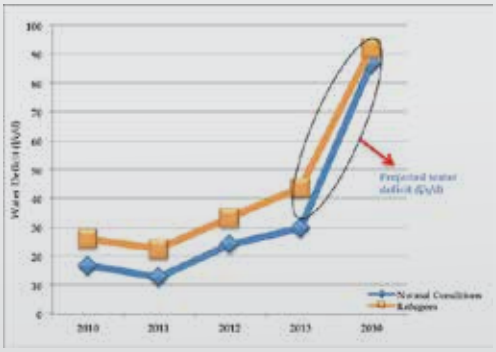


Figure 2.b. Per capital water deficit

At the governorate and district levels, calculated water deficit figures support the declining trend in the available water amounts. Figure 3 below presents the deficit value at the district level for the four middle governorates in the kingdom. As can be seen, the Amman and Zarqa governorates show a significant increase in the deficit amount between 2010 and 2013 under the post-crisis scenario. For instance, an increase in the deficit value by almost 25% was recorded in Qasabet Al-Zarqa district in 2011 between the normal and post-crisis scenarios. The value further increased in 2012 and 2013, when the percentage of Syrians in this area represents almost 9% of the Jordanian population in 2013.

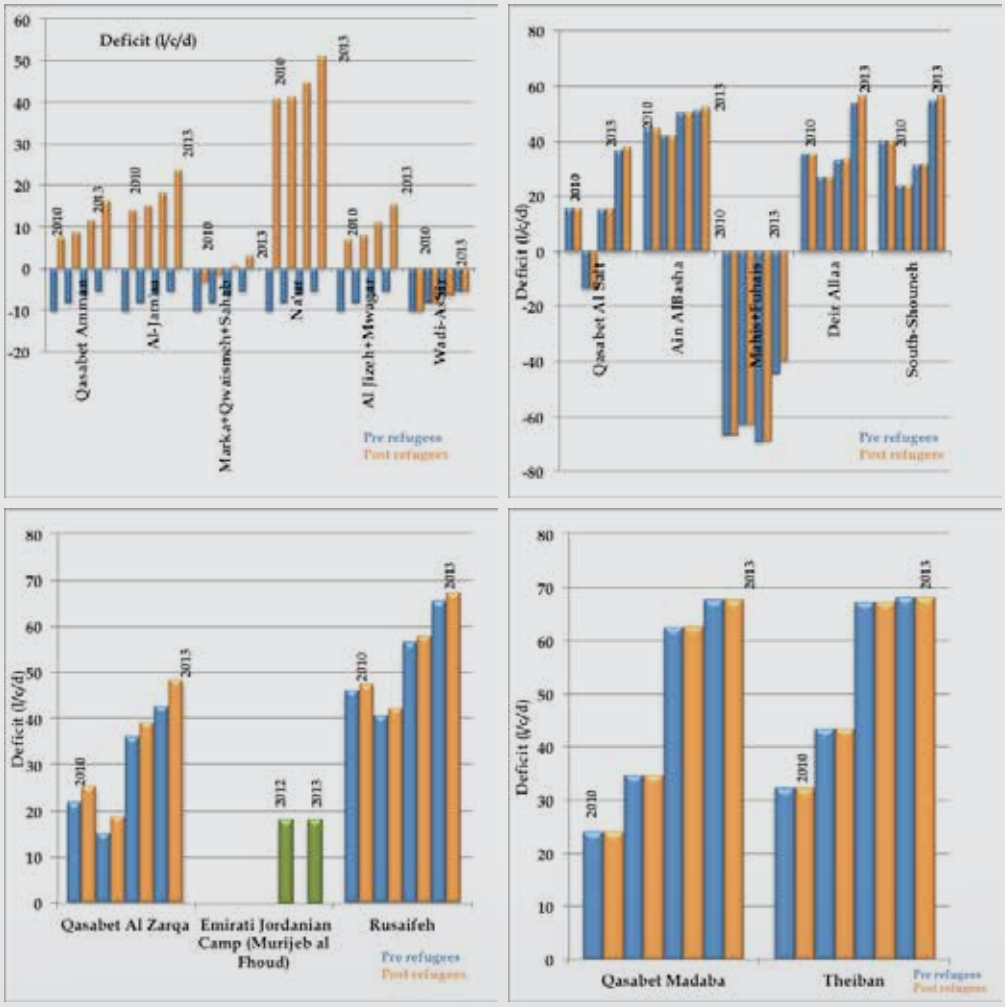


Figure 3. Deficit value for the four middle governorates

On the other hand, deficit values for the Amman governorate show a significant increase in 2012 and 2013. This trend is supported by the growing number of Syrians in Amman, where the percentage of Syrian population to Jordanians accounts for over 20% of the total population in 2013, particularly in Na'ur district.

Figure 4 shows the deficit values calculated for the northern governorates and their districts. As northern governorates have been hit hard by the refugee influx the deficit values show significant increase across most of the districts. One of the reasons for the decline in the water available is that a good part of the water that is usually allocated to these governorates is now being redirected to the refugee camps.

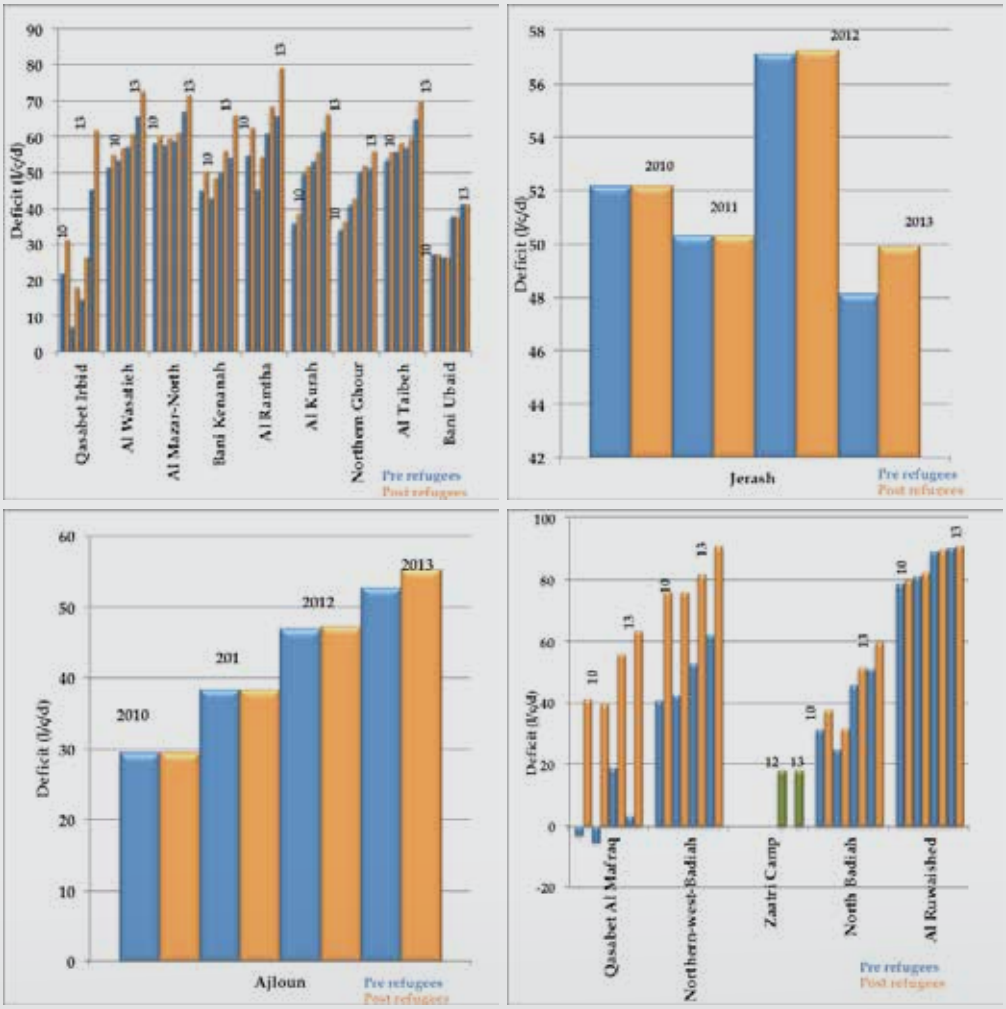


Figure 4. Water deficit values for the northern governorates

Of those most-affected governorates, a severe increase in deficit is noted in the Mafraq and Irbid governorates, when examined under the normal conditions and the post-crisis scenarios. This is attributed to many factors such as the absence of reliable water supply network in some locations, high percentage of leakage, bursts, and non-revenue or unaccounted-for water (NRW), including both physical and administrative losses, particularly in Mafraq where NRW accounts in 2013 for almost 61%, according to the MWI data.

Areas that are mostly affected include the Ramtha district in Irbid (percentage of Syrian people to Jordanians is around 2 to 1 in 2013), and Qasabet Al-Mafraq and northern-west Badiah districts (including Zaatri and Housha sub-districts for instance)

in Mafraq governorate (percentage of Syrians to Jordanians far exceeds 167% and 88%, respectively in 2013). In this respect, Figure 5 indicates a significant increase in water deficit in Ramtha between 2010 and 2013 by almost 47%, which is equivalent to the increase in Syrian population in this area. Likewise, a significant increase in water deficit has been recorded for Qasabet Al-Mafraq between 2010 and 2013 due to the increase in population and refugee settlements, where the water deficit almost quadrupled during that period.

Additionally, an increase in water deficit in some of the districts that are currently occupied by Syrians in the southern regions of the kingdom, has been noted. Qasabet Ma'an, for example with a 10% Syrian refugee population percentage, has recorded a correspondingly significant decrease in the water available per capita, with a deficit exceeding 40 l/c/d. That said, the situation is expected to only worsen with the growing number of refugees along with increasing temperatures in the south of the country, natural seasonal population shifts, and demand on the limited water resources, until and unless effective interventions are implemented.

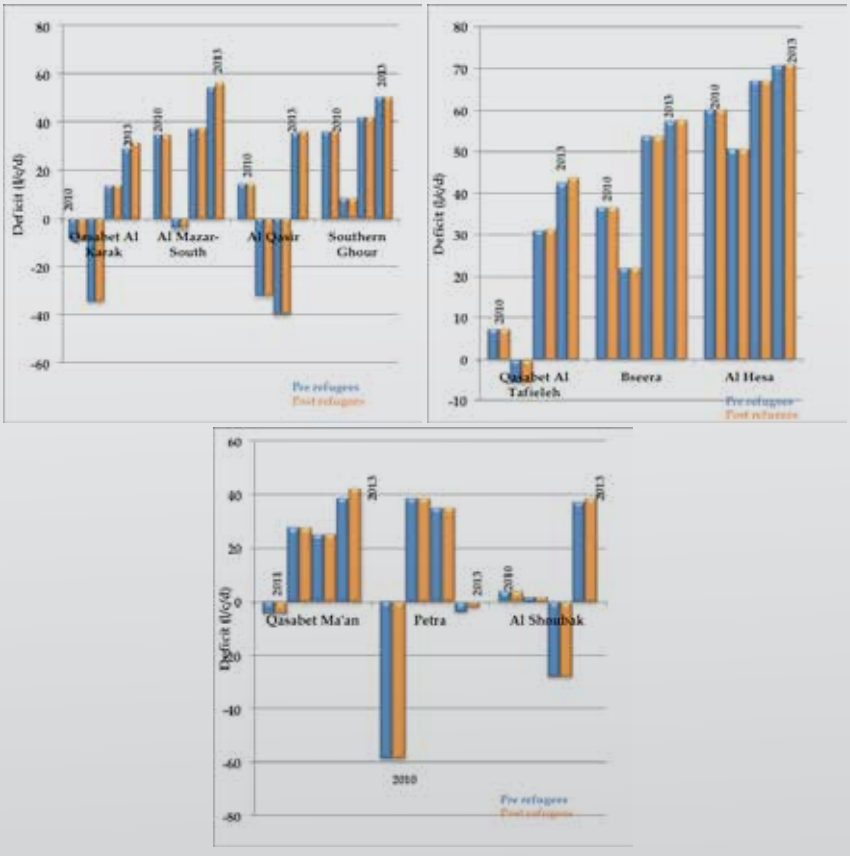


Figure 5. Water deficit values for south governorates

Jordan also has twelve groundwater basins, most of which are already being either fully exploited or over-exploited. Over-use of the groundwater resources has not only depleted the supply, but has also adversely impacted the quality of the water. For instance, the Al Azraq groundwater basin, that serves Zarqa, Mafraq, and parts of Amman governorates, has recorded an over-abstraction rate of 125% above the sustainable yield from 2010 to 2012. This will exacerbate the water problem in those governorates that are already suffering from a water deficit. Similarly, the North Wadi Araba basin has also recorded an over-abstraction rate of 90% above its allowable level. According to the MWI, this overexploitation has been due to the haphazard or poor enforcement of well-drilling regulations and the lack of control on licensed abstraction rates. In turn, this has lowered the water table a significant amount and resulted in significantly increased pumping costs.

Based on the aforementioned discussion, the water deficit gap tends to expand due to the burgeoning increase in population and refugee influxes. Moreover, the amount of water from the renewable resources is continuously declining as a result of the over pumping of groundwater, resulting in lowered water table in many basins and declining water quality. Likewise, with high levels of water losses in the transmission, distribution systems, storage tanks, and house connections (physical losses), a further part of the NRW may not be billed due to illegal consumption, and inadequate water metering (apparent losses).

3.5.3 Wastewater Treatment

The results of the analysis of inflow to capacity under the two aforementioned scenarios are summarized in Figure 6 below. As illustrated, the biggest impact in terms of the increase in the ratio of inflow to capacity is in wastewater treatment plants (WWTPs) in the northern governorates, and to a lesser extent in Amman. This is consistent with previous findings, and is mainly attributable to the concentration of Syrians (both refugees and non-refugees) in Amman and the northern governorates. Similar trends were found for the WWTPs in Baqa'a and Jiza.

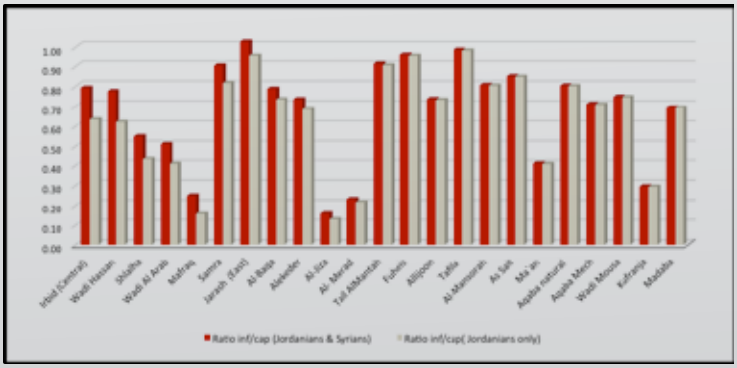


Figure 6. Ratio of Inflow per Capacity for each Treatment Plant between Jordanians only and Jordanians and Syrians year 2012 affected from worst to least (Irbid-highest and Madaba least)

Al Karak and Al Shobak Treatment Plants were already extended before the Syrian crisis, so for better illustration of the impact, it has been removed for the year 2012. The ratio exceeds one between the Jordanians and Syrians, and Jordanians only. Due to insufficient capacity of the treatment plants, the effluent quality impact must be taken into consideration.

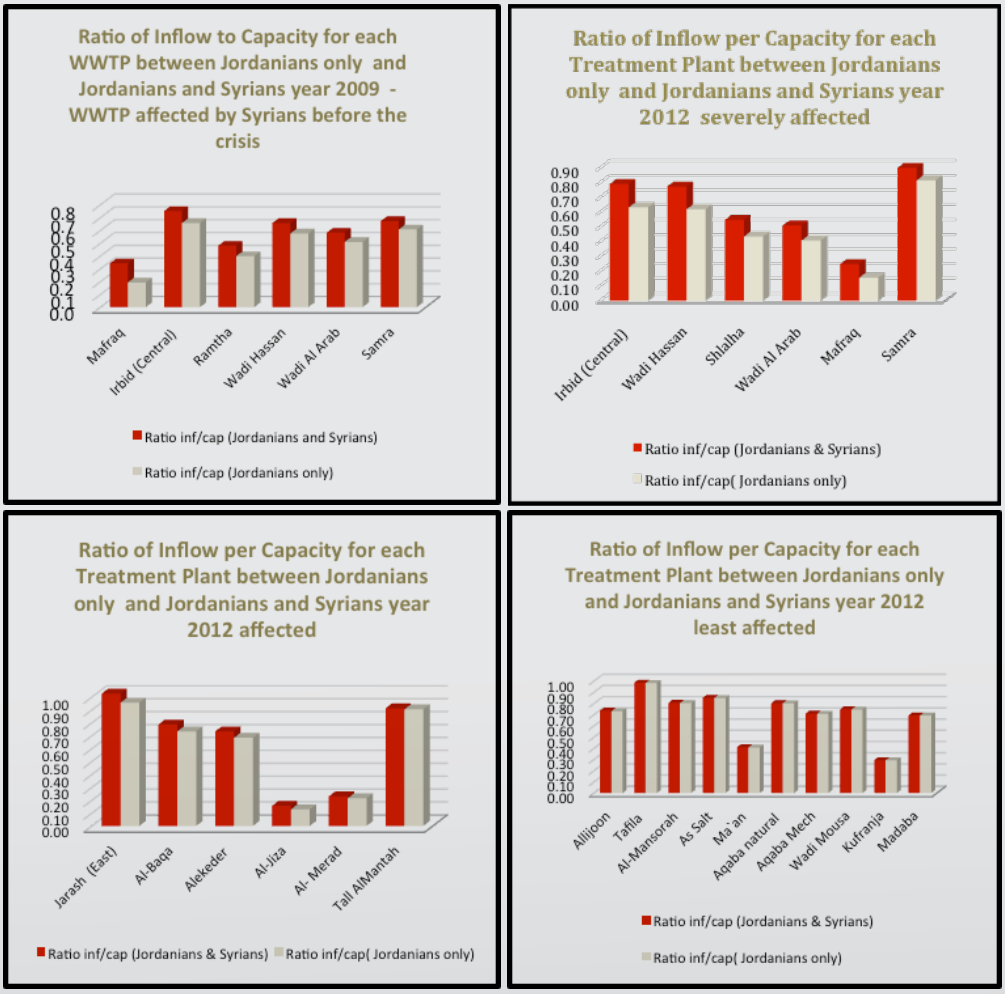


Figure 7. Ratio of inflow per capacity

Note: - Mu'tha, Ramtha and North Shoneh, no data are represented since they were not operating in 2012. - All WWTP's are arranged from left (worst) to right (least affected) in each graph. The scale applies for the impact of Syrians on host communities in Jordan. WWTP's that are least affected or not affected by Syrians do not indicate the best operating scenario for the WWTP.

In terms of quality, Table 2 below show the typical domestic sewage characteristics that were compared to the parameters of inflow after the Syrian crisis.

Parameter	Weak	Medium	Strong
TSS (mg/L)	100	200	350
BOD (mg/L)	100	200	400
COD (mg/L)	175	300	600

Table 2. Domestic sewage characteristics

The values for the "strong" wastewater were then compared to the values of those parameters for the various treatment plants as per the information provided by WAJ. The results of the comparison are summarized in Table 3 below.

Table 3. Quality Parameters for WWTPs

Treatment Plant	Standard Parameter Value mg/l		
	TSS 350	BOD 400	COD 600
Kufranja	605.4	671.3	1536.7
Baqa'a	576	611	1505
Akeider	-	-	-
Fuheis	496	531	947
Madaba	1015	1143	1932
Aqaba WSP	347	362	743
Aqaba WWTP	344	356	356
Mafraq	-	-	-
Wadi Hassan	753.7	1178	1629
Samra	668	707	1372
Sheikh Hussein	-	-	-
Jordan Valley	3898.6	1560.5	5182.7
Al-Amari	550	590	1031
Allujon	-	-	-
Al-Jiza	526.8	761.9	1349.1
Jerash	1270	1274	1455
Ma'an	275.8	390.6	551.7
Wadi Essir	389.1	595.8	940.5
Abu Nuseir	479.3	729.8	1054.4
Salt	541.1	588.3	1156.8
Karak	-	-	-
Tafilah	621.7	628.5	1010.1
Wadi Mousa	585.3	309.9	1012.2
Ramtha	441	888	1992
Wadi Arab	910	904	1296
Shobak	701	347.5	3695.5
Al-Miraad	697	725	1198
Irbid	722.3	958.2	1819.1

Source: Water Authority of Jordan (WAJ)

[1] Source: McGhee, T. J. (1999), Water Supply and Sewerage. McGraw-Hill International Editions, 6th edition. Singapore.

As can be seen, all WWTPs, without exception, exceed the internationally accepted recommended parameter values of wastewater quality. This indicates that in addition to the hydraulic pressures on WWTPs as defined above, there are serious water quality issues. Unfortunately, complete chronological data for all parameters in all treatment plants could not be found. Inclusion of such data would enable a quantification of the contribution of the Syrian refugees to the water quality issues more comprehensive to wastewater.

3.5.4 Sanitation and Sewerage

As mentioned, the total length of the sanitation networks in serviced communities was used to calculate the average meters of sanitation available for each household in those communities. While not a design parameter, this is an internationally used indicator to portray the extent of coverage. The calculation was done 1) using only the Jordanian population, and subsequently 2) after superimposing the Syrian refugee population numbers. The indicator was defined as an efficiency indicator for sanitation. The reduction in efficiency was then calculated by taking the percent decrease in the two calculated figures. The results are shown in the following table and figure.

Table 4. Decrease in Sanitation Efficiency

Governorate	Decrease in Efficiency of One Meter Serving Households 2013
Mafraq	51.62%
Irbid	30.29%
Zarqa	12.85%
Amman	5.09%
Jarash	4.69%
Ajloun	4.44%
Karak	3.58%
Ma'an	3.04%
Salt	2.38%
Tafila	1.99%
Aqaba	1.48%
Madaba	0.00%
Country average	15.30%

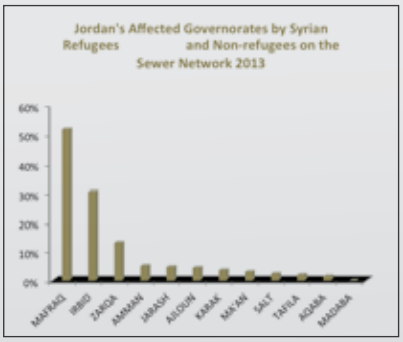


Figure 8. Sewer networks of affected governorates - 2013

Consistent with the findings in terms of wastewater treatment capacity, the pressure on sanitation facilities is now highest in Mafraq , and is increasing all over the kingdom. The impact of Syrians moving to Madaba is almost non-existent in 2013 as there has been a very small number of Syrians living there.

3.6 RECOMMENDED ACTIVITIES

Based on the results of the analysis, it is apparent that the Syrian refugee crisis is placing significant pressures across Jordan's water sector. While the analyses are of a basic nature due to the lack of detailed data, they clearly demonstrate and quantify the impact on water supply, treatment capacity, and sewerage. The following matrix summarizes the main areas of intervention.

Area of intervention	Priority Areas	Recommended Project Themes
Wastewater treatment capacity	The capacity of several existing WWTPs has to be expanded by as much as 20% in some governorates. The most urgent needs are in the northern governorates; namely, Irbid, Wadi Hassan, Wadi Arab, Jerash, Baqaa, and Akaider. Depending on the feasibility of upgrading existing WWTPs, the option of new construction might be a more viable option to help accommodate the increased flow, the worsened water quality, and the ability to accommodate new communities if they become serviced as indicated below.	WWTP expansion in Irbid, Mafraq, Baqaa, and Jizeh. Must explore the options of expansion versus new plants for some locations. Construction of new WWTPs in northern and central governorates (Mafraq, Jerash, Irbid, and Amman) Provision of compact units in critical areas
Wastewater networks	In addition to the deterioration in the sanitation networks for serviced communities, and the reduction in the efficiency of existing networks as a result of the Syrian refugees, there is a need to rehabilitate existing networks, and to serve communities that are currently unserved. With the continued, and forecasted, increase in Syrian refugees, public health conditions could become an issue in several communities. Areas that need expanded sanitation networks include Mafraq with the highest priority, followed by Irbid and Zarqa.	Rehabilitation of existing wastewater networks in northern governorates (Irbid and Mafraq) Construction of wastewater networks of unserved communities in the northern governorates
Water distribution network rehabilitation	As revealed by the water consumption analysis, there is an obvious need for additional water resources to meet the projected demand. While the Dissi Water project has helped ease off some of the pressure in Amman, and the other governorates that used to export water to Amman, there is still a need for additional water resources in order to cope with the increased demand. With the high NRW rates in some governorates, significant investments are needed to minimize the leaks component of such NRW. Those savings translate into additional water resources available for distribution.	Rehabilitation of water networks of all northern governorate main cities to reduce NRW Rehabilitation of water networks in select areas in the Kingdom with over-representation of Syrian refugees.
Pump stations	Along with the deteriorated water distribution network in various parts of the country, the pump station and transmission is in need of rehabilitation and upgrading in order to minimize the losses and to maximize the amount of water actually pumped to the various demand centers.	Rehabilitation of existing pump station in northern governorate transmission systems.
New-water resources	Given the over abstraction of most ground water aquifers and the increasing deficit in water supply, there is a need to create more resources to help cover the shortage in various areas of the country, especially in the northern and southern governorates.	Construction of at least two desalination of brackish water plants similar to the Zara Maeen project, along with the necessary conveyance and transmission system. Could be coupled with the use of renewable energy for the reduction in pumping costs.

Table 5. Proposed water sector intervention areas

3.6.1 Recommended Interventions to Counteract Impact from Refugee Influx and Demand

The following are direct interventions that are recommended to support the MWI to cope with the deficits in the water supply, wastewater collection, and wastewater treatment sectors resulting from the Syrian refugee crisis. We believe these interventions will result not only in an improvement of services for Jordanians as well as refugees, but serve to safeguard the quality of safe and reliable future water services.

Without a major infusion of new capital to develop these interventions, Jordan can expect to experience a serious degradation in services, increased levels of water-borne disease, and an inability of a large proportion of the population in the north to lead productive lives. This is particularly important given that most experts fully expect the refugee presence to increase and remain fairly constant over the next decade, or longer.



Project	Location	Type of Project	Estimated Cost ($)	Notes
WWTP Central Irbid	Irbid	Rehabilitation/ Expansion	15 million	For these WWTPs studies, are needed to determine the viability of expansion versus new plants. Some of the plants need modifications including nitrification and de-nitrification, odor removal, and sludge de-watering
WWTP Shallaleh	Irbid	Expansion	10 million	
WWTP Wadi Arab	Irbid	Rehabilitation/ Modification	15 million	
WWTP Baqa'a	Balqa	Rehabilitation/ Expansion	10 million	
WWTP Merad	Jerash	Rehabilitation/ Modification	10 million	
WWTP Jerash East	Jerash	Rehabilitation/ Expansion	10 million	
WWTP Akaider	Mafraq	Rehabilitation/ Modification	10 million	
WWTP Compact Units	Zaatari Camps	New	10 million	These are new units including compact units to provide treatment capacity for camps and for areas in Mafraq.
WWTP Units	Azraq Camps	New	5 million	
WWTP Mabraukah	Mafraq	New	10 million	
Sanitation Networks	Mafraq, Irbid, Zarqa, Amman, Jerash	Rehabilitation of Existing Networks	25 million	
Sanitation	Camps, Mafraq, Horan,Bait Ras, Kufr Yoba, Junaid	New networks to serve unserved communities	80 million	
Water distribution rehabilitation	Balqa, Madaba, Mafraq, Karak, Tafila, Ma'an	Rehabilitate existing networks to reduce NRW and supply definict	85 million	
Well rehabilitation	nationwide		150 million	
Water transmission projects	Various including the Dabooq-Ajloun, Wadi Arab, and Zai		50 million	Intended to connect the northern and central water systems and to convey water from new desalination sources
Pump Station Rehabilitation	various		10 million	These are intended to improve the overall efficiency of PSs, and to improve the water supply
Water resources-desalination	Three locations TBD	Additional water resources to help meet demand	350 million	
Total			700-800 million	

Table 6. Costed specific proposed interventions

4. LIST OF ATTENDEES

Embassy / Organization	Name
ACTED	Byron Pakula
ACTED	Gian Melloni
Al Ghad	Habes Alodwan
British Embassy	Jeff Tudor
Dustoor	Jameel Alsaydeh
EBRD	Nadine Hammad
Embassy of China	Wei Yan
Embassy of Korea	H.E. Hong-shi Choi
Embassy of Korea	Seoung ho Cho
Embassy of Sweden	Muna Barghouth
Embassy of Sweden	Anders Jägerskog
Embassy of the Netherlands	Basem Naouri
Embassy of the Netherlands	Sarah Ham
European Union	Ibrahim Laafia
French Development Agency	Serge PERRIN
German Embassy	Dr. (Mrs.) Irene Fellmann
GIZ	Sameer Abdel-Jabbar
id:rc	Tarek Tarawneh
International Relief & Development	Bashar Samarneh
Italian Embassy	Laura Cicineh
Japan International Cooperation Agency (JICA)	Toshiaki Tanaka
JICA	Hani Kurdi
JICA	Junji Wakui
Jordan Valley Authority	H.E Saad Abu Hammour
JVA	Fouad Ejelat
JVA	Mashour Harb
JVA	Qais Owais
KFW	Sawsan Aruri
KFW	Isabel Hoffman
Korea International Cooperation Agency (KOICA)	Young-Tae Han
KOICA	Eun oK Ko
MCA	Kamal Al Zou›bi
Millennium Challenge Corp.(USA)	Alex Russin
MercyCorps	Raed Nimri
MercyCorps	Ghassan Hazboun
MercyCorps	Rob Maroni
MercyCorps	Rania Zoubi

Embassy / Organization	Name
Ministry of Planning & International Cooperation	Safa El Naser
Ministry of Planning & International Cooperation	Halla Talhouni
Ministry of Planning & International Cooperation	Ebaa Al-Eassa
Ministry of Planning & International Cooperation	Waed Jaafreh
Miyahuna	Mohammad Malkawi
Ministry of Planning & International Cooperation	H.E. Ibrahim Al Saif
Ministry of Water and Irrigation	Basem Telfah
Ministry of Water and Irrigation	Nisreen Haddadin
Ministry of Water and Irrigation	Ali Subah
Ministry of Water and Irrigation	Suha Mughrabi
Ministry of Water and Irrigation	Rawan Al Batsh
Ministry of Water and Irrigation	Maria Rabadi
Ministry of Water and Irrigation	Mohamed al Momani
Ministry of Water and Irrigation	Ayman Haddadin
Ministry of Water and Irrigation	Adnan Al Zou'bi
Ministry of Water and Irrigation	H.E Hazem Al Naser
Ministry of Water and Irrigation	Muasher
Ministry of Water and Irrigation / PMU	Iyad Al Dihiyyat
Ministry of Water and Irrigation / PMU	Ekhlass Nassar
OXFAM	David Weatherill
OXFAM	Francesco Rigamonti
Public Action for Water, Energy and Environment Project	Robert Cardinalli
Public Action for Water, Energy and Environment Project	John Bromley
Public Action for Water, Energy and Environment Project	Mobadda Allabadi
Public Action for Water, Energy and Environment Project	Luma Mikhi
Public Action for Water, Energy and Environment Project	Nicholas Hornish
Spanish Agency for International Development	Gregorio Maranon
Swiss Agency for Development and Cooperation (SDC)	Georges Burri
The Inter-Islamic Network on Water Resources Development and Management (INWRDAM)	Murad Bino
The Inter-Islamic Network on Water Resources Development and Management (INWRDAM)	Shihab Al Beruiti
UNDP	Mohammad Alatoom
UNHCR	Amin Juzarbhai
UNICEF	Rozanne Chorlton
UNICEF	Esmaiel Ibrahim
UNICEF	Jamal Shah
UNICEF	Saeed Hameed
UNRC/UNDP	Costanza Farina

Embassy / Organization	Name
UNRCO	Michael Schaadt
USAID	Jack Dougherty
USAID	Doughlas Ball
USAID	Melissa Knight
Water Authority of Jordan	Susan Kilani
Water Authority of Jordan	Ziad Haddadin
Water Authority of Jordan	Muna Hindyeh
Water Authority of Jordan	Imad Momani
Water Authority of Jordan	Omar Salameh
Water Authority of Jordan	Ibrahim Obadah
Water Authority of Jordan	Tawfig Habashneh
Water Authority of Jordan	Atef Al Zubi
Yarmouk Water Company	Mohammad Rababa
Yarmouk Water Company	Ashraf Bataineh
Yarmouk Water Company	Asem Batyneh
Yarmouk Water Company	Kifah Mrayyan
Yarmouk Water Company	Salameh Mahasneh
Yarmouk Water Company	Hasan Hazaimeh

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