

# **Closed Compact Report: Jordan Compact**

September 5, 2018







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## Introduction

The Millennium Challenge Corporation's partnership with the Government of Jordan transformed the nation's water infrastructure, creating new opportunities for growth and stability in one of the most water poor countries in the world. The \$275.1 million investment helped improve water delivery to the Zarqa Governorate region of over 1 million people east of the capital city of Amman. Delivery was improved through increases in the supply of water available to households and businesses and through improvements in the efficiency of water delivery, the extension of a wastewater collection network, and the expansion of a wastewater treatment facility. As a result, 1,160 km of new water and wastewater pipelines were constructed, bringing water to more citizens and businesses in Zarqa and also reducing water loss from leaky pipes. The wastewater network expansion extended the wastewater system to nearly 55,000 additional people, collecting more wastewater for treatment. A highly acclaimed public-private partnership financing structure expanded a world-class wastewater treatment plant, increasing its capacity by one third and allowing it to treat 70 percent of the nation's wastewater. The compact also provided instruction and job opportunities to women interested in becoming plumbers. Effective procurement strategies and careful management of expenses enabled savings that were reallocated to fund the installation of additional wastewater pipes, the construction of a new water utility building in Zarqa, and the purchase of sewer cleaning vehicles to clean and maintain the water networks in Zarqa and Amman. The compact's investments were coordinated with USAID assistance and responded to Jordan's appeal for more long-term support to the country's water and wastewater infrastructure.

Already one of the world's driest countries, Jordan has faced a water shortage exacerbated by the needs of those displaced by the war in neighboring Syria. At the end of the MCC compact, more than one million Syrians were taking refuge in Jordan, further straining the water infrastructure. Demand for water increased during the compact period by 40 percent and government officials and development experts agree that Jordan will continue to require further investments in the water sector to address the stresses caused by the Syrian refugee crisis. The MCC compact was particularly important given the additional pressure on Jordan's water resources and infrastructure. Launched in 2010, months before the crisis in Syria began, the compact carefully targeted improvements to water and wastewater infrastructure in Zarqa, one of Jordan's largest cities. Around half the water that entered Zarqa's water system was being lost through leaks in the network, an unsustainably high loss given Jordan's already scarce water resources. Valued at the marginal cost of water production, these losses at the time amounted to more than \$10 million a year.

This report provides a summary of the tangible outputs of the compact program, documents changes in compact activities and the reasons behind them, details information on performance against targets in the monitoring plan, and summarizes the results of independent evaluations.

## Country Context

Jordan is a highly urbanized, resource poor country of over nine million people.<sup>1</sup> The country has no oil or natural gas and relies heavily on imports to meet its energy needs. Barely three percent of the land is arable, and only one percent is under permanent cultivation. With limited access to surface water or naturally recharged aquifers, Jordan ranks among the world's five most water scarce countries, with renewable freshwater resources that total only 150 cubic meters per person per year—a situation further exacerbated by rapid population growth, urbanization and other factors.<sup>2</sup> On a per capita basis, available fresh water supplies are expected to decline significantly over the next 15 years, driving up costs and impacting household expenditures and industrial productivity. The influx of Syrian refugees into Jordan since 2011 has further stressed the resource infrastructure, which was already suffering from structural issues prior to the refugee crisis.<sup>3</sup>

MCC's Board of Directors first selected Jordan as eligible for MCC compact assistance in November 2006. As part of its compact development process, MCC conducted analyses to determine the binding constraints to economic growth in the country, and the Prime Minister of Jordan established the Millennium Challenge Unit to manage the development of a detailed Constraints Analysis and Sector Analysis in the first half of 2008. The Unit then conducted a broad consultative process that garnered feedback from donors, private sector representatives, civil society organizations, and ordinary citizens in each of Jordan's twelve governorates. Throughout this process, the challenge of addressing Jordan's severe water shortages emerged as a key priority.

During further consultations, key stakeholders in the water, sewer, and sanitation sector emphasized the need to (i) improve water delivery systems to reduce water losses and (ii) expand capacities for collecting and treating wastewater and reusing it in agriculture, wherever appropriate. This led the Government to propose a compact comprised of four major projects related to the rehabilitation of the water distribution system and expansion of the capacity for collecting and treating wastewater in Zarqa Governorate, among the poorest and most urban areas in the country. A history of neglect coupled with rapid population growth had strained critical water and wastewater infrastructure throughout Zarqa. Residents continuously complained of sewer main overflows and water pipes made of cheap, flexible tubing that ran above ground through city streets, where they were subject to considerable wear and tear.

MCC agreed to jointly develop three of the four projects, which included rehabilitating and extending water distribution and wastewater collection networks and expanding the capacity of an existing wastewater treatment plant that treats the majority of wastewater from the Zarqa Governorate and the capital city of Amman. Through separate investments outside of the compact, the Government of Jordan agreed to fund the fourth project, a conveyor pipeline to carry high-quality treated wastewater to agricultural areas in the Jordan Valley; and contributed \$20 million to expand wastewater pumping stations to complement MCC's investments in the sector.

MCC and the Government of Jordan signed a five-year, \$275.1million compact in October 2010, to address the constraints outlined above. At that time, the Government of Jordan and MCC estimated that the compact would benefit more than 3 million people over 20 years, laying the groundwork for sustained economic growth by expanding access to clean water and improving wastewater treatment.<sup>4</sup> This

modern, more efficient water and sanitation system would create new opportunities for households, communities and businesses, as well as support stability in the region. MCA-Jordan was created soon after signing the compact to implement its programs.<sup>5</sup>

At the end of the compact in December 2016, the Government of Jordan and MCC had spent 99 percent of the allocated compact funds to increase the supply of water available to households and businesses and help improve the efficiency of water delivery, wastewater collections and wastewater treatment. Given the nature of the investments, the entire kingdom's population is expected to benefit from them. Further details of the compact results and impacts found in the final independent evaluation reports [here](#) and [here](#) and are summarized in the evaluation briefs [here](#) and [here](#).

- Original Amount at Compact Signing:

\$275,100,000

- Amount spent:

\$272,934,551

- Signed:

October 25, 2010

- Entry Into Force:

December 13, 2011

- Closed:

December 13, 2016

Estimated benefits correspond to \$270 million of compact funds, where cost-benefit analysis was conducted.

- 9,000,000 Estimated beneficiaries over 20 years
- \$596,000,000 Estimated net benefits over 20 years

(2012 USD) The total compact revised at time of signing

- [Compact Agreement](#)
- [Constraints Analysis](#)
- [M&E Plan](#)
- [M&E Plan](#)

# As-Samra Wastewater Treatment Plant Expansion Project

- \$93,030,000 Original Compact Project Amount
- \$97,882,950 Total Disbursed

## Estimated Benefits

Estimated benefits are included in the [Wastewater Network Project table](#).

## Project Summary

The As-Samra Wastewater Treatment Plant was constructed in 2008 with support from the U.S. Agency for International Development (USAID) to replace the highly polluting waste stabilization pond system outside Amman, and is the primary facility for treating wastewater from Jordan's Amman and Zarqa Governorates. However, the demands of a growing population had pushed the capacity of the plant to its limits. Without an expansion to properly handle the region's growing volume of wastewater, the plant would be overloaded, its ability to treat wastewater would deteriorate, and downstream agricultural areas that rely on treated water for irrigation would face serious food safety risks and the loss of markets for agricultural products. The objectives of the As-Samra Expansion Project were to (i) increase the capacity to treat wastewater from Amman and Zarqa Governorates, (ii) increase the volume of treated wastewater that is available as a substitute for freshwater for non-domestic use, and (iii) protect existing agriculture from the potential consequences of pollution from untreated wastewater.

Under a project finance public-private partnership, with help and a funding commitment from MCC, the plant underwent an expansion and technological upgrades, which allowed the Government to treat 70 percent of the country's wastewater and meet the region's wastewater treatment needs through 2025. The plant has improved the long-term sludge management and disposal practices and helped preserve Jordan's scarce water resources. The expanded plant provides 133 million cubic meters of high-quality treated water per year – equivalent to over 10 percent of Jordan's entire annual water resources – for irrigation in the Jordan Valley.

At the end of the compact, approximately 375,000 households (2,023,000 individuals) in the Zarqa Governorate and neighboring Amman benefitted from the project through additional supplies of freshwater transferred to these areas as larger volumes of treated wastewater were made available for substitution in agricultural applications in the Jordan Valley. This included approximately 8,500 households in the Jordan Valley (46,000 individuals) that receive consistent supplies of high-quality treated wastewater that can be used for irrigation. The As-Samra plant also provides bio-solids for potential reuse in fertilizer and fuel, and produces nearly 13 megawatts of energy, or 80 percent of its own energy needs, from biogas and hydropower, making it one of the most modern and energy efficient treatment plants in the Middle East.



Additionally, unused budget identified during implementation of other parts of the compact was reallocated to the project to purchase four high pressure jetting sewage cleaners enhance system maintenance and capacity, thereby leading to a longer life-span of the sewage lines. More information can be found in the Compact Changes section below.

The project was financed as a public private partnership using a build-operate-transfer arrangement. In these arrangements, a government assigns responsibility to a private sector entity to finance, design, build, operate, and maintain the facility for a certain period. The As-Samra expansion was financed in partnership with the Samra Wastewater Treatment Plant Company Limited (SPC), a private company that built the original plant and operates it under a concession from the Government of Jordan. Under this arrangement, the compact covered half the cost of construction, while SPC mobilized debt and equity funding to cover the remaining construction costs, along with project development and design, project management, and interest costs. Due to the grant nature of MCC's investment, the project was more affordable for the Government of Jordan and financially attractive for SPC and Jordanian banks. MCC's grant did not subsidize the private sector, as the private investors earn a return only on their investment. MCC's involvement also reduced the cost of capital, allowing lower water and wastewater tariffs to consumers than might otherwise had been necessary. Through this financing method, the private sector not only provided over 50 percent of the cost of construction, but it assured the Government that the facility will be operated and maintained at world class standards for 25 years. At the end of the concession period, in 2037, the agreement requires that the facility be transferred back to the Government of Jordan in good working order and at no additional cost. The project won international awards, including the "Water and Energy Exchange International Award for Innovative Financing," and the "Best Water Project Award" by World Finance Magazine.

The project represented MCC's first major participation in a build-operate-transfer agreement, and its role in providing what is referred to as "viability gap funding" was critical to expanding As-Samra. MCC also provided grant funding for the Jordanian government to hire transaction advisors to assist the Ministry of Water and Irrigation in the project's commercial negotiations.

## Key Performance Indicators and Outputs at Compact End Date

Key performance indicators and outputs at compact end date

Activity/Outcome	Key Performance Indicators	Baseline	End of Compact Target	Quarter 1 through Quarter 20 Actuals	Percent Compact Target Satisfied
As-Samra Expansion Project	Treated wastewater used in agriculture (%)	61	70	71	111%

Activity/Outcome	Key Performance Indicators	Baseline	End of Compact Target	Quarter 1 through Quarter 20 Actuals	Percent Compact Target Satisfied
<i>Outcome: Increase the volume of treated wastewater available as a substitute for freshwater in agricultural use</i>	Quality of As-Samra effluent meets standard (days)	0	0	6	100%
	Volume of waste water effluent discharged from the As-Samra plant per year (cubic meters)	65,000,000	99,000,000	109,445,676.78	131%
	Agriculture use of treated wastewater (hectares)	13,700	15,900	12,100	-73%
	Expansion of As-Samra Treatment Plant (%)	0	100	100	100%

## Explanation of Benefits as of Compact End Date

As of compact end date, the As-Samra Expansion Project successfully increased the amount of clean, treated water (quality effluent) available to farmers for irrigation in the Jordan Valley. Despite the increase in available treated water, agriculture use of treated wastewater by farmers in the Jordan Valley fell over the course of the compact. This reflects a broader decline within the Jordan Valley in the total number of hectares under cultivation. See “Evaluation Findings” for information on how this trend developed after the compact.

## Evaluation Findings

Independent evaluations for the Jordan Compact covered more than one project. The results of each independent evaluation, which is included below.

### Jordan Water Infrastructure Evaluation

In line with the cost benefit analysis, the evaluation measured three key benefits that were expected to arise as a result of the compact investments in Jordan. The key evaluations questions and key findings are stated below. More detail can be found in the [final independent evaluation report](#) and summarized in the [evaluation brief](#).

### Evaluation Questions:

1. **Water Supply:** Did the compact investments result in increased irrigation with additional blended water (freshwater + wastewater) in the Jordan Valley? Is the volume of irrigation using freshwater correspondingly decreasing? What reallocation of water is made possible by the compact investments?
2. **Water Consumption:** Did the WNP change the quantity of water consumed by households and enterprises in Zarqa (through reduced leaks and increased reliability)? Did the WNP affect time and money expenditure on water for consumers in Zarqa?
3. **Utility Performance:** Did the net cost recovery of the utility improve due to the compact, and is this related to service improvements? Did the WNP change consumer expenditure on wastewater management and disease prevention and treatment?

## Key Findings

- **Water Supply**
  - MCC expanded Zarqa's sewer networks, resulting in 5 million m<sup>3</sup>/per year more wastewater flowing to the As-Samra Wastewater Treatment Plant compared to what would have happened without the compact. This water was successfully treated by As-Samra and released to farmers in the Jordan Valley, which freed up more freshwater for consumers in Zarqa.
  - Farmers in the Jordan Valley increased use of blended water (a mix of treated wastewater and freshwater) for irrigation as a result of WNP efforts. Farmers did report declining quality in their irrigation water compared to controls, although total farm revenues did not decline.
  - This increased use of additional treated wastewater for irrigation allowed more fresh water (4-6 million m<sup>3</sup>/year, which is 0.5% of total national water use/year) to be supplied to urban areas in Jordan, and this amount may continue to increase over time reaching as much as 11 m<sup>3</sup>/year by 2050.
- **Water Consumption**
  - Billed consumption increased by 2-3 m<sup>3</sup>/quarter per connection, though some of this change was due to more accurate meter reading. There was no evidence that residents spent less on alternative, more expensive water sources, such as bottled water, an objective of the compact. The theory that consumers would shift towards utility water and away from such other water sources, thus saving time and money, did not materialize.
- **Utility Performance**
  - The Jordan Compact appears to have improved the Zarqa water utility performance, reducing administrative losses (via water meter replacement) and non-revenue water, or NRW (water that the utility does not collect payment for because of theft, billing errors, or leaks). However, decreases in NRW lagged expectations, perhaps due to lack of complete isolation of the improved network from the old network, or illicit water use.
  - Utility revenue increased, but so did costs. However, these changes may be due to the utility's privatization rather than the compact.
  - Operating costs rose. This was because compact infrastructure was not fully operated as expected, using more pumping than expected, relative to gravity-fed distribution, and because of the costs of additional wastewater management. Energy costs also rose more than expected. Finally, the pumping of expensive water from the Disi aquifer also increased costs over time, though this increase was expected.

## Water Smart Homes Evaluation

An additional evaluation was conducted on the Water Smart Homes (WSH) component of the Jordan Compact investments, the evaluation questions and key findings of which are stated below. More detail can be found in the [final independent evaluation report](#) and summarized in the [evaluation brief](#).

## Evaluation Questions

1. Did the WSH Outreach Campaign lead to significant changes in household water handling and storage that manifested in a) improved water potability and b) improved water efficiency at the household level?
2. Did the WSH Infrastructure Works Program lead to infrastructure improvements among beneficiaries?
3. Did National Aid Fund (NAF) beneficiaries experience economic benefits from these infrastructure and behavioral changes, specifically through reduced coping costs, increased household productivity, and/or improved health and well-being?
4. Did the plumbers training portion of the Water Smart Homes intervention lead to long term capacity and employment opportunities for the women who participated?

## Key Findings

- Outreach Campaign: Message Recall and Response
  - No evidence that households recalled the messages from the Water Smart Homes outreach campaign.
  - The WSH outreach campaign messages did not lead to changes in household water handling or water sourcing.
  - The WSH outreach campaign did not contribute to the project objective of reducing water-related costs for households.
- Household Water Infrastructure: Works Receipt and Usage
  - Most households targeted for infrastructure home improvements in water storage, water delivery, and sanitation received them, and still had them four years later.
  - Targeted households did not appear to use more piped water relative to non-targeted households but were 9 percentage points less likely to use tanker water.
  - There was no evidence of changes in household water-related costs, productivity, health, or well-being.
  - The WSH infrastructure improvement investments did not contribute to the project objective of reducing water-related costs.
- Women Plumber Program
  - 17 of the 26 trainees interviewed were still working as plumbers four years later (there were 30 trainees in total from the project).
  - Trainees' median personal income increased by 70 Jordanian Dinars/month, and their household income also increased, though this could have been due to factors other than the training.
  - While these results are positive, the women plumber program was always logically disconnected from the project objective of decreasing household water costs and therefore did not contribute to achieving it.

## Status of the evaluations:

Component	Status
<b>Water Infrastructure Evaluation</b>	
Baseline Report	Published in 2017
Midline Report	Published in 2019
Final Report	Published in 2020
<b>Water Smart Homes Evaluation</b>	
Final Report	Published in 2020

## Wastewater Network Reinforcement and Expansion Project

- \$58,220,000 Original Compact Project Amount
- \$75,789,801.20 Total Disbursed

The Wastewater Network Project and As-Samra Wastewater Treatment Plant Expansion Project provided the Zarqa and Amman Governorates with a more efficient wastewater treatment plant to improve the quality of wastewater flowing into the Jordan Valley, as well as reinforced the wastewater system within Zarqa by reinforcing the sewer lines in the Governorate. Due to the shared goals of these two projects, MCC calculated a combined ERR. The table below shows the combined benefits of the two projects.

### Estimated Benefits <sup>7</sup>

	<b>Estimated Economic Rate of Return over 20 years</b>	<b>Estimated beneficiaries over 20 years</b>	<b>Estimated net benefits over 20 years (present value)</b>
<b>At the time of signing</b>	14%	2.0 million[[This corresponds to the population increment of Zarqa and Amman over 20 years plus about 50,000 agricultural beneficiaries. The total estimated beneficiary population would have been about 5.1 million if one considers the total population as beneficiaries and not the cumulative increment. This is the position for the end of compact re-assessment.](5.1 million revised)	2005 PPP \$602 million
<b>At compact closure</b>	21%	9 million <sup>8</sup>	2012 constant \$493 million (approximately

	<b>Estimated Economic Rate of Return over 20 years</b>	<b>Estimated beneficiaries over 20 years</b>	<b>Estimated net benefits over 20 years (present value)</b>
			2005 PPP \$700 million) <sup>9</sup>

The economic analysis for the Wastewater Network and As-Samra Wastewater Treatment Plant Expansion Projects was based on valuing savings in the cost of water supply for the Government of Jordan due to the substitution of treated wastewater for use in irrigated agriculture where more expensive surface fresh water otherwise would have been used. The estimated ERR for the projects increased from 14 percent when the compact was signed to 21 percent at the end of the compact due primarily to two factors. First, the project exceeded its civil works targets, providing higher water collection capacity than anticipated at the time of compact development. Second, the cost of bulk fresh water rose during compact implementation, increasing the value of cost savings from substituting treated wastewater for fresh water for the Government.

## Project Summary

In 2007, the wastewater collection system in Zarqa Governorate was limited in reach and endangered public health. The system frequently overflowed into city streets and the surrounding environment, relied on pump stations that had insufficient capacity, and did not serve nearly 30 percent of the population. The Wastewater Network Project represented the largest investment in wastewater infrastructure improvements for Zarqa Governorate system. The objectives of the project were to (i) increase access to the wastewater network, (ii) increase the volume of wastewater collected within Zarqa Governorate for treatment and reuse, and (iii) reduce the incidents of sewage overflow.

The Wastewater Network Project was originally comprised of two activities: (i) the reinforcement of existing networks and rehabilitation of existing sewer main lines in West Zarqa, and (ii) the reinforcement of existing networks and rehabilitation of existing sewer main lines in East Zarqa.

The project extended service to households that were not connected to the sewer network by constructing over 300 kilometers of new sewers in the neighborhoods of East Zarqa and West Zarqa, both of which lacked access to the sewer network. The extension of lateral sewer lines raised wastewater service coverage rates from 72 percent to about 84 percent of the local Jordanian population, though coverage rates of the full population dropped due to the influx of Syrian and Iraqi refugees. These new customer connections also generated additional wastewater. The project provided more than 8,700 connection points to the wastewater pipes, which allowed over 54,800 people to be connected to the new wastewater system. These new customer connections generated additional wastewater which is treated at the As-Samra Wastewater Treatment Plant and reused in agriculture downstream in the Jordan Valley. The project also utilized unused budget identified during implementation of the compact to add 65 kilometers of pipes to the Princess Haya neighborhood of the Zarqa Governorate and to purchase high pressure jet cleaning vehicles for the water utility to enhance system maintenance. More information can be found in the Compact Changes section below.

## Key Performance Indicators and Outputs at Compact End Date

Activity/Outcomes	Key Performance Indicators	Baseline	End of Compact Target	Quarter 1 through Quarter 20 Actuals	Percent Compact Target Satisfied
Wastewater Network Project Outcome: <i>Increase access to the wastewater network, increase the volume of wastewater collected and reduce the incidents of sewage overflow</i>	Number of Complaints Received About Sewer Blockage	8,500	2,000	3,307	80%
	Volume of wastewater collected (cubic meters/year - millions)	24	31	37.5	193%
	Percentage of the population connected to the wastewater network	72	85	67.4	-35%
	Percentage of the population connected to the wastewater network - forecasted population	72	85	83.7	90%
	Total number of wastewater network subscribers	94,778	119,793	131,499	147%
	Total number of wastewater connection points constructed by MCC	0	5,653	8,768	155%
	Kilometers of pipelines that are expanded, reinforced or rehabilitated	0	287.0	295.4	103%



## Explanation of Results as of Compact End Date

By applying unused budget identified during implementation of the compact, the Wastewater Network Project built more kilometers of pipes and connection points than expected. With this expansion, more people subscribed to the wastewater network at the end of the compact than forecasted. Despite increasing the number of people served by the wastewater network beyond the target, the percentage of the population connected to the wastewater network fell over the course of the compact by 35 percent. This was due to the sudden influx of Syrian and Iraqi refugees roughly halfway through the compact term, which caused the population in Zarqa to increase unexpectedly. Without the influx of refugees, if the population had grown at the rate expected at the beginning of the compact, the percentage of the population served by the network would have increased from 72 to 85 with the wastewater network expansion, nearly achieving the compact target.

Over the life of the compact, Miyahuna-Zarqa began managing the Zarqa utility and improved the customer service provided at the call center. With this improvement in response to customer complaints, more calls were recorded by Miyahuna each time there was a sewer network blockage. Despite the increase in number of calls and improvements in recording, the number of complaints received about sewer network blockage still fell substantially over the life of the compact, reflecting a better performing network.

## Water Network Restructuring and Rehabilitation Project

- \$102,570,000 Original Compact Project Amount
- \$88,604,173.94 Total Disbursed

<b>Estimated benefits</b> <sup>10</sup>	<b>Estimated Economic Rate of Return over 20 years</b>	<b>Estimated beneficiaries over 20 years</b>	<b>Estimated net benefits over 20 years (present value)</b>
<b>At the time of signing</b>	19%	1,633,400	2005 PPP \$207 million
<b>At compact closure</b>	13%	National population exceeding 9 million <sup>11</sup>	2012 constant \$103 million (approximately 2005 PPP \$164 million) <sup>12</sup>

The original economic rate of return (ERR) was based on three main benefit streams. First, there is an estimated addition to household income that would come about as people shift demand away from expensive water sources (e.g. tanker water), to the less costly network water supply. Second, this shift was expected to also generate health benefits as a result of increased access to clean water. And third, the investment was expected to lead to lower water production costs as a result of reducing physical losses in the rehabilitated water network.

The closeout ERR is estimated at 13 percent, lower than the original rate, but still above MCC's 10 percent threshold. This number was driven by benefits realized from lower water production costs. However, the other two benefit streams did not take shape as projected at the beginning of the compact, resulting in a close-out ERR that declined below the original estimate. In the case of the first benefit stream, households in Zarqa were actually spending more on water that does not come from the network, like tanker and bottled water, at the end of the compact than they were before the compact began. While it was too soon to know whether this reflects the impact of the project (the new system had only been operational for a few months when the surveys that informed the closeout ERR were conducted), it means that households had not yet started to save money on water at the end of the compact.

This case highlights the potential significance of perceptions of people within the theory of change that underpins ERR estimates. Social perception, for example, trust in public services, is often not explicit and may not inform the project logic. But such perception can be a major determinant of investment performance that influences the level of use of a public service. Particularly when public demand is sensitive to the public's trust in service quality, perceptions may change slowly. In the future, the use of social networking might be a necessary tool to deploy in design of similar projects.

Additional data on how the project impacted the amount households spend on water is now available and may be used to generate an evaluation-based ERR<sup>13</sup>. For the second benefit stream, while it was originally thought that the project would generate economic benefits through improved hygiene and water consumption, research that emerged during the compact period indicated that water borne diseases are not driving health costs in Jordan.

## Project Summary

At the time of compact development, an estimated 50 percent of potable water supply in the Zarqa Governorate was lost through a combination of physical leaks, water thefts and administrative mismanagement. The water transmission and distribution network suffered from substantial disrepair, with parts comprised of cheap, flexible pipes that ran above ground through residential streets, where they were subject to puncture, wear and tear. Nearly 10,000 leaks were reported each year. The Water Network Project represented the largest investment in the water sector in the Governorate at the time. The objectives of the project were to (i) improve the efficiency of network water delivery and the condition of home water systems, and (ii) decrease certain costs that households in Zarqa Governorate incur to satisfy their basic water needs.

Through the Infrastructure Investment Activity, the project reduced high water losses by repairing and upgrading transmission and distribution pipes throughout Zarqa. The activity rehabilitated 864.7 kilometers of water pipes, built a new pump station, and installed 41,650 household water meters. It established clearer and more efficient district metering areas (DMAs), laying the foundation for better operation and management of the entire water utility. The activity also contributed to a decline in commercial and physical water losses from 61.6 percent to 50.7 percent across the Zarqa Governorate during the life of the compact, helping the Government manage increased pressure on water resources due to endemic water scarcity, population growth and the influx of Syrian refugees. The reduction of physical losses improved the cost recovery of the Zarqa water utility. The utility expected to achieve full cost recovery of operations and maintenance by 2019. (see “Evaluation Findings” for the challenges faced in this effort). In addition to reducing physical leaks, the project established the transition from periodic distribution under high pressure to more frequent gravity-fed distribution that improved customer service, reduced wear and tear on critical infrastructure, and extended the lifespan of the network.

The Water Smart Homes Activity improved the quality of plumbing and water storage in the homes of 3,958 poor families in Zarqa as well as in 22 public schools. The overall objective of the activity was to improve the condition of home water systems and decrease the water costs of households, particularly poor households. The activity used a two-prong approach: an outreach campaign on in-house water management of water quality and water conservation; and an infrastructure component that replaced or improved the plumbing and water storage systems of poor households. As a result, 3,958 households were supplied with improved water and wastewater. In addition, thirty women received training and tools to become self-employed as plumbers in response to a need within the community to sustain water improvements and proper management of resources. Some of these women worked as plumbers for construction companies responsible for implementing household water repairs under the compact, including replacing water tanks.

In addition to the original activities included in the compact, unused budget identified during implementation allowed MCA-Jordan and MCC to reallocate \$1,617,145 to fund construction of a new water utility administration building, intended to enhance the utility's operation and maintenance activities by placing staff in the same location and creating more space for customer service.

## Key performance indicators and outputs at compact end date

Activity/Outcomes	Key Performance Indicators	Baseline	End of Compact Target	Quarter 1 through Quarter 20 Actuals	Percent Compact Target Satisfied
Infrastructure Investment ActivityOutcome: <i>Reduce water losses, improve continuity of water service and improve overall efficiency and use of network water delivery leading to household substituting network water for costly alternatives</i>	NRW -Network Wide	61.6	46.6	50.7	72%
	NRW – MCC DMAs		19.3	35.5	62%
	NRW – Non-MCC DMAs		—	70.4	—
	Continuity of Supply – Network Wide	36	70	51.5	45%
	Continuity of Supply – MCC Areas		—	42.5	—
	Continuity of Supply – Non-MCC Areas		—	48.0	—
	Kilometers of pipelines that are expanded, reinforced or rehabilitated	0	741	864.7	117%
	Replacement of customer meters	0	36,168	41,650	115%
Water Smart Homes ActivityOutcome: <i>Reduce water losses, improve continuity of water service and improve overall</i>	Number of National Aid Fund households with improved water and wastewater network	0	4,494	3,958	88%

Activity/Outcomes	Key Performance Indicators	Baseline	End of Compact Target	Quarter 1 through Quarter 20 Actuals	Percent Compact Target Satisfied
<i>efficiency and use of network water delivery leading to household substituting network water for costly alternatives</i>	Number of people who attended the awareness sessions	0	52,200	64,002	123%

## Explanation of Results as of Compact End Date

The Water Network Project replaced more pipes and customer meters than planned at the beginning of the compact. At the end of the compact, non-revenue water and continuity of water supply remain higher than their end of compact targets. The higher than expected level of these outcome measures reflects the complex nature of the water network in Zarqa and the challenge of accurately measuring the benefits of the project to how the network functions.

Non-Revenue Water (NRW) measures the water that is pumped and then lost or unaccounted for, and is challenging to capture in Zarqa due the sprawling water network that must serve a rapidly growing population. Measuring NRW accurately requires reading nearly 170,000 customer meters on a consistent basis. While Miyhauna-Zarqa (the water utility) continues to make operational improvements, reading every customer's meter regularly is a long term goal, rather than a short-term reality. In recognition of this fact, MCA-Jordan and MCC worked with Miyahuna-Zarqa to measure NRW in areas where the compact improved the network and a selection of areas that were not improved. Areas with the improved network have a NRW of only 35.5 percent as compared to 70.4 percent in areas where the old network remains, reflecting the significant reduction in the amount of water leaked from the pipes in compact areas.

While this represents a significant improvement, NRW in compact areas is still not as low as the end of compact target. NRW is a combination of the amount of water lost from the pipes and commercial losses at the utility. At the beginning of the compact, MCC and MCA-Jordan assumed that the majority of the measured NRW was water leaked from the pipes, which was measured at zero in pressure tests performed on compact constructed pipes. Seven years later it is apparent that commercial losses are a bigger challenge in Zarqa than previously understood. USAID is building on the compact and working with the utility to reduce its commercial losses in order to reduce NRW even further.

MCC and the Government of Jordan originally expected that the investments would increase the hours of available water to customers. This expectation changed with improved understanding during the compact of how hours of supply were allocated and measured on the network. The utility in Zarqa reports the scheduled number of hours that engineers plan to allow water to flow to the network, not the continuity of supply. This means they capture the expectations of the network managers for how much water will be needed to service the demand in different areas, not how many hours of water different parts of the

network actually receive. In recognition of this measurement challenge, MCC and MCA-Jordan worked with Miyahuna-Zarqa to record the actual numbers for water serving compact areas and non-compact areas at the end of the compact.

Given this, the lower number of hours of water supplied to the network in compact areas reflects the reduction in physical losses in those areas of the network. When determining how many hours of supply to offer, the engineer watches the speed of the flow of water out of the reservoir. Miyahuna engineers report that when serving the areas improved by the compact, fulfilling customer demands requires fewer hours of supply and, thus, less water due to the reduction of leaks in compact areas.

## Compact Changes

Soon after entry into force of the compact in 2012, \$4.5 million was reallocated to the As-Samra Expansion Project from Program Administration and the Wastewater Network Project following an increase in cost of the original project due to inflation in construction costs and exchange rate pressures attributed to the movement in the euro, which led to prolonged negotiations. This modification increased the engineering, procurement and construction cost of the Project from \$88.8 million to \$93.4 million.

In 2014, compact budget savings were realized due to lower than expected construction costs on the Water Network Project and As-Samra Expansion Project as well as contingencies that were no longer necessary for the ongoing works projects. Between 2014 and 2016, these and other savings were re-allocated to the Wastewater Network Project and As-Samra Expansion Project to fund the following activities:

- Wastewater Network Project
  - Princess Haya Network Expansion. The compact was able to re-program \$18.9 million between 2014 and 2016 to fund approximately 65 km of wastewater network pipes in the Princess Haya neighborhood of Zarqa. This area had been studied during the project due diligence phase of the compact development process as it was adjacent to and west of the Wastewater Network Project area. During compact negotiations, it was determined that insufficient funds were available to further pursue this venture, and therefore the Princess Haya network was originally removed from the initial compact scope.
  - WAJ Administration Building. MCC reallocated approximately \$1.6 million between 2014 and 2016 to fund a consolidated administrative and operations building to house the local offices of the Water Authority of Jordan (WAJ), an autonomous corporate body linked to the Ministry of Water and Irrigation, responsible for the public water supply, wastewater services, and overall water resources planning. The construction of this building upgraded the operations capability of WAJ and enhanced customer service, thereby leading to ongoing stakeholder engagement and community involvement and improving the sustainability of the compact investment.
  - Sewer Jet Cleaning Equipment. Six (6) high pressure jetting sewage cleaners at a cost of \$964,000 were purchased to enhance system maintenance and design capacity, thereby leading to a longer life-span of the sewage lines. These were deployed by WAJ-Zarqa.
- As-Samra Expansion Project
  - Sewer Jet Cleaning Equipment. Four (4) high pressure jetting sewage cleaners at a cost of \$762,000 were purchased to enhance system maintenance, thereby leading to a longer life-span of the sewage lines. These were deployed by WAJ-Amman.

## Coordination and Partnerships

The Jordan Compact benefitted from successful donor coordination. MCC and USAID cooperated closely to help ensure that the United States' investments in Jordan's water sector were mutually reinforcing, cost-effective and sustainable. Input and collaboration between USAID and MCC played a significant role in the development of the As-Samra Wastewater Treatment Plant Expansion Project which built on previous work of USAID. USAID shared lessons learned on the original build-operate-transfer transaction of the plant. The agencies also collaborated on a feasibility study of bio-solid and sludge at the As-Samra Wastewater Treatment Plant. The study examined ongoing stockpiling of dried sludge and bio-solids at the plant, and developed short- and long-term solutions for proper use and disposal, including reuse in agriculture and land application. The results will assist the Government of Jordan in establishing a reuse strategy and developing related standards and guidelines. The organizations coordinated on sector policy, particularly during the development of the new National Water Strategy which called for a better management of scarce water resources and in analyzing tariff scenarios, on which USAID was the lead donor.

As previously stated, the compact's Women Plumbers Program (WPP) trained 30 women in semi-skilled plumbing. While a few of the trained women found employment, others needed further support to become economically active. To support program sustainability, MCC and MCA-Jordan explored establishing partnerships with other existing programs that support women's entrepreneurship in Jordan. USAID's Local Enterprise Support project will provide further support (training in business skills, coaching and provision of grants) to 24 of the 30 women graduates of the WPP to establish themselves as entrepreneurs through 2020.

MCC and the Government of Jordan also worked closely with donors most active in the water sector, including Japanese International Cooperation Agency (JICA), Germany's Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) and Kreditanstalt für Wiederaufbau (KfW). MCA-Jordan established a water advisory group that included representatives from USAID, GTZ (which represented KfW), and JICA. In addition, MCC and MCA-Jordan participated in a donor-lender task force to coordinate water sector projects in Zarqa, under the leadership of GTZ.

The complementary investments by the Government and other donors will amplify and improve sustainability of the MCC compact. The Government contributed a total of \$92.4 million in improvements in the water sector in Zarqa—exceeding the compact agreed-upon amount of \$73.7 million. These funds, managed independently, were used for the construction of additional pumping stations, wastewater and water lines, water meters and O&M training.



## Conditions Precedent

### Key Conditions Precedent

Key Compact Component(s)	Major Condition Precedent or Policy Reform Required	Rating
	<p><b>All Projects</b></p> <p>As a CP to the compact, the Government of Jordan is required to develop and implement a cost recovery plan, which may include tariff reforms, to achieve full cost recovery of the O&amp;M operations. (b) Prior to the first Disbursement of Program Funding after the second anniversary of the entry into force of the compact, the Government will have submitted an update to the plan originally submitted to MCC in November 2011. (c) Prior to the first Disbursement of Program Funding after the third anniversary of the entry into force of the compact, the Government will have submitted to the Council of Ministers a proposal, in form and substance satisfactory to MCC, requesting the tariff index adjustments identified in the plan.</p>	<p>1st Update Plan Submitted on April 1, 2014. The agreed tariff adjustments outlined in the Plan were implemented on May 7, 2014 when the Government of Jordan increased the wastewater tariffs by 15% and these changes became effective on July 1, 2014.</p>
As-Samra Wastewater Treatment Plant Expansion Project	<p><b>Cost recovery plan, to achieve cost recovery of the projected Treatment Charges as a result of the As-Samra Expansion Project.</b></p> <p>As a CP to the compact, the Government of Jordan is required to develop and implement a cost recovery plan, which may include tariff reforms, to achieve full cost recovery of the projected Treatment Charges as a result of the As-Samra Expansion Project. (2) Prior to the first Disbursement of Program Funding after the second anniversary of the entry into force of the</p>	<p>1st Update Plan Submitted on April 1, 2014. The agreed tariff adjustments outlined in the Plan were implemented on May 7, 2014 when the Government of Jordan increased the wastewater tariffs by 15% and these changes became effective on July 1, 2014.</p>

Key Compact Component(s)	Major Condition Precedent or Policy Reform Required	Rating
	compact, the Government will have submitted an update to the plan originally submitted to MCC in November 2011. (3) Prior to the first Disbursement of Program Funding after the third anniversary of the entry into force of the compact, the Government will have submitted to the Council of Ministers a proposal, in form and substance satisfactory to MCC, requesting the tariff index adjustments identified in the plan.	
As-Samra Wastewater Treatment Plant Expansion Project	<p><b>Establish an improved regime for storage, reuse and/or disposal of sludge according to international best practices</b></p> <p>Prior to the first Disbursement of Program Funding after June 30, 2013 the Government will have provided a duly signed contract for the feasibility study for a facility or facilities for the permanent disposal of sludge from the As-Samra Expansion Plant. Prior to the first Disbursement of Program Funding after December 31, 2014, the Government will have provided evidence satisfactory to MCC, that the Government has committed sufficient funds for the construction of the facility or facilities for the permanent disposal of sludge from the As-Samra Expansion Plant.</p>	<p>Met</p> <p>Feasibility Plan CP met June 2013. Financing for final disposal facility secured by WAJ from KfW on Dec 04, 2014.</p>

## Lessons Learned

**The Jordan Program’s clear focus—concentrated in one location (Zarqa) and in a single sector (Water)—made the works easier to manage, more impactful, and increased the likelihood of sustainability:** Concentrating on a single sector improved program management as it allowed for the recruitment of a highly trained water sector management team at MCA-Jordan with ready access to works at site. The program was highly visible in Zarqa due to its large-scale civil works that demonstrably improved water and wastewater infrastructure while also promoting awareness of issues regarding water availability and use in Jordan. This gave the program appreciable name recognition among the Jordanian people and may have promoted positive association with the United States. Finally, the program reinforced sustainability through multiple improvements to the water utility and its staff, policy changes, personnel training, equipment modernization and infrastructure improvements. These efforts are expected to enhance the operating structure and efficiency of the utility making it more cost effective and sustainable.

**Participating in a public private partnership (PPP) can prolong the compact development timeline:** While the As-Samra Wastewater Treatment Plant Expansion Project was successfully completed in advance of the five year compact implementation period, participating in a PPP slowed the compact development process. To ensure full commitment to the As-Samra PPP expansion, MCC required that all parties to the PPP agreement complete their negotiations and reach financial close prior to implementation. The negotiation period of any PPP is difficult to anticipate as project risks need to be addressed, allocated and agreed upon by the parties at this stage. As a result of protracted negotiations and a large number of signed agreements, the Jordan Compact development process lasted months longer than initially anticipated. However, the final result was an expansion of a world class wastewater treatment facility, guaranteed to sustainably operate for 25 years. If MCC pursues a similar arrangement in the future, it should anticipate the need to allow flexibility in the compact development timeline.

**Meeting the MCC’s five year implementation period remains challenging:** Final project results can, as in Jordan’s case, meet or exceed its initial compact design, but a smoother implementation can be achieved through better planning during the compact development process and flexibility during the implementation period. In major construction projects, a number of activities can be unplanned, and not having sufficient time to account for them can lead to many challenges. As an example, after awarding the wastewater contracts, it became clear that some of the technical designs were incorrect and needed to be revised. As there was no time to re-tender for new designs, MCA-Jordan mitigated this challenge by instructing its contractors to carefully commence limited works in parallel with finalizing the newly revised designs. While the approach was ultimately successful, the risk assumed required additional oversight which was conducted under a compressed time period.

## Lessons Learned from the Evaluations

Details on these lessons can be found in the “MCC Learning” document in the Final Evaluation Report packages on MCC’s Evaluation Catalog.

### Lessons Learned from the Compact as a Whole:

- Assess data quality early.
- Engagement in the M&E Plan drafting process and the Evaluation Management Process is critical to ensuring relevant and accurate results measurement:
  - Performance indicator definitions should be reviewed in detail to ensure that they are measuring the right thing at the right time and to confirm that baselines and targets are accurate.
  - Ensure that a project's stated outcomes and objective can be measured. If necessary, incorporate elements in the project design that make these measurements possible.
  - When agreeing to an evaluation design, particularly impact evaluation, the team must adequately consider tradeoffs and agree to rules of implementation.
  - Data collection methods, particularly for technical measures requiring engineering expertise, should be reviewed closely in the Evaluation Design Report.
  - Once an evaluation methodology is agreed on in an Evaluation Design Report, the full Evaluation Management Committee must communicate continuously to ensure the design is preserved.
- Ensure the compact objectives (Section 1.2 & Section 1.3 of the compact agreement), logic diagrams, economic models and other communications about what the compact intends to do all align.
- Learning for Future MCC Economic Models: Primary Substitution Effect Takes Longer, and Secondary Substitution Effect Did Not Occur.
- Key Personnel Changes May Need Evaluation Management Committee Review.

### **Lessons Learned Specific to the “Water Smart Homes” Investment:**

- Investment objectives and the corresponding investment design need to be agreed and documented in the compact agreement.
- Be sure project designs are based on thorough due diligence.
- Consult a wide range of stakeholders to ensure the theory of change is feasible.
- Ensure a logical link between gender-focused investments and the objective of the project.

## Endnotes

1. Population estimates vary between 9.4 million (World Bank, World Development Indicators, 2016) and 8.2 million (CIA, World Fact Book, 2016), depending in part on the count of recent migrants.
2. Water scarcity, stress and security are related concepts, of which the last, from a development perspective, arguably is the most relevant. Jordan is among the most water scarce, stressed and insecure countries in the world (see [https://maplecroft.com/about/news/water\\_security.html](https://maplecroft.com/about/news/water_security.html), accessed February 2018). For information on the water sector in Jordan see <http://www.mwi.gov.jo/sites/en-us/Hot%20Issues/Jordan%20Water%20Sector%20Facts%20and%20%20Figures%202015.pdf>.
3. Regarding the impact of refugees on Jordan's resources see <https://www.mercycorps.org/research/tapped-out-water-scarcity-and-refugee-pressure-jordan>.
4. The beneficiary estimate was later changed to reflect the expectation that the primary benefit stream will be from lower production costs of water over time. This reduces fiscal demands on the public purse and implies macroeconomic benefits to Jordan (lower national debt, a lower tax burden on the public, or changing government expenditures). Such macro benefits imply beneficiaries beyond Zarqa households. This change in method for counting beneficiaries takes account of income impacts that are derived rather than intermediated.
5. Under MCC's country ownership model, governments receiving MCC assistance are responsible for implementing the MCC-funded programs. Partner governments establish units known as accountable entities referred to as MCAs to manage implementation for compact projects.
6. The goal of MCC's investment was to sustain the quality of As-Samra's effluent and avert any potential for contaminated discharge. This is reflected in the 0 baseline and 0 target.
7. Estimated benefits correspond to \$188 million of project funds, where cost-benefit analysis was conducted.
8. The higher beneficiary number reflects the revised view of project benefits as primarily comprising resource savings to the economy at large. To date, observations do not validate expected changes in consumer usage of water and expenditure on water that were anticipated at the time of compact development. The number includes a farming population in the Jordan Valley that would have lost livelihoods in the absence of access to treated waste water to substitute for declining available supplies of fresh surface water for use in irrigation.
9. The original presentation was in 2005 PPP dollars for international comparisons. The end of compact analysis was carried out in 2012 constant values.
10. Estimated benefits correspond to \$82 million of project funds, where cost-benefit analysis was conducted.
11. The higher beneficiary number reflects the revised view of project benefits as primarily comprising resource savings to the economy at large. To date, observations do not validate expected changes in consumer usage of water and expenditure on water that were anticipated at the time of compact development.
12. The original presentation was in 2005 PPP dollars for international comparisons. The end of compact analysis was carried out in 2012 constant values.
13. Work on generating an evaluation-based ERR should be completed in the autumn of 2020.



## Reducing Poverty Through Growth

