PUBLIC PRIVATE PARTNERSHIP THROUGH, BUILD-OPERATE-TRANSFER IN JORDAN WASTEWATER SECTOR

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Abstract

Jordan has embarked upon a process of involving the private sector in the delivery of water and wastewater services. For the first time in Jordan and may be in the Middle East, the Ministry of Water and Irrigation (MWI) awarded a Build-Operate-Transfer (BOT) contract shared between the Public and Private Sectors for the purpose of rising finance from the private sector and share all kinds of risks, in addition to allow competition in different technology transfer and know-how.

The contract includes Funding, Design, Built, Operate and transfer back to the Government of Jordan after 25 years. The project of this contract is a wastewater treatment plant named As-Samra which is the largest wastewater treatment plant in Jordan this pant was constructed in 1985, its original design parameters was 68000 m3/day as average daily flow, it needs to be upgraded to 267000 m3/day, the cost of this project is $169 millions, Government of Jordan is sharing with $78 million in this project to alleviate the cost of treating the wastewater of Amman and Zarqa Cities (the two largest cities in Jordan with a population about 3.5 millions), the consortium of American and French companies who was awarded the contract on July 28,2002 will share with the rest.

Keywords: HKJ, MWI, BOT, As-Samra

1. COUNTRY PROFILE – THE HASHEMITE KINGDOM OF JORDAN

1.1 Basic data

Jordan is 91,880 square kilometers in area and located between latitudes 20.5 and 30.5 degrees to the North and longitudes 35 to 39.5 degrees to the East. It lies within the arid and semi-arid climatic zones and has a typical Mediterranean short rainy winter and a long dry summer. Annual precipitation varies with the location and topography, but in general ranges from 50 mm in the desert to 600 mm in the North West highlands. This means that 91.4 percent of the total area of the Kingdom receives an average annual rainfall less than 200 mm, whereas three percent of this area receives an annual rainfall greater than 300 mm.

The population of Jordan was 5.2 million at the end of year 2002, the natural rate of growth of 2.8 percent is one of the highest growth rates in the world.

The consequences of this situation led to a large imbalance between supply and demand, continued depletion of valuable aquifers beyond the points of ever being replenished and un-equal water distribution by region.

1.2 Jordan's water resources

Jordan water resources consist primarily of surface and ground water, the renewable water resources in 2002 were estimated to be about 866 million cubic meters (mcm), including ground water (275 mcm distributed among 12 basins), usable surface water (519 mcm distributed among 15 catchments basins) and treated wastewater 72 mcm, an additional 140 mcm/year of ground water is estimated to be available from fossil aquifers. Brackish aquifers are not yet fully explored, but at least 50 mcm/year is expected to be available for urban uses after desalination, treated wastewater is being used on an increasing scale for irrigation, primarily in the Jordan River valley. In year 2002, approximately 517 mcm of water was used for agricultures, 249 mcm was used for municipal purposes, 37 mcm was used for industrial purposes, and 7 mcm was used for livestock purposes, or about 63.8%, 30.7%, 4.5% and 1%, respectively, (Table (1) and Fig. (1) show the water demand for various sectors).

Again this reflects more limitations on the water supply than the actual demand, in general water used by the domestic sector has increased from 20% in 1990 to 30.7% in 2002 and water used by agricultural sector has decreased from 75% to 63.8% for the same period, in 2002, abstraction of groundwater resources exceeded the safe yield by 169 mcm.

Table 1: Water Demand for Various Sectors in mcm

	1995	2000	2005	2010	2015	2020
Agricultural	790	922	981	1002	992	963
Municipal	274	321	382	435	520	615
Industrial	37	54	80	102	134	168
Total	1101	1297	1443	1539	1646	1746

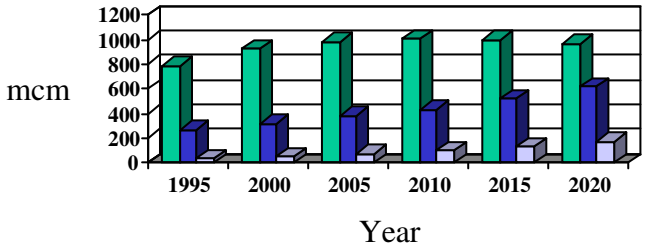

Fig 1: Water Demand for Various Sectors in mcm

In 1995 the total renewable water resources available was 657 mcm, this quantity gradually increased and will be increased as new development programs were and will be implemented. By 2020, Jordan will develop an estimated 1170 mcm of renewable water resources as shown in Table (2) and will be utilizing about 140 mcm of non-renewable ground water resources, the total water supply will approximately be 1310 mcm.

Table 2: Water Supply 1995-2020 in mcm

	1995	2000	2005	2010	2015	2020
Ground Water (Renewable)	277	277	277	277	277	277
Surface Water	215	220	227	234	234	234
Yarmouk River	107	155	235	235	235	235
Lower Jordan River	0	0	30	30	30	30
Wastewater Reuse	58	87	112	177	219	246
Peace Treaty (50 MCM)	0	30	50	50	50	50
Brackish Ground Water	0	0	44	55	75	88
Seawater Desalination	0	0	5	5	10	10
Fossil Ground Water	71	61	130	140	140	140
Total	728	830	1110	1203	1270	1310

Despite the proposed investment program for the water sector from the year 2002 to the year 2011 (US $ 2.5 billion in value), Jordan will be facing considerable water deficits each year, the water deficit for all uses will grow from about 373 mcm in 1995 to 436 mcm by the year 2020, as shown in Table (3) and Fig. (2), this deficit will continue to be covered partially by mining the ground water (i.e. abstraction in excess of the safe yield), its rate exceeds 20% of the safe yield, because no other option is available.

Table 3: Total Demand, Available Sources and Deficit in mcm

	1995	2000	2005	2010	2015	2020
Demand	1101	1297	1443	1539	1646	1746
Sources	728	830	1110	1203	1270	1310
Deficit	373	467	333	336	376	436

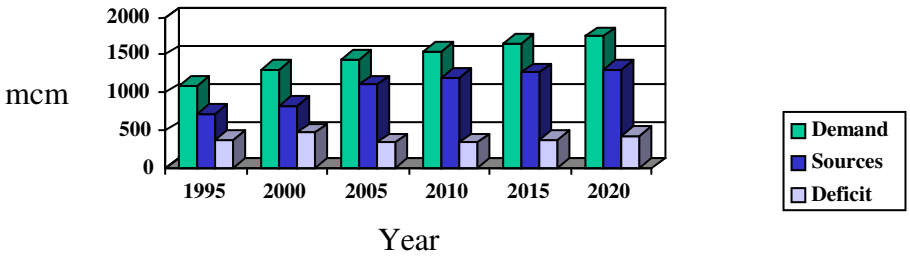

Fig 2: Total Demand, Available Resources and Deficit in MCM

Water resources as mentioned consist of surface water, ground water, and treated wastewater being used on an increasing scale for irrigation, it is generated at nineteen existing wastewater treatment plants as shown in table (4), it is an important component of Jordan's water resources with a total flow of 88.55 mcm in year 2003, the majority of the treated wastewater is discharged into various water courses and flows to the Jordan valley where it is used for irrigation.

Table (4): Actual Flow to Wastewater Treatment Plants in 1995, 2000 and 2003

	Year	1995	2000	2003
		m^3/day	m^3/day	m^3/day
1.	Samra	143441	170752	178902.3
2.	Aqaba	6014	8804	9329.3
3.	Irbid	7620	4610	7121.3
4.	Salt	3870	3403	3898
5.	Jerash	1450	2072	2913
6.	Mafraq	1290	1847	1805
7.	Balqa	6920	11185	11768
8.	Karak	1165	1231	1508
9.	Abu Nuseir	1497	1617	1977
10.	Tafila	1013	707	740
11.	Ramtha	1431	2340	2300
12.	Ma'an	1530	1892	2155
13.	Madaba	2440	4266	4178
14.	Kufrainja	730	1889	2223
15.	Wadi Seer	-	1113	1917
16.	Fuhis	-	1218	1523
17.	Wadi Araba	-	5985	7063
18.	Wadi Mousa	-	-	866
19.	Wadi Hassan	-	-	423
20.	Total m^3/day	180411	224931	242609.9
21.	Total (mcm)			
22.	m3/yr	65.9	82.324	88.55

Wastewater quantity is increasing with the increase of population, increase of water use and the development of sewerage system, the population is projected to be about 9.9 million by the year 2020, and the percentage of the population connected with sewerage service will increase from the current 60% percent today to percentage that will cover most of the townships and cities of the country, about 246 mcm per year of wastewater are expected to be generated in 2020 as shown in Table (5).

Table 5: Shows the future development of wastewater resources in mcm

Year	2005	2010	2015	2020
Wastewater inflow to treatment plants	146	177	219	246
Wastewater effluent of treatment plants	112	170	202	231
Treated wastewater inflow to reservoirs	-71	-86	-100	-114
Remaining treated wastewater resources	67	84	102	117

1.3 Jordan's water strategy

The Ministry of Water and Irrigation of Jordan prepared in April of 1997 a draft Water Strategy for Jordan, it was discussed and amended through contributions from the officials of the Ministry, the Jordan valley Authority (JVA) and the Water Authority of Jordan (WAJ), it was then forwarded to the Prime Minister who had it debated, augmented and approved by the Ministerial Development Council, and later discussed and endorsed by the Council of Ministers.
The Strategy defines long term goals that the government of Jordan seeks to achieve in the water and wastewater sector, following are some of these main goals for the wastewater sector.

- Wastewater shall not be managed as "waste". It shall be collected and treated to standards that allow its reuse in unrestricted agriculture and other non-domestic purposes, including groundwater recharge.

- Management of wastewater shall receive attention with regard to public health standards, industrial wastewater shall be carefully watched to avoid degradation of the quality of the effluent of wastewater treatment plants destined for reuse.

- The role of the private sector shall be expanded, the concepts of BOT shall be entertained and the impact of such concepts on the consumers shall be continually addressed and negative impacts mitigated. The private sector role in reuse of treated effluent shall be encouraged and expanded.

1.4 Jordan's water policies

Under Jordan's Water Strategy, services of policies were formulated by the Ministry of Water and Irrigation (MWI) and its two authorities JVA and WAJ and adopted by the competent bodies of Government.
Water Utility Policy, Irrigation Water Policy, Ground Water Management Policy and Wastewater Management Policy were prepared by the Minister and his staff; the Board of Directors in JVA and WAJ debated and approved them. These documents were then forwarded to the Prime Minister for consideration by the Ministerial Development Council, who reviewed and debated and the council of Ministers approved them in several dates in 1997 and 1998, these polices included the following.

1.4.1 Private sector participation

It is the intention of Jordan through private sector participation to transfer management of infrastructure services of water, wastewater and irrigated agriculture from the public to the private sector in order to improve performance, and upgrade the level of services.
The role of the private sector will expand with management contracts, concessions, BOT/BOO and other forms of private sector participation.

1.4.2 Water quality control and environment

Jordan has witnessed some deterioration in its water quality in the last two decades due to industrial pollution, over use of agrochemicals, drainage water, overloading of waste water treatment plants, over pumping of aquifers seepage from landfills and septic tanks and the improper disposal of dangerous chemicals by certain industries.
Jordan as well as many other countries has adopted international water quality standards or guideline values developed by the World Health Organization (WHO), the United States Environmental Protection Agency (EPA) and others.
MWI has to insure the safety of drinking water supplies, to prevent chemical, biological and physical pollution of water resources, maintain efficient wastewater systems, evaluate and update standards and guidelines for drinking water quality, adopting and enforcing effluent and study standards for municipal and industrial wastewater treatment plants.

1.4.3 Wastewater use

Wastewater will be collected, treated managed and used as a resource in an efficient and optimized manner.
Treated wastewater will comply with national standards and will be treated to a level appropriate for agriculture and possibly for ground water aquifer recharge.

1.5 Privatization law

Jordan engaged in active privatization in 1996 and adopted a Privatization Low in July 2000, Law no. 25 (2000). The Privatization law defines broadly privatization as enhancing the private sector role in the economy to include those state enter prizes that should be managed on a commercial basis.

Under this law, the Privatization Council is to decide on policies, enterprises, methods consultants and contracts regarding privatization processes, subject to clearance by the Cabinet of Ministers. It also recommends the establishment of independent regulatory commissions for sectors subject to privatization.
This Council is supported by a permanent agency, the Executive Privatization Commission (EPC). EPC is in charge of proposing and supervising the privatization processes in co-ordination with relevant agencies. The following is the statement of one of the articles in the law (Article-3).

"Privatization is defined as the adoption of and economic policy that enhances the role of the private sector in the national economy to include those particular public sector enterprises whose nature dictates that, management should be based on a commercial basis. In this contest, privatization aims at:

- Contributing to the attraction and flow of local, Arab and foreign investments by providing favorable investment and inductive environment.
- Direct private savings towards long-term investment to strengthen and consolidate the internal capital market and the national economy.
- Alleviate the debt burden on the Treasury through ceasing its financial commitments in terms of loans and grants for those projects deemed unsuccessful and unproductive.
- Manage economic projects through modern techniques including the usage of developed technology to open up stable markets and to penetrate new markets by emphasizing its international competitiveness".

2. As-SAMRA WASTEWATER TREATEMENT PLANT

As-Samra Wastewater Treatment Plant (WWTP) was constructed in 1985, it was originally conceived as a temporary facility during the expansion and upgrading of the overloaded Ain Ghazal Treatment Plant (AGTP) at Amman. However, it was decided that As-Samra WWTP will become the major treatment plant for Amman-Zarqa area and therefore, AGTP was abandoned.

2.1 Type of treatment

As-Samra WWTP is a Wastewater Stabilization Ponds (WSP) system. In this system, Wastewater Stabilization Pond (WSP) use biological treatment to stabilize the wastewater. These ponds have long detention times and do not have mechanical mixing or aeration. There are three types of ponds: Anaerobic, facultative and maturation ponds.

2.1.1 Anaerobic stabilization ponds

Anaerobic ponds are used to treat domestic and high strength organic wastewater that has high concentration of solids. The stabilization of wastes is achieved by anaerobic bacteria. Typically, anaerobic ponds are earthen basins with depth of up to 5m, added waste settle to the bottom of the pond and the partially clarified effluent is commonly discharged to another treatment process for further treatment. Anaerobic ponds generate odors due to the formation of hydrogen sulfide gas during the anaerobic digestion of the settled solids.

2.1.2 Facultative stabilization ponds

Facultative ponds are also called aerobic-anaerobic stabilization ponds because the stabilization of wastes is achieved by a combination of aerobic, anaerobic and facultative bacteria. Conventional facultative ponds are earthen basins that contain three zones. The first is a surface aerobically degrades organic matter. The second zone is the intermediate layer where decomposition of organic wastes is carried out by facultative bacteria in a partly aerobic and partly anaerobic environment. The bottom is the third zone where bacteria an-aerobically digest the sludge layer formed by the accumulation of large solids that have settled.

2.1.3 Maturation ponds

Maturation ponds are low rate stabilization ponds typically used for the removal of pathogens and intestinal nematode eggs. Long detention time, natural die-off bacteria and many unfavorable conditions help to improve the microbial quality of the incoming treated wastewater to the maturation ponds.

2.2 Design criteria

The original design parameters for As-Samra WWTP were:

Average Daily Flow	68,000 m^3/d
Peak Flow	148,000 m^3/d
Influent BOD_5 Concentration	526 mg/1
Influent BOD5 Loading	35,750 kg/d
Influent S.S Loading	42,000 kg/d
Total Detention Time	40 days

2.3 Reclaimed wastewater

The treated wastewater is discharged to Wadi Dhuliel after it passes through a chlorine contact basin and eventually to King Tala Dam. About 5 million cubic meters per year of treated wastewater is reused within the plant to irrigate olive trees, forest trees fodders and others, the rest which is discharged to Wadi Dhuliel part of it is used by the local farmers along the Wadi.

2.4 Disposal of sludge

Sludge generation in Wastewater Stabilization Ponds (WSP) system is very limited. Disposal of sludge is recommended only once every 5 to 7 years or even more. In As-Samra WWTP, sludge was removed from the anaerobic ponds in 1996. In that process all accumulated sludge in the anaerobic ponds was pumped to the two middle anaerobic ponds and other nearby dump area and left to dry out. The two ponds were replaced by other two new ponds. So the total number of the anaerobic ponds is still the same.

3. As-SAMRA BOT CONTRACT

3.1 Contract aims

The option was to run As-Samra (WWTP) by an International Operator as a first Public Private Partnership (PPP) in the region under BOT contract for 25 years including the 3 years design and construction period.

The implementation of this unique project comes in the framework of further development of wastewater infrastructure, the project will improve the environment, eliminate the odor around As-Samra area and improve the quality of water discharged and stored in King Talal Reservoir for irrigation and finally improve the agricultural products.

The new construction of As-Samra WWTP, located in the northeast part of Zarqa Governorate, will develop and expand the overloaded wastewater treatment system in the plant,(currently operating at three times its capacity), then transfer its ownership back to the government.

While the 18-year-old plant presently handles up to 68,000 cubic meters per day, the new plant will be able to handle up to 268,000 cubic meters daily – channeled from the 3.2 million inhabitants of both Amman and Zarqa Governorates.

3.2 Contract tendering and awarding

The expansion of As-Samra WWTP was tendered February, 2000. Five international joint ventures were pre-qualified at that time, two of which submitted offers. The contract was awarded to the winning group in July 2002 and was followed by financing negotiations with local banks. The contract included funding, designing, building, and operating a wastewater treatment plant with a capacity of 98 mcm per year, operating lift stations, pre-treatment facilities, and transmission lines, and then transferring back the ownership of the wastewater plant back to the Government of Jordan after 25 years. After long negotiations with the donors, the Government of Jordan represented by the Minister of Water and Irrigation signed the first build-operate-transfer (BOT) contract on Dec. 10, 2003 with all the consortium and banks representatives from other sides.

3.3 Contract financing

The implementing group of companies who signed the $169 million Restated Project Agreement with representatives of the consortium of implementing companies led by Suez Environment, and representatives of the lending institutions headed by the Arab Bank, was American and French companies who was awarded the contract on July 28, 2002 comprising the international firms of Suez Environment, Ondeo, Ondeo Degremont Inc. and Morganti Group, will put up $17 million in equity, the remaining $60 million will be borrowed from the consortium of lending banks – Arab Bank, Housing Bank for Trade and Finance Industrial Development Bank, Jordan Bank for Investment and Finance, and Arab Investment Bank, in addition to the Social Security Corporation – to be paid in 15 years. The treasury will finance the outstanding $14 million. USAID funded $ 78 millions as a grant to the Jordanian Government to reduce the cost of the cubic meters of treated wastewater from the newly refurbished plant.

The Swedish International Development Agency also contributed to As-Samra, with $5 million in technical assistance as consultations and supervision.

4. CONCLUSIONS

The conclusions are as follows:

- Jordan Suffers from a sever shortage of water, for domestic, industrial and agricultural purposes, within the next twelve years, Jordan will no be able to meet its increasing demands even if it uses all conventional water resources.

- Treated wastewater effluent has to be considered as a water resource and added to the water stock for reuse; this is warranted and deemed feasible in light of the semi-arid climate.

- Priority shall be given to agricultural reuse of treated effluent for unrestricted irrigation. Blending of treated wastewater with fresh water shall be made to improve quality where possible.

- The role of the private sector participation is expanded to transfer management of infrastructures and services from the public to the private sector, in order to improve performance and upgrade the level of service.

- Jordan awarded on the first of August 1999 a management contract for four years to a consortium led by International firm for the provision of water and waste water service in Amman the capital city of Jordan, the role of the private sector is expanded to other considered options in the Northern Governorates of Jordan as a management contract also.

- The approved to a BOT contract is considered to be a good first step towards greater BOT contract for specified operation and management of facilities in Jordan's water and wastewater sector. The use of BOT contract will relieve the Government of Jordan from the financial burden of capital investment. The lessons learned from Amman Management Contract were extremely helpful.

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The G20 IWG Survey on PPP Development underlying this Report provides reference on the frameworks for infrastructure financing through Public-Private Partnership in G20 economies, by focusing on systems of infrastructure policy governance (Chapter 1), legal approaches to PPP implementation (Chapter 2), mechanisms facilitating return on private investments in PPPs (Chapter 3), fiscal and other.Â Several countries also provide subsidised loans and support private partners in property transactions. G20 countries pay attention to the elimination of duplicative and incoherent supportive measures applied in a specific policy mix. Management of contingent liabilities in PPPs and fiscal monitoring are as well on the prospective policy agenda. I. Public-Private Partnership (PPP) projects harness both the public and the private sector to provide goods and services which are conventionally supplied by the public sector, while easing the stringent budgetary constraints placed on public expenditure. Since the 1990s, 1 749 PPPs worth a total of 336 billion euro have reached financial close in the EU. Most PPPs have been implemented in the field of transport, which in 2016 accounted for one third of the entire yearâ€™s investment, ahead of healthcare and education. II. However, to date EU-funds have been little used for PPPs.