



## Securing Jordan's Prosperity through Improved Water Management

*“Jordan today stands face to face with the reality of potentially frightening water shortages. ... The hard reality is that Jordan is consuming more water than it has available from secure (annually renewable) sources. A water catastrophe is imminent, as groundwater resources will slowly dry up.”*

Embassy of the Hashemite Kingdom of Jordan, Washington D.C.

### Introduction

Without a dramatic change in water resource management and public perception, Jordan will be unprepared to address the approaching challenge of water shortages. Such shortages will stop Jordan's economic development and severely affect its ability to provide for its citizens.

Left unaddressed, the following trends point to a troubling scenario in the near future:

- **Increasing demand and insufficient resources.** By 2020, expected sustainable water supply will be sufficient to meet only the projected demand from industry and municipal basic needs, not the demand from agriculture.
- **Over-exploitation of non-renewable sources.** More than half of the supply needed to meet current consumption is obtained from non-renewable underground aquifers. As a result, the water table is dropping throughout the Kingdom, and streams and oases are going dry. Soil salinity is increasing, thereby making land less productive.
- **Uneconomic use.** Agricultural activities consume 65% of the total water supply but contribute only 2.5% to the Gross Domestic Product. Farmers are not charged a fair price for the water they use.
- **Costly new sources.** The Government of Jordan is currently developing all affordable sources of renewable water, including treated wastewater and desalinated groundwater. New supplies from the proposed Disi aquifer and the Red Sea-Dead Sea Conveyor will be costly and unlikely to supply significant quantities of water before 2015, placing additional, irreparable stresses on aquifers.

There are a number of actions that Jordan can take now to avoid the most severe effects of water shortages. First, the Government should incorporate the impact on water resources into every decision it makes, whether at the national, regional or local levels. Second, it should educate Jordan's citizens about the crisis in water supplies in order to promote a culture of conservation among citizens and industry. And the Government must strictly enforce current laws and regulations, and consider new legislation to further support conservation efforts.

### Sustainable Supply and Projected Demand

Total water consumption has increased by almost 50% over the past twenty years. Municipal water consumption alone has tripled over this period with the growth in population.

Of the 941 million cubic meters (MCM) supplied in 2005, agriculture consumed 65%, municipal users consumed 31% and large industry consumed just 4%.

The illustration below shows projected demand for all users and the estimated long-term renewable supply. Over the next 15 years, municipal demand is projected to increase to almost 500 MCM by 2020.

The solid red line shows the growth of all planned sources of renewable water supply – comprising surface water from rivers, springs and reservoirs, and treated wastewater. For current purposes, renewable supply excludes all pumped groundwater and water from the potential Red Sea-Dead Sea conveyor scheme.

Planned sustainable supply increases are sufficient to meet increasing industrial and municipal demand over the next 15 years.

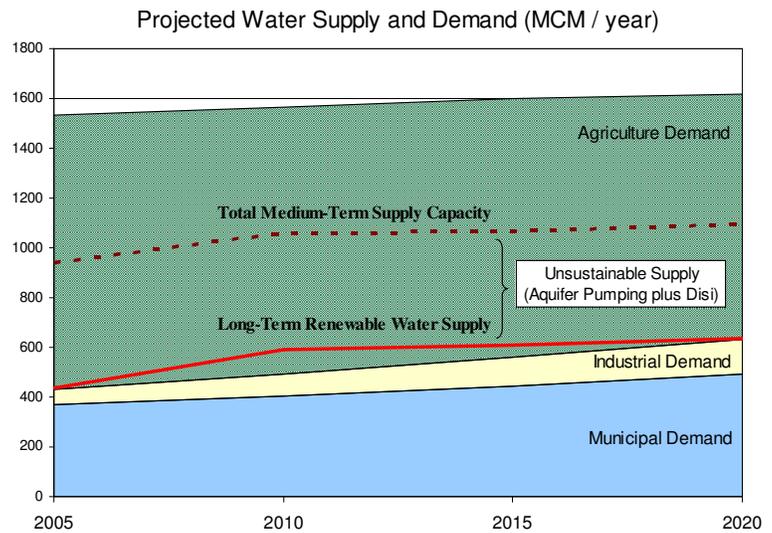
The dashed line indicates future water supply based on current usage as forecast by the Ministry of Water and Irrigation. This supply does not meet the potential agricultural demand for irrigation water.

The gap between the solid red line and the dashed line represents unsustainable supply, i.e., groundwater depletion including water from the planned Disi conveyor and brackish groundwater desalination. Jordanian users are currently relying on unsustainable pumping of groundwater to supplement the renewable water supply in order to meet the current demand.

### Competing Water Uses

Water consumption by Jordan's farmers is subsidized, i.e., farmers are provided water at below the cost of its delivery. In economic terms, this subsidy is equal in value to almost half of the agricultural sector's contribution to the Gross Domestic Product (GDP).

While the industrial sector pays JD 1,000 per m<sup>3</sup>, farmers in the Jordan Valley pay an average of JD 0.012 per m<sup>3</sup> for water and farmers pumping from private wells pay nothing for the first 150,000 m<sup>3</sup>. In 2005, about 67 MCM of free water was pumped – equivalent to supplying 100 liters per person per day to 1.8 million municipal residents for one year, nearly one-third of Jordan's population. Many farmers continue to use inefficient methods of irrigation, and to grow low-value, water-intensive crops. Because farmers pay artificially low prices for water, the value of their consumption is not reflected by their costs. Industry and tourism generate up to 50,000 new jobs each year, absorbing many new workforce entrants. Yet industry and tourism compete with agriculture for available water.



The current production of low-value crops contributes little to GDP.

Agriculture requires 240 MCM to contribute 1% to GDP whereas large industry only requires 2.5 MCM to contribute 1% to GDP. In other words, the economic return per unit of water used by industry is one hundred times the economic return from agriculture.

Moreover, industry contributed 3,777 jobs and, at least, 7,000 indirect jobs per MCM of water consumed in 2004. Tourism contributed 1,693 jobs per MCM. Agriculture employed just 148 workers per MCM – half of whom are foreign laborers – and contributed no income tax revenue to the treasury.

### Future Sources of Water

#### Groundwater

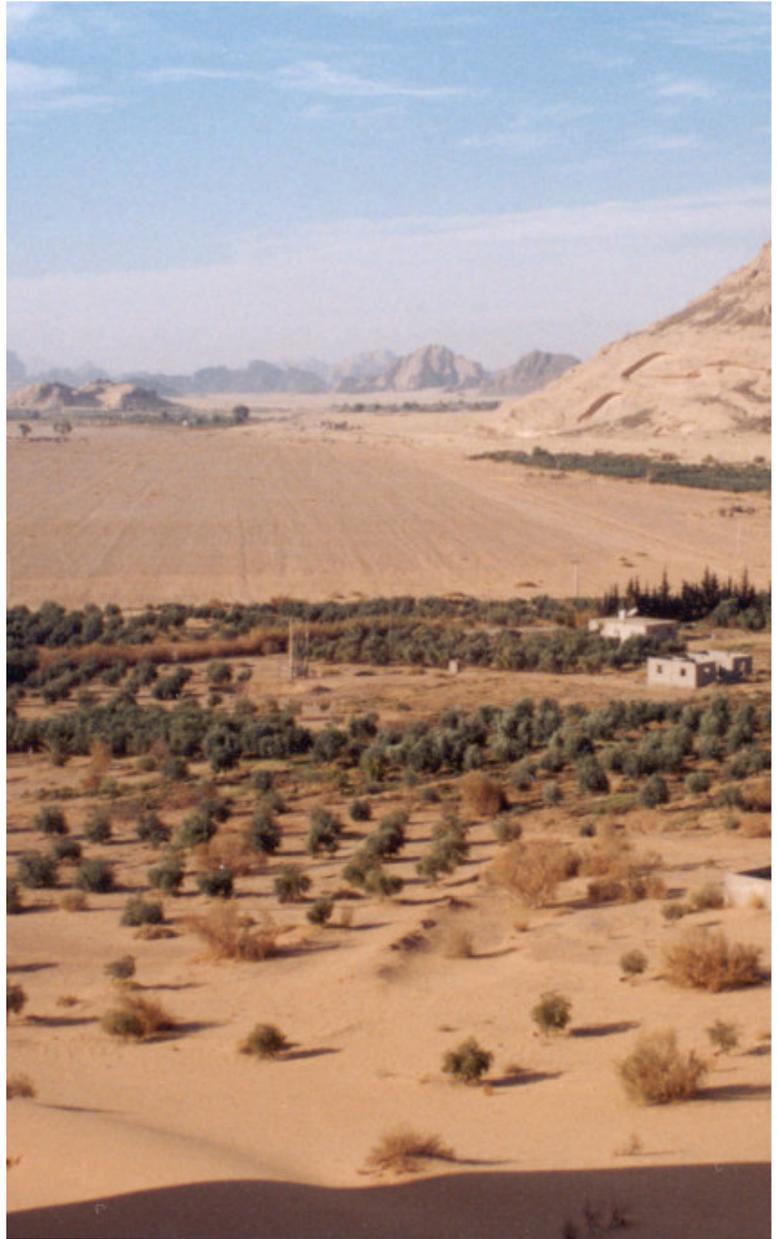
In recent years, groundwater has provided more than half the total water supply, putting 10 of the 12 groundwater basins in deficit conditions. Despite new regulations in 2002 setting lim-

its on groundwater extraction, more than a quarter of the 3,800 existing wells are unlicensed. Over-pumping has already significantly impacted Jordan's environment. Since the start of large-scale agricultural irrigation in the early 1980s, nearly a quarter of the springs in the Shoubak area have gone dry, and half show diminished flows. The Azraq wetland, the largest in the Middle East, used to attract up to half a million birds at any one time. After groundwater pumping started in the 1980s, the oasis completely dried up in 1992. Today, 10% of the oasis has been rejuvenated by using 1.5 MCM of groundwater pumped to the site each year.

Disi is an extensive fossil-water aquifer shared by Jordan and Saudi Arabia that functions as a strategic reserve. There is no sustainable annual rate of extraction. Currently 77 MCM is pumped from the Disi aquifer. Four farms in the area are using 60 MCM – equivalent to all the water consumed by heavy industry in Jordan. Proposals to pump Disi water to Amman will be costly (an estimated JD 0.700 per m<sup>3</sup>) and will only meet 20% of expected municipal demand by 2020.

### Renewable Sources

The least-cost renewable sources of water in Jordan are already being fully utilized. One area of significant saving, currently being supported by the Government, is the rehabilitation of municipal water networks. Unaccounted for water averages about 55% of total water supplied. Rehabilitation costs are relatively low – less than JD 0.250 per m<sup>3</sup> of water saved.



Reuse of treated wastewater is projected to double by 2020 to 245 MCM as new plants come online. About 70% of this wastewater will be available to replace fresh water for irrigation. However, once the capacity to treat municipal effluent is in place, wastewater output is limited to the growth in municipal effluent. Large scale desalination is possible in Aqaba, but supplying Amman would be expensive. The proposed Red Sea-Dead Sea Conveyor could provide desalinated water potentially satisfying 40% of projected 2020 total demand, but at a likely cost of JD 1.200 per m<sup>3</sup>. Furthermore, the Conveyor is unlikely to be completed before 2015 provided it passes all the necessary environmental, financial and political hurdles.

### Solutions

The range of water conservation and demand management solutions follow four themes:

**Awareness:** A public awareness campaign is necessary to explain the water crisis and the incentive measures to the general public, farmers, building owners and policy-makers. The most important incentive measure is to increase water tariffs, thereby encouraging farmers to switch to higher-value, water-efficient crops, and persuading urban consumers to reduce waste. Low tariffs encourage poor water management.

Conversely, by charging industry more than the full cost of delivery, the Government is deterring investment in some new industries. More audience-specific awareness events may be implemented through mass media, associations, chambers, schools, universities and water delivery utilities (water companies, Water Authority of Jordan (WAJ) and Jordan Valley Authority (JVA)).

**Policies, Laws and Reform:** The Government should establish policies and enforce laws to ensure Jordan's water is used efficiently and delivers a high return per cubic meter consumed. Following this approach, all users would pay a socially optimal price of water. Unsustainable extraction of groundwater would stop in order to prevent lasting economic and environmental harm. Water efficient building codes would be adopted and enforced.

In addition, the Government should consider creating a market for transferable water rights to help ensure optimal water use while guaranteeing farmers continuing access. Reforming current fresh-produce marketing requirements could increase returns to farmers. Creating and strengthening groundwater user associations could improve water allocation.

**Technology:** In addition to introducing affordable technologies to assist utilities in reducing water losses, agricultural, industrial and municipal consumers may also benefit from technologies that harvest, conserve and recycle water. Farmers should be encouraged to plant higher-value crops as well as adopt simple changes in operation and maintenance of on-farm irrigation systems to reduce water consumption. Other measures to promote cost-effective water usage include higher tariffs to encourage farmers to invest in better management practices and new technology, provided they have access to sufficient capital and training. For example, farmers using hydroponics technology are willing to pay 17 times more for water than the price charged in the Jordan Valley for irrigation water.

**Commercial Practices:** More business-like approaches to water resources management will save water and reduce Government costs. Water utilities should adopt the best commercial practices within a regulated water market. Best practices include focusing on customer service and providing a quality product that is properly valued and paid for by customers. In the longer term, the JVA and the WAJ should consider a transition from subsidized providers of a public service to commercial providers of a valuable commodity. Private sector participation in the water sector may be extended in this context. Most of these demand management solutions are relatively low-cost compared to the expense of developing new sources of supply. The Government should strengthen the existing Water Task Force with new private sector participation, including water users' associations representatives or create a new group to provide leadership in this endeavor. The Water Task Force or new Water Consultative Group should direct these reforms starting with the immediate actions described in the box below.

Without immediate action, the consequences of "business as usual" in the water sector will become increasingly severe and will impact social and economic development. Jordan's prosperity in the near future will be significantly constrained. The time for securing that future prosperity is now.

#### ***Immediate Actions Required to Address Water Crisis***

- Implement a public awareness program showing depletion of groundwater and its potential consequences and inform farmers of the current problems with irrigation.
- Enforce Groundwater Control Bylaw (No. 85) 2002 – enforce ground-water basin extraction limits and close illegal wells.
- Adopt and enforce water-efficient building and plumbing codes.
- Accelerate rehabilitation of municipal water delivery systems to reduce losses.
- Re-structure irrigation and pumping tariffs to reflect, at a minimum, the full cost of delivery of government-supplied surface and ground waters. Eliminate free pumping from private agriculture wells.
- Implement successful water harvesting practices outside of pilot project areas.
- Reform wholesale agricultural markets.
- Facilitate formation of water users' associations and examine benefits of variable water right trading.