



Friends of the Earth Middle East



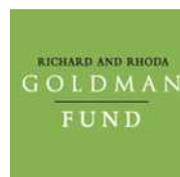
Towards a Living Jordan River:

An Economic Analysis of Policy Options for Water Conservation in Jordan, Israel and Palestine

Draft Report for Discussion Purposes
May 2010

EcoPeace/ Friends of the Earth Middle East
Amman, Bethlehem and Tel Aviv
www.foeme.org

Supported by the United States Agency for International Development (USAID), the Goldman Fund, the Global Nature Fund/ Ursula Merz Foundation and the Green Environment Fund.



EcoPeace/ Friends of the Earth Middle East (FoEME) is a unique organization at the forefront of the environmental peacemaking movement. As a tri-lateral organization that brings together Jordanian, Palestinian, and Israeli environmentalists, our primary objective is the promotion of cooperative efforts to protect our shared environmental heritage. In so doing, we seek to advance both sustainable regional development and the creation of necessary conditions for lasting peace in our region. FoEME has offices in Amman, Bethlehem, and Tel-Aviv. FoEME is a member of Friends of the Earth International, the largest grassroots environmental organization in the world.

For more information on FoEME or to download any of our publications please visit:

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Executive Summary

The Lower Jordan River (LJR) has witnessed a 98% reduction in its flow and a severe decline in its water quality with overwhelmingly negative impacts on the river's ecosystem and the livelihoods of the adjacent communities. Furthermore, the massive diversion of LJR's water resources is the most significant factor in the demise of the Dead Sea, the LJR's terminal lake.

Today it is widely acknowledged that the LJR is in urgent need of rehabilitation undertaken by the river's riparians in accordance with the level of damage caused by each country. EcoPeace/Friends of the Earth Middle East (FoEME) has therefore embarked on an ambitious project to foster political will and concrete action towards the rehabilitation of the Lower Jordan River by identifying the means for an integrated rehabilitation approach to be initiated by the region's decision makers. To that aim, FoEME has undertaken two studies, an environmental flows study and an economic analysis of water conservation options.

The environmental flows study¹ indicates that 400 million cubic meters (mcm) of water, increasing to 600 mcm over time, including 75% fresh and no more than 25% highly treated wastewater, is required annually to rehabilitate the LJR.

This complementary economic analysis concludes that the quantities of water required to rehabilitate the river are feasible at prices lower than the current marginal cost of water, in Israel that being at prices lower than seawater desalination and in Jordan at prices equal to or lower than treated sewage water.

This report presents the summarized findings of the economic studies for the three countries' water conservation options. It estimates the water savings from a range of different policies. The water savings identified from each individual policy can be considered as a "wedge" or piece of a pie towards a given conservation goal. This methodology of identifying conservation wedges has been developed by researchers at Princeton University in the context of greenhouse gas reduction and has been employed by numerous academic, government, private sector, and non-governmental researchers².

¹ Gafny, S., Talazi, S. & Al Shiekh, B. (2010) Towards a Living Jordan River: Strategy to Rehabilitate the Lower Jordan River. In Ya'ari, E (Ed.). Tel Aviv, Amman, Bethlehem, EcoPeace/FoEME.

² Pacala and Socolow (2004); Mui et al (2007); Nicols et al (2009); <http://cmi.princeton.edu/wedges>; <http://www.wri.org/project/climate-wedges>.

The findings identify possible "wedges" that in total will provide guidance to decision makers and the general public with regards to realistic economic and environmental options available to allow water to flow back into the Lower Jordan River, if there is political will to do so. FoEME has chosen not to include the more controversial and less sustainable options of seawater desalination and the building of the proposed Red Sea to Dead Sea Conduit in the analysis of supply side options. While recognizing that these options exist and in the case of seawater desalination are in operation today, the study has chosen to highlight that there are considerable water savings possible for all three water economies at prices well below the costs of these more controversial projects.

Based on the analysis of the present status of water supplies in Israel, Jordan and Palestine the consultants identified the possible potential alternatives for water savings in each sector of the national water economies of the three countries. The alternatives were then evaluated for their feasibility including cost-effectiveness.

This report concludes that in Israel an estimated 517 mcm of water could be conserved for other purposes, including for reallocation to the River Jordan, through better water management efforts at prices lower than desalination of seawater.

Likewise, in Jordan an estimated 305 mcm of water could be conserved for other purposes, including for reallocation to the River Jordan, through better water management efforts at prices lower than treated sewage water.

And in Palestine an estimated 92 mcm of water could be made available to improve domestic water needs in Palestinian communities, through better water management efforts.

The overall summary of the findings of the study are as follows:

Jordan

The summation of water conservation options in Jordan produces potential water savings of nearly 360 mcm per year. This is likely to be an over-estimate, as certain options overlap or partially crowd out others. In order to compensate for potential overlap between options, adjusted figures are given which are 15% lower than the unadjusted figures. From these adjusted figures, over 300 mcm of freshwater per year was identified as being available for conservation, at prices lower than the marginal cost of water in Jordan. For Jordan the following wedges were identified:

Supply Side:

- Municipal wastewater reclamation in agriculture
- Municipal rainwater catchment
- Reduction of water conveyance loss
- Farmland renting by JVA
- Accountability of supplied water

Demand Side:

- Public awareness
- Gardening reform
- Grey water for domestic use/double toilet flushing system
- Improved efficiency of irrigation
- Reform of agricultural water tariffs

Israel

The summation of the water conservation options in Israel produces potential water savings of nearly 800 mcm per year. This is likely to be an over-estimate, as certain options overlap or partially crowd out others. In order to compensate for potential overlap between options, adjusted figures are given which are 15% lower than the unadjusted figures. From these adjusted figures, over 670 mcm of freshwater per year was identified as being available for conservation, of which over 500 mcm is below the cost of seawater desalination. The identified “wedges” for Israel are:

Supply

- Reduced water losses from leakages
- Reduced water losses from reservoirs
- Rooftop rainwater collection

Demand

- Awareness raising
- Change in plant use in gardens
- Price increase in the agriculture sector
- Grey water use (irrigation)
- Grey water use (toilets)
- Removal of trade restrictions

Palestine

The summation of water conservation options in Palestine produces potential water savings of nearly 105 mcm per year. This is likely to be an over-estimate, as certain options overlap or partially crowd out others. In order to compensate for potential overlap between options, adjusted figures are given which are 15% lower than the unadjusted figures. From these adjusted figures, over 92 mcm of freshwater per year was identified as being available to improve domestic water needs in Palestinian communities. For Palestine the following wedges were identified:

Supply Side:

- Reclamation of municipal wastewater for agriculture
- Reduction of water conveyance loss
- Roof rainwater harvesting

Demand Side:

- Public Awareness
- Domestic savings due to the introduction of new technologies
- Improved efficiency of irrigation

Summary of Water Savings in Israel

A summation of the water conservation options identified in the Israeli analysis produces potential water savings of nearly 800 mcm per year. This is likely to be an over-estimate, as certain options overlap or partially crowd out others. In order to compensate for potential overlap between options, adjusted figures are given which are 15% lower than the unadjusted figures. From these adjusted figures, over 670 mcm of freshwater per year was identified as being available for conservation. Of this, over 500 mcm can be conserved at costs less than the marginal cost of water, i.e., the cost of desalination. An additional 150+ mcm of water per year can be conserved with current technology, but at costs that make it uncompetitive with desalination. Implementing the cost-effective measures would make unnecessary three large desalination plants, and/or alternatively, would free up water that could be returned to the natural flows of rivers. This amount represents nearly half of the natural flow of the Lower Jordan River.

The economic feasibility of the options shown was based on current prices. Changes in future prices of technologies, commodities, and externalities are likely to change the relative profitability of water saving options. By necessity this study had to limit its focus to options for which available data was available. Even with its limited focus, however, the study was able to identify numerous cost-effective options for water conservation at scales that would allow for significant stream restoration and/or reduction in the need for desalination. The figures for total water saved in the last three rows of the table have been reduced by 15% from the figures above to adjust for likely double-counting, as each option's water saving potential was evaluated in isolation.

Summary of Policy Wedges Examined in Israel

	Policy Wedge	Water Conserved by 2020 (mcm/year)			Cost Effectiveness (US\$/m ³)	Feasibility 1-Low 5-High
		Low	Medium	High		
Supply	Reduced water losses from leakages	29	51	73	0.45	4-5
	Reduced water losses from reservoirs	61	73	81	0.007	4-5
	Rooftop rainwater collection	4	7	13	2.14	1-2
Demand	Awareness raising	76	101	126	0.10	4-5
	Change in plants used in gardens	23	46	68	0.61	4-5
	Price increases in agricultural sector	70	138	200	0.30	3
	Grey water use (irrigation)	36	76	118	1.32	1-2
	Grey water use (toilets)	13	27	55	2.21	1
	Removal of trade restrictions	30	45	60	High	1
Unadjusted	Total - net cost less than desalination	289	454	608		
	Total - net cost more than desalination	53	110	186		
	Total	342	564	794		
Adjusted	Total - net cost less than desalination	246	386	517		
	Total - net cost more than desalination	45	94	158		
	Total	291	480	675		

Summary of “Wedges” in Jordan

It is estimated that approximately 359 mcm of water can be saved in Jordan from water conservation, although the possibility exists of the overlap between certain options. In order to compensate for the possible overlap of the options the figures estimates were adjusted to 15% lower than the figures given. The adjusted total water savings is estimated at 305 mcm. All the identified policy wedges in Jordan are aligned with the national policies, which makes them highly politically feasible. In addition, all the possible savings are either below or on the level of the current cost of marginal water production.

Evaluation of the economic feasibility of the proposed savings is based on current prices, the profitability of the proposed alternatives of water savings is subject to change due to the future price changes for technologies, commodities, etc.

Summary of Policy Wedges Examined by Jordan

Policy Wedge		Water Conserved by 2020 (mcm)			Cost effectiveness (cent/ m ³)	Long-term Feasibility Index (1 = low, 5 = high)
		Low	Medium	High		
Supply	Wastewater reclamation in agriculture	50	75	100	55	4
	Municipal rain catchment	7	10	13	51	4
	Reduction of water conveyance loss	17	21	25	51	3
	Farmland renting by JVA	8	12	16	55	3
	Accountability of supplied water	10	13	16	60	4-5
Demand	Public awareness	12	17	22	45-50	4-5
	Gardening reform	25	31	37	45-50	2-3
	Grey water for domestic use/double toilet flushing system	18	24	30	55-60	4-5
	Improved efficiency of irrigation	30	38	46	52	4-5
	Reform of agricultural water tariffs	40	47	54	55	4
TOTAL		217	288	359		

Summary of "Wedges" in Palestine

It is estimated that around 108 mcm of water can be saved in Palestine from water conservation, although the possibility exists of the overlap between certain options. In order to compensate for the possible overlap of the options the figures estimates were adjusted to 15% lower than the figures given. The adjusted total water savings is estimated at 92 mcm.

The Israeli military orders, rules and regulations regarding water and water transfer, extraction, sale and distribution, control of water use, granting permits and all matters regarding water resources are serious impediments. These figures mentioned are in addition to Palestine receiving a fair share of shared water resources.

Summary of Policy Wedges Examined by Palestine

	Annual mcm (average)	Cost effectiveness (cent/ m ³)	Long-term Feasibility Index(1 = low, 5 = high)
SUPPLY SIDE			
Wastewater reclamation for agriculture	39	55	4-5
Municipal rainwater catchments	9	52	4
Reduction of water conveyance loss	14.5	60	3--4
DEMAND SIDE			
Public awareness	14	45-50	4-5
Reduction of water for toilet flushing	21	55-60	4-5
Improved efficiency of irrigation	11	60	4-5
TOTAL	108.5		