CONCEPT PAPER:

SUSTAINABLE AQUIFER MANAGEMENT IN JORDAN'S HIGHLANDS

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I. BACKGROUND

The threats to Jordan's water supply from over-pumping of its aquifers are detailed in scientific and development planning documents dating back over two decades. In summary, Jordan is over-pumping 80% more water every year than the safe yield, and the imbalance is worsening because of population increases (estimated to double over the next 25 years) and precipitation decreases caused by climate change (estimated to at 50% in this century). The negative economic, social, and environmental consequences of continued depletion of Jordan's aquifers are difficult to project, but are clearly serious.

Across the country, about 6% of water is used in industry, about 30% for household use, and about 64% for irrigation. Clearly stated policies from King Abdullah and the Ministry of Water and Irrigation make household water the highest priority, yet in the populous northern and middle areas, the recharge to ground water is only equal to current water extraction for municipal and industrial use. The Disi Aquifer project to bring 6,000 year-old water to Amman from the south east of the country should be able to deliver 100 MCM, which is approximately the same volume of water currently over-pumped from ground water in the Amman-Zarqa and Azraq Basins, the supply from the Disi Aquifer is projected to last for about 5 decades.

The government has raised expectations that water supplies will increase, and at current rates of supply larger populations will have difficulty meeting basic health needs and business growth would be unlikely, and the high pumping costs will double or triple the cost of water. Very deep aquifers may also provide water in the future, but also at very high costs.

Desalinated Red Sea water will probably contribute to Jordan's water supply in the future, but unlimited supplies of fresh water sometimes promised would only be possible with unlimited funds for energy and infrastructure. The proposed Red-Dead conveyance system to produce desalinated faces serious technical, financial, environmental and political obstacles, which may be insurmountable, and certainly will be overcome only after years or decades of intensive work. No existing technology can produce desalinated water cheaply enough to use for irrigation (although increased volumes of municipal wastewater can be treated and used for agriculture or groundwater recharge).

The greatest danger of depletion of Jordan's aquifers is that crucial water sources will not be suitable for human consumption due to high salinity of the groundwater and become unusable for decades to come where the restoration of these aquifers will need decades to be suitable for human consumption again. This has already happened with some wells where the salinity exceeds 11,000 mg/l. The loss of usable groundwater in rural areas would eliminate most highland agriculture, displace communities, and force migration to the cities. Amman and other cities, already failing to support the cost of inexpensive

ground water for household use, could see failing businesses, swelling unemployment, and civil unrest. Serious salinization of critical aquifers or sub-aquifers is projected to begin within five years.

The most optimistic scenario is that groundwater levels will continue to decline and salinity levels will continue to increase, but that the costs for increased pumping and deeper drilling will be manageable for all but the most marginal farmers. This optimistic scenario works only if new water sources become available and increased costs are covered.

The Government of Jordan (GOJ) has adopted forward-thinking policies to protect groundwater, especially the 85/2002 Groundwater Bylaws and the New National Water Strategy prepared by the Royal Water Committee. However, implementation remains weak, especially in proposed reductions of groundwater use in the highlands through reductions in the use of free, highly subsidized, and uncontrolled (illegal) water. The gap between policy and reality is generally attributed to the interests and influence of wealthy individuals and prominent tribes. The Ministry of Water and Irrigation is initiating a number of activities to reduce groundwater use, but these do not reflect the urgency of the problem. Irrigated agriculture in the highlands is profitable for the individual landowners and is the only livelihood available to many poor rural residents, but it adds little to the national economy.

II. Development Challenge

Over-extraction of groundwater is at least a threat to Jordan's financial health, and potentially threatens the Kingdom's economic and social stability. Entrenched interests prevent significant reductions in water extractions, and no matter how efficient household, industrial, and agricultural uses become, demand will dangerously exceed supply for the foreseeable future. Even if this threat is over-stated and depletion of highland aquifers does not threaten Jordan's future, water scarcity will inevitably force people out of their current practices within 10 or 20 years and this transition should be planned. USAID has implemented many successful projects and project components to address components of the problem, but has never taken it on directly.

III. Outcome and Illustrative Results

The USAID Aquifer Management Project will work with Jordanian institutions to design and implement field and policy activities that lead to prompt and sustained reductions in the extraction of groundwater from the most important aquifers in Jordan.

Results that could contribute to this goal include:

- Unpermitted (illegal) wells are closed in important highland basins
- Tariffs for water use in all sectors reflect its market value

- Relevant authorities have the enforcement capacities necessary to enforce water laws

- Mapping areas of recharge to ground water and declare these areas as protected areas

- Help the MWI in finding and implementation of methods for increasing the recharge to aquifers

- Rural water users have accepted significantly lower withdrawal rates as a result of:
    - Understanding of the severity of the water crisis and the impending impossibility of agricultural irrigation
    - A significant role in preparing the transition out of irrigated agriculture (especially for poor farmers)
    - Acceptance of the rule of law
    - New and attractive alternatives to irrigated agriculture, such as crops and livestock requiring minimal water, sales of water rights municipal users, and replacement of irrigated crops with clean energy production.

- Monitoring capacities in MWI are sufficient to:
    - Track the status and trends of all important aquifers in the country
    - Identify significant water users in the highlands and calculate volumes used
    - Forecast changes in aquifers based on climate and extraction scenarios
    - Forecast the cost and availability of water.

IV. Illustrative Interventions

The project will collaborate with other USAID projects and other donor programs to develop activities and policies for the government of Jordan and stakeholders in the highlands. All interventions must respect their ultimate ownership. Within this serious social and political constraint, interventions should be designed not to improve water use but to transform it. Interventions to reduce the pumping of water from highland aquifers might include:

- **Stakeholder Engagement:** To reduce water extraction, the participation and acceptance from diverse groups will be required for significant water to succeed. The project must use or create venues to provide information and allow stakeholders to shape activities. The Highlands Forum is the leading activity today—it is well conceived but to small and slow-moving to effect large-scale change. The project should find ways to use the momentum and intellectual strengths of the Highlands Forum without marginalizing the implementers and participants.

  Distinct but coordinated activities will be needed within and among diverse GOJ entities to get the entire GOJ to support the initiative.

- **Policy Development and Legal Reform:** To reduce water extraction, the project must work with GOJ entities to draft, adopt, and implement new policies in the areas of water allocation, tariffs, enforcement, customs, and other areas.

- **Capacity building:** To reduce water extraction, the institutional capacities and individual skills will need to increase in the MWI, Ministry of Environment, Ministry of Energy, landowners, farmers, and others.

- **Economic Alternatives:** Reductions in water extraction will require trade-offs, especially economic alternatives to the current, unsustainable, water uses. For political reasons, alternatives will probably be required for the affluent as well as the poor. The project will seek relevant models in Alternative Development (counter-narcotics). Alternatives to irrigated agriculture may include crops and livestock requiring minimal water, sales of water rights municipal users, and replacement of irrigated crops with clean energy production.

  A promising opportunity to reduce agricultural water use in the highlands may be to enable rural residents and landowners to produce and sell sustainable electricity from wind or solar instead of irrigated crops. Beyond water conservation, this approach could contribute greatly to Jordan's goal of 10% renewable energy, and by-laws to allow individual electricity producers to sell to the grid are being prepared. The concept is already endorsed by MWI, but the project must develop basic information such as individual and public infrastructure and investment costs, potential revenues, financing options, and technical requirements. If swapping water for power proves feasible, the project must develop ***and directly support*** an implementation program, probably entailing public-private partnerships and credit arrangements for infrastructure.

- **Monitoring:** Despite significant past investments, to verify reductions in water extraction and the status and trends of highland aquifers, the project must improve the capacities in MWI and other Jordanian governmental and scientific institutions. Investments in appropriate monitoring, computing, and communications technologies must be leveraged or made directly.

- **Work in the Jordan Valley:** This project will focus on the highlands, but the many interrelationships and arbitrary divisions between highlands and the valley in terms of water use, tariffs, political influence, agriculture, wastewater treatment, and other issues will inevitably require the project to take on limited work in the Jordan Valley.

V. Analyses

As indicated above, analysis of economic, financial, social, environmental, and other technical issues will be required in the course of implementation to design effective interventions.

A ten-year evaluation of USAID's work in the water sector will be conducted in January and February, 2011. This report should clarify what approaches have been most tactically efficient and strategically effective.

Gender: Complete consideration of gender roles in this project will be most important for activities to develop alternative incomes and for community-level interventions on changing water use. In accord with ADS 201.3.9.3, bidders and implementers submitting work plans will be required to address how this project will account for differences in the roles and status of women that it will affect, and how the results of the project will affect women and men differently.

Environment: An Initial Environmental Evaluation will be prepared for the Activity Approval Document. The expected threshold decision will be a categorical exclusion with conditions for technical assistance activities and a requirement for a complete Environmental Assessment or Programmatic Environmental Assessment for infrastructure or activities that result in large-scale changes of land use.

VI. Partner Involvement

The Minister and the Secretary General of Water and Irrigation have frequently expressed their need for a program such as this, have outlined a modest version of it in response to USAID's 2010 Conditions Precedent, and enthusiastically support components of it through the Highland Forum. The Minister of Finance also stated his support for the objectives of such a program.

VII. Funding Requirements

A large project is required to change the frame of reference for use of water in Jordan's highlands. The notional amount is $50 million over five years. Expenditures should be greatest in years three and four, when solutions are implemented.

VIII. Issues and Assumptions

The fundamental challenge to this project is that aquifer conservation requires overcoming entrenched political, social, and economic interests, which may not be possible.

A fundamental assumption is that there are viable alternative income opportunities. Financing for such a transition will be expensive and complex. The potentially promising development of renewable energy requires a host of legal, technical, and engineering analyses to even determine its feasibility.

IX. Schedule

January 5: AAD and SOW submitted

January 20: AAD approved

January 27: Final SOW to RCO

February 17: RFTOP released to IQC firms

April 1: Proposals due

September 1: Contract begins

Water and Environment

CONDITION PRECEDENT NO.1: Implement a plan to regulate pumping from Highland aquifers

Required Action: The Ministry of Water and Irrigation (MWI) shall establish and implement a plan to end over-pumping in Jordan's Highland aquifers by 2016. Preliminary actions will be taken in 2011.

Description: This CP follows actions taken and pledged to by the Government of Jordan in completion of the 2010 CPs. Affordable water is critical to Jordan's stability. The most abundant, highest-quality, and least expensive water is in the Amman-Zarqa, Azraq, and other Highland aquifers. These aquifers are at least 50% over-drawn, and increasing groundwater salinity and depth threatens their viability. Loss of the highlands aquifers could threaten Jordan's economic development and social stability. The Ministry of Water and Irrigation (MWI) is therefore requested to establish a five-year Implementation Plan with realistic, steady, quantitative annual benchmarks, to end the over-extraction from these aquifers. This Implementation Plan must be approved by the Cabinet in order to unify the Government of Jordan on these measures and to move implementation forward quickly. Further, the Implementation Plan, including planned changes in groundwater tariffs and allocations, must be introduced publicly in order to promote transparency and develop public support. The Implementation Plan must include the following:

- A representative list of wells from each major Highland aquifer, agreed upon by MWI and USAID prior to submission of the Implementation Plan, along with baseline sample dates. Depth to the water table and salinity are to be reported for each well by August 1.
- Revisions to irrigation policies that reduce "free" water allocations, as described in response to the 2010 CPs.
- Measured and documented reductions in extraction rates, by August 1 of every year, starting in 2011.
- A plan to license or close all wells in the country by August 1, 2013. By this date, 20% of currently unlicensed wells are to be closed or licensed.
- Written standards for regulation of all wells, and annual requirements for measuring compliance and overall effectiveness of the policy.

Documentation Required:

1. Copy of the Implementation Plan that meets requirements outlined above.
2. Copy of Cabinet approval of the Implementation Plan, as well as documentation from a major Jordanian newspaper and MWI website regarding the public notification of the new Implementation Plan and related water allocation policies.
3. Map coordinates, locality names, and photos or other descriptions of permitted or closed wells.
4. Proof that "free" water allocations are reduced to 50,000 m3 or less per user.

Completion Date:

1. May 1, 2011: Submission of the Implementation Plan.
2. June 1, 2011: Revisions to irrigation policies that reduce "free" water allocations, as described in response to the 2010 CPs.
3. August 1, 2011: Documentation of Cabinet approvals, publication, and first achievements.

CONDITION PRECEDENT NO.2: Assure the autonomy and regulatory independence of the Miyahuna water utility

Required Action: The Ministry of Water and Irrigation (MWI) shall re-establish financial and management autonomy of the Jordan Water Company (Miyahuna) and remove institutional conflicts of interest.

Description: Given the water crisis currently facing Jordan and the imminent delivery of costly water from new sources, it is imperative that Jordan's water and wastewater utilities are efficient, transparent, and accountable. Loss of water to theft, leaks, and mis-measurement is unaffordable and costs development opportunities. In order to achieve these vital efficiencies, the financial and management autonomy of Miyahuna must be assured. In addition, institutional conflicts of interest should be removed in order promote such autonomy. For example, the acting CEO of Miyahuna for the past eight months, responsible for financial and operational policies, has been the Secretary General of the Water Authority of Jordan (WAJ), which sells water to Miyahuna.

As part of the establishment of autonomy, MWI is requested to assure full staffing of Miyahuna's management positions, in keeping with internationally recognized best practices, and to prepare a clear plan to allow the transfer to Miyahuna of fixed assets, autonomous operations and maintenance (O&M) responsibilities, and the capacity for autonomous financial operations and cost recovery. This plan is to be approved by the Cabinet.

In addition, in order to prevent institutional conflicts of interests, MWI is requested to enforce regulations for Miyahuna that include appropriate by-laws to ensure compliance with international standards, including rules regarding the appointment of Board members and Chairperson.

Documentation Required:

1. Proof that all senior management positions in Miyahuna are filled with permanent staff by June 1, 2011, and that there are no position vacancies.
2. Documentation that financial and management deficiencies identified by USAID's assessment of Miyahuna in May 2009 have been addressed.
3. A clear plan for the empowerment of Miyahuna (including transfer of assets, O&M responsibilities and O&M funding capacities), as well as proof of Cabinet approval of same.
4. Copy of new draft regulations and appropriate by-laws, as described above.

Completion Date:

1. June 30, 2011: Documentation showing all Miyahuna staff positions filled.

2. August 1, 2011: All other required documentation.