WATER SCARCITY IN THE MIDDLE EAST: REGIONAL COOPERATION AS A MECHANISM TOWARD PEACE

HEARING BEFORE THE

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Our next witness will be Dr. Uri Shamir. Dr. Shamir.

STATEMENT OF URI SHAMIR, PH.D., FACULTY OF CIVIL ENGINEERING, LAWRENCE AND MARIE FELDMAN CHAIR IN ENGINEERING, DIRECTOR OF THE STEPHEN & NANCY GRAND WATER RESEARCH INSTITUTE

Mr. **SHAMIR.** Thank you, Mr. Chairman. Thank you very much. I am glad to appear here in front of the Committee together with my colleague Ihab Barghothi. Let me begin with some background on water and sewage in the region. It has been mentioned before by Committee Members that the whole area is arid or semi-arid and experiences large annual hydrological variability, has suffered periodically sequences of dry years and consequently severe water shortages. I propose to discuss water demand and supply in Israel, a situation that is paralleled in Jordan and the Palestinian areas, and then describe Israel's plans, going finally to the regional picture and to water as a means for regional cooperation.

Agriculture in Israel used to be a major user of water. More than 70 percent of the potable water was used in agriculture. During droughts the allocation for irrigation could be curtailed and this provided the necessary flexibility for management under conditions of hydrological variability. Water use efficiency in agriculture grew dramatically, greater value of product per unit of water, sometimes also referred to as more crop per drop.

As you know, Israel is the world leader in water use efficiency. Recycling and water conservation in industry has also been very successful. In the urban area, consumption per capita is relatively low, as compared to European and United States standards, and conservation efforts are continuing. However, urban demands are growing with the rising population. Today over half of the potable water in Israel goes to the urban areas, and it will grow by 2020 to over 70 percent of the available average natural potential. To meet the rising urban demands potable water allocation in agriculture has been reduced in Israel in the last few years by a factor of more than two. Many field crops have been discontinued, and the remaining crops are high investments and high value, such as orchards and greenhouses. These crops are much less flexible to water use restrictions under conditions of drought. Thus, all potable

water consumption for the urban, agricultural and industrial uses is practically inflexible, cannot be used as a buffer for reduction during sequences of dry years. Thus, the only option in parallel with continued conservation and efficient use is to augment the supply of potable water.

In 2001, the Israeli National Water Development Plan was adopted, and it contains the following components: Continued strict protection and careful management of the natural resources, including replenishment of the depleted aquifers to sustainable long term levels; desalination of seawater, 500 million cubic meters a year, about 1/3 of the natural water potential in five to six plants along the Mediterranean coast. The immediate plan has been set to 315 million cubic meters a year. In addition, desalination of brackish groundwater and advance treatment of polluted ground waters, and import of 50 million cubic meters a year from Turkey. This is a political project, the component of the strategic relation with Turkey, even though it cannot compete successfully economically with desalination. And this brings me to the regional picture.

Large-scale desalination of seawater is the only viable long-term solution for water shortage in the region. Israel has suggested that a desalination plant be constructed for the West Bank on the Israeli coast. The plant would be constructed and operated by donor countries for the Palestinians. The space for the plant and the pipeline access to the West Bank will be provided by Israel. The West Bank would then be fed partially from local groundwater sources, augmented by desalination from a plant that can be increased over time as the demands rise.

I would like to contrast this with the Red Sea-Dead Sea Project that has been discussed. There you have to construct the entire project and invest all of the 4- to 5 billion dollars estimated today before you get the first benefit. Desalination on the coast can be done incrementally at lower cost, in my opinion.

Getting back to agriculture in Israel, as in Jordan and the Palestinian areas is not merely an economic activity. It provides other important national benefits, keeping open and green spaces, providing basic food supply, maintaining the social fabric of the agricultural community and keeping the population distributed throughout the land. To sustain this agriculture, the reduced freshwater supply is augmented with treated sewage effluent. The quantity in Israel will be doubled in the coming years. Sewage poses a danger to human health, as Mr. Bromberg has said, to the environment and to water resources. If it is treated properly to high quality standards, it can be used for irrigation, for stream flow augmentation, for wetlands and nature preservation. As urban water use rises with the population, so does the amount of sewage that can be treated and returned for use. About 2/3 of the water supply to the urban area can be recycled. There is therefore a very strong link between water and sewage. There can be no development of water supplies, especially for the Palestinians, without proper treatment of the sewage for reuse or safe disposal.

Sewage in the West Bank, as has been pointed before, poses a severe threat to Israel, as it flows downhill into Israeli territory as well as into the aquifer and is currently not treated at all or at best poorly treated. There is therefore urgent need to complete the planning, construction and continuous operation of about 16 sewage treatment projects on the West Bank, from the collection networks all the way to the

effluent.

What is the current cooperation in the region on water? Jordan and Israel signed in 1994 a Peace Treaty in which water is a major component. Cooperation between the parties since then is excellent and no major problems have arisen that could not be settled amicably. The Palestinian Authority and Israel signed in September 1995 the interim Oslo II agreement in which water and sewage are prominent elements. The parties have made every effort to adhere to the agreement in spite of difficulties due to the current security problems. Regular meetings take place at all levels—policy, technical and field, and there have been joint declarations, "to keep water out of the cycle of violence."

Water is practically the only domain in which the Palestinian Authority and Israel continue to cooperate effectively, even though this is hampered by the prevailing circumstances. The U.S. continues to play a vital role in helping the parties to work together and in resolving difficult issues. The United States chairs regular trilateral meetings with the Palestinian and Israeli delegations, at which both general and specific problems are resolved.

USAID has been an important force on the ground helping the Palestinians in addressing their water and sewage problems, especially planning, funding and responsibility for construction of water and sewage work. These activities of the USAID are currently hampered by security problems, but should be sustained nevertheless and resumed once conditions allow.

Another area of cooperation is joint research projects. They should be encouraged and funded, as it creates solid bridges of personal and institutional cooperation and enhances mutual understanding for joint problem solving.

What elements can we see for long-term solution? Elements of regional cooperation or management of the shared water resources is the mechanism for building peace in the region, as was stated in the call for us to testify. I believe Gaza is largely self contained. It will continue to get its water from local groundwater, augmented by local desalination and some import from the Israeli system as per the Oslo II agreement. The Mountain Aquifer will be managed jointly by Israel and the Palestinians based on the premises and principles of the Oslo II agreement. Major desalination on the Mediterranean coast and delivery directly to the West Bank funded by donors for the Palestinians, this is the only viable long-term solution for the West Bank.

The Palestinian-Israeli Joint Water Commission will continue to operate along the principles of the Oslo II agreement. The United States and other donors will help the Palestinians to develop their water systems and especially to construct and operate in a reliable fashion sewage treatment plants in the West Bank. Israel and Jordan will continue to seek jointly additional sources in both their territories, and the Jordan-Israeli Joint Water Commission will continue to operate as per the peace treaty. Israel will continue to control and carefully manage its natural resources and maintain full control of the sources in the north. The parties will continue to collaborate on conservation and efficient water use, protection of the quantity and quality of the natural resources, treatment of sewage and reuse of the effluent.

In a broader regional perspective, water from the great rivers in the north could become a component in the regional water and peace scheme. This would engage Lebanon and Syria in regional water management schemes for the benefit of all.

And, finally, joint projects of applied research, development, and application in desalination, hydrology, water treatment, sewage treatment and reuse should be promoted as valuable components of regional cooperation. Thank you.

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And, finally, joint projects of applied research, development, and application in desalination, hydrology, water treatment, sewage treatment and reuse should be promoted as valuable components of regional cooperation. Thank you.

Mr. **SMITH OF MICHIGAN.** Dr. Shamir, thank you.

[The prepared statement of Mr. Shamir follows:]

PREPARED STATEMENT OF URI SHAMIR, PH.D., DIRECTOR OF THE GWRI, FACULTY OF CIVIL ENGINEERING, LAWRENCE AND MARIE FELDMAN CHAIR IN ENGINEERING, STEPHEN & NANCY GRAND WATER RESEARCH INSTITUTE

BACKGROUND: WATER AVAILABILITY AND USE

1. Israel has been using the full potential of its natural water resources for several decades, and has drawn down the sources below dangerous levels during sequences of drought years (e.g., 2001–2002).

2. Large hydrological variability is typical in the region. The average annual natural recharge in Israel's three main sources—the Coastal Aquifer, the Mountain Aquifer and Lake Kinneret (Sea of Galilee)—for the 70 year period 1932–2002 is 1457 mcm (see footnote 5) (1.18 million acre-feet/year; 1,055 mgd;) with a standard deviation of 458 mcm/year. Over this period it has been as low as 657 mcm/year (less than half the average) and as high as 3563 mcm/year (2.45 times the average).

All figures in this report are rounded, for clarity of presentation.

3. Water quality in the sources has deteriorated due to over-exploitation and to human activity above the aquifers. For example, over the 33 year period 1970–2003 average Chlorides concentration in the Coastal Aquifer rose from 160 to 260 mg/liter and Nitrates from 34 to 57 mg/liter.

4. The situation of the sources in Jordan and in the Gaza Strip is the same or worse.

5. On the demand side, Israel is a world-pioneer in conservation and efficient water use in agriculture and industry. Water productivity in agriculture grew by a factor of

5–10 over the last several decades.

6. Substantial conservation has also been achieved in the urban sector, and more is being done to constrain the rise in per-capita consumption.

For comparison: residential per capita water use (in litres per capita per day): Jordan—94; Israel—170; Italy—250; Canada—326; US single dwellings—382. Residential (home and yard) is about 2/3 of total urban use.

7. Urban demand keeps rising with growth of the population—from the current 6.7 million to 8.6 million forecasted in 2020. Even with a constant per-capita consumption, this will bring the urban use to about 960 mcm/year, over 70% of the natural potential.

8. Fresh water allocation to agriculture has been curtailed drastically—from a former consumption of 1,200 mcm/year to 530 mcm/year.

9. Total demand for potable water over the coming decade is forecasted to rise from the current 1350 to 1535 mcm/year, which exceeds the average natural replenishment and is far greater than the low values of replenishment.

CLOSING THE WATER BALANCE GAP: DESALINATION AND REUSE OF SEWAGE EFFLUENTS

10. Repeated occurrence of water-shortage crises due to droughts led to adoption in 2001 of a national plan to augment the supply through a 10-year program of sea-water desalination. It was initially set for desalination of about 500 mcm/year (360 mgd)—over one-third of the natural potential!—to be produced in 6–7 plants along the Mediterranean coast. Subsequent decisions have reduced the immediate plan to 310 mcm/year.

11. Other sources to be developed: desalination of brackish groundwater in several suitable locations (50–60 mcm/year) and treatment of groundwater that is too polluted to be used directly.

12. Import of 50 mcm/year from Turkey is a "political project", justified on the basis of the overall relations between the two countries, not on professional considerations or an economic justification.

13. Agriculture has national values beyond the narrow economic, including protection of open spaces and green environments, self-supply of basic foods, and maintaining the social fabric of the agricultural sector.

To sustain the required level of agriculture, the reduction in potable water allocation is compensated by the supply of reclaimed sewage—to be raised from the current level of 270 mcm/year to a projected 530 mcm/year. Soil salination and damage to plants associated with reuse of effluents have to be overcome by advanced (membrane) treatment of the effluents.

14. The quantities of sewage increase with the rise in urban water use. Untreated or

poorly treated sewage creates a serious danger to health, to water resources and to the environment.

15. On the other hand, properly treated sewage can be used for irrigation, flow augmentation in streams, and wetlands. About two-thirds of the urban sewage can be reclaimed for reuse.

16. Where there is no use for the treated effluents, they can be discharged into the environment without detriment—provided they are treated to high quality levels.

17. Similar solutions are relevant for Jordan and the Palestinian areas. Therefore Israeli researchers are cooperating with Palestinian and Jordanian colleagues in refining technologies for treatment and reuse of sewage effluents.

18. Israel faces a very serious threat of sewage from the West Bank percolating into the Mountain Aquifer, a major source of potable water for both Israelis and Palestinians, and flowing downhill into its streams.

There is urgent need to complete the planning, construction and operation of some 16 sewage projects in the West bank—collection, treatment and reuse or safe disposal. Funding for these projects, provided to the Palestinians, is a major concern. The plants must be operated by companies with proven international expertise and experience.

CONCLUSIONS OF THIS PART

19. In spite of great achievements in efficient water use in Israel, there is a negative balance between demands and the availability of natural supplies, a deficit that is growing with time.

20. The shortage is exacerbated by the large hydrological variability that is typical in the region. Sequences of dry years have resulted in serious deterioration of quantities and qualities in the sources.

21. A similar situation exists throughout the Palestinian areas and Jordan. Their situation is even worse, as they are land-locked (except for the Gaza Strip, and an opening for Jordan at Aqaba) and much of the demand is located at high elevations.

22. The entire region is water-short, and subject to large hydrological variability. Dividing the scarce natural water resources is not a viable solution for all Parties in the region. It must lie in production of very large quantities of new water, primarily desalination of sea-water.

23. Treatment and re-use of sewage effluents for irrigation, for nature and for stream flow augmentation is an important component of the solution, provided the sewage is treated to high quality.

24. Proper solution of the sewage problem in the West Bank is a critical element in solving the regional water and environment problem.

EXISTING REGIONAL COOPERATION

25. Jordan and Israel signed a Peace Treaty in October 1994, in which water is a major component. Cooperation between the Parties since then is excellent, and no major problems have arisen that could not be settled amicably.

26. The Palestinian Authority and Israel signed in September 1995 the interim Oslo II Agreement, in which "water and sewage" are an important element. The Parties have made every effort to adhere to the Agreement, in spite of the difficult security problems. Regular meetings take place at the field, technical and policy levels, and there is a mutual agreement "to keep water out of the cycle of violence".

27. Water is practically the only domain in which the Palestinian Authority and Israel continue to cooperate effectively, even though it is hampered by the difficult security situation.

28. The US has played a critical role in helping the Parties to work together and in resolving difficult issues. The US chairs regular Tri-Lateral meetings with the Palestinian and Israeli delegations, at which both general and specific problems are discussed.

29. The US, through US–AID, has been an important force on the ground, helping the Palestinians in addressing their water and sewage problems. Carrying out studies, and especially funding and responsibility for construction of water and sewage works have a significant impact. These activities of US–AID are currently hampered by security problems, but should be sustained nevertheless, and resumed fully once conditions allow.

30. Considerable regional cooperation in applied research is ongoing, and should be encouraged and funded. This is creating solid bridges of personal and institutional cooperation, which enhances mutual understanding for joint problem-solving.

ELEMENTS OF A LONG-TERM SOLUTION: REGIONAL COOPERATION IN MANAGEMENT OF SHARED WATER RESOURCES - A MECHANISM TO BUILD PEACE IN THE REGION

31. Gaza gets its water from local groundwater, augmented by desalination and some import from the Israeli system—as per the Oslo II Agreement.

32. Coordinated management of the Mountain Aquifer by Israel and the Palestinians—based on the principles of the Oslo II Agreement.

33. Major desalination on the Mediterranean Coast (proposed at Hadera) and delivery directly to the West Bank, funded by Donors for the Palestinians. This is the only viable long-term solution for the West Bank.

34. The Palestinian-Israeli Joint Water Commission continues to operate along the principles of the Oslo II Agreement.

35. The US and other Donors help the Palestinians to develop their water systems, and

especially to construct and operate over time in a reliable fashion sewage treatment plants in the West Bank.

36. Israel and Jordan continue to seek jointly sources in both their territories for additional supply to Jordan, to be paid by Jordan, as per the Jordan-Israel Peace Treaty.

37. The Jordan-Israeli Joint Water Commission continues to operate as per the Peace Treaty.

38. Israel augments its own supplies as described above and maintains full control of its natural water resources in the North.

39. A attractive option would be a larger regional perspective, in which water from the great rivers in the North is a component in a regional "water-and-peace" scheme. This would engage Lebanon and Syria in regional water management schemes for the benefit of all.

40. Joint projects of applied research, development and application in desalination, hydrology, water treatment, sewage treatment and reuse are valuable components of regional cooperation. These activities build bridges and contribute to joint problem-solving.