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Brackish water management and use in Jordan

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Abstract

The severity of water problems in Jordan was realized at the beginning of the 1980s. Many strategies and measures were proposed to alleviate and overcome these problems. These mainly include supply augmentation measures through constructing various hydraulic structures and groundwater exploitation. In addressing supply management, it was concluded that no single action could remedy the nation's water shortage. Rather, many integrated actions are needed to ensure water availability, suitability, and sustainability. Among those options, the development of new water resources such as brackish water were identified as a potential source for supply augmentation.

Keywords: Brackish; Water management; Jordan

1. Background

It was proposed that desalinized brackish water (with a TDS of 1000–10,000 mg/1) could increase water supply in the Zarqa Basin and other areas of the Jordan Valley. Hydrological Services International carried out a cursory study in 1991. The study identified sources of brackish water and recommended some site-specific studies [1].

The Japan International Cooperation Agency (JICA) has conducted an evaluation of brackish groundwater resources potential and quality in the central and southern parts of the Jordan Valley [2]. The potential amount of brackish water that is feasible for development and utilization is substantial. However, when referring to statistics about brackish water, the quality, quantity, and location of this resource should be carefully studied in order to assess future brackish water development and management. The Appendix presents a summary of estimates of brackish water resources in Jordan.

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1.1. Magnitude of the issue

Desalination of brackish water seems to offer a reasonable source of supply augmentation as a non-conventional water resource. Several brackish springs were identified in various parts of the country. Tentative estimate of stored volumes of brackish groundwater for the major aquifers suggest immense supply, but not all of these quantities could be feasible for utilization.

1.2. Stakeholders

Besides the Ministry of Water and Irrigation, many agencies will be involved in desalination. These include the Ministry of Agriculture, Ministry of Municipal Affairs and Environment, Ministry of Health, Ministry of Industry, Ministry of Tourism, the Higher Council for Science and Technology, The Royal Scientific Society, the private sector, and NGOs.

2. Current policy status

1. It was stipulated in the Economic and Social Development Plan (1993–1997) under infrastructure policies that one of the main infrastructure sector policies is regulating the use of ground and surface water for various purposes by assessing the quantity and the quality of brackish groundwater;

2. In the Treaty of Peace [3], signed on 26 November, 1994, Annex 11, page 2 Article (2) /d regarding water from the Jordan River, it states that: "Jordan is entitled to an annual quantity of 10 Mm^3 of desalinated water from the desalination of about 20 Mm^3 of saline springs now diverted to the Jordan River."

3. Actions taken

Studies and projects were carried out to evaluate the feasibility of water desalination in Jordan. Some of the proposed actions focused on utilizing the water in the Gulf of Aqaba for water supply and desalination for major industries. Technologies used and proposed were multi-stage flash (MSF) or reverse osmosis (RO) and electrodialysis (ED).

Currently, there are few, very small desalination plants which are used for industrial purposes. Technologies used in these plants are RO and ED, i.e., Hussein thermal station, oil refinery, Electricity Authority, and medical industries. Moreover, the JICA [4] carried out a study on the evaluation of brackish groundwater resources potential and brackish groundwater quality for the Jordan Valley which included the Esban, Kafrain, Karameh, and Abu Zieghan areas. The study formulated a brackish groundwater resource development strategy for the northern part of Jordan including the Jordan Valley and Amman City. The study concluded that there is a potential for producing 60 Mm^3/y of desalinated brackish water in the study area. A pilot plant producing 5 MCNI/y of desalinated water was proposed in the Kafrain/Hisban area, and recently studies were carried out to desalinate 30 Mm^3 from Kafrien/Hisban for the urgent need in Amman, as well as 10 Mm^3 from seawater at Aqaba, mainly for industrial purposes, in addition to some small desalination units in the desert area.

4. Policy gaps

1. Absence of policies, laws and regulations for brackish water use and management.

2. Lack of guidelines and standards regarding the possible uses and methods of disposal of brine (final product of desalination). Disposal of the resulting brine from desalination will be restricted to specific locations. A water policy (maybe under water quality and protection component) should address this issue since the proposed Environmental Law is about to be approved.

5. Policy recommendations under consideration

1. Develop plans for efficient utilization of all possible brackish water resources through an integrated water resources management plan.

2. Plan and develop appropriate desalination plants near brackish water sources to be utilized for human settlements in the desert areas and for Badia development.

3. Encourage local industries for the production of components of desalination plants especially RO membranes.

4. Encourage brackish water use in agriculture and industry through technology, transfer and research.

5. Develop policies for efficient conductive uses of fresh and brackish water for all sectors. Some industries, such as potash, need only 16% of fresh water out of 11 Mm^3 to be used in the year 2000.

6. Encourage research and studies for the utilization of solar technology in brackish water desalination and for potential uses of brine.

6. Linkages to other policy issues

This policy issue is linked to many other issues, including water resource assessment and monitoring, development of water resources and criteria for prioritization, standards, guidelines and monitoring incentives and enforcement. Moreover, it is related to policy planning, implementation and evaluation procedures, and appropriate technology

7. Constraints to resolving the issue

Constraints may include economic feasibility, technology transfer, training, operation and maintenance costs. Other constraints include lack of reliable data regarding reliable brackish water reserves.

8. Next steps for policy development

- Presentation of the policy profile to policy team and NM members.
- Review and refinement of the profile in light of comments.
- Draft for policy statement, strategies, and action plans.
- Analysis of interactions and linkages among various policy statements
- Legal review and draft for legislation.

References

[1] Hydrogeological Services International, Water resources policies planning and management: report on brackish groundwater resources in Jordan, 1991.

[2] Japan International Cooperation Agency, Progress report, the study on brackish groundwater desalination in Jordan, Tokyo, June 1994.

[3] Peace Treaty between the Hashemite Kingdom of Jordan and the State of Israel, November 1994.

[4] Japan International Cooperation Agency, Progress report, the study on brackish groundwater desalination in Jordan, Tokyo, November 1994.

Appendix

In recent studies by UNDP and PRIDE, it was reported that hydrogeological knowledge on reliable estimates of brackish groundwater resources in Jordan is “poor”. However, the following is a summary of available estimates of brackish water resources by basins.

In the Disi sandstone, it is reported that about 27,000 Mm^3 of brackish groundwater is available which is distributed in the Jordan River, Azraq, Hammad, the Dead Sea and Sarhan basins. The depth of water in the Sarhan area is about 2000 m from the surface.

The volume of brackish water stored in the Kurnub sandstone is reported as 75,000 Mm^3 in Azraq, Hammad, Dead Sea, Sirhan, and Jafer

basins distributed as 16,990, 12,550, 26,440, 12,620 and 6400 Mm^3, respectively.

However, most of the Kumub sandstone in the Dead Sea basin is outcropping, and its water discharges directly to the local wadis. Nevertheless, this water was counted in the discharge of brackish springs. The depth of ground water in the Hammad and Sarhan basins in the Kumub sandstone is about 1000 m, while in the Jafer basin the thickness of the sand stone unit is only around 50 m.

In light of the questionable quality of the above estimates, it is recommended that an assessment of brackish water resources in terms of quantity, quality, and location for all basins should be carried out.