

# Management of Transboundary Aquifers of Kuwait: A Cooperative Approach

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## Abstract

In the arid environment of Kuwait where there is no surface water, usable groundwater resource is limited, and the country mainly depends on the seawater desalination for its freshwater need, judicious management of the available groundwater resource is imperative for the well-being of the country. It is important to recognize in this context that the Dammam Limestone Formation and Kuwait Group, the two aquifers exploited in Kuwait, are 'transboundary' in nature (i.e., they extend beyond the international boundary of the country) and are present in the other adjacent countries of the Arabian Peninsula. Kuwait is making every effort to manage these aquifers sustainably and protect them from environmental pollution. However, with the increasing demand for water that has led to the over exploitation of the groundwater resources in all the 'aquifer states' that share these aquifers, development of a cooperative groundwater management plan will be beneficial for all the stakeholders concerned. Advantage of the newly adopted draft 'Law of Transboundary Aquifers' by the General Assembly of the United Nations that emphasizes on such cooperation for the greater benefits of all concerned, may be taken to formulate and execute such a plan in not too distant a future.

**Key Words:** Dammam Limestone Formation, Kuwait Group, Groundwater, Arabian Peninsula

## 1. INTRODUCTION

### *1.1. Background*

As with any semi-arid to arid country, usable water is a very precious commodity in Kuwait. The freshwater need of the country is almost entirely met by the seawater desalination. The country has, however, some brackish groundwater resource that is exploited mainly for agricultural and industrial use. The aquifers that host this brackish groundwater are transboundary (located within the jurisdiction of more than one state) in nature. The cooperative management of this resource by the 'aquifer states' is vital for its sustainable exploitation, preservation and protection.

### *1.2. Hydrogeology of Transboundary Aquifers in Kuwait*

In Kuwait, usable (total dissolved solids contents  $\leq 5000$  mg/l) groundwater is exploited from clastic sediments of Kuwait Group aquifer and the unconformably underlying dolomitic limestone of the Dammam Limestone Formation aquifer. Most of the recharge to these aquifers takes place from the lateral flow of groundwater down the natural hydraulic gradient toward the east and the northeast from recharge sites in the highlands of Saudi Arabia lying to the west and the southwest of the country, where these and other underlying formations extend and are exposed to the surface (Fig. 1). Thus the aquifer system of Kuwait is transboundary in nature with the major recharge zone located in Saudi Arabia and the discharge zone extending along the coastal parts of Kuwait and the lower parts of the Shatt El-Arab valley in Iraq.

## 2. CURRENT STATUS OF GROUNDWATER RESOURCE MANAGEMENT IN KUWAIT

In view of the ever increasing demand for water in Kuwait with increase in population and the living standard, pressure on the usable groundwater resources in Kuwait is increasing with time. In order

to preserve this precious resource for the future generation, Kuwait is currently making every effort to manage the exploitation of the aquifers sustainably. Extensive hydrogeological studies and numerical modeling have shown that the aquifers that extend from Saudi Arabia to Kuwait are interlinked vertically. Lateral recharge from Saudi Arabia through these aquifers has been estimated to be in the range of 180,000 – 185,000 m<sup>3</sup>/d (Mukhopadhyay et al., 1994). However, the current production (in excess of 450,000 m<sup>3</sup>/d) from these aquifers far outstrips the recharge and the aquifers are being effectively mined, causing a large drawdown in and around the brackish water fields of central and southern Kuwait. The freshwater lenses (total dissolved solids contents  $\leq 2000$  mg/l) underlying the surface depressions of Raudhatain and Umm Al-Aish areas in North Kuwait, though minor in volume, are strategic in nature due to the absence of any other natural occurrence of freshwater in Kuwait. Optimum utilization of this resource is also getting priority attention in this context (Hadi et al., 2006).

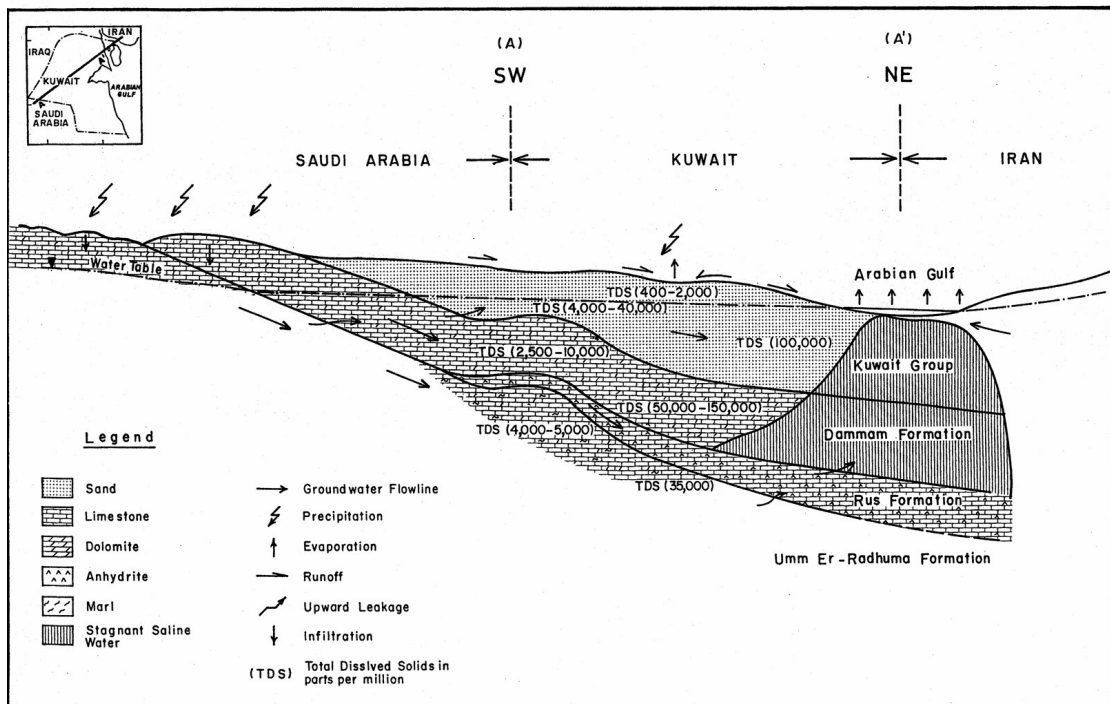


Fig. 1. Generalized hydrogeologic cross-section across Arabian Peninsula, depicting the recharge and the discharge zones.

The protection of the groundwater resources in Kuwait from the environmental pollution is another important consideration for Kuwait. A conceptual design for the monitoring network across the country has been developed as an early warning system for the detection of the contamination of the aquifers from various sources and recommendations have been put forward for the adoption of policies and procedures that will protect the groundwater resources of Kuwait from both intentional and unintentional deterioration in quality through environmental pollution.

### 3. FUTURE NEED OF GROUNDWATER MANAGEMENT IN KUWAIT

#### 3.1. Co-operative Management

Though Kuwait is making every effort to manage and protect its groundwater resources in a sustainable manner, in view of the ‘transboundary’ nature of the aquifers, the exploitation intensity and

distribution of the exploitation centers in the up-gradient areas will have significant effects on the lateral inflow volume and the potentiometry of the aquifer system in the State of Kuwait. This, in turn, should affect their exploitability in Kuwait. Furthermore, any environmental pollution taking place at the upstream side of the aquifer system will have the potential for affecting the water quality in the downstream side in Kuwait. In view of the above, a comprehensive and cooperative hydrogeological evaluation of the aquifer system covering these neighboring countries is called for to assess the long-term sustainability of these aquifers in the region as regards to the quantity and quality of the water produced from them.

### 3.2. Relevance to the 'Law of Transboundary Aquifers'

It is heartening to note that the General Assembly of the United Nations (UN) being “convinced of the need to ensure the development, utilization, conservation, management and protection of groundwater resources in the context of the promotion of the optimal and sustainable development of water resources for present and future generations” and “affirming the importance of international cooperation and good neighborliness in this field”, in its resolution 63/124 dated 11<sup>th</sup> December, 2008, has adopted the draft “Law of Transboundary Aquifers”. At present, Kuwait has no formal understanding with any of the neighboring countries on the exploitation of its transboundary aquifers. It is, however, realized that such agreements on the sustainable management of the aquifers will be of mutual interest and the proposed draft of the ‘Law of Transboundary Aquifers’ can provide a framework for such formal agreements. Kuwait will make all efforts to arrive at such bilateral and / or regional agreements with the ‘aquifer states’ as detailed in the articles of the draft law.

## 4. CONCLUSIONS

Usable (both fresh and brackish) groundwater resource of Kuwait is limited and over exploited. In view of the ‘transboundary’ nature of the aquifers of Kuwait and their exploitation in the neighboring states, joint formulation of an optimum management scheme for these aquifers by all the ‘aquifer states’ is pre-requisite for their sustainability in the long term and protection from environmental and natural degradation in their quality. The recent adoption of the draft ‘Law of Transboundary Aquifers’ by the General Assembly of the UN is a timely step in this direction. It is hoped that the law will soon be finalized after taking into considerations the view points of all the stakeholders concerned. Kuwait is looking forward to take advantage of this law in reaching mutual understanding with its neighboring states to initiate cooperative study of its ‘transboundary’ aquifers that should ultimately lead to the adoption of a mutually beneficial management plan for these aquifers by all the states sharing them one way or the other.

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