

# Groundwater Quality and Levels

## GROUNDWATER QUALITY

Groundwater quality can be affected by both natural and anthropogenic activities. In aquifers unaffected by human activity, the quality of groundwater results from geochemical reactions between the water and rock matrix as the water moves along flow paths from areas of recharge to areas of discharge. In general, the longer groundwater remains in contact with soluble materials, the greater the concentrations of dissolved materials in the water. The quality of groundwater also can change as the result of the mixing of waters from different aquifers. In aquifers affected by human activity, the quality of water can be directly affected by the infiltration of anthropogenic compounds or indirectly affected by alteration of flow paths or geochemical conditions.

Contamination of fresh groundwater by saline water is a common problem in the region. Salinity of groundwater generally is measured in terms of total dissolved solids or dissolved chloride. In humid areas and where recharge is abundant, potential groundwater salinization is limited because of the natural flushing by freshwater. Conversely, in semiarid areas, the absence of natural flushing by freshwater enhances the accumulation of salts and saline water. Natural sources of saline water include:

- encroachment of sea water near the Mediterranean Sea and Red Sea;
- upward migration of highly pressurized brines in the Jordan Rift Valley and other areas; and
- subsurface dissolution of soluble salts originating in rocks throughout the region.

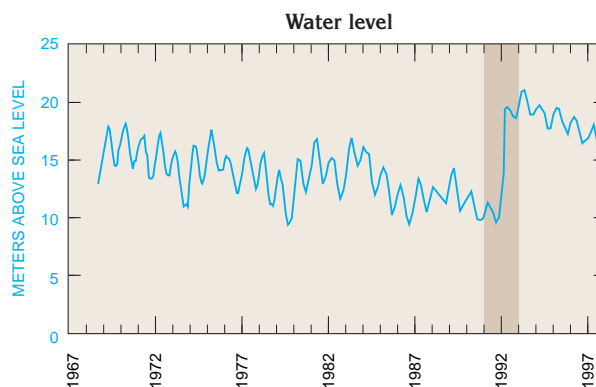
East of the Jordan Rift Valley and Wadi Araba, water at depths of a few hundred meters below land surface generally is saline. Within these areas of generally high salinity, it is possible that a local source of acceptable, relatively fresh water exists.

Heavy pumping in some areas has led to water-level declines and changes in flow directions in the aquifers. In some cases, this has induced saline water from the sea or deep brines, to move into and contaminate an aquifer.

In addition to natural sources, groundwater quality can be affected by agricultural, municipal, and industrial activities in the recharge zone of the aquifer. Potential sources of contamination include recycled irrigation water, wastewater from human activities, and waste by-products from industrial activities. Nitrate is an important constituent in fertilizers and is present in relatively high concentrations in human and animal wastes. In general, nitrate concentrations in excess of a few milligrams per liter indicate that water is arriving at the well from shallow aquifers that are polluted from human or animal waste, or from excess nitrates used in agriculture. Water-quality changes for selected groundwater basins are described in the following sections.

## GROUNDWATER LEVELS

Changes in water levels in wells reflect changes in recharge to, and discharge from an aquifer. Recharge rates vary in response to precipitation, evaporation, transpiration by plants, and surface-water infiltration into an aquifer. Discharge occurs as natural flow from an aquifer to streams or springs, as evaporation and transpiration from the shallow water table, as leakage to vertically adjacent aquifers, and as withdrawal from wells. Where water-level changes are due to withdrawals, they also may reflect changes in groundwater flow direction. Water-level changes for selected groundwater basins are described in the following sections.



*This hydrograph illustrates the effect of a heavy rainy season on water levels in a well in the Mountain Belt. Note recovery of 10 m during the wet winter of 1991–92.*