WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

DETERMINING THE SOURCE OF WATER PUMPED FROM WELLS ALONG THE LOWER COLORADO RIVER

LOWER COLORADO RIVER

The lower Colorado River provides more than 97 percent of the annual water supply to the river valley from the east end of Lake Mead to Laguna Dam (fig. 1) and is the principal source of water for users. Water is stored in three surface reservoirs and in an aquifer of permeable sediments and sedimentary rocks in the river valley. Water is pumped directly from the river and from wells on the flood plain, on adjacent alluvial slopes, and in interconnected tributary valleys.

Most of the water in the aquifer originated from the river because of the hydraulic connection between the river and the aquifer and overbank flow prior to building of the dams. Unsaturated sediments and sedimentary rocks around reservoirs were saturated with water from the river as the reservoirs filled. Isotope ratios of hydrogen and oxygen in water from wells indicate that most of the water in the aquifer beneath the flood plain and in many places beneath the alluvial slopes originated from the river. Precipitation in surrounding mountains and inflow from tributary valleys contribute some water to the aquifer.

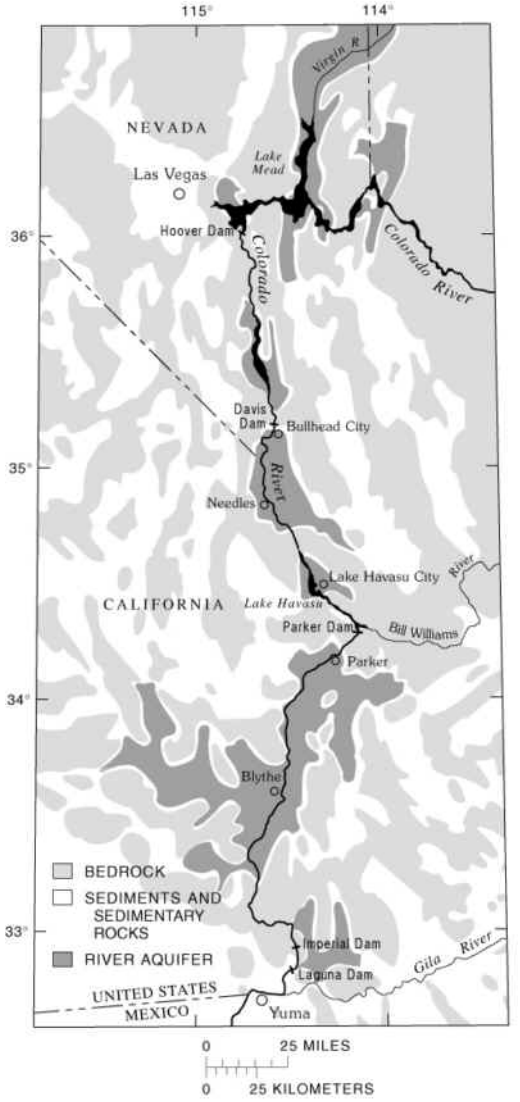

Figure 1. The lower Colorado River and areal extent of the river aquifer.

WHY ACCOUNT FOR PUMPAGE?

Water in the lower Colorado River is apportioned among the States of Arizona, California, and Nevada by the U.S. Supreme Court Decree of 1964, *Arizona v. California*. The decree is specific about the responsibility of the Secretary of the Interior to account for the consumptive use of water from the mainstream. Consumptive use is defined to include "water drawn from the mainstream by underground pumping." To aid in implementing the decree, it was necessary to develop a method to identify the source of water pumped from wells.

WHICH WELLS YIELD WATER THAT ORIGINATED FROM THE RIVER?

Water pumped from wells on the alluvial slopes adjacent to the flood plain and reservoirs and in the tributary valleys originated from the river and from precipitation in the surrounding mountains and tributary valleys. The U.S. Geological Survey, in cooperation with the Bureau of Reclamation, developed

a method to identify wells that yield water that originated from the river by using an accounting surface. Use of an accounting surface provides a uniform criteria based on hydrologic principles for all users pumping water from wells. Definition of the "river" aquifer and delineation of the subsurface limits were required prior to the generation of the accounting surface in the river aquifer.

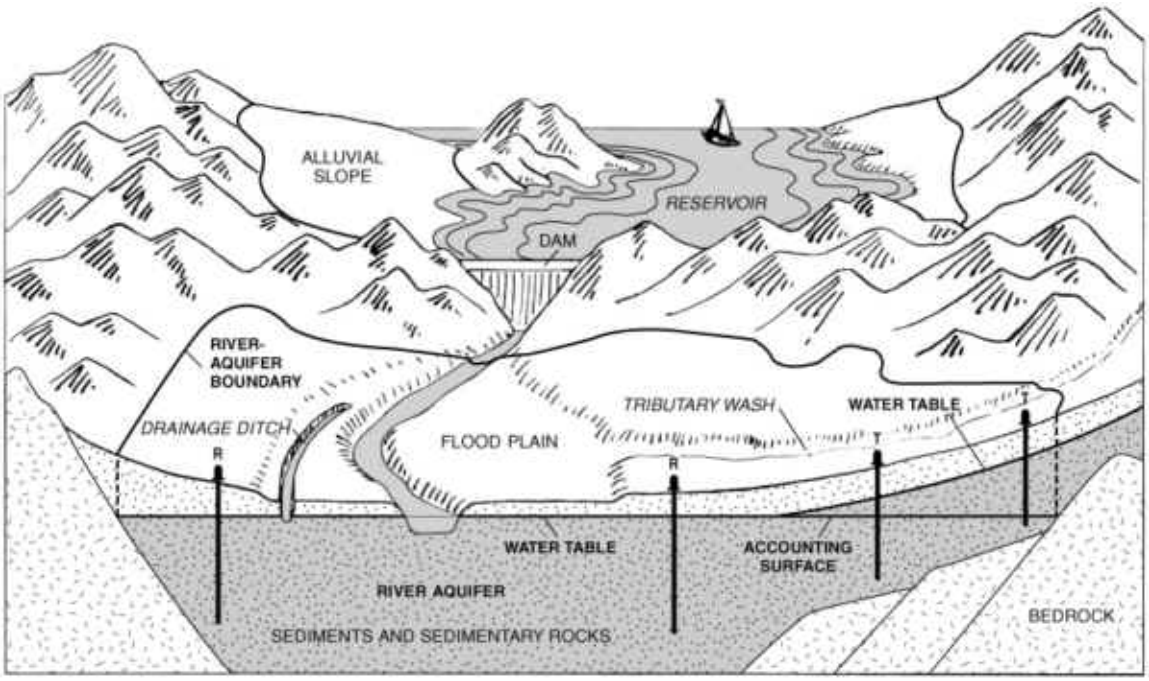

Figure 2. Schematic cross section of the river aquifer and accounting surface.

RIVER AQUIFER

Permeable sediments and sedimentary rocks that fill the structural basins of the lower Colorado River valley and adjacent tributary valleys form the river aquifer, which is saturated with water that originated from the Colorado River. Geophysical gravity studies, well logs, and previous hydrologic and geologic studies provided data on the extent and thickness of the sediments and sedimentary rocks; total thickness ranges from 0 to more than 5,000 feet. The subsurface limits of the river aquifer are the nearly impermeable bedrock of the bottom and sides of the basin. The water table of the river aquifer extends from the river, beneath the flood plain, and under the alluvial slopes until it intersects bedrock (shown in cross section, fig. 2). That intersection projected to the land surface shows the areal extent of the river aquifer (shown on the surface, fig. 2 and in fig. 1).

ACCOUNTING SURFACE

The accounting surface represents the water table of the river aquifer that would exist if the only source of water to the aquifer was the river. Wells that tap the river aquifer outside the flood plain with a static (nonpumping) water level at or below the accounting surface are presumed to yield water that originated from or will be replaced by water from the river (fig. 2, wells labeled R). Wells with a static water level above the accounting surface are presumed to yield water that originated from precipitation and inflow from tributary valleys (fig. 2, wells labeled T).

The accounting surface was generated by using river profiles of the Colorado River; water-level elevations of reservoirs, lakes, marshes, wetlands, and drainage ditches; and static-water-level elevations in wells. River profiles were computed for the highest median monthly projected discharge for the near future (1992-2001). Near reservoirs, the elevation of the accounting surface is defined by the annual high water-surface elevation used to operate the reservoir under normal conditions.

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