



National Water-Quality Assessment Program

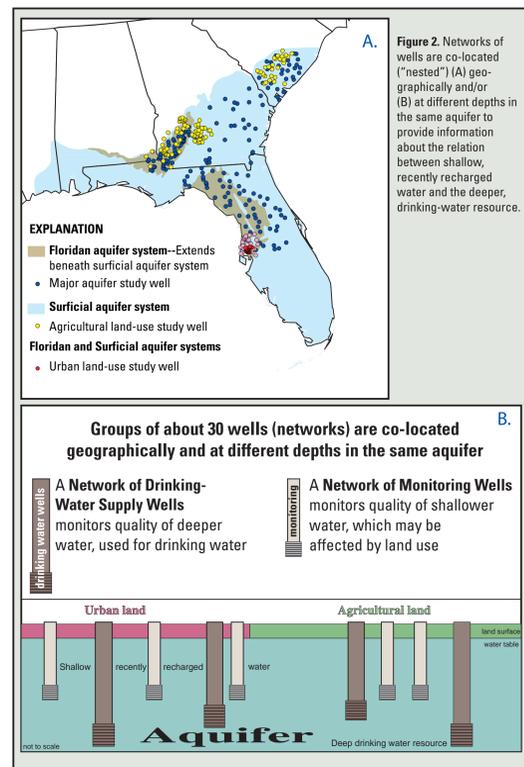
Water-Quality Assessments of Principal Aquifers

By Terri Arnold, Wayne Lapham, and Leslie DeSimone

Objectives of the Principal Aquifer Assessments –

- Describe the quality of water in the part of the groundwater resource used for drinking-water supply.
- Determine contaminants of concern in each Principal Aquifer in relation to human health benchmarks.
- Identify and describe the regional effects of land use on shallow groundwater quality.
- Identify processes controlling water quality and contaminant transport.
- Assess regional trends in groundwater quality.

Network Design – In the NAWQA program, wells are organized in networks designed to answer a specific question or objective. A network generally has about 30 wells. One type of network provides information on the effects of the overlying land use on shallow groundwater quality. The second type of network provides information on the quality of the deeper groundwater resource that is used for drinking-water supply. These two types of networks may be co-located geographically and/or at different depths in the same aquifer to provide information about the relation between shallow, recently recharged water and the deeper, drinking-water resource (figures 2a and b). The Principal Aquifer assessments use data collected from 1991-2010 from these nested well networks.



This poster provides introductory and background information to compliment the nine posters describing regional assessments of groundwater quality and trends in Principal Aquifers of the United States. These Regional Assessments evaluate water-quality conditions and trends in the Principal Aquifers of the Nation that are most used for public water supply (figure 1). Results of the Principal Aquifer Assessments will be presented in a series of detailed reports about each aquifer and in U.S. Geological Survey Circulars corresponding with the groups of aquifers shown in figure 1. Additionally, a tenth Circular synthesizing all NAWQA data available for Principal Aquifers will be published. The series of Circulars is planned for release in 2013.

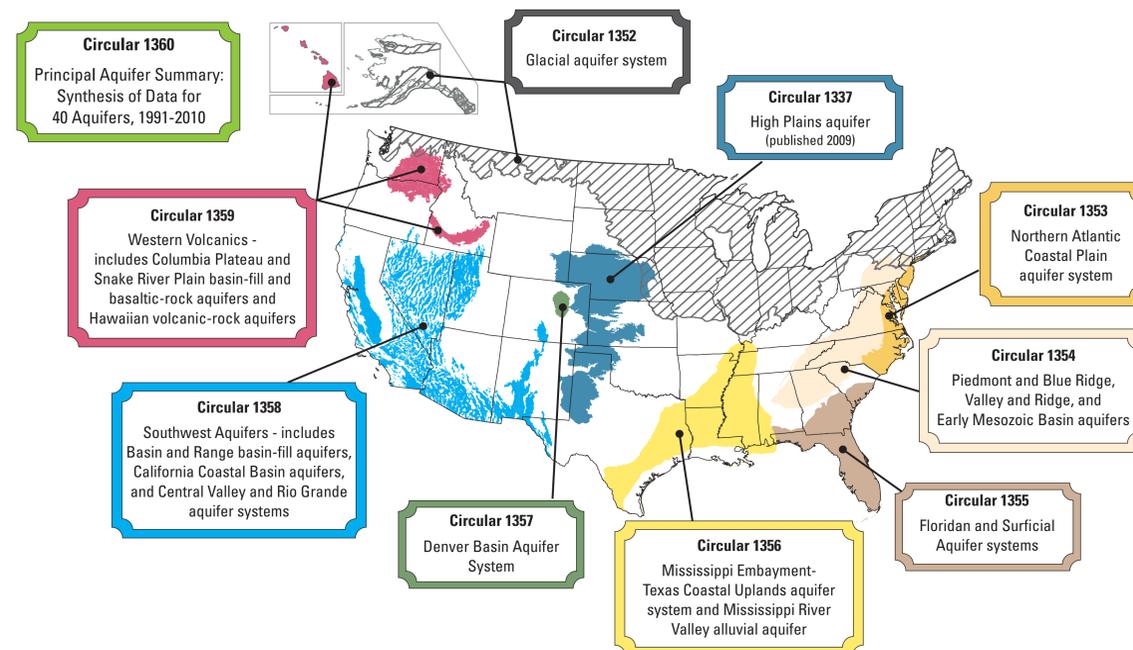


Figure 1. Principal aquifer studies during the second decade of the National Water-Quality Assessment Program (2002-2012). Groups of principal aquifers (shown in the same color) will be summarized in a single Circular.

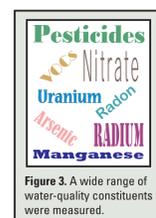


Figure 3. A wide range of water-quality constituents were measured.

Constituents Measured in the Principal Aquifer Assessments –

A wide range of water-quality properties and constituents were measured (table 1, figure 3.). Constituent concentrations were compared to human-health benchmarks, including USEPA Maximum Contaminant Levels (MCLs) and USGS Health-Based Screening Levels (HBSLs), to determine constituents of potential concern for human health in each aquifer. The constituents most frequently present at these elevated concentrations were mostly naturally occurring trace elements (arsenic, manganese, uranium) and nitrate. Man-made organic chemicals – pesticides and volatile organic compounds – were frequently detected at low concentrations but were rarely greater than human-health benchmarks. In all aquifers, man-made organic chemicals were more frequently detected, and more often exceeded benchmarks, in shallow groundwater underlying agricultural and urban land use, than in deeper groundwater used for drinking water.

Table 1. Water-quality properties and constituents measured in wells used for the Principal Aquifer Assessments.

Constituent group	Number of analytes	Approximate number of wells with data ¹
Water properties	6	7,100
Major ions	10	7,100
Trace elements	23	5,700
Nutrients	7	7,000
Radionuclides	5	4,700
Pesticides	155	7,000
Volatile organic compounds	86	6,000
Fecal indicator bacteria	2	1,500

¹Not all wells sampled for all constituents in each group

Sources and Processes Affecting Water Quality and Contaminant Transport – Results of the Principal Aquifer Assessments show that there are common sources and processes that effect water quality and transport of contaminants. Some of the common processes and sources are shown in figure 4.

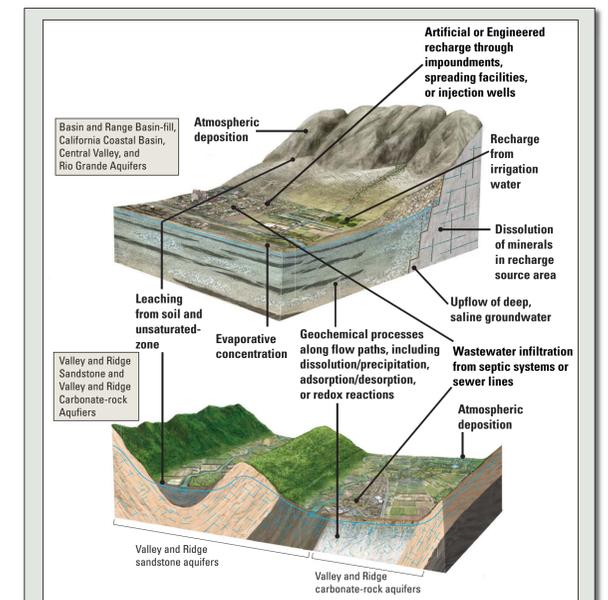


Figure 4. Some of the major sources and processes affecting constituents in groundwater, shown with examples of aquifers in the southwestern United States and in the Appalachian region in the East.

How Can These Assessments Be Used? – Results from the Principal Aquifer assessments can help identify both the common and unique sources and processes among aquifers that affect groundwater quality and transport of contaminants. Regional-scale models that integrate aquifer characteristics, land use, and water-quality monitoring data will help water managers to extrapolate findings to unmonitored aquifers of similar composition and characteristics.