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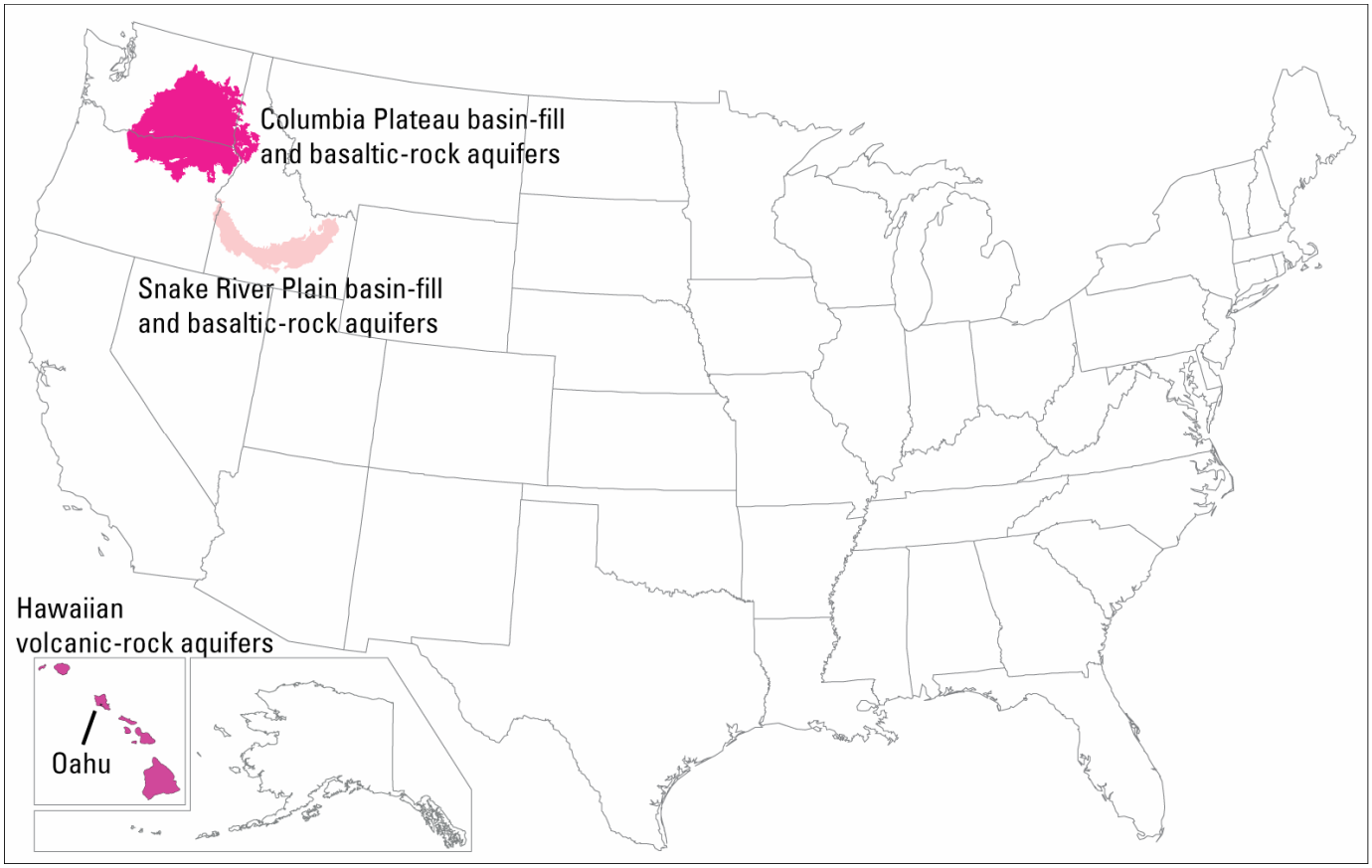
NATIONAL WATER-QUALITY ASSESSMENT PROGRAM

Water Quality in Principal Volcanic Aquifers of the Western United States

The U.S. Geological Survey (USGS) is conducting a National Water-Quality Assessment (NAWQA) that is now in its second decade of study. Analysis in Cycle I (1991-2000) occurred at a local scale of "Study Units" and at the national scale using data collected by the Study-Unit teams. Analysis in Cycle II (2001-2010) is being conducted at an intermediate, regional scale between local and national scales, and is organized by major river basins and principal aquifers that typically span several states.

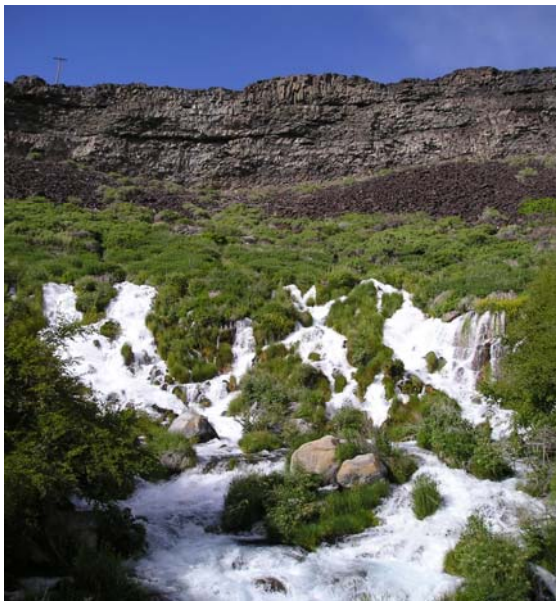
The western volcanics study brings together three areas with similar aquifer properties: Columbia Plateau basaltic-rock aquifers, Snake River Plain basaltic-rock aquifers, and Hawaiian volcanic-rock aquifers. These are extensive provinces of layered igneous rocks (mostly basaltic lava flows) that host regional ground-water flow systems. Important sedimentary aquifers (basin-fill aquifers) overlie basalts of the Columbia Plateau and Snake River Plain. In Hawaii, sediments overlie volcanic-rock aquifers along the coastal perimeter of the islands, but the sedimentary aquifers are not used as drinking-water sources.



The volcanic-rock aquifers are highly susceptible to contamination because they are mostly unconfined and are overlain by thin or well-drained soils. All three areas are farmed intensively, were irrigated heavily for most of the 20th century, and have had agricultural fertilizers and pesticides applied. Numerous agricultural and industrial chemicals have been detected in ground water, though most concentrations are below human-health guidelines.

A notable exception is nitrate, a nutrient for which elevated concentrations commonly are ascribed to fertilizer application, animal manure, or nitrogen-fixing plants (legumes) such as alfalfa. In NAWQA Cycle I sampling, nitrate concentrations in 20 percent of Columbia Plateau wells and 3 percent Snake River Plain wells were above the U.S. Environmental Protection Agency drinking-water guideline of 10 milligrams per liter. No wells in Hawaii had nitrate concentrations above the guideline.

The western volcanics study seeks to explain the causes of such similarities and differences through statistical analysis of soil properties, crop types, and other factors. Past trends in water quality also are under study, with an eye toward future forecasting through the use of ground-water modeling.



Left: High-capacity well pumping into an irrigation transmission canal on the Snake River Plain, Idaho. In the background is a spray-irrigation “wheel line”.

Right: Ground water discharging from the Snake River aquifer in the Thousand Springs area, Idaho. Nitrogen and phosphorus in the spring water may contribute to eutrophication (excessive growth of aquatic plants) along this reach of the Snake River. Basalt cliffs are visible in the upper background.

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For online information, reports, and data from the NAWQA program:
http://water.usgs.gov/nawqa/