



# WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

## U.S. GEOLOGICAL SURVEY GROUND-WATER STUDIES IN WASHINGTON

### GROUND-WATER ISSUES

Washington is divided into two profoundly different climatic zones by the north-trending Cascade Range. East of the Cascade Range, ground water is a major source of irrigation water and serves as the source of supply for nearly all of the municipal and domestic demand. West of the Cascade Range, municipal, domestic, and industrial demand is met through conjunctive use of surface and ground water. In 1985, ground water was the source of supply for 17 percent of the water used in Washington. Of all ground water used, 51 percent was for irrigation, 28 percent for public supply, 12 percent for rural-domestic and livestock use, and 9 percent for industry. Public supplies from ground water served about 1.5 million people in the State. Ground-water use in Washington is expected to increase in the future owing to continued population growth. The major issues related to ground water in Washington are:

- Contamination from radionuclides, disposal of wastes, and saltwater;
- Ground-water availability;
- Conjunctive use of ground water and surface water; and
- Indian water rights.

### U.S. GEOLOGICAL SURVEY PROGRAMS

The U.S. Geological Survey (USGS), established in 1879, is the principal source of scientific and technical expertise in the earth sciences within the Federal government. USGS activities include research, quantitative investigations, data collection, and services in the fields of hydrology, geology, and cartography. The mission of the Water Resources Division of the USGS is to develop and disseminate scientific information on the Nation's water resources. The activities of the Water Resources Division in Washington are conducted by scientists, technicians, and support staff in offices in Tacoma, Vancouver, Pasco, and Spokane.

Hydrologic-data stations are maintained throughout Washington to record stream discharge and stage, reservoir and lake storage, ground-water levels, well and spring discharge, quality of surface and ground water, snowpack, and glacial activity. Water-resources data are stored in the USGS National Water Data Storage and Retrieval System. These data are used by water managers, planners, and others involved in making decisions that affect Washington's water resources.

During 1987, the USGS, in cooperation with the Washington State Department of Ecology (WSDE), measured water levels in about 1,000 observation wells. Water-level measurements from wells are used to determine ground-water-level trends; however, these measurements need to be integrated with other hydrologic observations and quantitative ground-water investigations to be relevant and useful to resource managers.

The USGS has conducted more than 400 hydrologic investigations in Washington since 1910. During 1987, the Survey entered into cooperative agreements with 45 local, State, and Federal agencies to conduct hydrologic investigations in

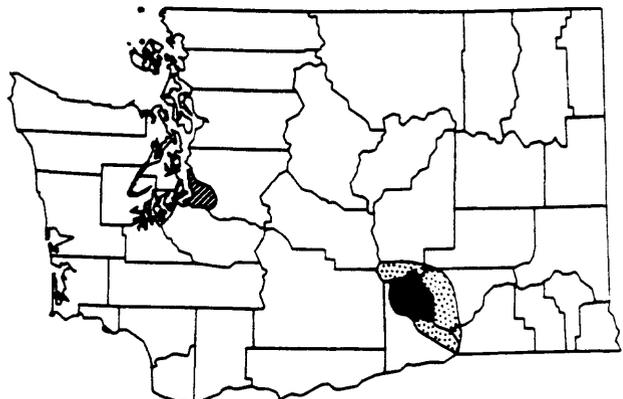
Washington; five of these investigations were concerned with quantitative studies of ground water. Three examples of studies conducted by the USGS to address specific ground-water issues in Washington are discussed in the following sections.

### Contamination from Radionuclides and Hazardous Wastes at Hanford Nuclear Reservation

Operation of the Hanford Nuclear Reservation began in 1944; its purpose was to aid in the development of nuclear weapons. At its peak of operation after World War II, there were nine reactors, five reprocessing plants, and an assortment of sites for storage and disposal of liquid and solid radioactive and hazardous wastes. Wastes were disposed of by a variety of methods, including deep-well injection, infiltration of liquids through trenches and retention ponds, burial in trenches and pits, and, in some cases, direct discharge to the Columbia River. Recent disposal of radioactive wastes has been more restricted and monitoring has been expanded, but low-level radioactive wastes, such as tritium, are still being released, and radioactivity has reached the ground-water system and the Columbia River. The USGS has had more than 40 years of experience in defining the geology, flow systems, and quality of ground water in the aquifers of the Columbia Plateau adjacent to the Hanford Reservation. Since 1982, the USGS has participated in the Interagency Hydrologic Working Group with the U.S. Department of Energy, its contractors, and Battelle Pacific Northwest Laboratories to define the ground-water flow systems in the Hanford Reservation area. Owing to the USGS' expertise in

#### STUDY AREAS

-  Hanford Nuclear Reservation
-  Benton-Franklin Counties area
-  Southwestern King County



geohydrology and its long experience in defining the ground-water flow system in the adjacent areas of the Columbia Plateau, the USGS and U.S. Environmental Protection Agency (EPA), Region 10, have agreed that the USGS will provide technical review, oversight, and advice to EPA managers regarding both Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act sites on the Hanford Reservation.

#### Rise of the Water Table and Degradation of Water Quality in the Benton-Franklin Counties Area

The water table in the Benton-Franklin Counties area has risen as much as 200 feet in response to leakage of irrigation canals, to the application of irrigation water, and to the rise of the Columbia River water levels (caused by the construction of dams). In some areas, water-table rises have caused ponding and waterlogging of soils on farm property, and the drowning of septic-tank systems. Ground water near canals and irrigated farms has become contaminated by agricultural chemicals, and ground water near septic-tank systems has become contaminated with septic leachate. Since 1985, the USGS has been studying these problems, and has inventoried and measured water levels in more than 1,000 wells in the area to define the ground-water levels and develop the hydrologic information that was used to build the project data base. Leakage rates and water losses from ponds and in about 90 miles of canals in 28 canal reaches were measured. The leakage measurements were conducted for lined and unlined canals in a variety of soil and geologic settings. Losses from unlined canals ranged from 0.2 to greater than 2 feet per day (ft/d). Lined canals tend to leak less, but rates ranged widely (from 0.04 to 0.94 ft/d) depending on the type, quality, and maintenance of the lining. Water-quality samples were collected from 328 ground-water sites and 32 surface-water sites. Substantial contamination of ground water was indicated in that 19 percent of the sampled wells yielded water that exceeded the 10-milligrams-per-liter concentration of nitrate recommended in the EPA National Interim Primary Drinking Water Standards.

#### Availability of Ground Water in Southwestern King County

Present ground-water conditions, the geohydrologic framework, and future ground-water problems near Puget Sound have been studied since 1986 by the USGS in cooperation with the WSDE, King County, and local water utilities. In the Puget Sound area, surface-water supplies are almost fully allocated, and ground water is being considered to meet future needs; however, ground-water availability, its relation to the surface-water resource, and seawater intrusion must all be considered by managers in development of new supplies. During this study, the USGS has accomplished an in-depth examination of regional stratigraphy and definition of major water-bearing and confining units. Ground-water-level data and water-level-contour data has enabled the determination of regional patterns of ground-water flow in the major aquifers. In addition, data related to recharge, ground-water use, and hydraulic characteristics of the sediments have also been collected and assessed. The water-quality sampling program was designed to determine regional patterns of ground-water quality and to assess existing water-quality characteristics in relation to land-use practices. An especially appealing aspect of this investigation to the local agencies has been the USGS' role in providing data frequently and sharing conceptual ideas with the agencies' technical representatives. Throughout the study, there has been a free exchange of data and ideas that enabled local water managers to plan and make water-resource development decisions on the basis of the most current understanding of the ground-water

system. The results of this study will continue to aid the State and local water managers in planning future ground-water development.

#### GROUND-WATER MANAGEMENT

The principal agencies responsible for ground-water management in Washington are the Washington State Department of Ecology, the Washington State Department of Social and Health Services, and county governments. The Department of Ecology is responsible for administering all ground-water uses greater than 5,000 gallons per day, regulates well drillers, well drilling, and well completion, and is responsible for ground-water pollution control. The Department of Social and Health Services is responsible for regulating public water-supply systems. County governments usually are involved in managing ground water. All of these agencies use ground-water data and results of investigations conducted by the USGS. The following State, local, and Federal agencies have entered into cooperative cost-sharing agreements with the USGS to conduct ground-water investigations in Washington:

Benton County	Seattle Department of Parks and Recreation
Cities of Kennewick, Pasco, Pullman, Richland, and West Richland	South Columbia Basin Irrigation District
City of Seattle, Water Department	Southwestern King County Regional Water Association
City of Tacoma Public Utilities	U.S. Army Corps of Engineers
Clark County	U.S. Bureau of Reclamation and Indian Affairs
Columbia Irrigation District	U.S. Department of Energy
Cowlitz County	Washington State Departments of Ecology, Natural Resources, and Transportation
Franklin County	
King County Planning Department	
Puyallup Indian Nation	
San Juan County	

#### SELECTED REFERENCES

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- , 1985, National water summary 1984—Hydrologic events, selected water-quality trends, and ground-water resources: U.S. Geological Survey Water-Supply Paper 2275, 467 p.
- , 1987, Subsurface transport of radionuclides in shallow deposits of the Hanford Nuclear Reservation, Washington—Review of selected previous work and suggestions for further study: U.S. Geological Survey Open-File Report 87-222, 61 p.
- Vaccaro, J.J., 1986, Plan of study for the regional aquifer-system analysis, Columbia Plateau, Washington, Northern Oregon, and Northwestern Idaho: U.S. Geological Survey Water-Resources Investigations Report 85-4151, 25 p.

Information on technical reports and data related to ground water in Washington may be obtained from:

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