U.S. Department of the Interior
U.S. Geological Survey

Water-Resources Activities of the U.S. Geological Survey in Alaska, 1997

The overall mission of the U.S. Geological Survey's Water Resources Division is to provide the hydrologic information and understanding needed for wise use and management of the Nation's water resources. For nearly 100 years, the U.S. Geological Survey has studied the occurrence, quantity, quality, distribution, and movement of the surface and ground water that constitutes the Nation's water resources. As the principal Federal water-data agency, the U.S. Geological Survey collects and disseminates about 70 percent of the water data currently being used by numerous State, local, private, and other Federal agencies to develop and manage our water resources. This nationwide program, which is carried out through the Water Resources Division's 48 District offices and 4 Regional offices, includes the collection, analysis, and dissemination of hydrologic data and water-use information, areal hydrologic resource appraisals and other interpretive studies, and research projects. Much of this work is a cooperative effort in which planning and financial support are shared by State and local governments and other Federal agencies.

ACTIVITIES

The Water Resources Division's activities in Alaska are divided into three broad categories:
(1) *Collection of hydrologic data.* These data are required for planning and conducting hydrologic appraisals and hydrologic research. In 1997, this type of work constitutes the major part of the Division's efforts in Alaska.
(2) *Hydrologic appraisals.* These appraisals include studies of water resources in areas likely to be or being affected by mineral or urban development; investigations of potential hydrologic hazards; and studies of ground- and surface-water contamination on Federal lands.
(3) *Basic and applied research in hydrologic topics unique to cold climates.* Subjects being studied include quantity and quality of surface and ground water; hydrologic instrumentation; and glacier, snow, and ice dynamics.

ALASKA'S WATER RESOURCES

A wide range of climate directly influences the water resources of Alaska. Precipitation ranges from less than 10 inches per year (principally snow) in Arctic Alaska to 200 to 300 inches per year (principally rain) in Southeast Alaska.

Surface Water

Alaska has about 36 percent of the entire Nation's average annual streamflow; if lakes and glaciers are included, Alaska has more than 40 percent of the entire Nation's surface-water resources. Streamflow in southeast Alaska alone is comparable to the mean annual streamflow of the Mississippi River. This streamflow does not enter the ocean in the form of one large river, but by way of numerous smaller rivers and streams. Alaska has seven of the 20 largest rivers in the United States: the Yukon, Kuskokwim, Copper, Stikine, Susitna, Tanana, and Nushagak.

Alaska has so many lakes they are essentially uncounted. Nearly 100 lakes are larger than 10 square miles in size. Iliamna Lake is Alaska's largest with a surface area of about 1,000 square miles.

Springs throughout the State are found as innumerable small seeps and as warm or mineral waters that support recreational centers. On the North Slope, flows from large springs produce widespread icings in winter.

Snow and Glaciers

Snow covers most of the State for one-half to three-quarters of the year. Freezing and thawing of water affects virtually all of the State to some extent. Glaciers cover nearly 30,000 square miles in Alaska—about 5 percent of the total area of the State—but produce approximately 35 percent of Alaska's runoff and 10 percent of the Nation's runoff. If all the glacial ice melted, it would take a river the size of the Yukon about 150 to 200 years to drain all the water. Glaciers play a key role in water storage, timing of peak flows, and sediment transport.

Ground Water

Ground water is an undeveloped resource in most of Alaska: in many areas, potential development of the resource far exceeds current use. Ground-water conditions are diverse: major aquifers are present in the alluvium of large river valleys (Yukon, Tanana, Kuskokwim, Susitna), in glacial outwash deposits under coastal basins (Cook Inlet) and valleys (Seward and Juneau), and in carbonate bedrock of the Brooks Range. In other areas, however, the fine-grained material of glacial and glacial-lake deposits and the low permeability of consolidated rocks offer a much less promising ground-water potential. In addition, the recharge, discharge, movement, and thus the availability of ground water over much of the interior, western, and northern parts of the State and on the flanks of the Alaska Range are restricted by permafrost—permanently frozen ground.

Water Quality

The quality of Alaskan waters is generally acceptable for most uses. However, available data do indicate naturally occurring problems such as suspended sediment in glacier-fed streams, salt-water intrusion, and undesirable concentrations of iron or arsenic in ground water at various locations. Local pollution from septic tank leakage has occurred in several locations.

- •Alaska's land area cover about one-fifth of the conterminous U.S.
- •Alaska has tens of thousands of streams that discharge about 36 percent of the entire nations's average annual stream outflow

Surface-Water Stations

Period of Project: 1948 to present

Chief: Kendall R. Thompson

Location: Statewide

Purpose:

(1) Collect surface-water data sufficient to satisfy needs for uses such as (a) assessment of water resources, (b) operation of reservoirs or industries, (c) forecasting, (d) disposal of wastes and pollution controls, (e) discharge data to accompany water-quality measurements, (f) legal requirements, and (g) research or special studies. (2) Collect data necessary for analytical studies to define—for any location—the statistical properties of and trends in water in streams, lakes, and estuaries for use in planning and design. In 1996, 88 surface-water sites were monitored.

Ground-Water Stations

Period of Project: 1947 to present

Chief: Kendall R. Thompson

Location: Statewide

Purpose:

(1) Collect water-level data sufficient to provide a minimum long-term data base so that the general response of the hydrologic system to natural climatic variations and induced stresses is known and potential problems can be defined early enough to allow proper planning and management. (2) Provide a data base against which the short-term records acquired in areal studies can be analyzed. This analysis could (a) provide an assessment of the ground-water resource, (b) allow prediction of future conditions, (c) detect and define pollution and supply problems, and (d) provide the data necessary for management of the resource. In 1996, 58 ground-water sites were monitored.

Quality-of-Water Stations

Period of Project: 1949 to present

Chief: Kendall R. Thompson

Location: Statewide

Purpose:

(1) Collect, analyze, and publish water-quality data from selected surface- and ground-water sites in Alaska. (2) Contribute to a national water-quality data base requisite to nationwide and regional planning and action programs. In 1996, water quality data were collected at 14 sites.

Sediment Stations

Period of Project: 1949 to present

Chief: Kendall R. Thompson

Location: Statewide

Purpose:

(1) Collect sediment data from selected surface-water sites in Alaska. (2) Provide a data base needed to assess sediment transport characteristics of drainage areas. (3) Contribute to a national bank of sediment data for broad Federal, State, and local water-resources planning and management. In 1996, sediment data were collected at 1 site.

Alaska Water-Use Data Program

Period of Project: 1978 to present

Chief: Gary L. Solin

Location: Statewide

Purpose:

(1) Collect, store, and disseminate water-use data that will complement water-availability and water-quality data currently collected under ongoing programs. (2) Assist Federal, State, and local management efforts for water use. (3) Study changing water-use patterns in rural Alaska.

Ice and Climate Research

Period of Project: 1993 to present

Chief: Gordon L. Nelson

Location: Northwestern U.S. and Alaska

Purpose:

(1) Understand the role of snow and ice masses in the hydrologic cycle, and the complex interactions that take place between snow and ice and the global climate system. (2) Obtain this understanding through a combination of field measurements; passive, active, and visual satellite and aircraft remote-sensing observations; and analysis of long-term climatic records. (3) Analyze the field measurements, which provide essential *in situ* information to understand the remotely sensed data. (4) Continue to extend the 37-year record of winter and summer mass balances at South Cascade Glacier. (5) Determine the regional, continental, and global distributions of the key components of the hydrologic cycle by remote sensing techniques. (6) Develop new approaches, algorithms, and processing schemes, and implement and verify established techniques in new situations. (7) Analyze climate change with satellite records that approach 20 years in length.

- •Permafrost underlies about 85 percent of Alaska
- •About 60 percent of the wetlands area of the U.S. is in Alaska

Hydrologic Processes and Hazards at Alaska Volcanoes

Period of Project: 1988 to present

Chief: Christopher F. Waythomas

Location: Cook Inlet and Aleutian Islands

Purpose:

(1) Identify, describe, and study the hydrologic processes and hydrologic hazards at glacier-clad volcanoes in Alaska, several of which are close enough to population centers to be considered potential threats to life and property. (2) Focus on specific research topics such as volcanigenic tsunamis, volcanic debris avalanches, glacier-volcano interactions, and Holocene eruptive histories.

Climate/Glacier/Runoff Studies in Alaska: Benchmark Monitoring at Gulkana and Wolverine Glaciers, Alaska

Period of Project: 1989 to 1997

Chief: Rod S. March

Location: Southcentral Alaska

Purpose:

(1) Understand and evaluate the changing water-resource and hazard potential of glaciers and glacier- derived runoff in Alaska in relation to climate. (2) Sustain and analyze the long-term climate, mass balance, runoff, and ice-flow observations on Gulkana and Wolverine Glaciers as part of a global network of "benchmark" glacier basins reported by the World Glacier Monitoring Service. (3) Calibrate the cumulative observational data by comparison with absolute measurements of net ice-volume change.

Publication of Alaskan Glacier Data Sets

Period of Project: 1990 to 1997

Chief: Dennis C. Trabant

Location: Southcentral Alaska

Purpose:

(1) Compile a long-term, high-quality, internally consistent data series in the mountain-glacier environment. (2) Develop and apply standard data analysis and reporting techniques, and systematically release internally consistent data through a series of USGS publications. (3) Interpret the climate/glacier relations found for the study glaciers and publish findings in journal articles. (4) Evaluate methods for extending climate/glacier relational analysis to regional and global scales. (5) Publish all the historical data from Wolverine, Gulkana, Black Rapids, Columbia, Knik, Redoubt Volcano, and Spurr Volcano Glaciers in Alaska, and the unpublished data from Maclure Glacier, California.

Stream Channel Stability and Scour at Bridges in the State of Alaska

Period of Project: 1994 to 1997

Chief: Robert L. Burrows

Location: Statewide

Purpose:

(1) Assess scour (the removal of sediment by water flow) at selected bridge sites. (2) Evaluate sites by using existing information. (3) Do further field surveys if evaluation indicates a potential problem or hazard. (4) Develop efficient assessment tools.

Geohydrology of the Fairbanks International Airport

Period of Project: 1991 to 1997

Chief: Michael R. Lilly

Location: Fairbanks

Purpose:

(1) Define the geohydrology of the airport area to help support environmental cleanup efforts by the airport and its lease holders. (2) Study the effects of the Chena and Tanana Rivers on the ground-water system of this area.

Geohydrology of the University of Alaska Fairbanks Area

Period of Project: 1992 to 1997

Chief: Michael R. Lilly

Location: Fairbanks

Purpose:

(1) Describe the geohydrology of the University of Alaska Fairbanks area, which is a complex environment of discontinuous permafrost and varying bedrock. (2) Determine factors influencing recharge areas to the university water-supply-well network.

Geohydrology of Fort Wainwright, Alaska

Period of Project: 1993 to 1997

Chief: Michael R. Lilly

Location: Fort Wainwright near Fairbanks

Purpose:

(1) Review existing ground-water data and catalog appropriate data in USGS databases. (2) Extend a Fairbanks subregional ground-water model from nearby USGS project areas to understand the geohydrologic processes at Fort Wainwright. (3) Collect geohydrologic data to support Superfund cleanup efforts.

Natural Attenuation of Chlorinated Hydrocarbons in an Active Ground-Water/Surface-Water Environment

Period of Project: 1996 to 1998

Chiefs: Michael R. Lilly and Kathleen A. McCarthy

Location: Fort Wainwright near Fairbanks

Purpose:

(1) Identify the physical, biological, and geochemical processes that contribute to natural attenuation of chlorinated hydrocarbons in ground water. (2) Study the effects of an interactive ground-water/surface-water system on the natural attenuation process in the study area, which is adjacent to the Chena River.

Effect of Boatwakes on Erosion Along the Kenai River, Alaska

Period of Project: 1996 to 1997

Chief: Joseph M. Dorava

Location: Kenai River

Purpose:

(1) Determine streambank erosion that has occurred on the Kenai River during 1996. (2) Determine the process or processes that cause or accelerate the erosion. (3) Differentiate the erosion that is caused by natural causes from that caused by boatwakes.

Effect of Ice Formation and Streamflow on Salmon Incubation Habitat in the Lower Bradley River, Alaska

Period of Project: 1993 to 1998

Chief: Ronald L. Rickman

Location: Bradley River near Homer

Purpose:

(1) Determine the volume of flow that must be released from the fish-water bypass to maintain a minimum of 40 cubic feet per second in the lower Bradley River during the winter. (2) Determine if a reduced flow requirement will provide adequate protection of spawning beds. (3) Gain insight into the lower limit of flow that would provide assurance of egg survival in the event of unexpected decreases in flow.

Runoff and Suspended-Sediment Characteristics from Urbanized Areas of Elmendorf Air Force Base, Alaska

Period of Project: 1996 to 1997

Chief: Timothy P. Brabets

Location: Elmendorf Air Force Base near Anchorage

Purpose:

(1) Determine the runoff characteristics from the urbanized area of Elmendorf Air Force Base. (2) Determine the suspended-sediment characteristics of the urban runoff. (3) Simulate long-term urban runoff characteristics from Elmendorf.

—Elisabeth F. Snyder

These activities are being conducted in cooperation with the following:

FEDERAL AGENCIES
- U.S Air Force
  - Elmendorf Air Force Base
- U.S. Army Alaska
- U.S. Army Corps of Engineers
- U.S. Army Environmental Center
- U.S. Navy
- U.S.D.A Forest Service
- National Park Service
- Alaska Power Administration
- Central Intelligence Agency

STATE AGENCIES
- Alaska Departments of:
  - Community and Regional Affairs
  - Environmental Conservation
  - Fish and Game
  - Natural Resources
  - Transportation and Public Facilities
    - Fairbanks International Airport
- Alaska Energy Authority
- University of Alaska Fairbanks

LOCAL AGENCIES
- Municipality of Anchorage
- City and Borough of Juneau
- Kenai Peninsula Borough
- City and Borough of Sitka
- City of Yakutat

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