Activities of the ALASKA DISTRICT

WATER RESOURCES DIVISION, U. S. GEOLOGICAL SURVEY, 1990

U. S. Geological Survey
Open-File Report 90-157

Activities conducted in cooperation with State, Federal, and local agencies.

ACTIVITIES OF THE ALASKA DISTRICT WATER RESOURCES DIVISION U. S. GEOLOGICAL SURVEY, 1990

Compiled by Elisabeth F. Snyder

U. S. GEOLOGICAL SURVEY

Open-File Report 90-157

Activities conducted in cooperation with:

NATIONAL PARK SERVICE
U.S.D.A. FOREST SERVICE
U.S. DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS
U.S. AIR FORCE
U.S. COAST GUARD
ALASKA DEPARTMENT OF NATURAL RESOURCES
ALASKA DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
ALASKA ENERGY AUTHORITY
MUNICIPALITY OF ANCHORAGE
FAIRBANKS NORTH STAR BOROUGH
CITY AND BOROUGH OF JUNEAU
KENAI PENINSULA BOROUGH
MATANUSKA-SUSITNA BOROUGH
CITY AND BOROUGH OF SITKA

Anchorage, Alaska
1990

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information
write to:

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U.S. Geological Survey
Water Resources Division
4230 University Drive, Suite 201
Anchorage, Alaska 99508-4664

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MESSAGE FROM THE DISTRICT CHIEF

The U.S. Geological Survey began describing the water resources of Alaska more than 80 years ago. This early work was related to the gold rush and concurrent need for streamflow data. Following World War II, surface-water data collection activities expanded and ground-water studies were undertaken in the Anchorage, Fairbanks, and Juneau areas.

Construction of the Trans-Alaska Pipeline during the 1970's gave impetus to increased water-resources studies and data-collection activities. The Federal-State cooperative water-resources program was expanded during the early part of the decade. However, during the 1980's, both Federal and State funding for water-resources studies and data collection has declined.

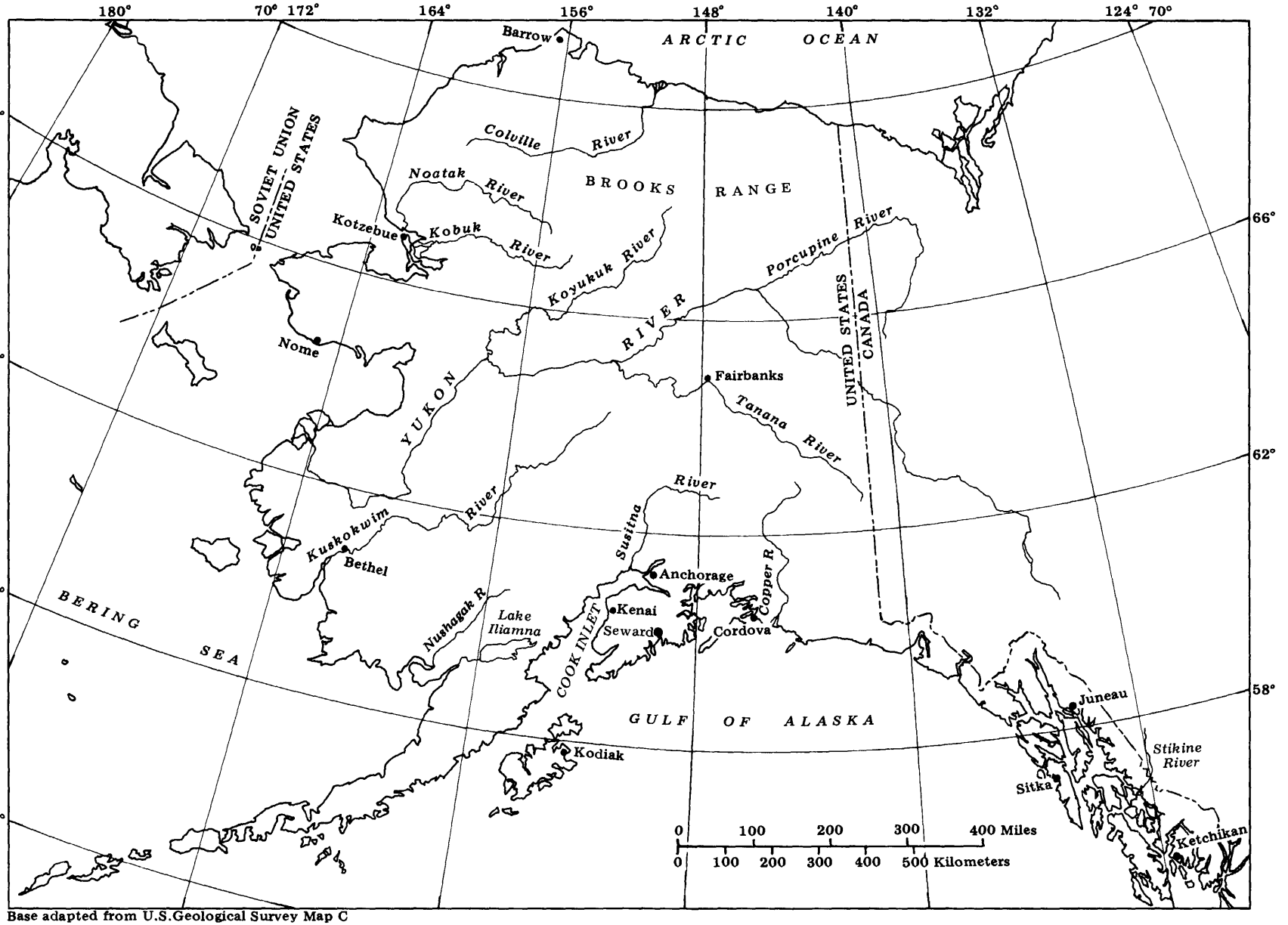
The quantity and quality of the water resources of Alaska remain relatively undescribed compared to those in the rest of the United States. Thousands of the State's streams have never been measured or sampled and, except for the few large population centers, information regarding ground-water resources is sparse. Only a relative handful of Alaska's thousands of lakes and glaciers have been adequately studied.

The need for accurate and timely water-resources information is as critical as ever, and as the development of Alaska's natural resources proceeds the information needs will continue to expand.

Although these are difficult times for Federal, State and local governments, the Alaska District of the Survey's Water Resources Division will continue its efforts to provide information needed to wisely conserve, protect, and manage the State's water resources.

Philip J. Carpenter
District Chief
U.S. Geological Survey
Water Resources Division
Anchorage, Alaska
March 1990

CONTENTS



Base adapted from U.S.Geological Survey Map C

ACTIVITIES OF THE ALASKA DISTRICT,

WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY, 1990

Compiled by Elisabeth F. Snyder

INTRODUCTION

The overall mission of the U.S. Geological Survey's Water Resources Division is to provide the hydrologic information and understanding needed for the best use and management of the Nation's water resources. For about 90 years, the U.S. Geological Survey has studied the occurrence, quantity, quality, distribution, and movement of the surface and underground water that composes the Nation's water resources. As the principal Federal water-data agency, the 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 43 District offices and 4 Regional offices, includes the collection, analysis, and dissemination of hydrologic data and water-use information, areal 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. One category is the collection of hydrologic data required for the planning and conduct of hydrologic appraisals and (or) hydrologic research. In 1990, this type of work constitutes the major part of the Division's efforts in Alaska. A second category is the conduct of hydrologic appraisals. These appraisals include: studies of water resources in areas likely to be or being affected by mineral, energy, fisheries, coastal zone, or urban development; investigations of potential hydrologic hazards; and studies of ground- and surface-water contamination on Federal lands. The third category is the conduct of 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; glacier and snow and ice dynamics; and limnology.

ALASKA'S WATER RESOURCES

Glaciers cover nearly 30,000 square miles in Alaska, about 5 percent of the total area of the State. However, snow forms a veneer on most of Alaska for one-half to three-quarters of the year, and the freezing and thawing of water affect virtually all of the State to some extent.

Surface Water

Surface waters of Alaska include many large rivers. The Yukon River ranks fifth in size in the United States, and six Alaskan rivers (Yukon, Copper, Stikine, Susitna, Kuskokwim, and Tanana) are among the 30 largest U.S. rivers. Glacial sources for most Alaskan rivers cause important hydrologic consequences in addition to the heavy loads of glacier-derived silt carried by the glacial streams. Even a small glacier-covered area in a drainage basin can have a significant effect on the amount and timing of runoff.

Alaskan lakes are so numerous they are essentially uncounted. Lake Iliamna, Alaska's largest, has a surface area of 1,000 square miles. Springs occur throughout the State -- 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.

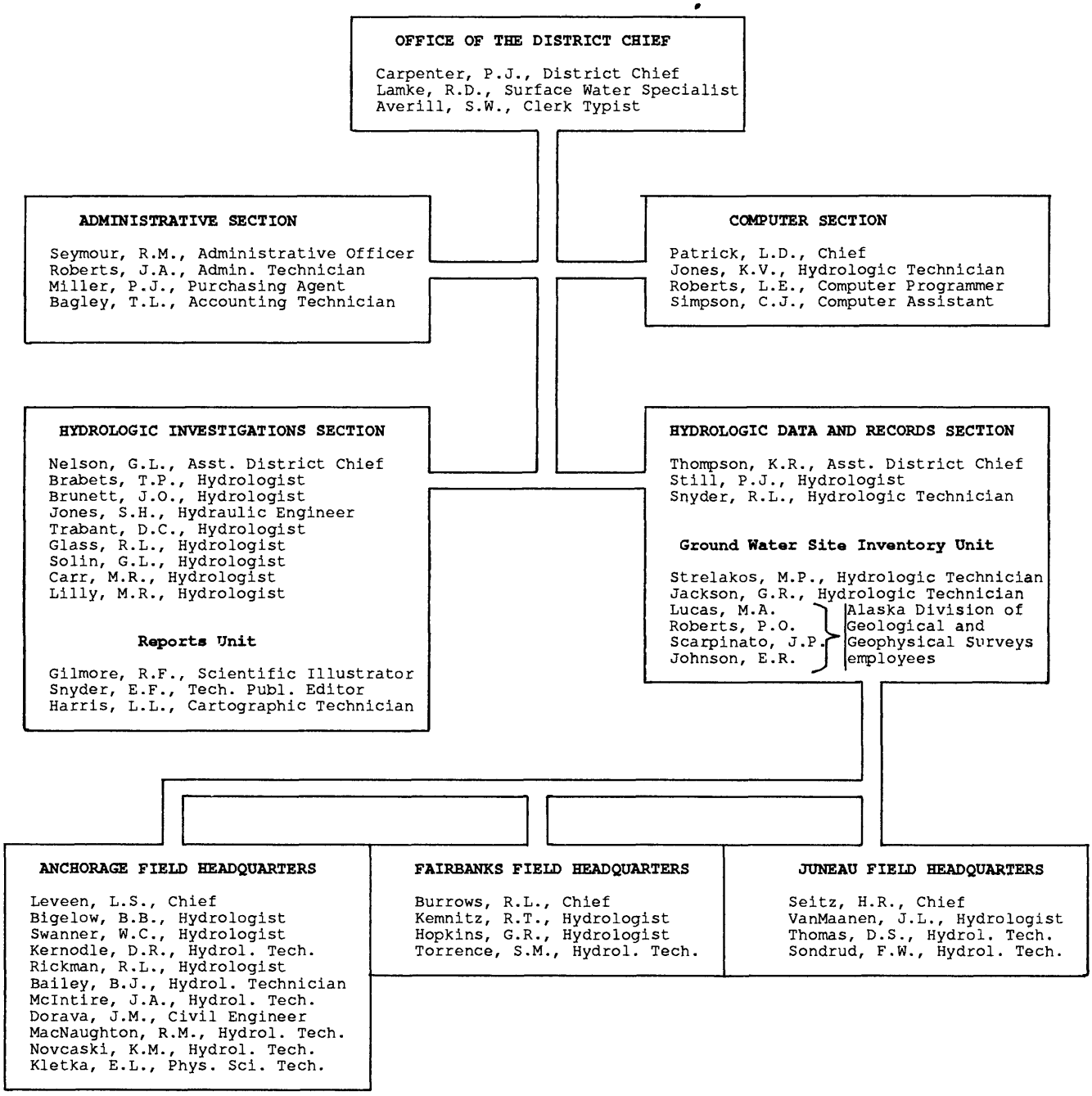
Ground Water

Ground water is an untested resource in most of Alaska, and 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 many areas, however, the fine-grained material of glacial and glacial-lake deposits and poorly permeable 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, and 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, and an increasing number of cases of ground-water contamination by gasoline or other petroleum products have been reported in the past few years.

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
ALASKA DISTRICT

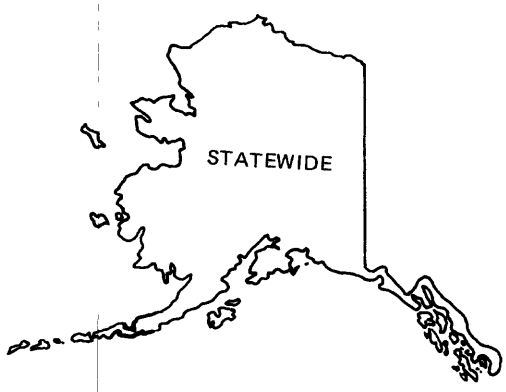


Inquiries regarding projects described in this report may be directed to the following offices:

District Office	4230 University Drive Suite 201 Anchorage, Alaska 99508-4664	(907)786-7100
Anchorage Field Headquarters	1209 Orca Street Anchorage, Alaska 99501	(907)786-7100
Fairbanks Field Headquarters	800 Yukon Drive Fairbanks, Alaska 99775-5170	(907)479-5645
Juneau Field Headquarters	P.O. Box 1568 Juneau, Alaska 99801	(907)586-7216

SURFACE WATER STATIONS

Period of Project:
Continuous since July 1948



Chief:
Robert D. Lamke
Anchorage

Funding:
U.S. Geological Survey
U.S. Army Corps of Engineers
U.S.D.A. Forest Service
Alaska Departments of
Natural Resources
Transportation and Public Facilities
Alaska Energy Authority
Municipality of Anchorage
Kenai Peninsula Borough
City and Borough of Juneau
City and Borough of Sitka

Purpose:
To provide a surface-water data base through collection, analysis, and publication of records for gaging stations and selected sites along streams and lakes throughout Alaska. The gaging network is operated in cooperation with other Federal, State, and local agencies. The surface-water data base provides information for research purposes of surveillance, planning, design, hazards warning, accounting systems, operation, and management in various water-related fields.

Status:
The ongoing data-collection effort and processing continues. In 1990, the U.S. Geological Survey is operating 90 gaging stations and 70 crest-stage gages in Alaska.

Reports:

Data are published in the U.S. Geological Survey annual report "Water Resources Data for Alaska".

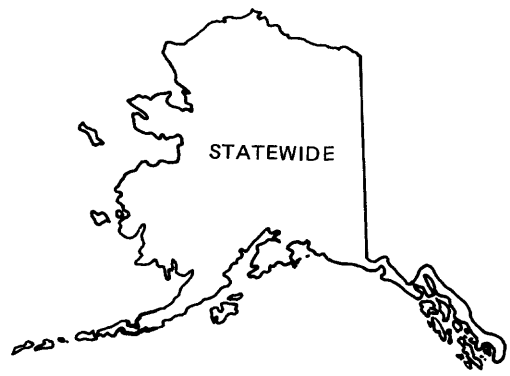
Planned Reports:

Jones, S.H., Flash floods of July 14, 1987 near Black Rapids, Alaska: U.S. Geological Survey Water-Resources Investigations Report.

Lamke, R.D., Alaska floods and droughts, chapter *in* National Water Summary, 1988-89--Hydrologic events and floods and droughts: U.S. Geological Survey Water-Supply Paper 2375.

_____Historical surface-water records in southeast Alaska: U.S. Geological Survey Open-File Report.

GROUND WATER STATIONS



Period of Project:

Continuous since June 1947

Chief:

Kendall R. Thompson
Anchorage

Funding:

U.S. Geological Survey
Alaska Department of Natural Resources
Municipality of Anchorage
Kenai Peninsula Borough
Matanuska-Susitna Borough

Purpose:

Ground water is an important source of water supply for many Alaskan communities. Thus, it is essential to observe the effects on ground-water quantity and quality exerted by such factors as climatic variations and withdrawal patterns. Water-level data are collected to provide a base against which short- and long-term fluctuations can be compared for proper planning and management.

Status:

About 75 wells are currently being monitored for water levels. Of these, 27 are equipped with recorders that record water levels on a continuous basis. Water levels in other wells are measured from 2 to 12 times per year.

Reports:

Data are published in the U.S. Geological Survey annual report "Water Resources Data for Alaska."

QUALITY OF WATER STATIONS

Period of Project:

Continuous since June 1949

Chief:

Kendall R. Thompson
Anchorage

Funding:

U.S. Geological Survey
U.S.D.A Forest Service
Alaska Energy Authority
Municipality of Anchorage
City and Borough of Juneau

Purpose:

To collect, analyze, and publish water-quality data for selected sites in Alaska. In addition to serving needs of cooperating agencies, the records contribute to a national water-quality data base requisite to nationwide and regional planning and action programs.

Status:

Water-quality data collection is continuing at about 25 surface-water stations and several miscellaneous surface-water or ground-water sites. Water-quality data may consist of chemical or biological constituents, sediment concentration, or temperature monitoring. Included are five National Stream Quality Accounting Network stations. One hydrologic benchmark station provides data for a basin in which the hydrologic regimen will likely be governed solely by natural conditions.

Reports:

Data are published in the U.S. Geological Survey annual report "Water Resources Data for Alaska."

SEDIMENT STATIONS

Period of Project:

Continuous since July 1949

Chief:

Harold R. Seitz
Juneau

Funding:

U.S. Geological Survey
National Park Service
Municipality of Anchorage

Purpose:

To provide a data base needed to assess sediment transport characteristics of drainage areas required for water resources planning and management.

Status:

Collection of miscellaneous sediment data is continuing at five National Stream Quality Accounting Network stations, one benchmark station, and several other stations.

Reports:

Data are published in the U.S. Geological Survey annual report "Water Resources Data for Alaska."

ALASKA WATER USE DATA PROGRAM

Period of Project:

Continuous since April 1978

Chief:

Leslie D. Patrick
Anchorage

Funding:

U.S. Geological Survey
Alaska Department of Natural Resources

Purpose:

To establish an effective and coordinated program for collecting, storing, accessing, and disseminating water-use data. Information will help resolve critical water problems such as water-quality residuals, environmental impact, energy development, and resources allocation.

Status:

In 1989, water use was monitored in those areas of Alaska which are sites of existing or potential major hydrogeologic problems. The 1988 water-use data was synthesized into monthly and yearly averages. Data entry was continued into the Land Administration System.

Reports:

Solley, W.B., Merk, C.F., and Pierce, R.R., 1988, Estimated use of water in the United States in 1985: U.S. Geological Survey Circular 1004, 82 p.

Patrick, L.D., Snyder, E.F., and Harle, M.L., Alaska--Water supply and demand, chapter *in* National Water Summary 1987--Hydrologic events and water supply and demand: U.S. Geological Survey Water-Supply Paper 2350 [in press].

ESTUARINE HYDRODYNAMICS OF TURNAGAIN ARM

Period of Project:

October 1986 to September 1990

Chief:

Stanley H. Jones
Anchorage

Funding:

U.S. Geological Survey
Alaska Department of Transportation
and Public Facilities

Purpose:

To develop a basic understanding of the hydrodynamic processes in Turnagain Arm and to provide data on rapidly varying water velocities and water stage during a tidal cycle. To determine rates of scour and fill in the deep channels of the arm during a tidal cycle. To improve methods and techniques for collecting hydraulic data under severe conditions posed by the high tidal range and high water velocities.

Status:

Data on tidal stage, wind speed, and wind direction were collected from various locations along Turnagain Arm. River stage and fresh-water discharge data were collected at Twentymile River, Portage Creek, and Placer River. A coarse-grid model of Turnagain Arm from McHugh Creek to Twentymile River was developed. Bathymetric surveys were made in the active channels. Aerial photographs of the area were taken.

Planned Reports:

Jones, S.H., Hydrologic and hydraulic data for Turnagain Arm: U.S. Geological Survey Open-File Report.

_____Estuarine hydrodynamics of Turnagain Arm, Alaska: U.S. Geological Survey Water-Resources Investigations Report.

ASSESSMENT OF GROUND-WATER CONTAMINATION AT THE U.S. COAST GUARD SUPPORT CENTER, KODIAK ISLAND, ALASKA

Period of Project:

February 1987 to September 1990

Chief:

Jilann O. Brunett
Anchorage

Funding:

U.S. Geological Survey
U.S. Coast Guard

Purpose:

To determine the extent and severity of a wide variety of petroleum products from fuel tanks, pipelines, and waste storage containers which may have contaminated soil and water at several locations on the U.S. Coast Guard's Support Center. To describe the following geohydrologic conditions in areas of concern: surface drainage network, ground-water levels and flow direction, and areas of ground/surface water exchange.

Status:

In 1989, investigations were completed on 19 specific areas, 13 additional wells were drilled, and a reconnaissance was made throughout the Support Center for possible areas of improper disposal of wastes. Geologic mapping, including a seismic study of depth to bedrock, was completed through a contractor. Reports describing the results of the study are being written.

INSTALLATION RESTORATION PROGRAM--CLEAR AIR FORCE STATION

Period of Project:

October 1987 to September 1990

Chief:

Gordon L. Nelson
Anchorage

Funding:

U.S. Geological Survey
U.S. Air Force

Purpose:

To acquire data to confirm the presence or absence of environmental contamination at 16 sites at Clear Air Force Station, Alaska; and to select and describe a remedial action appropriate for mitigating any confirmed environmental contamination.

Status:

All observation and water-supply wells were sampled twice for possible contaminants. Minor clean-up work was done at a small DDT spill site and at an old landfill. Additional sampling was done at the fire-training pit, the DDT spill site, Lake Sansing, and observation wells downgradient of the Site 1 landfill. Decision Documents have been drafted for the Air Force.

FIORD-CLOSURE POTENTIAL OF HUBBARD GLACIER, ALASKA

Period of Project:

October 1987 to September 1990

Chief:

Dennis C. Trabant
Fairbanks

Funding:

U.S. Geological Survey
U.S.D.A. Forest Service

Purpose:

To collect ice velocity, bathymetry, terminus location, and tidal data. To predict fiord closure and overflow into the Situk River after closure, and to assess the possibility of dam failure.

Status:

Three time-lapse cameras have been operating discontinuously. Analysis of the photos has begun. Three radio-beacon motion markers were recovered and surveyed, and one new radio beacon was deployed. One satellite motion telemetry station was recovered, modified, and moved to a new location. Three vertical aerial photographic flights were accomplished in 1989. Six new photogrammetric panels were placed, surveyed, and photographed. The calving terminus was surveyed. The tidal signal from the Marble Point gage in Russell Fiord was compared with the Yakutat Bay tidal signal as a real- time indicator of the effective closure of Russell Fiord. Two survey nets were joined by surveying links between them. Beach slopes were surveyed at two sites to increase the accuracy of sea level determination from the vertical photography.

Planned Reports:

Trabant, D.C., Krimmel, R.M., and Post, Austin, Advance of Hubbard Glacier and influence on Russell Fiord, Alaska: A preliminary forecast: U.S. Geological Survey Open-File Report.

HYDROLOGIC PROCESSES AND HAZARDS AT ALASKA VOLCANOES

Period of Project:

March 1988 to September 1993

Chief:

Timothy P. Brabets
Anchorage

Funding:

U.S. Geological Survey

Purpose:

To identify and describe the hydrologic and hydraulic processes, and hydrologic hazards posed by glacier-clad volcanoes, several of which are close enough to population centers to be considered potential threats to life and property.

Status:

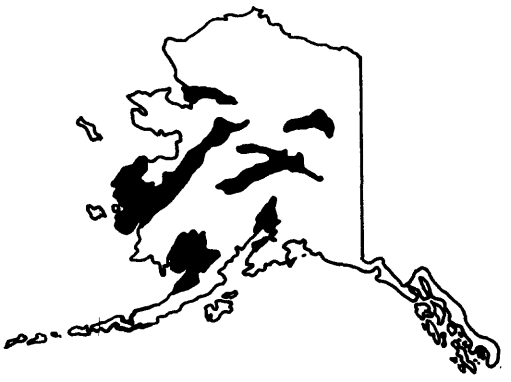
In 1989, geodetic control was established at nine monuments near the Redoubt Volcano by Global Positional System techniques. At approximately 50 locations around the volcano, monopulse radar was used to determine the ice thickness. A radio transmitter was placed in the summit crater to help determine snow and ice accumulation.

Planned Reports:

Brabets, T.P., Snow and ice volumes, Redoubt Volcano, Alaska: U.S. Geological Survey Open-File Report.

_____Hydrologic hazards of Redoubt Volcano, Alaska: U.S. Geological Survey Professional Paper.

INTERMONTANE AQUIFERS OF ALASKA, REGIONAL AQUIFER-SYSTEM ANALYSIS



Period of Project:

March 1989 to September 1992

Chief:

Gordon L. Nelson
Anchorage

Funding:

U.S. Geological Survey

Purpose:

Develop a data base to support both the comprehensive analysis of the regional aquifer system and future ground-water (GW) studies. Delineate and describe GW flow systems quantitatively and evaluate the accuracy of the descriptions in areas where data are sparse. Develop an understanding of the hydrologic processes in various parts of Alaska, so that knowledge gained by analyses of data-rich areas can be used to support analyses of sparse-data areas. Develop a comprehensive mathematical model of the GW flow system in Cook Inlet Basin and additional models of selected areas where water-budget information is critical to overall project. Develop less-detailed models of other intermontane aquifers. Evaluate the geochemistry of GW and surface water in the basins and relate them to paths of GW flow.

Status:

The need for the study and the available data were evaluated and reviewed. A plan of study was formulated and a report on the plan was prepared. The report included descriptions of the aquifers, methods to be employed in the analysis, and bibliographies of pertinent studies.

Planned Reports:

Nelson, G.L., Zenone, Chester, Brabets, T.P., and Snyder, E.F., A study plan of the intermontane aquifers of Alaska: U.S. Geological Survey Water-Resources Investigations Report.

Additional reports will be planned, pending approval of the "Study Plan."

RECONNAISSANCE OF TAKU GLACIER NEAR JUNEAU, ALASKA

Period of Project:

July 1989 to September 1990

Chief:

Dennis C. Trabant
Fairbanks

Funding:

U.S. Geological Survey
Alaska Department of Natural Resources

Purpose:

To determine the historical and present rates of the advance of Taku Glacier, the general mass balance, and the existence of a former glacier-dammed lake in the Taku River valley. To determine from the data the probability of Taku Glacier's advancing to eventually block the Taku River and forming a glacier-dammed lake.

Status:

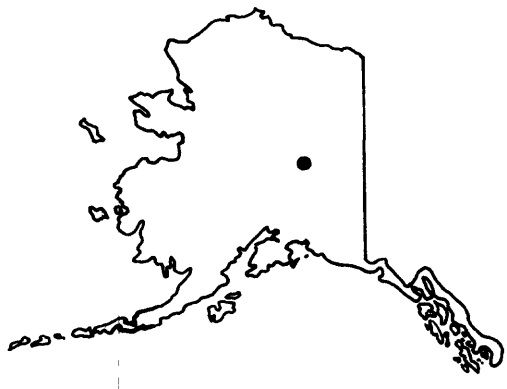
Two existing U.S. Coast and Geodetic Survey points were occupied and four new control stations were established, surveyed, and paneled for photogrammetric location. Eight additional photo panels were set and surveyed. Aerial photography with greater than 60 percent overlap was obtained on the lower 25 kilometers of Taku Glacier. Ice thickness sounding was successful in the lower 10 kilometers of the glacier. Two mass balance stakes and five other motion targets were set on the glacier and surveyed for future motion analysis. A time-lapse camera was operated near the motion markers for several months. Photogrammetric analysis of the aerial photographic record, which begins in 1948, has begun.

Planned Reports:

Motyka, R., and Trabant, D.C., Summary of data, Taku Glacier: Report planned in cooperation with Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys.

Trabant, D.C., Predictions of future activity at Taku Glacier: Journal article.

UTILIZATION OF USGS DATA BY AUTOCAD AND RBASE



Period of Project:

January 1989 to September 1991

Chief:

Robert L. Burrows
Fairbanks

Funding:

U.S. Geological Survey
Fairbanks North Star Borough

Purpose:

To make U.S. Geological Survey hydrologic data available to the Fairbanks North Star Borough by using the same computer hardware and software. To prepare a demonstration product utilizing AUTOCAD and RBASE fulfilling a specific need of the North Star Borough.

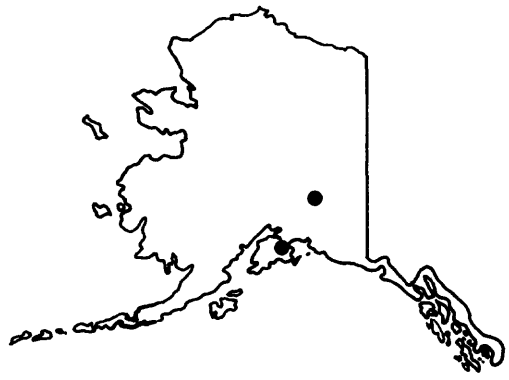
Status:

Computer purchase is proceeding. Discussions with Fairbanks North Star Borough will decide on the demonstration project and content.

Planned Reports:

Report format and contents are dependent on topic chosen for demonstration project.

GLOBAL CHANGE HYDROLOGY: EVALUATION OF RESPONSE OF GLACIER FLOW TO CHANGES IN CLIMATE, RUNOFF, AND MASS BALANCE AT GULKANA AND WOLVERINE GLACIERS, ALASKA



Period of Project:

October 1989 to September 1993

Chief:

Dennis C. Trabant
Fairbanks

Funding:

U.S. Geological Survey

Purpose:

To establish "benchmark" glacier basins for long-term mass balance, climate, runoff, and glacier flow observations as part of an international effort to improve understanding of how climate change may affect water stored as glacier ice and influence the global hydrologic cycle.

Status:

New project.

Planned Reports:

Data reports and journal articles beginning in 1992.

BIBLIOGRAPHY

This bibliography includes reports published from 1987 to January 1990 by Geological Survey authors on the water resources of Alaska.

For a comprehensive listing of reports from 1870 to 1976, please refer to:

Feulner, A.J., and Reed, K.M., 1977, Bibliography of reports by members of the U.S. Geological Survey on the water resources of Alaska, 1870-1976: U.S. Geological Survey Open-File Report 77-687, 112 p.

For reports published between 1977 through 1986, please refer to the bibliographies in:

Snyder, E.F., compiler, 1984, Activities of the Alaska District, Water Resources Division, U.S. Geological Survey, 1984: U.S. Geological Survey Open-File Report 84-246, 33 p.

_____1987, Activities of the Alaska District, Water Resources Division, U.S. Geological Survey, 1987: U.S. Geological Survey Open-File Report 87-38, 24 p.

Bigelow, B.B., 1988, Hydrologic data collection activities in the Solomon Gulch Basin, near Valdez, Alaska: U.S. Geological Survey Open-File Report 88-719, 15 p.

Brunett, J.O., 1990, Lateral movement of contaminated ground water from Merrill Field landfill, Anchorage, Alaska: U.S. Geological Survey Open-File Report 89-624, 20 p.

Bugliosi, E.F., 1988, Hydrologic reconnaissance of the Chilkat River basin, southeast Alaska (with special reference to the Alaska Chilkat Bald Eagle Preserve): U.S. Geological Survey Water-Resources Investigations Report 88-4023, 38 p.

Chacho, E.F., Jr., Burrows, R.L., and Emmett, W.W., 1989, Detection of coarse sediment movement using radio transmitters, *in* International Association for Hydraulic Research, XXIII Congress, Ottawa, Canada, August 21-25, 1989, Proceedings: The National Research Council Canada, p. B-367 - B-373.

Emery, P.A., and Seitz, H.R., 1987, Hubbard Glacier is still on the move: *Geotimes,* (May issue) v. 32, no. 5, p. 8-9.

Glass, R.L., 1987, Water resources near Dillingham in the Bristol Bay area, Alaska: U.S. Geological Survey Water-Resources Investigations Report 87-4141, 27 p.

_____1987, Ground-water levels in Anchorage, Alaska, 1985: U.S. Geological Survey Open-File Report 87-546, 15 p. + 1 oversize sheet.

_____1988, Map showing depth to bedrock, Anchorage, Alaska: U.S. Geological Survey Open-File Report 88-198, 1 sheet.

Glass, R.L., and Brabets, T.P., 1988, Summary of water resources data for the Girdwood-Alyeska area, Alaska: U.S. Geological Survey Open-File Report 87-678, 24 p.

Jones, S.H., and Zenone, Chester, 1988, Flood of October 1986 at Seward, Alaska: U.S. Geological Survey Water-Resources Investigations Report 87-4278, 43 p. + 2 plates.

Knott, J.M., Lipscomb, S.W., and Lewis, T.W., 1987, Sediment transport characteristics of selected streams in the Susitna River basin, Alaska: Data for water year 1985 and trends in bedload discharge, 1981-85: U.S. Geological Survey Open-File Report 87-229, 51 p.

Lamke, R.D., and Bigelow, B.B., 1987, Floods of October 1986 in southcentral Alaska: U.S. Geological Survey Open-File Report 87-391, 31 p. (Updated 1988).

Lipscomb, S.W., 1987, Sediment-discharge data for the lower reach of Campbell Creek, Anchorage, Alaska: May to October 1986: U.S. Geological Survey Open-File Report 87-101, 8 p.

_____1987, Calibration and verification of a one-dimensional flow model to the Knik and Matanuska Rivers, southcentral Alaska, *in* Huntsinger, R.G., technical chairman, Water quality in the great land -- Alaska's challenge: Proceedings, American Water Resources Association, Water Research Center-Institute of Northern Engineering, University of Alaska, Fairbanks, Report IWR-109, p. 43-54.

_____1988, Sediment-discharge data for the lower reach of Campbell Creek, Anchorage, Alaska: May to September 1987: U.S. Geological Survey Open-File Report 88-81, 12 p.

_____1989, Flow and hydraulic characteristics of the Knik-Matanuska River estuary, Cook Inlet, southcentral Alaska: U.S. Geological Survey Water-Resources Report 89-4064, 52 p.

Madison, R.J., McElhone, T.J., and Zenone, Chester, 1988, Alaska ground-water quality: U.S. Geological Survey Open-File Report 87-712, 8 p.

Maurer, M.A., and Woods, P.F., 1988, Index to limnological data for southcentral Alaskan lakes: U.S. Geological Survey Open-File Report 87-529, 146 p.

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GPO 793-321/23041