UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER-RESOURCES ACTIVITIES IN UTAH

BY THE U.S. GEOLOGICAL SURVEY,

JULY 1, 1984, TO JUNE 30, 1985

Compiled by Stefanie L. Dragos

Open-File Report 85-493

Salt Lake City, Utah
July 1985

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

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CONTENTS

CONTENTS—Continued

ILLUSTRATIONS

WATER-RESOURCES STUDIES IN UTAH

BY THE U.S. GEOLOGICAL SURVEY,

JULY 1, 1984, TO JUNE 30, 1985

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INTRODUCTION

This report summarizes the progress of water-resources studies in Utah by the U.S. Geological Survey from July 1, 1984, to June 30, 1985. Much of the work was done in cooperation with the State of Utah and local agencies. Additional supporting funds were transferred from other Federal agencies or appropriated directly to the Geological Survey.

The State and local cooperators were:

Utah Department of Natural Resources
- Division of Water Rights
- Division of Water Resources
- Division of Wildlife Resources
- Division of Oil, Gas, and Mining
- Geological and Mineral Survey

Utah Department of Transportation
Utah Department of Health, Division of Environmental Health
Bear River Commission
Salt Lake County
Salt Lake County Division of Flood Control and Water Quality
Central Utah Water Conservancy District
Lower Gunlock Reservoir Corp.

The Federal cooperators were:

Bureau of Land Management
Bureau of Reclamation
Federal Energy Regulatory Commission
Federal Emergency Management Agency

The program in Utah during the period of this report consisted of 23 projects, and a discussion of each project is given in the following pages. Short descriptions are given at the end of the report for three proposed projects to be started on or after July 1, 1985.

In addition to the 26 projects mentioned above, work was being completed on reports for 5 other projects. The status of reports of those projects is as follows:

UT 129
Plantz, G. G., and Price, Don, Hydrologic monitoring in the coal fields of central and southern Utah--Summary of data collected during August 1978-September 1984: U.S. Geological Survey Water-Resources Investigations Report (in review).

UT 139

Holmes, W. F., and Wilberg, D. E., Determination of vertical hydraulic conductivity and specific storage of a confining bed using the Hantush modified and Neuman and Witherspoon ratio methods: U.S. Geological Survey Water Supply Paper article (in review).

UT 156

Avery, Charles, Bedrock aquifers of eastern San Juan County, Utah: Utah Department of Natural Resources Technical Publication (in review).

UT 157

McCormack, H. F., Lindskov, K. L., and Stolp, B. J., Hydrologic maps of the Price 30 X 60 minute quadrangle, Utah: U.S. Geological Survey Water-Resources Investigations Report (in press).

UT 161

Christensen, R. C., Johnson, E. B., and Plantz, G. G., Manual for estimating streamflow characteristics of natural-flow streams, Colorado River Basin in Utah: U.S. Geological Survey Water-Resources Investigations Report (in review).

THE FOLLOWING REPORTS WERE RELEASED TO THE OPEN FILE:

Blanchard, P. J., Ground-water conditions in the Kaiparowits Plateau area, Utah and Arizona, with emphasis on the Navajo Sandstone: U. S. Geological Survey Open-File Report 84-579.

Blanchard, P. J., Ground-water conditions in the Lake Powell area, Utah and Arizona, with emphasis on the Navajo Sandstone: U.S. Geological Survey Open-File Report 85-93.

Christensen, R. C., Johnson, E. B., and Plantz, G. G., Streamflow characteristics of the Colorado River Basin in Utah through September 1981: U.S. Geological Survey Open-File Report 85-421 (in press as Utah Hydrologic-Data Report No. 42).

Freethey, G. W., Kimball, B. A., Wilberg, D. E., and Hood, J. W., General hydrogeology of the aquifers of Mesozoic age, upper Colorado River basin--excluding the San Juan Basin--Colorado, Utah, Wyoming, and Arizona: U.S. Geological Survey Open-File Report 84-716.

Hamblin, L. S., 1984, Water-resources studies in Utah by the U.S. Geological Survey, July 1, 1983, to June 30, 1984: U.S. Geological Survey Open-File Report 84-585.

Mason, J. L., Atwood, J. W., and Beuttner, P. L., Selected test-well data from the MX-missile siting study, Tooele, Juab, Millard, Beaver, and Iron Counties, Utah: U.S. Geological Survey Open-File Report 85-347 (in press as Utah Hydrologic Data Report 43).

Plantz, G. G., 1984, Hydrologic reconnaissance of the Kolob, Alton, and Kaiparowits Plateau coal fields, south-central Utah: U.S. Geological Survey Open-File Report 84-071 (in press as U.S. Geological Survey Hydrologic Investigations Atlas 684).

Sandberg, G. W., and Sultz, L. G., Reconnaissance of the quality of surface water in the upper Virgin River basin, Utah, Arizona, and Nevada, 1981-82: U.S. Geological Survey Open-File Report 85-90.

THE FOLLOWING REPORTS WERE PUBLISHED:

Arnow, Ted, 1985, Water-level changes in Great Salt Lake, 1843-1984, Abstract, in Proceedings of Problems and prospects for predicting Great Salt Lake Levels Conference, March 1985, University of Utah.

Arnow, Ted, 1985, Rise of Great Salt Lake, Utah: U.S. Geological Survey Water-Supply Paper 2275, p. 31-33.

Avery, Charles, 1984, Ground-water conditions in Utah, spring of 1984: Utah Division of Water Resources Cooperative Investigations Report 24.

Bunch, R. L., and Harrill, J. R., 1984, Compilation of selected hydrologic data from the MX missile-siting study, east central Nevada and western Utah: U.S. Geological Survey Open-File Report 84-702.

Christensen, R. C., and others, 1984, Quality and quantity of runoff and atmospheric deposition in the urban area of Salt Lake County, Utah, 1980-81: U.S. Geological Survey Water-Resources Investigations Report 84-4011.

Clark, D. W., 1985, The ground-water system and simulated effects of ground-water withdrawals in northern Utah Valley, Utah: U.S. Geological Survey Water-Resources Investigations Report 85-4007.

Clark, D. W., and Appel, C. L., 1985, Ground-water resources of northern Utah Valley: Utah Department of Natural Resources Technical Publication 80.

Danielson, T. W., and Hood, J. W., 1984, Techniques for determining recharge to the Navajo Sandstone, lower Dirty Devil River basin, Utah: U.S. Geological Survey Water-Resources Investigations Report 84-4154.

Gates, J. S., 1984, Hydrogeology of northwestern Utah and adjacent parts of Idaho and Nevada, in Geology of northwest Utah, southern Idaho, and northeast Nevada: Utah Geological Association Publication 13.

Gates, J. S., 1984, Utah ground-water resources: U.S. Geological Survey Water-Supply Paper 2275, p. 415-420.

Herbert, L. R., Cruff, R. W., and Waddell, K. M., 1985, Seepage study of six canals in Salt Lake County, Utah, 1982-83: Utah Department of Natural Resources Technical Publication No. 82.

Holmes, W. F., 1984, Ground-water hydrology and projected effects of ground-water withdrawals in the Sevier Desert, Utah: Utah Department of Natural Resources Technical Publication No. 79.

Holmes, W. F., 1985, Water budget and ground-water occurrence in the Uinta Basin of Utah, in Geology and energy resources, Uinta Basin of Utah: Utah Geological Association Publication 12.

Lindskov, K. L., and Kimball, B. A., 1984, Water resources and potential hydrologic effects of oil-shale development in the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Professional Paper 1307.

Lindskov, K. L., and Kimball, B. A., 1984, Surface-water resources of the southeastern Uinta Basin, Utah and Colorado: U.S. Geological Survey Water-Supply Paper 2224.

Lindskov, K. L., 1984, Floods of May-June 1983: Utah Geological and Mineral Survey Water Resources Bulletin 24.

Lines, G. C., 1985, The ground-water system and possible effects of underground coal mining in the Trail Mountain area, central Utah: U.S. Geological Survey Water-Supply Paper 2259.

Lines, G. C., and others, 1984, Hydrology of Area 56, Northern Great Plains and Rocky Mountain Coal Provinces, Utah and Colorado: U.S. Geological Survey Water-Resources Investigations Open-File Report 83-38.

Plantz, G. G., 1984, Selected hydrologic data, Kolob-Alton-Kaiparowits coal-fields area, south-central Utah: Utah Hydrologic-Data Report 41 (Open-File Report 83-871).

Price, Don, 1984, Map showing selected surface-water data for the Manti 30 X 60-minute quadrangle, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1482-A.

Price, Don, 1984, Map showing selected surface-water data for the Nephi 30 X 60-minute quadrangle, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1512-A.

Price, Don, 1984, Map showing selected surface-water data for the Price 30 X 60-minute quardangle, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1513-A.

Price, Don, 1984, Map showing selected surface-water data for the Huntington 30 X 60-minute quadrangle, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-1514-A.

ReMillard, M., and others, 1984, Water Resources data for Utah, water year 1983: U.S. Geological Survey Water Data Report UT-83-1.

Stephens, D. W., 1984, Water-quality investigations of the Jordan River, Salt Lake County, Utah, 1980-82: U.S. Geological Survey Water-Resources Investigations Report 84-4298.

Stephens, D. W., 1984, Dissolved-oxygen regime of the Jordan River, Salt Lake County, Utah: U.S. Geological Survey Water-Resources Investigations Report 84-4056.

Teller, R. W., and Chafin, D. T., 1984, Selected drill-stem test data for the upper Colorado River Basin: U.S. Geological Survey Water-Resources Investigations Report 84-4146.

Thomas, Blakemore, 1984, Problems with statistical flood-frequency analysis of streams in Utah, in Proceedings of Conference on Delineation of landslide, flash flood, and debris flow hazards in Utah, Utah Water Research Laboratory, Utah State University.

Thompson, K. R., 1984, Reconnaissance of toxic substances in the Jordan River, Salt Lake County, Utah: U.S. Geological Survey Water-Resources Investigations Report 84-4155.

Thompson, K. R., 1984, Annual suspended-sediment loads in the Green River, Utah, 1930-82: U.S. Geological Survey Water-Resources Investigations Report 84-4169.

Thompson, K. R., 1984, Annual suspended-sediment loads in the Colorado River at Cisco, Utah: U.S. Geological Survey Water-Resources Investigations Report 85-4011.

Waddell, K. M., 1985, Models for evaluating the effects of a causeway and dikes on the salinity balance of Great Salt Lake, Abstract in Proceedings of problems and prospects for predicting Great Salt Lake Levels Conference, March 1985, University of Utah.

CURRENT PROJECTS

COLLECTION OF HYDROLOGIC DATA - SURFACE WATER

Number: UT 00-001-FOICL

Cooperating Agencies: U.S. Bureau of Reclamation; U.S. Bureau of Land Management; Federal Energy Regulatory Commission; Utah Division of Water Rights; Utah Division of Water Resources; Utah Geological and Mineral Survey; Utah Division of Environmental Health; Bear River Commission; Salt Lake County; Central Utah Water Conservancy District; Lower Gunlock Reservoir Corp.; Salt Lake County Division of Flood Control and Water Quality.

Staff: R. W. Cruff, Hydrologist, Project Chief (part time)
Other District personnel as assigned

Period of Project: Continuing

Objective: To obtain data on stream discharge or stage and reservoir or lake stage at selected sites throughout Utah.

Approach: Standard methods for the operation and maintenance of gaging stations and for the computation, computer storage, and publication of streamflow records were used.

Progress: Data collection and computation necessary for the publication of records for 195 streamflow stations, 15 reservoirs, and 2 lake-stage stations continued during the year. (See figure 1 for locations of stations.) In addition, monthly measurements were made of rates of flow and density of water moving through the breach in the causeway across Great Salt Lake. Periodic measurements were also made of rates of flow and density of water moving through the culverts through the causeway. The stations are classified as follows:

Current purpose or project related	125
Hydrologic	54
Benchmark or long-term change	12
Regulated	4
Reservoirs (long-term management)	15
Lake stage	2

Gaging stations discontinued were:

Parriette Draw near Ouray
Parriette Draw at mouth, near Ouray
Cottonwood Creek near Orangeville
Lake Fork below Taskeetch Damsite, near Mountain Home
Wolf Creek above Rhoades Canyon, near Hanna
Water Hollow near Fruitland
Hobble Creek at Daniels Summit, near Wallsburg
North Fork Virgin River below Bullock Canyon, near Glendale
North Fork Virgin River above Zion Narrows, near Glendale
Hooper Slough near Hooper
Howard Slough at Hooper
Goggin Drain near Magna
Kennecott Drain near Magna

Gaging stations established were:

Santa Clara River at St. George
Clover Creek near Clover
Ft. Pierce Wash near St. George
Ash Creek above Toquerville
North Creek near Virgin
East Fork Virgin River at mouth

Canal-loss studies: A reconnaissance of the Davis-Weber and Ogden Valley canals and a reach of the Weber River was made to obtain information needed for planning loss-gain studies. Flow measurements were started on the two canal systems and the river reach. The seepage study report for canals in Salt Lake County was completed.

Flood report: Assembled data for and began preparation of a report of the 1983 and 1984 flooding in the Great Basin.

Plans for Next Year: Continue operation of network. Prepare 1985 water-year records for publication. Complete flood report for the Great Basin. Complete the seepage measurements and analyse the data for the Davis-Weber and Ogden Valley canals and the Weber River. Prepare report on the losses and/or gains.

Reports:

Cruff, R. W., Data uses and funding sources for the stream-gaging program in Utah: U.S. Geological Survey Open-File Report (in press).

ReMillard, M. D., and others, Water resources data for Utah, water year 1983: U.S. Geological Survey Water-Data Report UT-83-1.

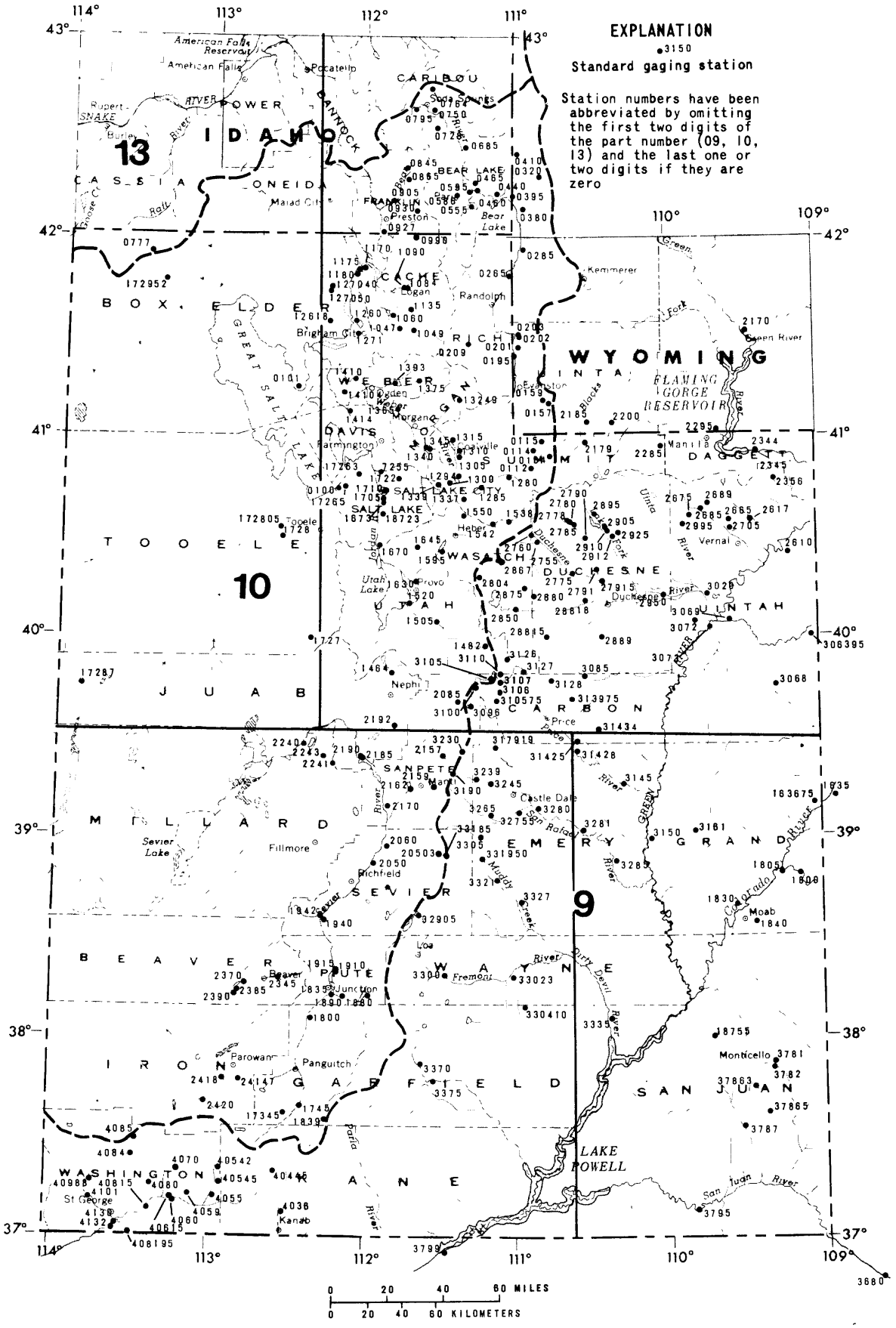
ReMillard, M. D., and others, Water resources data for Utah, water year 1984: U.S. Geological Survey Water-Data Report UT-84-1 (in press).

"Streamflow and reservoir contents in Upper Colorado River Basin" is issued monthly.

Herbert, L. R., Cruff, R. W., and Waddell, K. M., 1985, Seepage study of six canals in Salt Lake County, Utah: Utah Department of Natural Resources Technical Publication 82.

Lindskov, K. L., Potential effects of anticipated coal mining on salt loads of the Price, San Rafael, and Green Rivers, Utah: U.S. Geological Survey Water-Resources Investigations Report, in preparation.

Christensen, R. C., Moosburner, O. M., and others, High-water runoff conditions for the 1983-84 water years in the Great Basin: U.S. Geological Survey Water-Supply Paper, in preparation.



Location of gaging stations, September 1984.

COLLECTION OF GROUND-WATER DATA AND GROUND-WATER CONDITIONS IN UTAH

Number: UT 00-002-FC

Cooperating Agencies: Utah Division of Water Rights;
Utah Division of Water Resources;
Utah Division of Wildlife Resources;
Utah Department of Transportation

Staff: L. R. Herbert, Hydrologic Technician, Project Chief (part time)
G. Smith, Hydrologic Aid (part time)
R. L. Seiler, Hydrologist, Editor of annual ground-water report (part time)
Other District personnel as assigned

Period of Project: Continuing

Objectives: To obtain long-term records of ground-water levels, to determine water-level changes for yearly or other periods, and to determine withdrawals from and status of development of aquifers in the State. To make an annual evaluation of ground-water conditions in Utah.

Approach: Measure water levels annually or semiannually (normally February-March and September) and operate continuous water-level recorders on selected wells. Visit selected pumped irrigation wells, measure discharge, determine the ratio of water produced to energy consumed, and use the ratio along with energy-consumption data to compute total pumpage. Visit selected flowing wells and measure discharge. Obtain estimates of ground water withdrawn by wells for public supply and industrial use from the Utah Division of Water Rights. Obtain additional estimates of industrial use of water from wells from users or by rating pumps and using the ratio of water produced to energy consumed with energy-consumption records. Determine the number and sizes of new wells drilled annually from well drillers' reports to the Division of Water Rights. Prepare an annual report on ground-water conditions in Utah which includes data, graphs, and maps showing water-level changes, withdrawals from wells, number of wells drilled in defined ground-water basins or areas, and a discussion of ground-water conditions in each basin or area. Store water-level data in computer files and publish selected data in the annual report of water-resources data for Utah.

Progress: Water levels were measured in about 1,100 wells in February or March, of which about 600 also were measured in September. Continuous water-level recorders were maintained on thirty-three wells. Locations of the water-level observation wells are shown in figure 2. During the irrigation season, about 500 pumped irrigation wells were visited, discharge was measured at about one-half of the wells, and the ratio of water production to energy-consumption were determined. Natural flow was measured for about 50 wells. Number and sizes of new wells drilled were determined. The twenty-second in the series of annual reports on ground-water conditions in Utah was completed.

Plans for Next Year: Collecting, recording, and publishing of data on water levels, ground-water withdrawals, and wells drilled will continue. The twenty-third in the series of annual ground-water reports will be compiled.

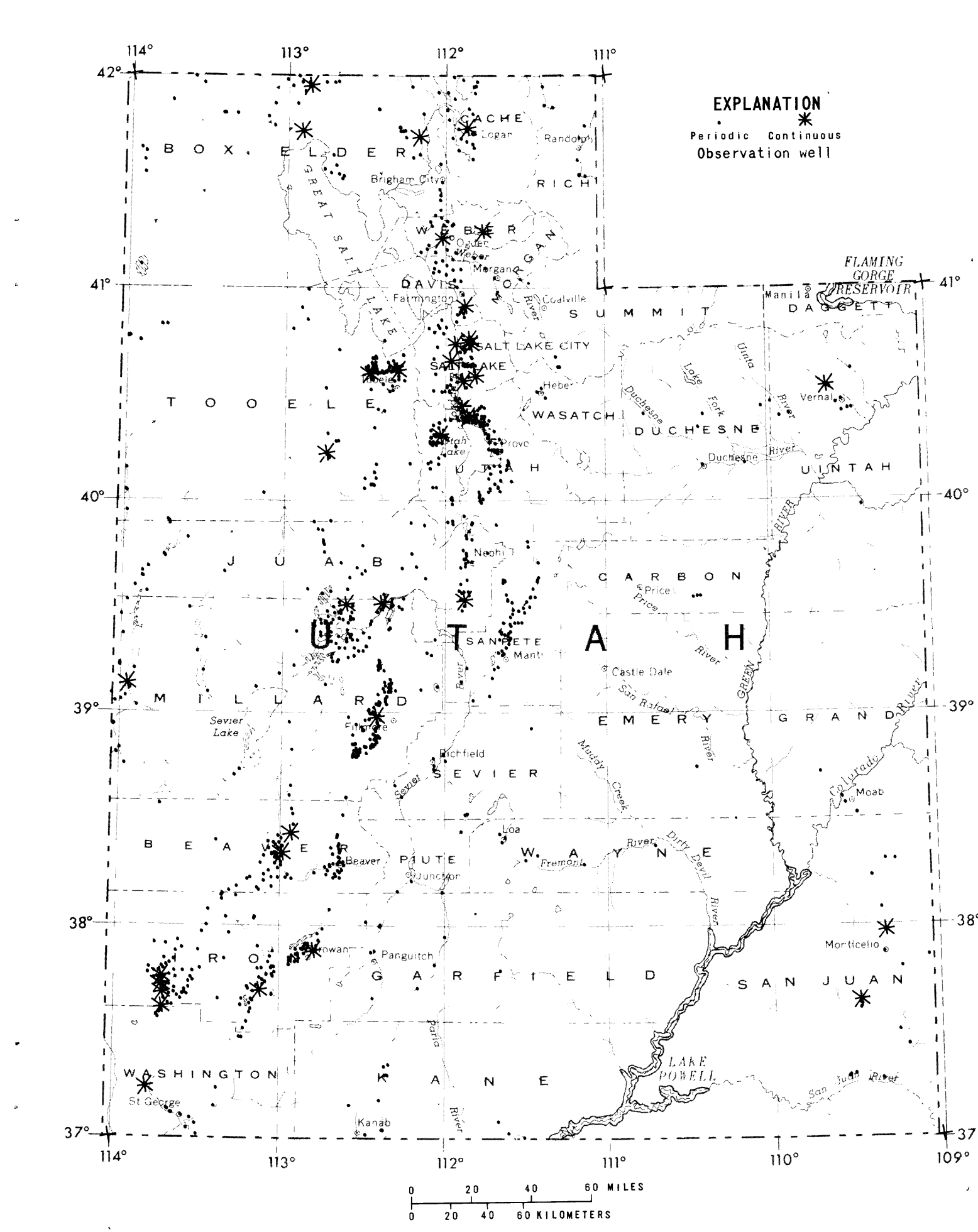
Reports:

ReMillard, M. D., and others, Water resources data for Utah, water year 1983: U.S. Geological Survey Water-Data Report UT-83-1.

ReMillard, M. D., and others, Water resources data for Utah, water year 1984: U.S. Geological Survey Water-Data Report UT-84-1 (in press).

Water-level-change maps, February or March 1985, for 15 areas in Utah--Issued April 1 as local press releases and distributed to agencies and interested individuals.

Seiler, R. L., and others, 1985, Ground-water conditions in Utah, spring of 1985: Utah Division of Water Resources Cooperative-Investigations Report 25.



Location of observation wells where ground-water levels were measured, September 1984.

COLLECTION OF HYDROLOGIC RECORDS—WATER QUALITY AND FLUVIAL SEDIMENT

Number: UT 00-003-FOIC; UT 00-004-FOIC

Cooperating Agencies: Utah Division of Water Rights;
Utah Division of Water Resources;
U.S. Bureau of Land Management;
U.S. Bureau of Reclamation

Staff: R. W. Cruff, Hydrologist, Project Chief (part time)
Other District personnel as assigned

Period of Project: Continuing

Objectives: To obtain long-term records of the quality of water at selected stream sites (fig. 3), springs, and wells (fig. 4) and of sediment (fig. 3) at selected stream sites in Utah; and to obtain shorter-term records for use by other Federal or State agencies involved in development of water resources or protection of the environment.

Approach: Standard methods for the collection and analysis of chemical-quality and fluvial-sediment samples and computer storage and publication of data were used.

Progress: Water-quality data were collected at 24 surface-water sites in Utah. Chemical-quality records were collected daily at 9 stream sites and periodically at 15 stream sites. Specific-conductance values were obtained at an additional 162 stream-gaging stations in Utah. Sediment data were collected daily at 2 sites and periodically at 22 sites. Water-temperature data were obtained daily at 9 stream sites and monthly at about 155 stream sites. Data on the quality of ground water were collected at about 170 wells in Utah.

All water-quality records were compiled for inclusion in the annual water-resources data report.

Plans for Next Year: Continue collecting and processing data and preparing records for publication.

Reports:

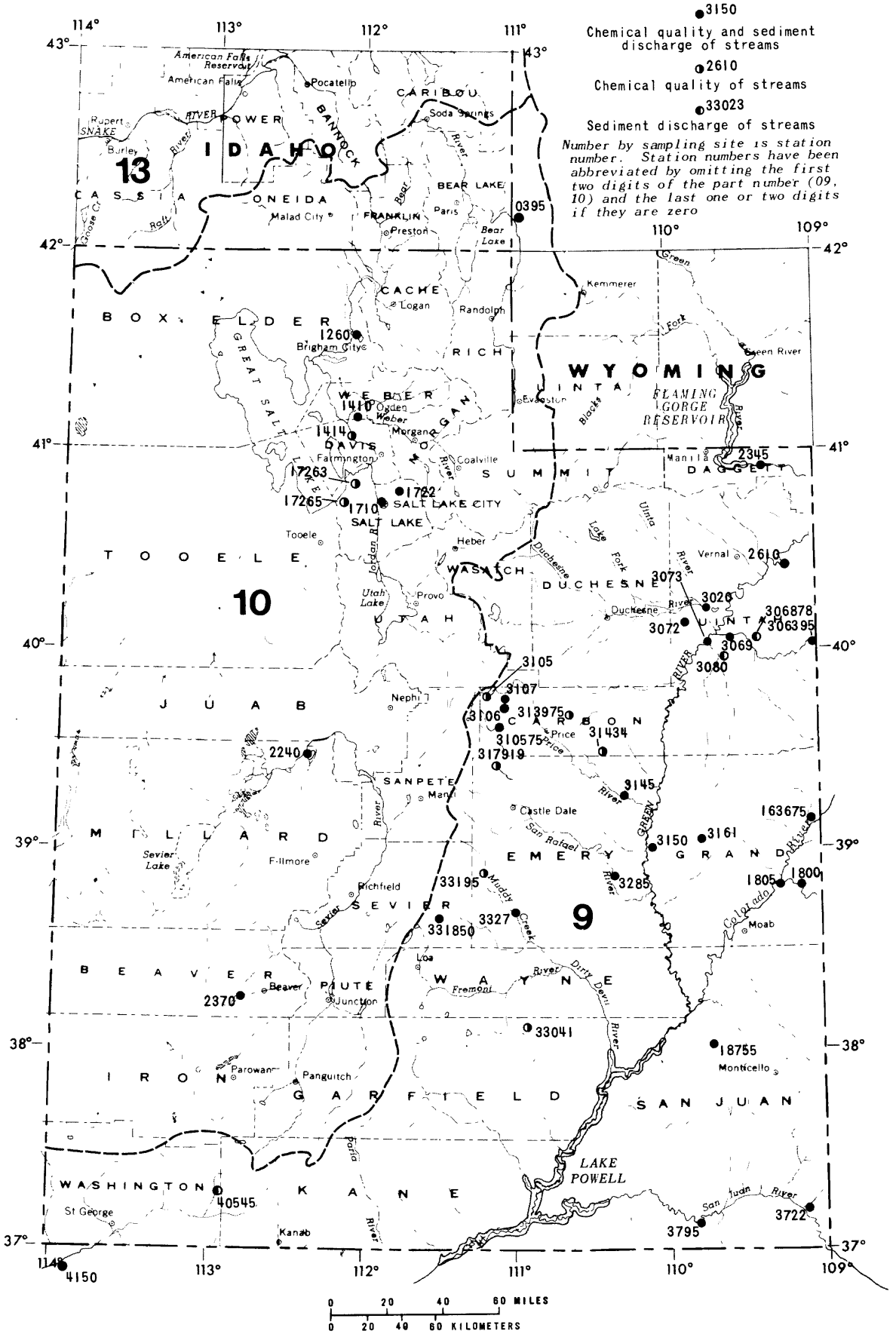
ReMillard, M. D., and others, Water resources data for Utah, water year 1983: U.S. Geological Survey Water-Data Report UT-83-1.

ReMillard, M. D., and others, Water resources data for Utah, water year 1984: U.S. Geological Survey Water-Data Report UT-84-1 (in press).

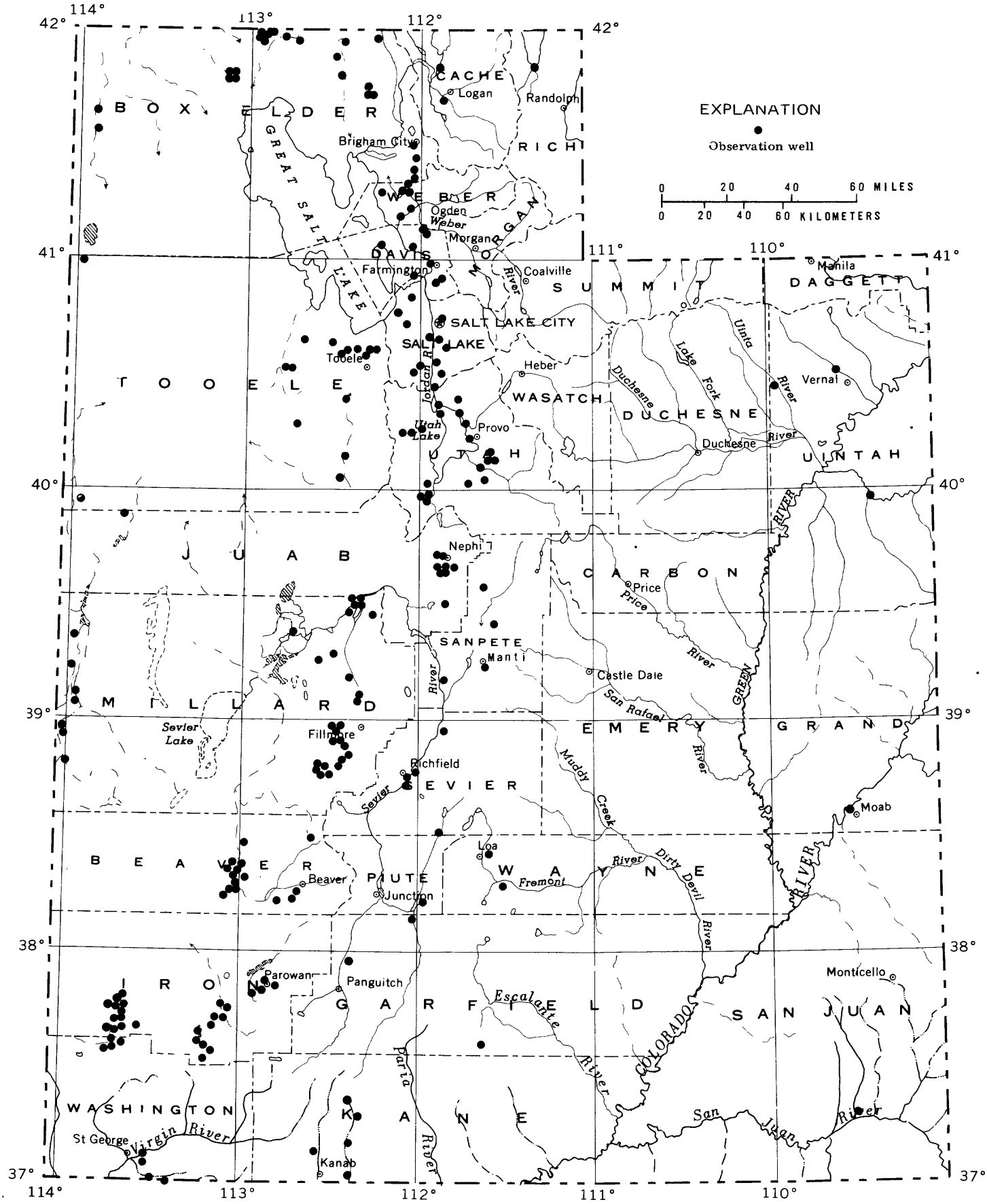
Thompson, K. R., 1985, Annual suspended-sediment loads in the Green River at Green River, Utah: U.S. Geological Survey Water-Resources Investigations Report 84-4169.

Thompson, K. R., 1985, Annual suspended-sediment loads in the Colorado River near Cisco, Utah, 1930-82: U.S. Geological Survey Water-Resources Investigations Report 84-4011.

Price, Don, Ground-water quality monitoring in Utah--A summary of data collected through 1983: Utah Department of Natural Resources Information Bulletin (in review).



Location of surface-water quality stations, September 1984.



Location of observation wells where water samples are collected for monitoring ground-water quality, July 1985.

FLOOD MAPPING

Number: UT 00-006-0

Cooperating Agency: Federal Emergency Management Agency

Staff: R. C. Christensen, Hydrologist,
Project Chief (part time)
R. W. Cruff, Hydrologist (part time)
Other District personnel as assigned

Period of Project: Began May 1983, continuing

Objectives: To delineate the parts of areas selected by the Federal Emergency Management Agency (FEMA) that are subject to inundation by floods of selected recurrence intervals, primarily the 100-year flood. The information is needed by FEMA to assist State and local agencies to control development in the flood-plain areas and to determine rates for the flood-insurance program.

Approach: Determine areas subject to inundation by floods of selected magnitude by ground surveys or photogrammetric methods. Determine frequency relationships using local historical information, gaging-station records, and other applicable information. Determine water-surface profiles at flood stage using step-backwater models or by other acceptable methods and present the results in reports prepared to FEMA specifications.

Progress: Meetings with several communities in Utah (Tooele, Morgan, Ephraim, Fairview, and Washington) and FEMA were held to decide which ones are to be studied.

Plans for Next Year: Prepare planning document for the flood studies of the communities selected by FEMA and begin fieldwork.

Reports: None.

STATEWIDE WATER USE

Number: UT 00-007-C

Cooperating Agency: Utah Division of Water Rights

Staff: G. E. Pyper, Hydrologic Technician, Project Chief
R. L. Baskin, Hydrologic Technician (part-time)
Brent Johnson, Engineer, Utah Division of Water Rights
Other State and District personnel as assigned

Period of Project: Began July 1977, continuing

Objective: To obtain information about withdrawals and return flows of water for various uses and about consumptive use of water in connection with each type of withdrawal.

Approach: Field inventory and measurement of surface-water diversions and some types of ground-water diversions, verification of user measurements and records, and acreage and crop surveys to aid in computing consumptive use by irrigation. The results of a pilot study in Tooele Valley will be used to determine the best way of estimating water use for irrigation for the State. State personnel are collecting data on public supply and industrial use; Geological Survey personnel are collecting data on irrigation use.

Progress: Mail surveys were made to determine water use by about 350 public suppliers and 130 major self-supplied and public-supplied industries. Approximately 30 public suppliers were visited during the year to verify the data. The report on water use during 1982 and 1983 by public suppliers and industry is being prepared. Data are being prepared for entry into the State and National water-use systems. Work has continued on comparing various methods, including satellite photography, to determine water use for irrigation in Tooele Valley.

Plans for Next Year: Data for public supply and industrial use will continue to be collected and verified. Data will be submitted to the National water-use data base in Reston, VA. Work will continue on determining irrigated acreage and water use by irrigation. Compilation of data for the national 5-year water-use report will be completed.

Reports:

Johnson, Brent, Utah water-use data, public and industrial water supplies, 1982 and 1983: Utah Department of Natural Resources, Utah Water-Use Report (in preparation).

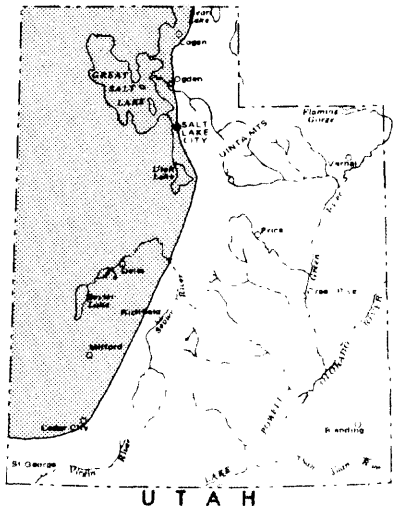
Pyper, G. E., and Baskin, R. L., Comparison of methods to estimate use of water for irrigation, Tooele Valley, Tooele County, Utah: Utah Department of Natural Resources, Utah Water-Use Report (in review).

GREAT BASIN REGIONAL AQUIFER SYSTEMS ANALYSIS

Number: UT 81-147-F

Staff: J. L. Mason, Hydrologist, Project Chief
J. S. Gates, Hydrologist (part time)
P. R. Gallagher, Hydrologic Technician (part time)

Period of Project: October 1980 to September 1985



Objectives: This study is one in a series of National studies of regional aquifer systems that together will cover much of the United States. The Great Basin study is headquartered in Carson City, NV, with part of the work located in the Utah District office. The overall objective is to assemble hydrologic information and create predictive capabilities necessary for effective management of ground water. The Great Basin is made up of individual basins that have basin-fill aquifers of similar origin, but these aquifers are either not connected hydrologically or have limited connection, sometimes by way of consolidated-rock aquifers underlying the uplands that separate basins and underlying the basins themselves. Specific objectives are to establish common principles governing occurrence, recharge, movement, discharge, and quality of water in the aquifers of the Great Basin, and to construct digital-computer models of the ground-water systems, representative basins, or groups of hydrologically-connected basins. The models will be used to help understand the natural (pre-development) flow and geochemical systems and to predict effects of future development and differences in the effects of various management strategies.

Approach: Computer simulation will be used to analyze the existing hydrogeologic regime and to provide the capabilities of predicting the effects of future development. The simulations will incorporate hydraulic effects and will be initiated early in the study to help determine the overall nature of the flow system, to identify sensitive parameters and data needs, and to determine what segments of the system, if any, can be treated independently. Assembling available hydrogeologic data on the Great Basin is an important part of the work, and collection of new data needed for successful simulation may require fieldwork. The present distribution of water quality throughout the area will be described using available and project-collected data. These data will be used to interpret the water-quality distribution in terms of the original flow pattern and geochemical processes, and an effort will be made to predict water-quality changes in response to future development, waste disposal, or artificial recharge.

Progress: The digital-computer model of the Milford area has been completed and a report is being prepared. A good match between measured and computed water-level data has been achieved for a transient simulation for the period

from 1950 through 1982. Predictive simulations using ground-water withdrawals equal to the average rate for 1979-1982 through the year 2020 show that further water-level declines of approximately 25 feet are likely. The model indicated that pumping at twice the average rate would cause about 85 feet of additional drawdown. All geophysical data for Tule Valley have been evaluated and a report is in preparation.

Plans for Next Year: Contingent on funding, two phases of work are planned. First, summary reports will be reviewed and input data for the digital-computer model of the Milford area will be documented. A brief report on the test-drilling around Sevier Lake will be prepared. Second, the Tule Valley digital-computer model will be revised, based on hydrogeologic information inferred from geophysical data.

Reports:

Bedinger, M. S., Gates, J. S., and Stark, J. R., 1984, Maps showing ground-water units and withdrawal, Basin and Range Province, Utah: U.S. Geological Survey Water-Resources Investigation Report 83-4122-A.

Bedinger, M. S., Mason, J. L., Langer, W. H., Gates, J. S., Stark, J. R., and Mulvihill, D. A., 1984, Maps showing ground-water levels, springs, and depth to ground water, Basin and Range Province, Utah: U.S. Geological Survey Water-Resources Investigation Report 83-4122-B.

Thompson, T. H., and Nuter, Janet, 1984, Maps showing distribution of dissolved solids and dominant chemical type in ground water, Basin and Range Province, Utah: U.S. Geological Survey Water-Resources Investigations Report 83-4122-C.

Bedinger, M. S., Reed, J. E., Gates, J. S., and Harrill, J. R., Potential for regional ground-water flow with applications in the Basin and Range Province, to be submitted for publication in the Geological Society of America Bulletin (in review).

Gates, J. S., 1984, Hydrogeology of northwestern Utah and adjacent parts of Idaho and Nevada: in Geology of northwest Utah, southern Idaho, and northeast Nevada, Utah Geological Association Publication 13, p. 239-248.

Mason, J. L., Atwood, J. W., and Buettner, P. L., Selected text well data from the MX-missile siting study, Tooele, Juab, Millard, Beaver, and Iron Counties, Utah: Utah Hydrologic-Data Report No. 43 (in press).

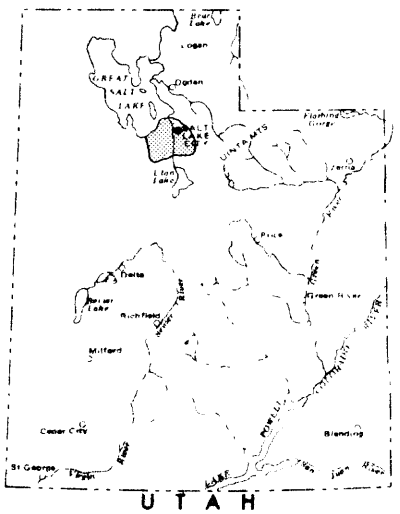
Bunch, R. L., and Harrill, J. R., 1984, Compilation of selected hydrologic data from the MX missile-siting investigation, east central Nevada and western Utah: U.S. Geological Survey Open-File Report 84-702.

Harrill, J. R., Gates, J. S., and Thomas, J. M., Major ground-water flow systems, in the Great Basin area of Nevada, Utah, and adjacent states: U.S. Geological Survey Hydrologic Investigations Atlas (in review).

Mason, J. L., Simulated alternatives for ground-water withdrawals and their effects on the basin-fill aquifer in the Milford area, southwestern Utah (in preparation).

GROUND-WATER CONDITIONS IN SALT LAKE VALLEY, WITH ANALYSIS BY FLOW AND SOLUTE-TRANSPORT MODELS

Number: UT 81-150-C



Cooperating Agencies: Utah Division of Water Rights; local water-management agencies and municipalities

Staff: K. M. Waddell, Hydrologist, Project Chief
R. L. Seiler, Hydrologist
D. K. Solomon, Hydrologist (part time)

Period of Project: July 1981 to June 1985

Objectives: (1) To determine the current state of the Salt Lake Valley's ground-water system in terms of water levels, recharge, movement, discharge, water quality, and volumes of water of various qualities in storage; and (2) to improve understanding of the valley's ground-water flow system and transport of dissolved solids by construction of digital-computer models of the system that will simulate ground-water flow and cross sections that will illustrate the transport of dissolved solids.

Approach: (1) Update files of data on water levels, withdrawals and natural discharge, and water quality; (2) supplement available information with additional data collected on water levels and quality, recharge and discharge, aquifer and confining-bed parameters, and water in storage; (3) construct a three-dimensional digital model of the system to simulate ground-water flow and cross sections of solute transport. Use the model to simulate changes in water levels resulting from potential ground-water development; and (4) publish results as a Utah Department of Natural Resources Technical Publication.

Progress: Completed collection of water-quality data. Completed calibration of cross sections of solute transport. Completed and submitted for review the basic-data report, the report on the flow-system model, and the water-quality report.

Plans for Next Year: None.

Reports:

Seiler, R. L., Selected hydrologic data for Salt Lake Valley, Utah, February 1969 to January 1985: Utah Hydrologic-data Report No. 44 (in review).

Waddell, K. M., Seiler, R. L., Santini, M. D., and Solomon, D. K., Groundwater conditions in and predicted effects of increased withdrawals from wells, Salt Lake Valley, Utah: Utah Department of Natural Resources Technical Publication (in review).

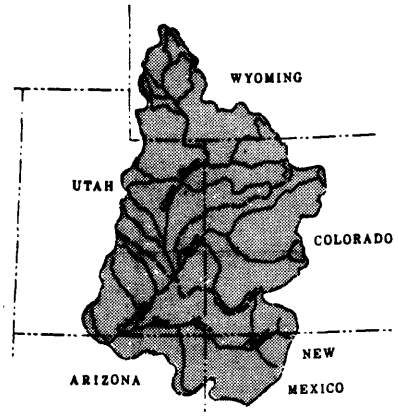
Waddell, K. M., Seiler, R. L., and Solomon, D. K., Chemical quality of ground water in Salt Lake Valley, Utah, 1969-84: Utah Department of Natural Resources Technical Publication (in review).

Seiler, R. L., Solomon, D. K., and Waddell, K. M., Three-dimensional digital ground-water model for Salt Lake Valley: U.S. Geological Survey Open-File Report (in preparation).

REGIONAL AQUIFER SYSTEMS ANALYSIS-MESOZOIC SANDSTONE AQUIFERS IN THE UPPER COLORADO RIVER BASIN

Number: UT 81-154-F

Staff: G. W. Freethey, Hydrologist, Project Chief
B. E. Thomas, Hydrologist
G. E. Cordy, Hydrologist
J. F. Weigel, Hydrologist
B. A. Kimball, Hydrologist (Colorado District, part time)
L. N. Thurgood, Hydrologic Technician (part time)
S. Kelly, Hydrologic Technician (part time)



Period of Project: October 1981 to September 1986

Objectives: This study is one of the series of National studies of regional aquifer systems that together will cover much of the United States. In the Upper Colorado River Basin, aquifers that are truly regional include the complex of thick sandstones of Jurassic and Triassic age and carbonate and sandstone aquifers of Mississippian and Permian age. This study will target the thick sandstones of the Mesozoic System and locally related aquifers of lesser extent. The study is intended to (1) provide a basin-wide data base; (2) define and quantify recharge, occurrence, movement, discharge, and quality of ground water; (3) model the system(s) in order (a) to understand the natural (pre-development) flow and geochemical system(s) and (b) to evaluate or predict the effects of future development and differences in these effects due to various management strategies.

Approach: Computer simulation will be the main tool used to analyze the hydrogeologic regimen of the Mesozoic aquifers system. The results of prior local, areal, and regional studies will be collected and combined, and basic data from those studies will be updated. Concurrently, subregional-flow models will be constructed in order to test provisional hypotheses and show areas where additional data are needed. Following will be a period of data collection, during which the models will be updated as field data are obtained. Final analyses will incorporate consideration of the effects of development on the ground-water flow regimen and storage, on surface-water flow, and on possible water-quality changes that would accompany development. Results of the study will appear as a planning document, data report(s), hydrologic atlases, model documentation, and a final interpretive report.

Progress: Stratigraphic and hydrologic data continue to be compiled, updated, and entered into computer storage. A hydrologic atlas presenting a general framework of the ground-water system in rocks of Mesozoic age has been approved for publication. New maps showing thickness, areal extent, lithofacies changes, potentiometric contours, and thickness of saturated zones

are being prepared for five aquifer units and five confining units in the Mesozoic system. Hydrologic properties extracted from aquifer tests, drill-stem tests, specific-capacity tests, and laboratory analyses of rock samples are being compiled and analyzed. A report of the hydrologic properties is being prepared. Ground-water flow models have been constructed for two subregions within the study area and reports are in review. A third subregional model is in the development stage and a report is in preparation. Chemical-mixing models are being constructed for Mesozoic aquifer units for two of the same subregions to analyze the mixing of ground waters from multiple aquifers. An assessment of aquifer discharge to streams based on chemical mixing of ground water and surface water is also underway.

Plans for Next Year: The final report defining the Mesozoic ground-water system will be completed. Data reports for aquifer hydraulics, lithology, and water levels will be prepared. A regional steady-state model of the principal Mesozoic aquifer system will be developed to test the conceptual distribution of aquifer properties, recharge, and discharge. The possible development of these aquifers will be qualitatively assessed and this assessment will be tested with the regional model.

Reports:

Freethey, G. W., and Cordy, G. E., Definition of the ground-water flow system in the Mesozoic rocks of the Upper Colorado River Basin in Colorado, Utah, Wyoming, and Arizona: U.S. Geological Survey Professional Paper (in preparation).

Freethey, G. W., Kimball, B. A., Wilberg, D. E., and Hood, J. W., 1984, General hydrogeology of aquifers of Mesozoic age, Upper Colorado River Basin--excluding the San Juan Basin--Colorado, Utah, Wyoming, and Arizona: U.S. Geological Survey Open-File Report 84-716, (to be published as a U.S. Geological Survey Hydrologic Investigations Atlas).

Kimball, B. A., Mixing and chemical reaction of ground water in the Navajo Sandstone aquifer, Dirty Devil River basin, Utah: Journal article (in preparation).

Taylor, O. J., Hood, J. W., and Zimmerman, E. A., 1983, Plan of study for the regional aquifer systems analysis of the Upper Colorado River Basin in Colorado, Utah, and Wyoming: U.S. Geological Survey Water-Resources Investigations Report 83-4184.

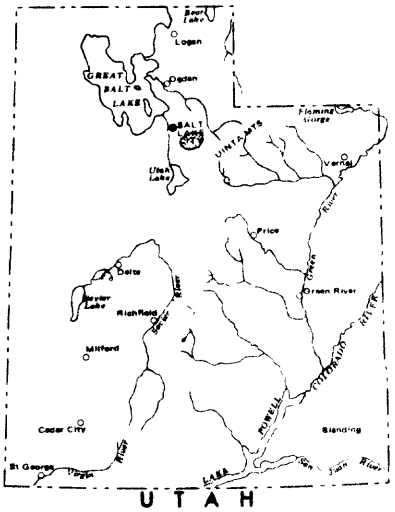
Taylor, O. J., Hood, J. W., and Zimmerman, E. A., 1984, Hydrogeologic framework of the Upper Colorado River Basin in Colorado, Utah, Wyoming, and Arizona: U.S. Geological Survey Hydrologic Investigations Atlas HA-678.

Thomas, B. E., Simulation analysis of the interaction of the Navajo Sandstone aquifer and Lake Powell near Wahweap Bay, Utah and Arizona: U.S. Geological Survey Water-Resources Investigations Report (in review).

Weigel, J. F., Selected hydraulic and lithologic data for the Mesozoic formations of the Upper Colorado River Basin in Colorado, Utah, Wyoming, and Arizona: U.S. Geological Survey Water-Resources Investigations Report (in preparation).

Weiss, E. J., Ground-water flow model for the Navajo Sandstone in southeast Utah: U.S. Geological Survey Water-Resources Investigations Report (in review).

HYDROLOGY OF THE PARK CITY AREA



Number: UT 82-158-C

Cooperating Agency: Utah Division of Water Rights

Staff: W. F. Holmes, Hydrologist, Project Chief
M. Enright, Hydrologic Technician
K. R. Thompson, Hydrologist (part time)

Period of Project: July 1982 to June 1985

Objectives: Define the surface-water and ground-water hydrology and the relationship between them. Characterize consolidated and unconsolidated rock aquifers. Estimate the effects of ground-water withdrawals from both aquifers and the effects of surface-water diversions and construction of a large reservoir on the system. Determine ground-water quality and estimate the effects of continued development on water quality.

Approach: Define surface-water hydrology using existing records, additional monitoring sites, and two new gages, to estimate average surface-water inflow and outflow in the study area and their quality. Estimate evapotranspiration by mapping phreatophytes, water surfaces, and wetland. Inventory all wells, drain tunnels, mines, and springs. Conduct seepage runs along major canals and streams to estimate recharge or discharge. Estimate direction of ground-water movement from water-level measurements in existing wells. Determine geologic characteristics such as strike, dip, fracturing or jointing, that may control ground-water occurrence and its flow direction. Estimate hydraulic characteristics from aquifer tests. Collect samples from wells and springs, surface water, and mines for chemical analysis; and determine water quality of the system. Characterize ground-water quality in both aquifers, and use data to infer source and movement of ground water. If feasible, construct a ground-water model to test the conceptualized ground-water system. If funds are available, drill test holes in both unconsolidated and consolidated rocks.

Progress: Data collection and interpretation are complete. The final report, which includes basic data, has been written and is in review.

Plans for Next Year: None.

Reports:

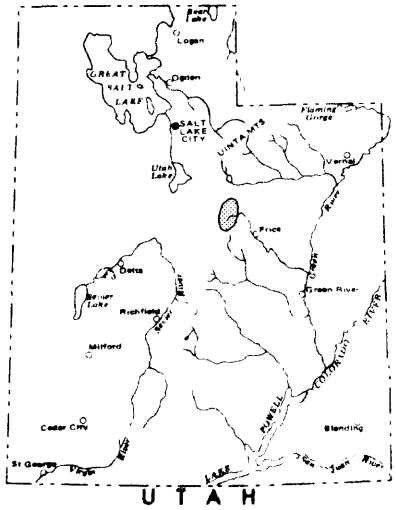
Holmes, W. F., Thompson, K. R., and Enright, M., Water resources of the Park City area, Utah, with emphasis on ground water: Utah Department of Natural Resources Technical Publication (in review).

SEDIMENT AND TRACE-METALS TRANSPORT IN STREAMS IN THE PLEASANT VALLEY COAL-RESOURCE AREA, CENTRAL UTAH, AND THEIR EFFECTS ON SCOFIELD RESERVOIR

Number: UT 83-160-I

Cooperating Agency: U.S. Bureau of Land Management

Staff: D. W. Stephens, Hydrologist, Project Chief
K. R. Thompson, Hydrologist (part time)
J. B. Wangsgard, Hydrologic Technician (part time)



Period of Project: October 1982 to September 1985

Objectives: Determine sediment and common trace-metal loads in selected streams in the Pleasant Valley coal-resource area and determine if coal-mining and coal-washing operations have increased loads. Determine loads entering Scofield Reservoir and their effects on reservoir geochemistry.

Approach: Monitor and compute sediment loads at existing gaging stations on (1) Pleasant Valley Creek near its point of inflow to Scofield Reservoir and (2) in Eccles Canyon (a tributary to Pleasant Valley Creek) downstream from an extensive area clearcut for mining and associated roads and downstream from a coal-washing plant. Also construct and maintain a gaging station and sediment-monitoring site on one other tributary to Pleasant Valley Creek that is unaffected by mining; or on Fish Creek, which has experienced no mining, and is the major inflow source for Scofield Reservoir. Analyze for the types and weights of metal oxides attached to selected sediment samples in order to compute trace-metal loads. Collect a set of reservoir-sediment core samples and analyze for trace-metal content; and collect soil samples in undisturbed areas and areas disturbed by mining and analyze for available ions. Analytical work will be performed in the U.S. Geological Survey Central Laboratory. Predict effects of present and future sediment and trace-metal transport into Scofield Reservoir on reservoir geochemistry. Prepare interpretive report by October 1985.

Progress: Data collection has been completed on Scofield Reservoir and the area streams, and a draft of the final report has been prepared. Preliminary analysis of the data indicates there are significantly larger concentrations of suspended sediment, manganese, iron, and dissolved solids in Eccles Creek (in a coal-mined area) than Boardinghouse Creek (nonmined). Generally, 1983-84 were both years of record streamflows and each year was distinct in its flow-concentration patterns. Reservoir data indicate the record inflows reduced the potential for blue-green algae blooms and improved the water quality in 1983-84. It is not likely that heavy metals would be mobilized to any extent from the reservoir sediments and anaerobic phosphorus release is minor in comparison to the inflows of phosphorus.

Plans for Next Year: None.

Reports: Stephens, D. W., Extraction of periphyton adenosine triphosphate and variability in periphyton biomass estimation (submitted to Archives fur Hydrobiology for publication).

Stephens, D. W., Why Scofield Reservoir is eutrophic: Effects of non-point source pollution on a water-supply reservoir in Utah; in "Proceedings of National Conference on Nonpoint source pollution" to be published in June 1985.

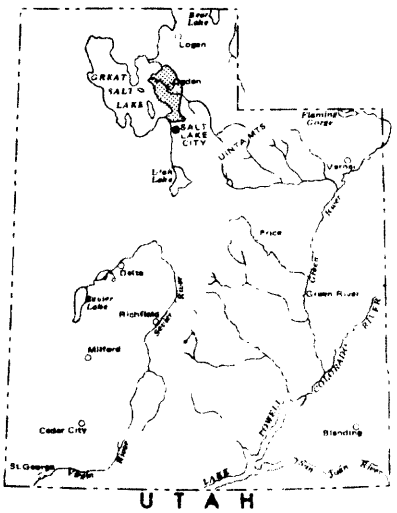
Stephens, D. W., Thompson, K. R., and Wangsgard, J. B., Sediment, trace metals, and nutrients in Scofield Reservoir and in streams in the Pleasant Valley area, Utah: U.S. Geological Survey Water-Supply Paper (in preparation).

GROUND-WATER HYDROLOGY OF THE EAST SHORE AREA

Number: UT 83-162-C

Cooperating Agency: Utah Division of Water Rights

Staff: D. W. Clark, Hydrologist, Project Chief
C. L. Appel, Hydrologist (part time)
G. G. Plantz, Hydrologic Technician
P. M. Lambert, Hydrologic Technician (part time)
K. Bossart, Hydrologic Technician (part time)



Period of Project: July 1983 to June 1986

Objectives: (1) To assess current conditions in terms of recharge, movement, and discharge of ground water, water levels, ground-water quality, and volumes of water in storage. (2) To increase knowledge and understanding of the ground-water system of the East Shore area and how it functions. (3) To construct a digital-computer model of the system that can simulate past and current conditions in the area and possible effects of changes in discharge and recharge.

Approach: (1) Update well data, including water-level and water-quality data, and put them in computer storage. (2) Conduct a comprehensive inventory of ground-water discharge, including that from wells; to drains, and streams; by evapotranspiration by phreatophytes; and to Great Salt Lake. (3) Estimate recharge, where feasible, from streams, irrigation, precipitation, and by subsurface flow from consolidated rock. (4) Conduct aquifer tests to add to knowledge on hydraulic characteristics of the basin fill. (5) Construct three-dimensional digital models covering the area to simulate ground-water flow and effects of changes in the system. (6) Prepare basic-data and model reports, and an interpretive report for publication by the Utah Department of Natural Resources.

Progress: Water levels were measured in about 175 wells in March 1985 to be used in compiling potentiometric-surface maps. Water levels in about 50 of these wells are measured at least monthly to determine seasonal fluctuations. More than 200 wells have been inventoried, including all major pumped wells. About 70 wells were sampled for water-quality analysis, including resampling about 30 wells sampled in the late 1960's to determine possible water-quality changes. Ground-water discharge has been measured at least once at about 70 flowing wells, including about 30 having long-term discharge records. Discharge has been measured in about 30 drains. Seepage measurements to determine ground-water recharge have been made on the Weber and Ogden Rivers. Aquifer tests have been conducted on large-discharge pumped wells and water-level recovery tests have completed on flowing wells. Seismic-reflection data

from the sediments beneath the Farmington Bay area of Great Salt Lake have been collected. Preliminary work on steady-state calibration of the two separate digital ground-water models continues. All well data collected to date have been entered into computer storage. Most preliminary work on the basic-data report is complete.

Plans for next year: Continue to make monthly water-level measurements in selected wells. Remeasure discharge in selected drains and in about 30 drains not yet measured. Measure discharge from flowing wells in five land sections and in selected wells already measured. Conduct seepage studies on several of the smaller perennial streams to determine ground-water recharge from streams. Conduct aquifer tests on large-discharge flowing wells where possible. Complete the basic-data report. Interpret the geophysical data from the Great Salt Lake seismic study. Complete steady-state and transient-state calibration of two models. Complete data analysis for all aspects of the project. Prepare final interpretive report.

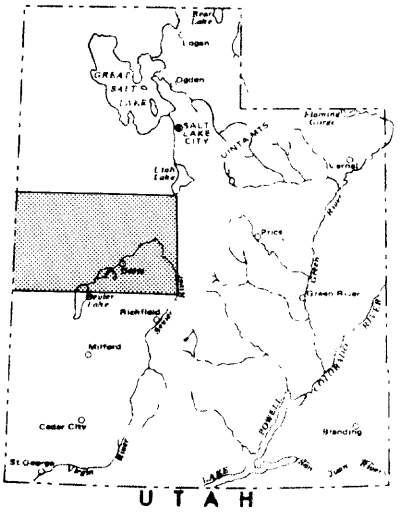
Reports: None

DISCHARGE AND CHEMICAL QUALITY OF WATER FROM SELECTED SPRINGS IN PARTS OF JUAB, MILLARD, AND UTAH COUNTIES

Number: UT 84-164-I

Cooperating Agency: U.S. Bureau of Land Management

Staff: W. F. Holmes, Hydrologist, Technical Supervisor
D. E. Wilberg, Hydrologic Technician, Project Chief
B. J. Stolp, Hydrologic Technician (part time)
Other District personnel as assigned



Period of Project: December 1983 to March 1985

Objectives: To provide the Bureau of Land Management with data concerning water quality, discharge, geologic source, and permanence for 79 selected springs in parts of Juab, Millard, and Utah Counties. The data from the laboratory analysis and field inventory will be used to evaluate the suitability of water from each spring for stock, wildlife, and human consumption and to provide the Bureau of Land Management with information they can use in the water-rights adjudication process.

Approach: The sampling procedure will require two visits to each of the 79 springs; one during the seasonal high-flow period of spring and one during the low-flow period of summer and early fall. The high-flow visit will include determination of location, collection of water sample for laboratory analysis, measurement of discharge, interpretation of geologic source and a description of the structure that may control the occurrence of a spring at a particular location, titration of spring water to determine alkalinity, and measurement of specific conductance, pH, and temperature. The second visit will include a measurement of discharge as a basis for seasonal variability, measurement of temperature and specific conductance, and a panoramic photograph to document the spring setting. If there is a large discrepancy in specific conductance between the first and second visits, another water sample will be collected for laboratory analysis.

Progress: Field inventory and sampling were completed. Data were tabulated and copies of the table of chemical analyses were provided to the Bureau of Land Management. A draft of the final report was completed and has received technical review.

Plans for Next Year: None.

Reports:

Wilberg, D. E., and Stolp, B. J., Discharge, chemical quality of water, and physical characteristics of selected springs in Juab, Millard, Utah, and Tooele Counties, Utah: U.S. Geological Survey Water-Resources Investigations Report (in review).

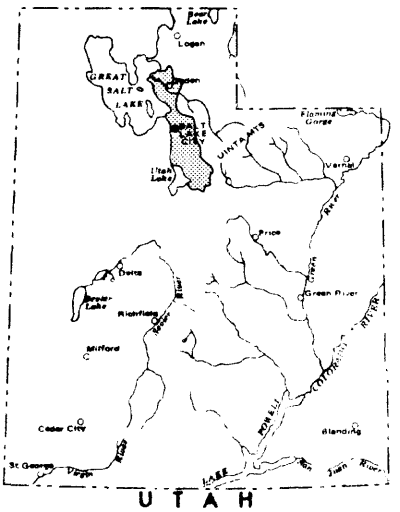
FLOOD CHARACTERISTICS OF URBAN WATERSHEDS

Number: UT 84-165-C

Cooperating Agency: Utah Department of Transportation

Staff: K. L. Lindskov, Hydrologist, Project Chief (part time)
L. R. Herbert, Hydrologic Technician (part time)
M. L. Palmer, Hydrologic Technician (part time)
Other District personnel as assigned

Period of Project: July 1984 to September 1987



Objectives: (1) Obtain hydrologic data for 12 representative urban watersheds to define frequency relations of peak flow and volumes of flood flow. The results will be used to determine the impacts of urban development on floods along the Wasatch Front (Salt Lake, Davis, and parts of Utah and Weber Counties). (2) Develop methods for determining peak flow and volumes of flood flow for selected recurrence intervals for ungaged urban watersheds. (3) Document increases or decreases in peak flow between the canyon mouth and the mouths of major streams that receive most of their flow from mountain snowmelt, flow through the urban areas, and are tributary to the Jordan River, Utah Lake, and the Great Salt Lake. This will provide methods for estimating snowmelt runoff combined with the thunderstorm runoff contributed by the areas between the canyon mouth and the stream mouth.

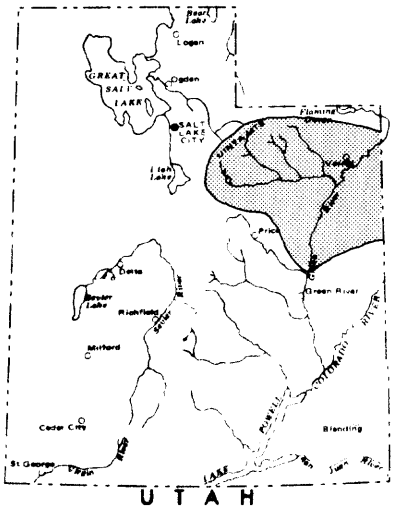
Approach: Floodflow and rainfall data will be obtained at sites in 12 representative urban watersheds for 3 years. The data for about 20 storms will be used to calibrate an urban rainfall-runoff model for each site. The model will be used, along with long-term rainfall data, to simulate a long-term period of flood flows. After the data collection and record simulation are complete, various techniques will be investigated for transferring the information from gaged to ungaged sites. One possible method would be to relate flow characteristics to basin and climatic characteristics using multiple-regression techniques. Case histories will be compiled by comparing peak flow at canyon mouths with peak flow at points where selected larger streams empty into the Jordan River, Utah Lake, and the Great Salt Lake. This will enable modification of the snowmelt peak flow as measured at the canyon mouth.

Progress: Twelve watersheds were selected and instrumented to record runoff and rainfall. Data for the 1984 water year have been filed for input to a rainfall-runoff model. Long-term records of rainfall intensity for the Salt Lake International Airport were obtained from the National Oceanic and Atmospheric Administration.

Plans for Next Year: Maintain the 12 urban-stream sites that have been instrumented for measuring flood runoff, review the records monthly, and process the data for input to a rainfall-runoff model. Determine basin characteristics and urban-development factors for the 12 urban watersheds. Begin calibration of an urban-rainfall-runoff model.

Reports: None.

DEPTH TO BASE OF MODERATELY SALINE GROUND WATER, UINTA BASIN



Number: UT 84-166-C

Cooperating Agency: Utah Division of Oil, Gas, and Mining

Staff: L. W. Howells, Hydrologist, Project Chief
M. S. Longson, Hydrologic Technician (part time)

Period of Project: April 1984 to June 1986

Objectives: To determine the depth to the base of ground water containing 10,000 milligrams per liter or less of dissolved solids in the Uinta Basin; to portray the depth on three maps (Greater Altamont-Bluebell oil-field, western Uinta Basin, and eastern Uinta Basin); and to prepare a report including at least the latter two maps, tables of ground-water data used in preparing the maps, a discussion of how the maps were prepared, and a brief summary of the basin's hydrogeology. This will aid the State in determining criteria to protect ground water from contamination during exploration for and production of oil and gas.

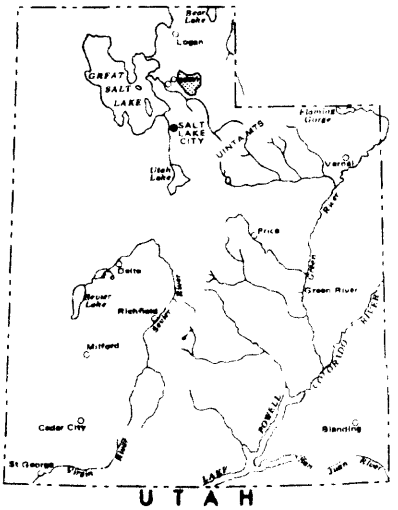
Approach: The files of the Utah Division of Oil, Gas, and Mining, Utah Division of Water Rights, U.S. Geological Survey, Bureau of Land Management, and oil companies will be searched to locate data on ground-water quality, borehole-geophysical logs that could be interpreted to indicate ground-water quality, and geologic information related to hydrogeology. A map of the Greater Altamont-Bluebell oil-field will be prepared first to develop techniques. Data on water production from oil-fields in the basin will be updated, if time permits. Empirical relations between water quality and formation resistivity (from resistivity logs) will be developed. Maps showing contours of the depth to the base of water with 10,000 milligrams per liter or less of dissolved solids will be prepared using water samples, empirical relations between resistivity and water quality, theoretical determination of water quality from resistivity data, and geologic information. Cross sections will be prepared from the maps to illustrate complex changes in water quality.

Progress: A file of chemical analyses of water and measured water resistivities was compiled from the files of various public agencies, commercial laboratories, and oil and gas operators. The depth to the base of moderately saline water has been determined from geophysical well logs in selected oil tests for the Greater Altamont-Bluebell oil-field.

Plans for Next Year: Completion of log analysis for the Greater Altamont-Bluebell oil field and preparation of the contour maps of the depth to the base of moderately saline water. Completion of log analysis for the rest of the Uinta Basin and preparation of the final report.

Reports: None.

WATER RESOURCES OF OGDEN VALLEY, WEBER COUNTY, WITH EMPHASIS ON GROUND WATER



Number: UT-84-167-C

Cooperating Agency: Utah Division of Water Rights

Staff: Charles Avery, Hydrologist, Project Chief
Other District personnel as assigned

Period of Project: July 1984 to June 1987

Objectives: Assess current conditions in Ogden Valley in terms of recharge, movement, and discharge of ground water, surface-water and ground-water relationships, ground water in storage, and general water quality. Gain a better understanding of the hydrologic system and its operation, and estimate the effects of potential changes in discharge from the ground-water reservoir. Conduct a reconnaissance of ground-water occurrence in the drainage basin upstream from Ogden Valley.

Approach: Conduct a well and spring inventory in Ogden Valley, including collection of water-level, discharge and specific-capacity, and water-quality data. Inventory wells and major springs, and determine the general occurrence of ground water in the upstream drainage basin. This information will be placed in the WATSTORE data base. Conduct a survey of ground-water discharge in Ogden Valley, including that from wells, springs, base flow in streams, and evapotranspiration by phreatophytes. Also estimate by various methods the discharge from the artesian aquifer to Pineview Reservoir, and attempt to estimate the effects of stage changes in the reservoir on this discharge. Estimate recharge to Ogden Valley, where possible, including that from streams, irrigation, precipitation, and subsurface flow from consolidated rocks bounding the valley. Establish an observation-well network, including wells near surface-water bodies. Use surface geophysics to map the base of the valley fill. Conduct aquifer tests to more precisely determine the hydraulic characteristics of the valley fill. Construct a digital-computer model of the valley to simulate ground-water flow and effects of changes in the system.

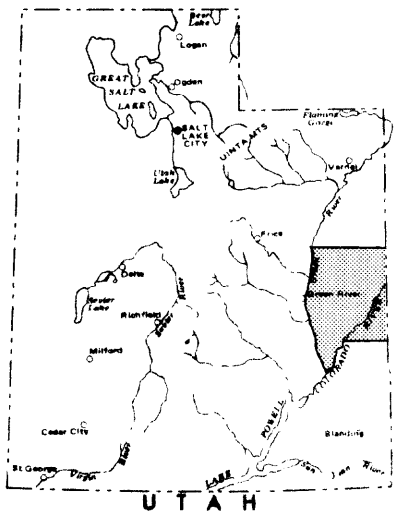
Progress: The project proposal-planning document has been written. Existing water-level and water-chemistry data have been compiled. Most collected and compiled data have been entered in WATSTORE. Data have been assembled for and preliminary runs made of the digital-computer model. Water levels in 21 wells in an observation-well network were measured monthly. Flow in the Spring Creek drainage was measured monthly at six staff gages. Mass measurement of yearly low ground-water levels was done in late winter. Wells with large discharge (generally not domestic wells) were inventoried. A seepage study was conducted on the Middle Fork of the Ogden River. Major springs in the

upper drainage area were inventoried. The warm springs at Wolf Creek Resort were sampled for chemical analysis.

Plans for Next Year: Seepage studies will be conducted on irrigation canals. The Ogden Valley canal will be included as part of the canal-loss studies under project UT-001. Mass measurement of yearly high ground-water levels in late spring-early summer will be done. Distribution and rate of evapotranspiration will be estimated. An aquifer test in the Ogden City well field will be done in addition to individual short-term tests. Water from selected wells will be sampled for chemical analysis. Electrical resistivity may be used to determine the base of the valley fill. Data will be assembled for the computer model and simulation runs will be made.

Reports: None.

GROUND-WATER CONDITIONS IN GRAND COUNTY AND NORTHWESTERN SAN JUAN COUNTY, WITH EMPHASIS ON THE ENTRADA, NAVAJO, AND WINGATE SANDSTONES



Number: UT 84-168-C

Cooperating Agency: Utah Division of Water Rights

Staff: P. J. Blanchard, Hydrologist, Project Chief
Other District personnel as assigned

Period of Project: July 1984 to June 1987

Objectives: (1) To increase knowledge and understanding of the ground-water system(s) in Grand County, including areas and rates of recharge, movement, and areas and rates of discharge. (2) To determine the hydrologic characteristics of the aquifers. (3) To determine the chemical quality of ground water. (4) To estimate the hydrologic effects of increased development of energy resources and related withdrawals of ground water. The upland areas of northern Grand County (Book and Roan Cliffs) will be investigated in less detail than the lower areas in southern Grand County.

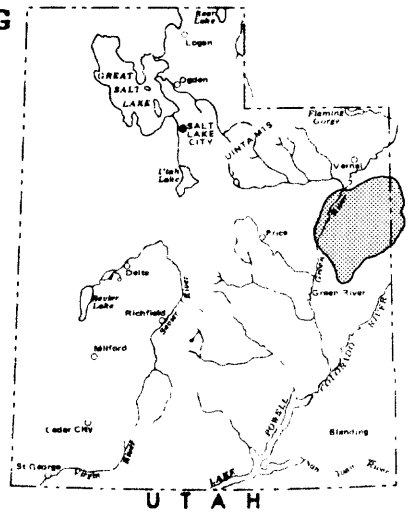
Approach: (1) Inventory wells, springs, and exploration holes and enter data into computer storage. Wells and springs in the Entrada-Navajo-Wingate sequence will have first priority. (2) Estimate recharge to the ground-water system(s) from precipitation, streams, and interformational movement. (3) Prepare potentiometric-surface maps to help define ground-water movement. (4) Estimate discharge from the ground-water system(s) from wells, springs, evapotranspiration, seepage to streams, and by interformational movement. (5) Determine aquifer characteristics from aquifer tests and laboratory analysis of shallow-core and outcrop samples. (6) Estimate the amount of usable water in storage based on aquifer-thickness data from well logs and estimates of saturated thickness from measured water levels in wells. (7) Determine the chemical quality of ground water by collecting and analyzing water samples from wells and springs, and attempt to identify the sources of constituents in the water. Investigate natural contamination of fresh ground water by saline ground water from the Paradox Formation. (8) Attempt to determine (a) the hydrologic effects of increased energy-resource extraction, and (b) the effects of related ground-water withdrawals on the quantity and quality of ground water. (9) Construct a digital model of the area or parts of the area, if the data base is adequate and modeling is judged to be feasible, to simulate past and current water levels and predict future water-level changes. (10) Drill one to three test holes in areas where data are deficient, if funds are available; or reenter abandoned oil-tests to obtain water-level and water-quality data.

Progress: Files of the Division of Water Rights in Salt Lake City, and the Bureau of Land Management and the National Park Service in Moab have been searched for ground-water data. Review of Petroleum Information files for selection of oil-test wells to reenter is in progress. Well and spring inventories are in progress. The existing digital model of Spanish Valley has been reviewed to determine its suitability as a starting point for additional modeling.

Plans for next year: Complete well and spring inventories and conduct aquifer tests. Complete review of Petroleum Information files, select test wells for reentry, and reenter the wells for water-sample collection, water-level measurement, and, if feasible, packer tests. Conduct seepage studies on selected stream reaches. Monitor drilling by private companies in Spanish Valley to gain insight into the relationship between bedrock aquifers and the overlying unconsolidated material. Begin construction of a digital model of Spanish Valley if available data are adequate, and a model relevant to the project objectives is possible.

Reports: None.

SUMMARY OF THE GEOLOGICAL SURVEY'S OIL-SHALE HYDROLOGY PROGRAM IN COLORADO, UTAH, AND WYOMING



Number: UT 85-169-F

Staff: Don Price, Hydrologist, Project Chief

Period of Project: October 1984 to September 1986

Objective: To highlight significant results of hydrologic studies under the Geological Survey's oil-shale hydrology program in generally nontechnical language.

Approach: Compile a draft of a report utilizing contributions from personnel in the Colorado, Utah, and Wyoming Districts. The project chief is responsible for (1) compiling several sections of the report, including sections dealing with the physical setting and water resources of the southeastern Uinta Basin oil-shale area; (2) coordination of the preparation of sections dealing with the physical setting and water resources of the adjacent oil-shale areas in Colorado and Wyoming from coauthors in the Colorado and Wyoming Districts; and (3) assembling, editing, and processing the report. The report will be compiled and assembled during Fiscal Year 1985. Review, revision, and other processing will be done during Fiscal Year 1986.

Progress: Drafts (including tables and figures) of the following sections of the report are completed: (1) Origin and quantity of oil shale; (2) physical setting and water resources of the southeastern Uinta Basin; and (3) potential effects of an oil-shale industry on water resources.

Drafts (including tables and figures) of the sections dealing with the physical setting and water resources of the oil-shale area in Colorado are about 90 percent complete. Drafts of the sections dealing with the physical setting and water resources of the oil-shale area of Wyoming are about 10 percent complete.

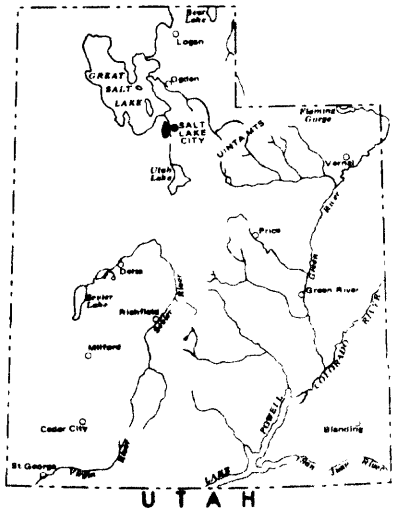
Plans for Next Year: Obtain colleague review of the manuscript, revise as required following review, and complete other required processing of the report.

Reports:

Price, Don, Ellis, S. R., and Wilson, J. F., Jr., Water for an oil-shale industry--A summary of the Geological Survey's program to study the hydrology of the oil-shale areas of Colorado, Utah, and Wyoming: U.S. Geological Survey Professional Paper (in preparation).

RECONNAISSANCE OF DECKER LAKE, SALT LAKE COUNTY

Number : UT 85-170-C



Cooperating Agency: Salt Lake County Division of Flood Control and Water Quality

Staff: D.W. Stephens, Hydrologist, Project Chief (part time)
K.R. Thompson, Hydrologist (part time)
J.B. Wangsgard, Hydrologic Technician (part time)

Period of Project: April 1985 to September 1986

Objectives: Quantify the range of nonstorm inflows, outflow, and water quality of Decker Lake. Quantify the range of storm inflows and outflow and effects of storm loads of nutrients, metals, and sediment on the lake's water quality.

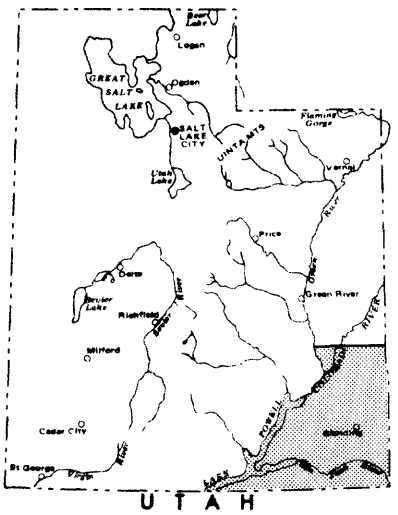
Approach: Inflow and discharge will be measured whenever water-quality samples are collected. This will include nonstorm and storm samples at four inflow points and the outflow channel. Nonstorm samples will be collected monthly from May through September. Samples from five storms will be collected as flow-weighted composites from the inflow points and the outflow channel and a point sample from the lake. Analyses will be made of major trace metals, hardness, nitrogen and phosphorus species, oil and grease, and suspended sediment. Samples for bacterial enumeration will be collected for processing by the Salt Lake City-County Health Dept. During July, pesticide analyses and a gas-chromatograph/flame-ionization detector scan for toxic organic compounds will be done on several water samples. Sediment cores will be used in laboratory experiments to determine leaching rates for various trace metals and nutrients.

Progress: Monthly nonstorm samples have been collected and a sediment-accumulation study completed. Since its completion in 1969, the east pond of Decker Lake has accumulated 26,000 cubic yards of sediment with a mean depth of 18 inches. The west pond has accumulated more than 70,000 cubic yards with a mean depth of 24 inches.

Plans for next year: Continue the nonstorm monthly sampling and prepare for sampling of five storms. Incubate the cores to determine leach rates for the metals and nutrients, and complete a bathymetric map of the lake.

Reports: None.

DEPTH TO BASE OF MODERATELY SALINE GROUND WATER, SAN JUAN COUNTY



Number: UT 84-171-C

Cooperating Agency: Utah Division of Oil, Gas, and Mining

Staff: L. W. Howells, Hydrologist, Acting Project Chief
Dale Van Dam, Hydrologic Technician

Period of Project: February 1985 to March 1987

Objectives: To determine the depth to the base of ground water containing 10,000 milligrams per liter or less of dissolved solids in San Juan County; to portray the depth on a map or maps; and to prepare a report including the map(s), tables of ground-water data used in preparing the map(s), a discussion of how the map(s) were prepared, and a brief summary of the county's hydrogeology. This will aid the State in determining criteria to protect ground water from contamination during exploration for and production of oil and gas.

Approach: The files of the Utah Division of Oil, Gas, and Mining, Utah Division of Water Rights, U.S. Geological Survey, Bureau of Land Management, and oil companies will be searched to locate data on ground-water quality, borehole-geophysical logs that could be interpreted to indicate ground-water quality, and geologic information related to hydrogeology. Empirical relations between water quality and formation resistivity (from resistivity logs) will be developed. Maps showing contours of the depth to the base of water with 10,000 milligrams per liter or less of dissolved solids will be prepared using water samples, empirical relations between resistivity and water quality, theoretical determination of water quality from resistivity data, and geologic information. Cross sections will be prepared from the maps to illustrate horizontal changes in water quality.

Progress: Project planning and compilation of the data for the study have been started.

Plans for Next Year: Complete the compilation of data on water quality and availability of resistivity logs. Begin determining water quality from resistivity logs.

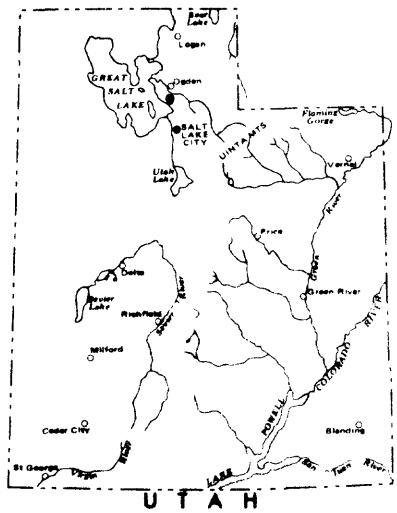
Reports: None.

EVALUATION OF HAZARDOUS-WASTE SITE (TRICHLOROETHENE), CHEMICAL DISPOSAL PIT NO. 3, HILL AIR FORCE BASE, DAVIS COUNTY

Number: UT 85-172-F

Staff: K. M. Waddell, Hydrologist, Project Chief
D. W. Stephens, Hydrologist (part time)
Vacancy, Hydrologist
Vacancy, Hydrologist or Hydrologic Technician

Period of Project: December 1984 to September 1985



Objectives: This project is part of the Survey's National Program on Toxic Waste and Ground-Water Contamination. The site is one of several located in various parts of the United States where field research is done on the movement and fate of hazardous waste in various hydrologic environments. At the Hill Air Force Base site the study will focus on: (1) Definition of the hydrogeologic characteristics of the site, including geologic units, perched water bodies, and the ground-water flow system. (2) Definition of the occurrence and movement of trichlorethene (TCE) at the site, including processes of solution in ground water, movement in flowing ground water by convection and dispersion, volatilization to the unsaturated zone, and movement as vapor in the unsaturated zone. (3) Determine if any reactions are occurring between TCE and inorganic mineral and organic compounds in the subsurface, including adsorption of TCE on inorganic or organic material. (4) Determine the ultimate fate of TCE at the site--either by volatilization, chemical reactions, or microbial degradation. (5) Develop methods of sampling and chemical analysis to support work under items 1 through 4.

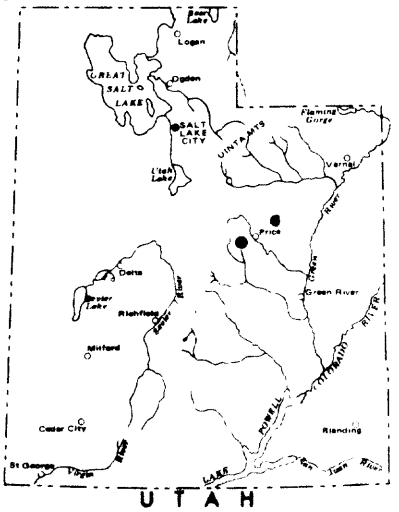
Approach: (1) Drill several test holes at the site, measure water levels, collect water samples, collect and analyze core samples and obtain geophysical logs in all holes. Obtain neutron-moisture logs seasonally in boreholes to estimate recharge. Measure hydraulic conductivity of material in the unsaturated zone. Conduct aquifer tests. (2) Determine solution of TCE in ground water and volatilization rates typical of the subsurface environment. Sample ground water and soil gases to determine TCE concentrations, and model movement in the saturated and unsaturated zones. (3) Analyze core samples to estimate chemical reactions and adsorption involving TCE. (4) Determine the potential for microbial degradation and the kinetics of the process. (5) Devise techniques and instruments to sample TCE in the saturated and unsaturated zones and adsorbed on other material. This may involve establishing a controlled laboratory environment, where occurrence of TCE could be simulated under saturated and unsaturated conditions, and where experimentation with sampling techniques could be done. Determine the most efficient and accurate methods for analyzing for TCE in liquid and vapor form.

Progress: A project proposal has been prepared and some existing data have been compiled. A visit was made to the site and the study was discussed with Air Force personnel.

Plans for Next Year: Because the Air Force likely will proceed with site cleanup or some remedial action in the next 1 to 2 years, which might destroy the study area, this project will be terminated in September 1985.

Reports: None.

HYDROLOGIC EVALUATION OF THE CASTLE VALLEY RIDGE AND ALKALI CREEK COAL-LEASE AREAS



Number: UT 85-173-I

Cooperating Agency: U.S. Bureau of Land Management

Staff: R.L. Seiler, Hydrologist, Project Chief (part time)
R.L. Baskin, Hydrologic Technician

Period of Project: March 1985 to January 1987

Objectives: In order to allow the U.S. Bureau of Land Management to evaluate hydrologic conditions for an environmental-impact statement for the Castle Valley Ridge and Alkali Creek coal-lease areas, the following objectives have been defined: (1) Determine aquifer characteristics, the degree of aquifer-stream interconnection, areas and types of recharge and discharge (including spring discharge and its variability), ground-water movement (including influences of geologic structure on movement), and ground-water quality and storage. (2) Determine the pre-mining variability in quantity and quality of streamflow and sediment loads. (3) Estimate potential effects of proposed coal mining on the hydrologic system.

Approach: The hydrologic system of the two areas will be defined using information from previous studies supplemented with site-specific data collected through September 1986. Information obtained will include data on quantity and quality of spring discharge and streamflow, water levels in and aquifer tests of wells, discharges of nearby mines, geologic features such as faults and fracturing, and evapotranspiration along stream channels. Most springs and wells will be inventoried. Two sets of base-flow measurements will be obtained on all perennial streams to determine losing and gaining reaches. Periodic water-quality and suspended-sediment samples will be obtained for laboratory analysis. In 1985 it will be determined whether test drilling is feasible. If so, specifications for drilling will be prepared; one or two test holes will be drilled; water levels will be measured; water-quality samples will be obtained for analysis, if possible; and bail or slug tests will be made to estimate hydraulic conductivity of the aquifer(s). Pre-mining quantity and quality of streamflow and ground-water movement and quality will be documented for possible postmining comparison studies.

Progress: Literature review is nearly completed and field-data collection has begun.

Plans for Next Year: Continue data collection, including a complete spring and well inventory and seepage studies on selected stream reaches, and determine whether test drilling is feasible.

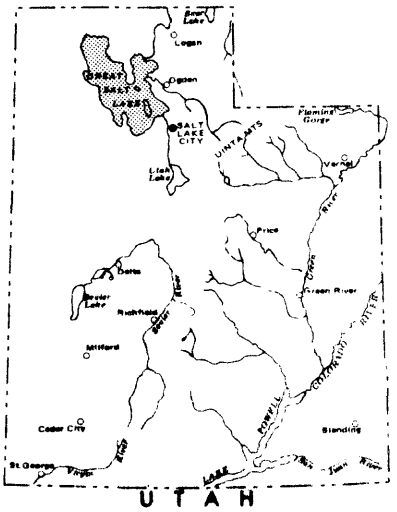
Reports: None

HYDROLOGIC ATLAS OF THE GREAT SALT LAKE

NUMBER: UT 85-174-F

Staff: Ted Arnow, Project Chief (part time)

Period of Project: April 1985 to September 1985



Objective: To describe the water-level and water-quality fluctuations of Great Salt Lake from 1843 to the present and to discuss natural and man-related causes of the changes.

Approach: Prepare a Hydrologic Atlas describing and illustrating the changes in the lake since 1843.

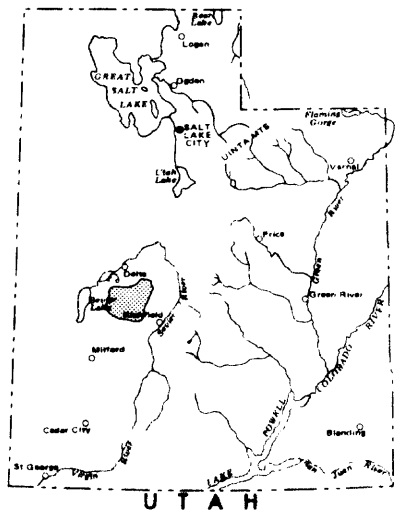
Progress: An outline of the text of the Atlas has been prepared.

Plans for next year: Prepare and process report.

Reports: None.

PROPOSED PROJECTS

GROUND-WATER HYDROLOGY OF PAHVANT VALLEY AND ADJACENT AREAS



Cooperating Agency: Utah Division of Water Rights

Staff: W. F. Holmes, Project Chief
M. Enright, Hydrologic Technician
K. R. Thompson, Hydrologist (part time)

Period of Project: July 1, 1985 to June 30, 1988

Objectives: (1) Improve understanding of the ground-water system and how it functions, including directions of movement, aquifer coefficients, locations and amounts of recharge and discharge, ground-water quality, and amount of water in storage. (2) Provide an assessment of the current state of the ground-water system by determining the changes in water levels and water quality due to increased withdrawals for irrigation, changes in the amounts and locations of recharge and discharge, and recirculation of ground water pumped for irrigation. (3) Project the effects of continued large ground-water withdrawals on water levels and water quality.

Approach: (1) Input existing ground-water data into computer storage. (2) Collect data on discharge of ground water from wells, springs, drains, and to streams and estimate discharge by phreatophytes and subsurface outflow. (3) Estimate recharge from streams, unconsumed irrigation water, precipitation, and subsurface inflow from consolidated rocks. (4) Determine the relationship between ground-water withdrawals and increasing concentrations of dissolved solids. (5) Conduct aquifer tests and reanalyze data from past tests. (6) Construct a three-dimensional digital model to provide a method of evaluating the components of the flow system and their interactions and to simulate past and present ground-water flow conditions. (7) Project the effects of potential changes in recharge and discharge on the various components of the system using the ground-water model. (8) Prepare a basic-data report for release to the open file, an interpretive report for publication by the Utah Department of Natural Resources, and document the ground-water model in an open-file report.

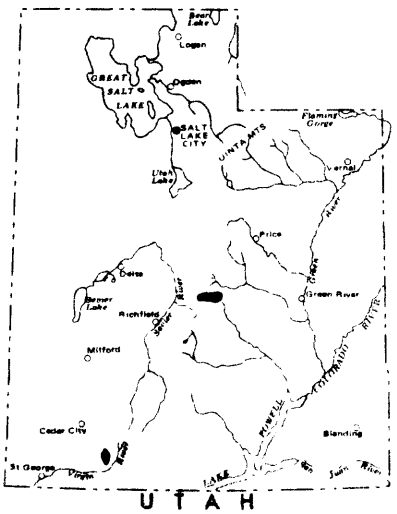
Plans for next year: Prepare a planning document, and compile existing data and enter into computer storage. Begin field inventory of wells and springs. Locate wells suitable for aquifer tests.

HYDROLOGIC EVALUATION OF THE QUITCHUPAH, PINES, AND L. C. HOLDING COAL-LEASE AREAS

Cooperating Agency: U.S. Bureau of Land Management

Staff: Vacancy, Project Chief
Vacancy, Hydrologist or Hydrologic Technician

Period of Project: October 1985 to September 1987



Objectives: Characterize the pre-mining aspects of the local hydrology of two coal-lease areas which have been designated by the Bureau of Land Management as priority areas in their coal-leasing program. Resulting data and evaluations will be used in environmental-impact statements. Aspects of hydrology to be included are: (1) Average streamflow, variability in flow, quality, and fluvial-sediment production. (2) Geologic units and their water-bearing characteristics and identification of geologic structure that may influence hydrology; and in the L. C. Holding lease, general stability of local geologic units in relation to sediment production, road construction, and mining. (3) Recharge, movement, and discharge of ground water; ground-water quality; and ground water in storage. (4) Potential effects on the pre-mining hydrologic system of coal mining in and near the coal-lease area. In the L. C. Holding lease area, this will include (a) potential post-mining fluvial-sediment production in the lease area, (b) stability of geologic units during road construction and of overburden during underground coal-mining (to evaluate the potential for land subsidence), (c) potential effects on the downstream surface-water habitat of the woundfin minnow, and (d) potential effects on the hydrology of alluvial valleys and flood plains if they or underlying aquifers are disrupted by mining.

Approach: (1) Measure streamflow in and near the lease areas periodically and correlate flow with that for nearby gaging stations. Estimate average and peak flows using regression relations developed in prior Bureau of Land management-U.S. Geological Survey studies. Sample streamflow for chemical analysis and periodically for suspended-sediment concentration. (2) Field evaluation of water-bearing characteristics of geologic units and hydrologic effects of geologic structure (supplementing available geologic maps with limited field investigations). One test hole will be drilled and tested in each of the three areas if funds and suitable test locations that will produce useful data are available. Tests will include determining the water level in each hole, taking a water sample, and attempting to determine hydraulic conductivity of the water-bearing material. In the L. C. Holding lease area, map the extent of underlying alluvial aquifers. Obtain any data on stability of geologic units, especially those that will be overburden during coal mining. Obtain consulting help from Geologic Division on stability of

geologic units. (3) Identify sources of ground-water recharge, and points or areas of discharge. Make seepage studies on streams to identify areas of ground-water recharge and discharge if suitable stream reaches area available. Make a complete inventory of springs and wells in and near the lease areas. Use any available ground-water level data to estimate direction of movement. Obtain hydrologic data from nearby existing coal mines in hydrologically similar areas. Sample water from springs and wells for chemical analysis. Estimate saturated thickness of geologic units and the volume of ground-water in storage. (4) Using available hydrologic, mine-plan, mine-production, and mining-method data, make qualitative estimates of the potential hydrologic effects of mining.

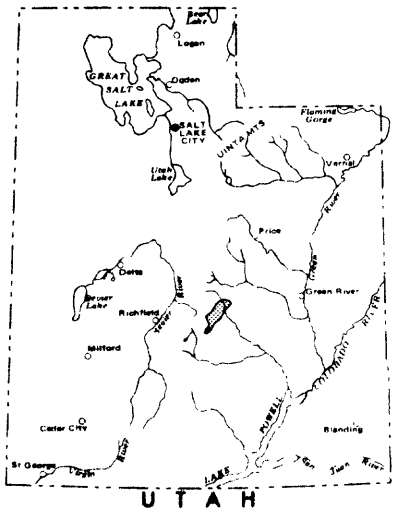
Plans for Next Year (pending approval and funding): Compile all available data in the three coal-lease areas. Begin collection of data in the field on surface-water flow and quality, ground-water occurrence (inventory wells and springs) and quality, and hydrologic characteristics of geologic units. Determine whether test-drilling is feasible and if so, prepare specifications.

ROCK FRACTURES IN THE EMERY COAL FIELD, AND THEIR EFFECT ON GROUND-WATER FLOW

Cooperating Agency: U.S. Bureau of Land Management

Staff: B. J. Stolp, Hydrologist (part time), Project Chief

Period of Project: October 1985 to June 1987



Objectives: Gather all existing hydrologic and geologic data for the Emery coal field. Collect additional data in the field on rock fractures and coal cleats. Analysis of these data will enable the following questions to be answered: (1) Do fractures, both natural and man-induced, occur in some preferred orientation, and what are the variations in fracture density, continuity, and aperture? What are their relations to faults, folds, depth of burial, and lithology? (2) How do these fractures affect the hydraulic parameters in the area and can those effects be predicted and modeled? (3) Can the type and extent of fractures induced by land subsidence and their effect on mine inflow be identified and predicted?

Approach: (1) Search through existing literature to assemble any information on fracturing that pertains to ground-water flow and effects on hydraulic coefficients of consolidated-rock aquifers. (2) Gather all existing geologic information available for the Emery coal-field area, including information on land subsidence. (3) Determine the amount and source of water flowing into the mines of the Emery coal field. (4) Measure the orientation, frequency, aperture, and continuity of the rock fractures and coal cleats in the Emery coal field. (5) With the above information, reevaluate all aquifer-test data from the Emery coal field in an attempt to quantify the amount of flow that is ocurring along fractures. (6) Use computer simulation and other techniques to search for possible ways whereby hydrologic impacts and land subsidence can be predicted and minimized.

Plans for Next Year (pending approval and funding): Compile all available data in the Emery Mine area. Begin collecting field data on fractures and on inflow of water to the Emery Mine.