

WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY
IN NEBRASKA, 1984

Compiled by J. E. McKinney and R. A. Engberg

U.S. GEOLOGICAL SURVEY

Open-File Report No. 85-181

Lincoln, Nebraska

1985



UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information
contact:
District Chief, WRD
U.S. Geological Survey
406 Federal Building
100 Centennial Mall, North
Lincoln, NE 68508

Copies of this report can be
purchased from:
Open-File Services Section
U.S. Geological Survey
Box 25425, Federal Center
Denver, CO 80225
Telephone: (303) 234-5888

MESSAGE FROM THE DISTRICT CHIEF

The State of Nebraska has a greater abundance of water than most of the surrounding States. The major water issues in the State concern the management of these water resources in regard to their availability areally across the State and temporally over the changing seasons and cycles of weather. Management also concerns the protection of the supply of water from deterioration through contamination.

The U.S. Geological Survey in Nebraska began providing data to allow for better management of the State's water near the end of the 19th Century. Since then, the U.S. Geological Survey activities have continued and have included the monitoring of hydrologic conditions, detailed studies to describe the hydrology of specific areas, and studies to add to the basic scientific knowledge of hydrology. Projects in all these areas continue today. The work has been supported through Federal funding, through support from other Federal agencies, and through cooperative programs with many State and local agencies.

The Nebraska District looks forward to a continuation of this work and will strive to anticipate and supply water data and hydrologic knowledge needed for efficient and equitable management of the State's water resources.

William M. Kastner

CONTENTS

	Page
U.S. Geological Survey origin and mission-----	1
Water Resources Division-----	2
Basic mission and program-----	2
Nebraska District office-----	3
Source of funds-----	6
Cooperating agencies-----	6
Water conditions-----	7
Streamflow-----	7
Ground-water levels and withdrawals-----	10
Water quality-----	10
Current projects-----	15
Surface water stations-----	16
Ground water stations-----	17
Water quality stations-----	18
Sediment stations-----	19
Flood investigations-----	20
Water-use acquisition for Nebraska-----	21
Hydrogeology of the Platte-Republican watershed in Frontier, Hayes, Hitchcock, Lincoln, and Red Willow Counties, Nebraska--	22
Hydrogeology of south-central Nebraska-----	23
Central Midwest Regional Aquifer System Analysis, Nebraska-----	24
Hydrology of the southern part of the Sand Hills Region of Nebraska-----	25
Nebraska surface water network evaluation-----	26
Water quality variations in Antelope Creek and Dead Man's Run, Lincoln, Nebraska-----	27
Nonpoint-source contamination in water from selected areas of the High Plains Aquifer in Nebraska-----	28
Evaluation of surface geophysical methods as applied in the Nebraska sandhills-----	29
Reports published by Nebraska District, 1980-84-----	30
Where to obtain Geological Survey publications-----	32
Other information available-----	33

ILLUSTRATIONS

	Page
Figure 1. Chart showing Nebraska District organization-----	4
2. Graphs showing comparison of 1983 water year monthly mean discharges to long-term means for selected gaging stations-----	8
3. Map showing areas of significant water-level changes, predevelopment to fall 1983-----	11
4. Graphs depicting areal distribution of major ground-water withdrawals and trends in ground-water levels in Nebraska-----	12
5. Map showing areas of past, present, and potential problems of ground-water quality-----	13

TABLES

	Page
Table 1. Comparison of runoff during the 1983 water year with maximum and mean water-year runoff for selected stations on the North Platte, South Platte, and Platte Rivers-----	9
2. Existing and potential areas of ground-water quality problems in Nebraska-----	14

U.S. GEOLOGICAL SURVEY ORIGIN AND MISSION

The U.S. Geological Survey was established by an act of Congress on March 3, 1879, to provide a permanent Federal agency to conduct the systematic and scientific "classification of the public lands, and examination of the geological structure, mineral resources, and products of the national domain." An integral part of that original mission includes publishing and disseminating the earth-science information needed to understand, to plan the use of, and to manage the Nation's energy, land, mineral, and water resources.

Since 1879, the research and fact-finding role of the USGS has grown and been modified to meet the changing needs of the Nation it serves. As part of that evolution, the USGS has become the federal government's largest earth science research agency, the nation's largest civilian mapmaking agency, the primary source of data on the nation's surface- and ground-water resources, and the employer of the largest number of professional earth scientists. Today's programs serve a diversity of needs and users. Programs include:

Conducting detailed assessments of the energy and mineral potential of the Nation's land and offshore areas.

Investigating and issuing warnings of earthquakes, volcanic eruptions, landslides, and other geologic and hydrologic hazards.

Conducting research on the geologic structure of the Nation.

Studying the geologic features, structure, processes, and history of the other planets of our solar system.

Conducting topographic surveys of the Nation and preparing more than 60,000 topographic and thematic maps and related cartographic products.

Developing and producing digital cartographic data bases and products.

Collecting data on a systematic basis at more than 45,000 sites nationwide to determine the quantity, quality, and use of surface and ground water.

Conducting water-resource appraisals to describe the consequences of alternative plans for developing land and water resources.

Conducting research in hydraulics and hydrology, and coordinating all Federal water-data acquisition.

Using remotely-sensed data to develop new cartographic, geologic, and hydrologic research techniques for natural resources planning and management.

Providing earth-science information through an extensive publications program -- about 4,000 reports and 1,000 new maps annually -- and a network of public access points.

Along with its continuing commitment to meet the growing and changing earth-science needs of the Nation, the USGS remains dedicated to its original mission to collect, analyze, interpret, publish, and disseminate information about the natural resources of the Nation -- providing "Earth Science in the Public Service."

Water Resources Division

Basic Mission and Program

The Mission of the Water Resources Division is to provide the hydrologic information and understanding needed for the optimum utilization and management of the Nation's water resources for the overall benefit of the people of the United States.

This is accomplished, in a large part, through cooperation with other Federal and non-Federal agencies, by:

Collecting, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

Conducting analytical and interpretive water-resource appraisals describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface and ground water.

Conducting supportive basic and problem-oriented research in hydraulics, hydrology, and related fields of science to improve the scientific basis for investigations and measurement techniques and to understand hydrologic systems sufficiently well to quantitatively predict their response to stress, either natural or manmade.

Disseminating the water data and the results of these investigations and research through reports, maps, computerized information services, and other forms of public releases.

Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and ground waters.

Providing scientific and technical assistance in hydrologic fields to other Federal, State, and local agencies, to licensees of the Federal Power Commission, and to international agencies on behalf of the Department of State.

Authority for carrying out the Division's mission derives from legislation of 1879, which created the Geological Survey; and legislation of 1888 and 1894, which provided for gaging the streams and determining the water supply of the Nation. Congressional appropriations have been made annually since 1894 for gaging streams and performing other functions relating to water resources. In 1964, the mission was broadened to include the role of lead agency in the coordination of the activities of all Federal agencies in the acquisition of certain water data. This responsibility, assigned to the Department of the Interior by Office of Management and Budget Circular A-67, was delegated to the Geological Survey and its Water Resources Division by the Department.

Nebraska District Office

The Nebraska District office of the Water Resources Division of the U.S. Geological Survey is headquartered in Lincoln, Nebraska. The mailing address of the District office is:

U.S. Geological Survey
Room 406, Federal Building
100 Centennial Mall, North
Lincoln, NE 68508

The Nebraska District, under the direction of William M. Kastner, consists of two operating sections, Hydrologic Surveillance and Hydrologic Studies, and two support units, Administrative Services and Technical Services. General organization of the District is shown on figure 1.

The Hydrologic Surveillance Section is responsible for the systematic collection of surface-water, ground-water, and water-quality data and the publication of basic water records, as well as construction, operation,

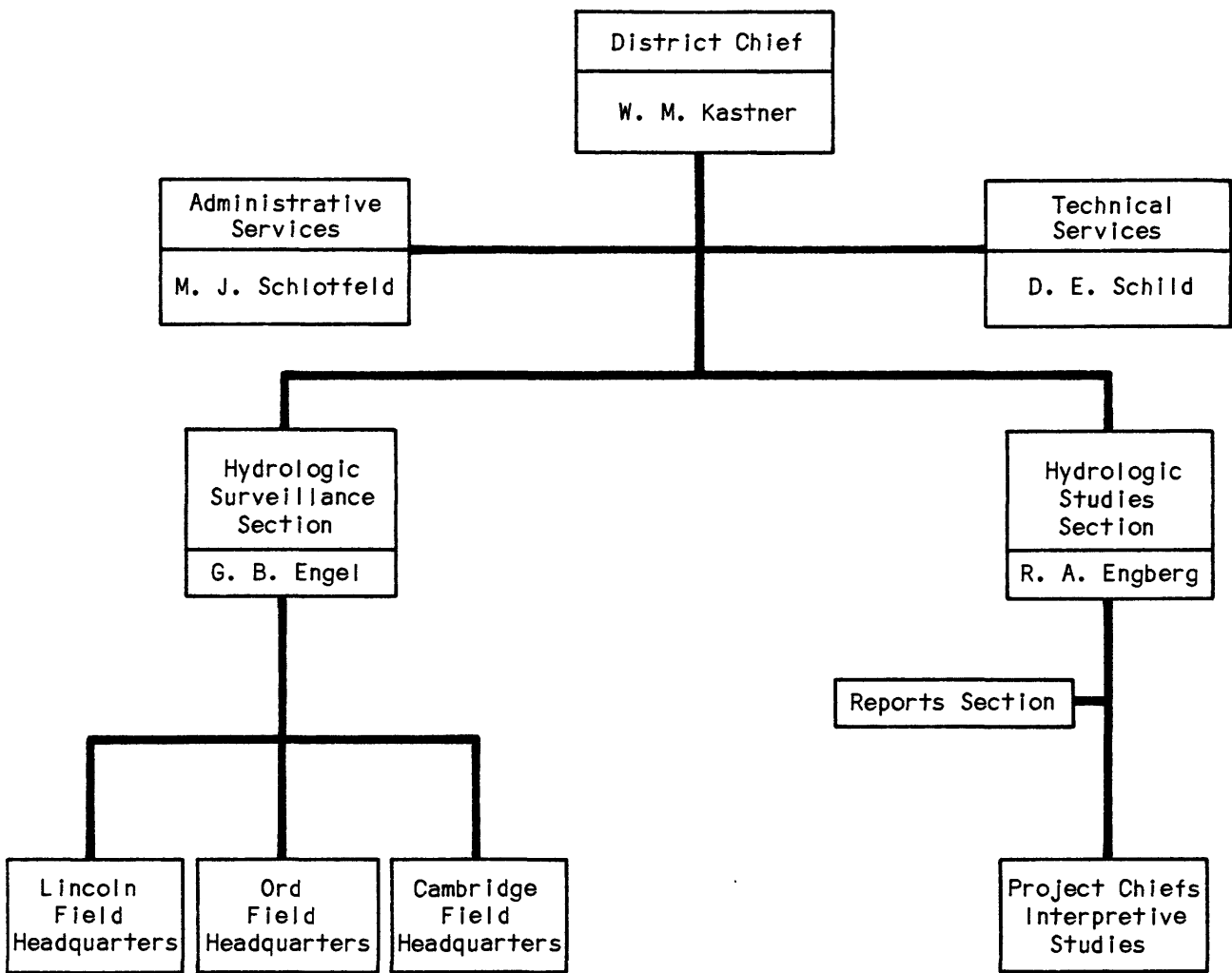


Figure 1.--Nebraska District organization.

and maintenance of the hydrologic station network. Data collected include continuous and periodic records of stream discharge, reservoir and lake contents, low-flow seepage measurements, ground-water levels, and chemical quality of surface and ground water. Data-oriented projects, including network analyses, flood plain studies, and water use, in conjunction with the Hydrologic Studies Section, also are carried out by members of the Surveillance Section. Field offices are located at Lincoln, Ord, and Cambridge.

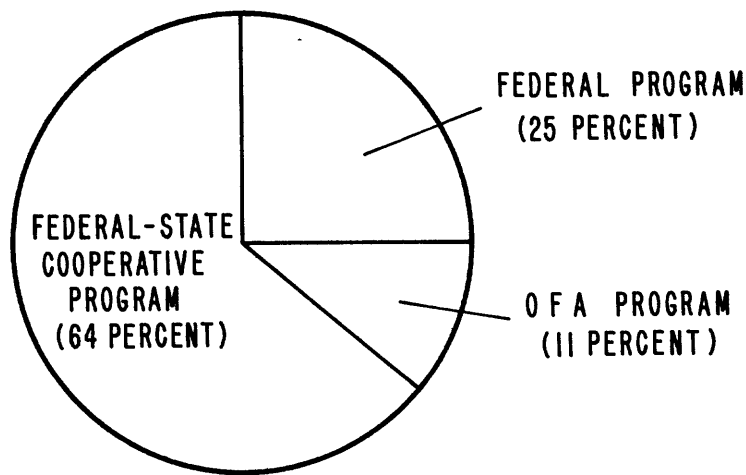
The Hydrologic Studies Section conducts both problem-oriented and resource-appraisal studies within the State. These studies analyze and interpret hydrologic and geologic systems and their relationships to availability, quantity, quality, and use of water within the State. Current projects include description of the hydrology and development of predictive capabilities using mathematic simulation of ground-water systems; regional aquifer system assessments; surface geophysics; water-quality variations in urban streams; and identifying and quantifying nonpoint-source contamination of the ground-water system.

Technical Services provides automatic-data-processing (ADP) services for the District. It is responsible for developing and maintaining files of water-related data, maintaining a program library, and for answering computer-related data requests.

Administrative Services is responsible for financial management, budgeting, personnel, payroll, procurement, equipment maintenance, and other administrative activities for the District.

SOURCE OF FUNDS

Water-resources investigations by the Nebraska District are funded from three major sources: (1) Federal program funds, which are appropriated annually to the Geological Survey; (2) Federal-State cooperative program, where funding is shared 50/50 with various State agencies; and (3) other Federal agencies (OFA), where funding is received from the agencies that request work. In fiscal year 1984, the financial support for these programs in Nebraska was about \$2,050,000, which was distributed as follows:



COOPERATING AGENCIES

Major parts of the Nebraska District programs depend heavily on support of other agencies. State and local agencies currently providing funds or matching technical and professional services are:

- Conservation and Survey Division, University of Nebraska
- Nebraska Department of Water Resources
- Nebraska Department of Environmental Control
- Nebraska Natural Resources Commission
- Big Blue River Compact Administration
- Central Platte Natural Resources District
- Little Blue Natural Resources District
- Lower Republican Natural Resources District

Twin Platte Natural Resources District
Upper Loup Natural Resources District
City of Lincoln
City of Grand Island

Federal agencies currently providing funds for work of special interest to them are:

U.S. Army, Corps of Engineers
U.S. Bureau of Reclamation
Federal Emergency Management Agency

WATER CONDITIONS

Streamflow

Greater-than-normal precipitation over most of Nebraska during the 1983 water year resulted in streamflow that exceeded long-term means for most streams in the State. Comparisons of monthly mean discharges to long-term means for seven gaging stations are shown in figure 2. The curves of monthly mean discharges generally account for more water than do the curves representing long-term means, with one exception. Although precipitation generally was near normal in the area drained by Medicine Creek above Harry Strunk Lake, streamflow was less than normal for nearly the entire year.

Total runoff volumes during the 1983 water year at several stations on the North Platte, South Platte, and Platte Rivers were maximums for the period of record (see table 1). Runoff ranged from 2.4 to 4 times the mean annual runoff for 3 stations on the North Platte River, 6.6 times the mean at South Platte River at North Platte, about 4 times the mean at Platte River stations near Overton and near Grand Island, and 2.5 times the mean at Platte River near Louisville.

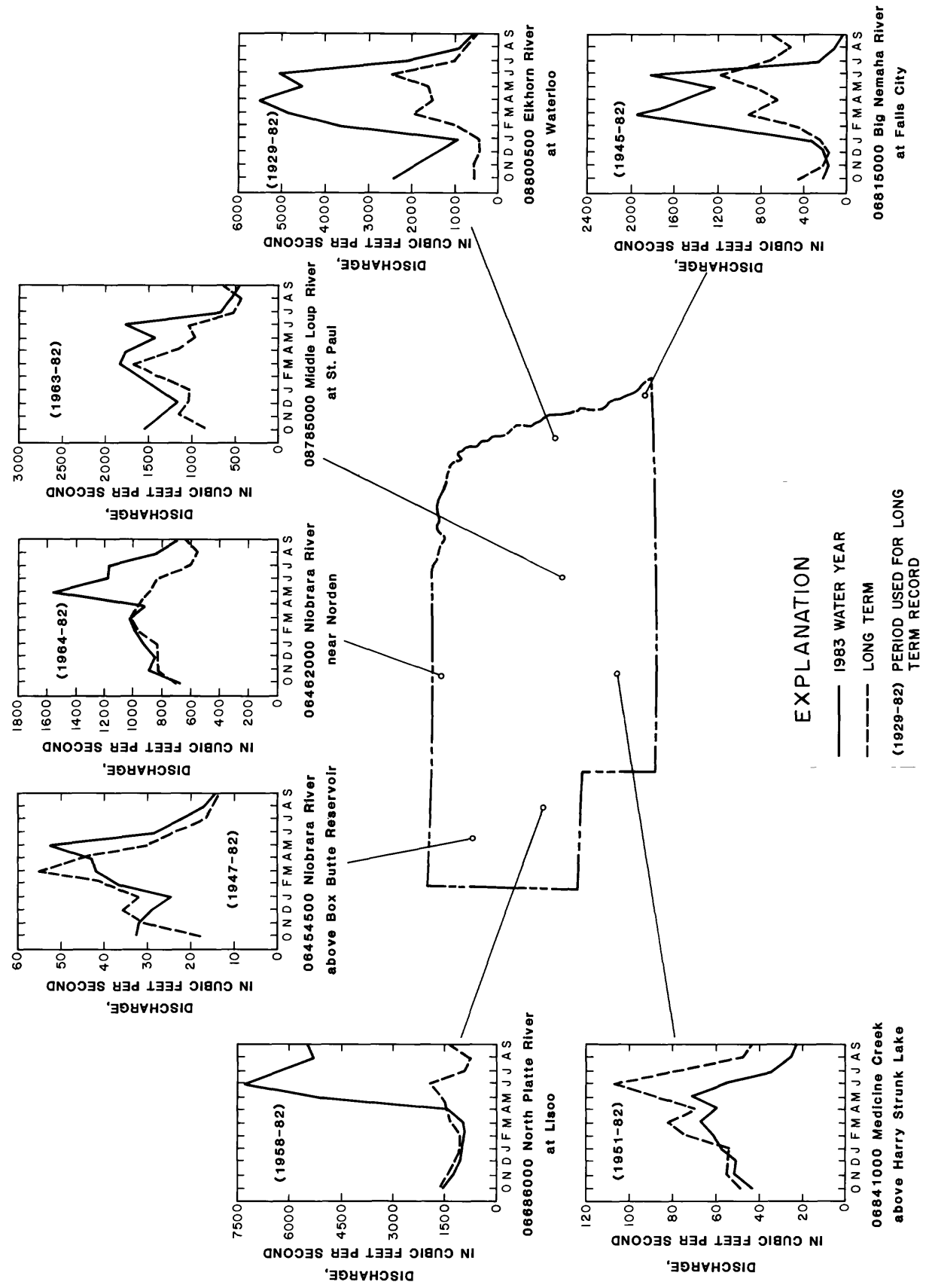


Figure 2.--Comparison of 1983 water year monthly mean discharges to long-term means for selected gaging stations.

Table 1.--Comparison of runoff during the 1983 water year with maximum and mean water-year runoff for selected stations on the North Platte, South Platte, and Platte Rivers

Station identification	Runoff during 1983 water year (million acre-feet)	Previous maximum water-year runoff Million acre-feet	Water year	Mean water-year runoff (million acre-feet)	Period of record used for mean (water years)
06679500 North Platte R. at Mitchell	2,014	1,597	1973	500.6	1958-82
06686000 North Platte R. at Lisco	2,277	2,183	1973	955.6	1958-82
06693000 North Platte R. at North Platte	1,638	1,625	1933	489.8	1941-82
		¹ 1,244	1973		
06765500 South Platte R. at North Platte	1,679	1,056	1942	253.6	1932-82
06768000 Platte River near Overton	4,224	2,780	1973	1,008	1944-82
06770500 Platte River near Grand Island	3,898	2,690	1973	972.3	1944-82
06805500 Platte River at Louisville	9,927	6,648	1973	4,136	1954-82

¹Maximum since 1941 (Lake McConaughy storage began).

Ground-Water Levels and Withdrawals

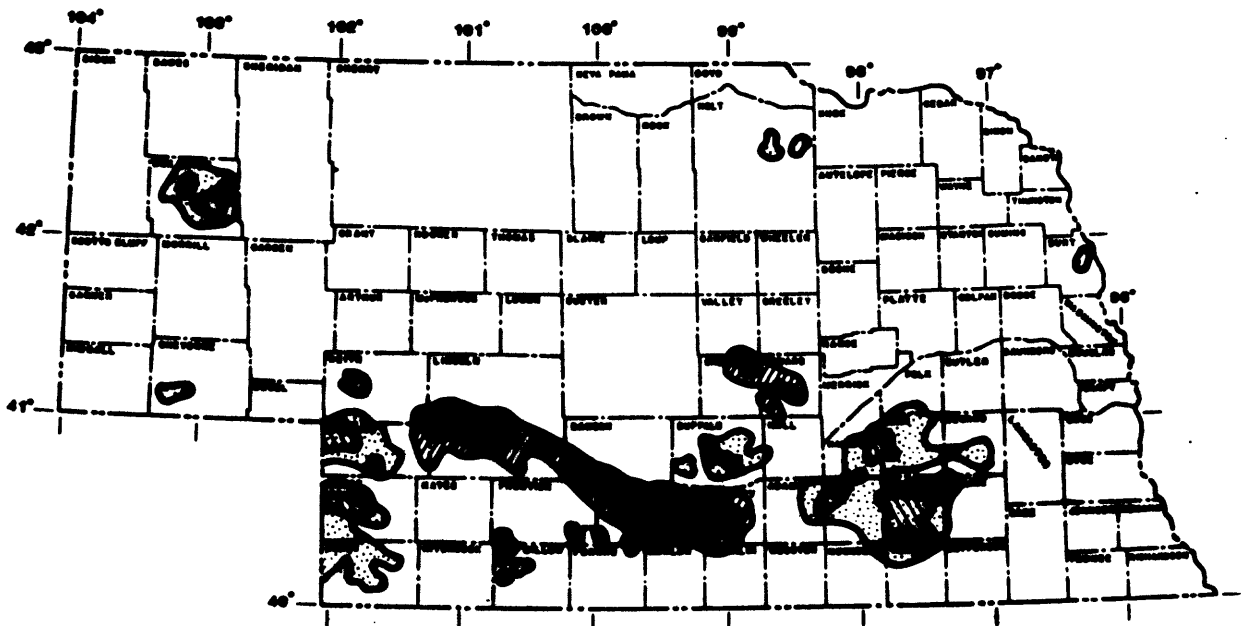
Significant water-level changes from predevelopment water levels have occurred in several places in Nebraska. Water-level declines occur when withdrawals from storage exceed recharge. Water-level rises occur in areas where surface water diverted for irrigation recharges the aquifer in amounts greater than those withdrawn. Areas of significant water-level changes in Nebraska, based on fall 1983 water-level measurements are shown in figure 3.

Ground water was withdrawn at an annual rate of more than 100 million gallons per day from 24 Nebraska counties in 1980. Areal distribution of these withdrawals is shown in figure 4. Also in the figure are long-term hydrographs for representative wells showing ground-water level trends. Five of the hydrographs show overall declines for the period of record. The sixth hydrograph (number 15), for a well in Phelps County, shows a sharp rise from 1958 to about 1970, followed by a 5-year period of very little rise or decline, and finally by gradual decline. This well is located in an area where the aquifer has been recharged by infiltration of applied irrigation water derived from the Platte River system, or by seepage directly from the canals.

Water Quality

The quality of ground water is of concern to Nebraskans. Problems related to ground-water quality are caused by either point-source or nonpoint-source contamination. Typical point sources of contamination are septic systems, barnyard or feedlot waste, and municipal or industrial wastes; typical nonpoint sources are lands to which fertilizers or pesticides have been applied.

Areas where there are or have been problems with ground-water quality and where there is potential for such problems are shown in figure 5. Nonpoint-source contamination problems, both existing and potential, are given in table 2 and coded by number to figure 5.



EXPLANATION
WATER-LEVEL CHANGES, IN FEET





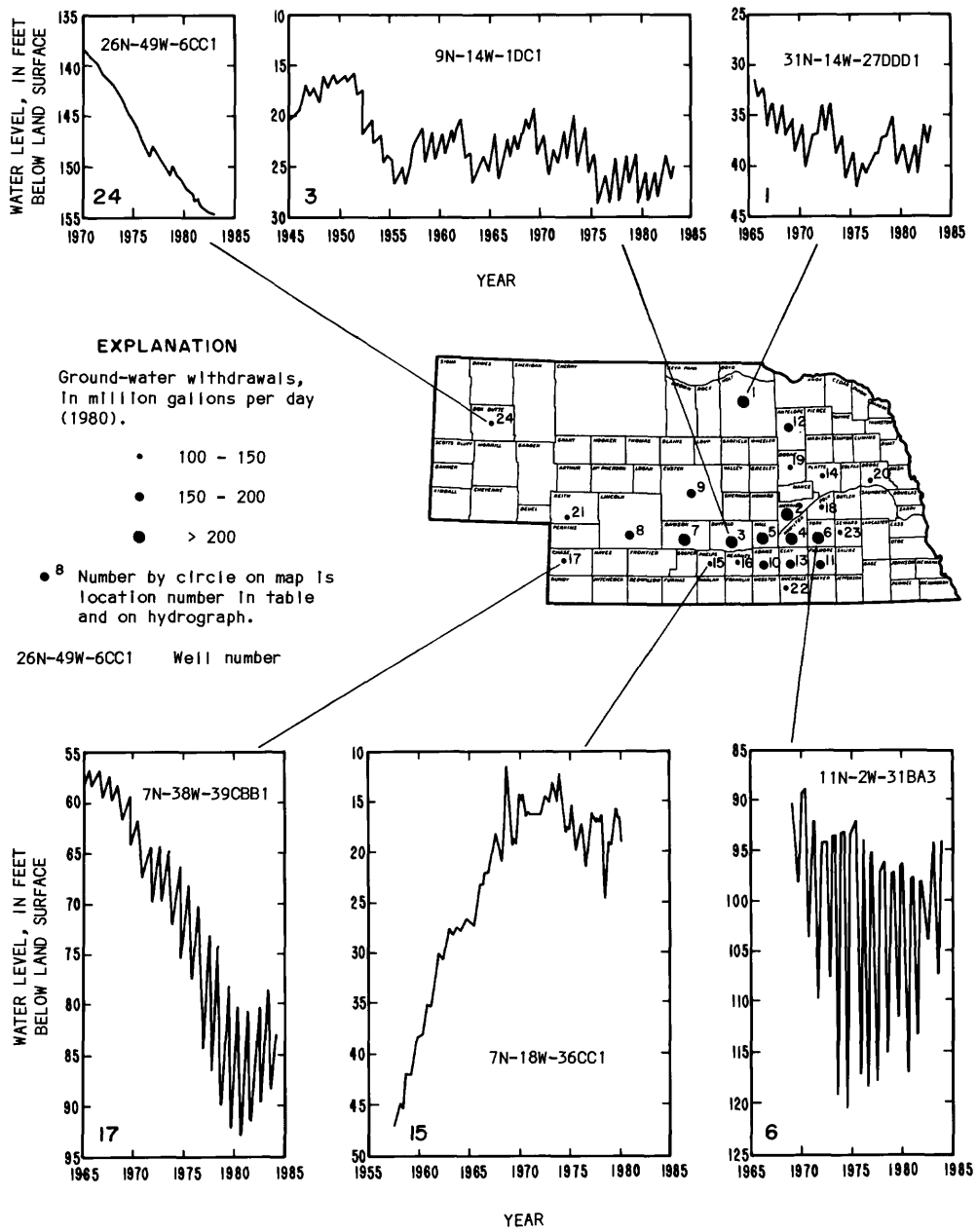
- | | |
|---|--|
|  + 10 TO +20 |  -10 TO -20 |
|  > + 20 |  > -20 |

Figure 3.--Areas of significant water-level changes, predevelopment to fall 1983.



WITHDRAWAL CHARACTERISTICS^{1/}

No. on map	Geographic area	No. on map	Geographic area	No. on map	Geographic area
1	Holt County	9	Custer County	17	Chase County
2	Merrick County	10	Adams County	18	Polk County
3	Buffalo County	11	Fillmore County	19	Boone County
4	Hamilton County	12	Antelope County	20	Dodge County
5	Hall County	13	Clay County	21	Keith County
6	York County	14	Platte County	22	Thayer County
7	Dawson County	15	Phelps County	23	Seward County
8	Lincoln County	16	Kearney County	24	Box Butte County

^{1/} Withdrawals are listed in order of production.

Figure 4.--Graphs depicting areal distribution of major ground-water withdrawals and trends in ground-water levels in Nebraska.

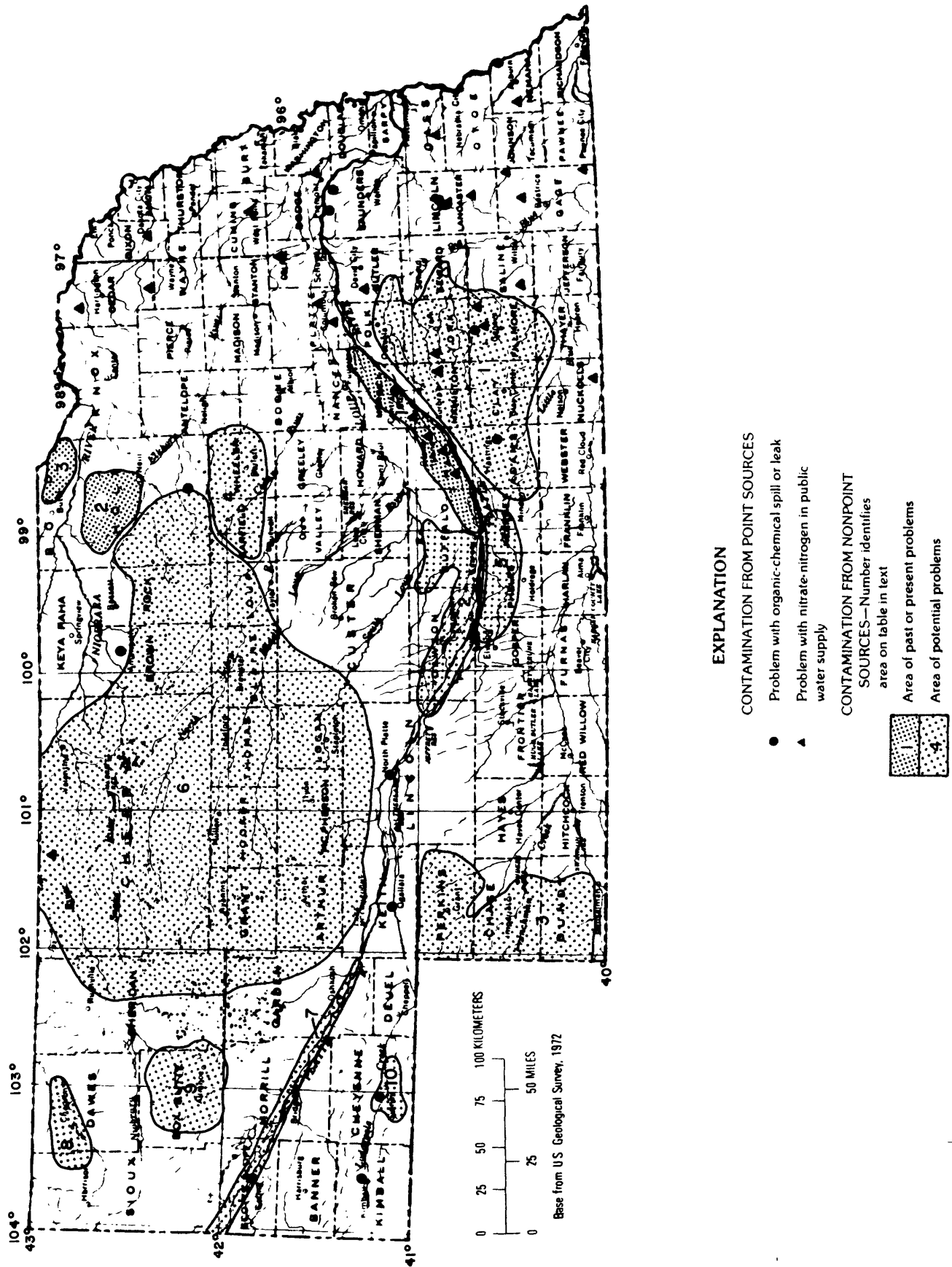


Figure 5.--Areas of past, present, and potential problems of ground-water quality.

Table 2.--Existing and potential areas of ground-water quality problems in Nebraska
(Engberg, 1984)

a. Existing problem areas

Code no.	Area	Problem	Source
1	Central Platte River valley	Nitrate-nitrogen concentrations ranging from 10 to 30 milligrams per liter.	Fertilizer nitrogen, barnyard and feedlot waste; septic systems.
2	Holt County	---do-----	Fertilizer nitrogen from extensive irrigation development.
3	Boyd County	Selenium concentrations greater than 10 micrograms per liter.	Water from Pleistocene deposits composed of reworked Pierre Shale or in contact with seleniferous member of Pierre Shale.

b. Potential problem areas

Code no.	Area	Possible problem	Possible source or reason
1	Big Blue River basin.	Nitrate-nitrogen, pesticides in ground water.	Agricultural chemicals; area has had water-level declines.
2	Parts of Buffalo, Dawson, and Lincoln Counties.	Nitrate-nitrogen, pesticides in ground water; increased salinity.	Agricultural chemicals; adjacent area to central Platte valley. Area in Buffalo County has had water-level declines. Extensive development of irrigation in Dawson County.
3	Upper Republican River basin.	-----do-----	Agricultural chemicals; possible importing of surface water to supplement ground water. Area has had water-level declines.
4	Parts of Garfield and Wheeler Counties.	Nitrate-nitrogen, pesticides in ground water.	Agricultural chemicals; sandy soil in area being developed on large scale for center-pivot irrigation.
5	Parts of Gosper, Kearney, and Phelps Counties.	Nitrate-nitrogen, pesticides in ground water; increased salinity.	Agricultural chemicals; area has had rising water levels as a result of recharge of aquifer by surface water from irrigation.
6	Sand Hills	Nitrate-nitrogen, pesticides in ground water.	Agricultural chemicals; potential agricultural development.
7	North Platte River valley.	Nitrate-nitrogen, pesticides in ground water; increased salinity.	Agricultural chemicals; aquifer is recharged by surface water from irrigation.
8	Parts of Dawes and Sioux Counties.	Radioactive constituents in ground water.	Natural uranium in ground water and potential for contamination associated with in-situ uranium mining.
9	Most of Box Butte County.	Nitrate-nitrogen, pesticides in ground water.	Agricultural chemicals; area has had large water-level declines.
10	Part of Cheyenne County.	-----do-----	Agricultural chemicals; area has had water-level declines.

CURRENT PROJECTS

To accomplish the program objectives of the Water Resources Division, various elements of the work are assigned to individual projects, depending on the type of work needed. For example, if records of stream-flow are needed, that element of work is assigned to the project "Surface Water Stations (NE001)." If water-level data are needed, that element of work is assigned to "Ground Water Stations (NE002)."

Descriptions of the various projects currently in operation are given on the following pages. The area or areas of study for each project are shown on a small map of Nebraska along with each project.

SURFACE WATER STATIONS
(NE001)

Project Leader: Glenn B. Engel

Project Period: Continuous since 1900

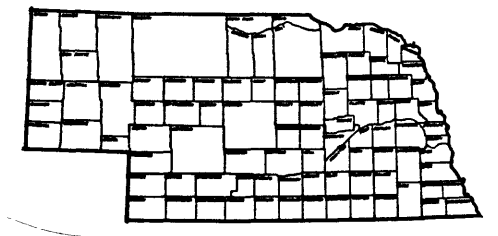
Location: Statewide

Objective:

- A. To collect surface-water data sufficient to satisfy needs for current-purpose uses, such as (1) assessment of water resources; (2) operation of reservoirs or industries, (3) forecasting, (4) disposal of wastes and pollution controls; (5) discharge data to accompany water-quality measurements; (6) compact and legal requirements; and (7) research or special studies.
- B. To collect data necessary for analytical studies; to define, for any location, the statistical properties of, and trends in, the occurrence of water in streams, lakes, estuaries, etc., for use in planning and design.

Progress: All data collected on schedule and the annual water-year records for 1984 are being prepared for publication. On October 1, 1983, there were 155 continuous-record stations in operation and 9 crest-stage partial record stations.

Plans for 1985 water year: Continue operation of present network of stations with minor additions and discontinuances. Upgrade stations that have older equipment and shelters.

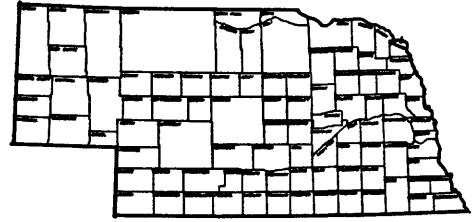


GROUND WATER STATIONS
(NE002)

Project Leader: Vacant

Project Period: Continuous since 1934

Location: Statewide



Objective:

- A. To collect water-level data sufficient to provide a minimum long-term data base by which the general response of the hydrologic system to natural climatic variations and induced stresses can be better understood and potential problems can be defined early enough to allow proper planning and management.
- B. To provide a data base against which the short-term records acquired in areal studies can be analyzed. This data base is needed to (1) assess the ground-water resource, (2) predict conditions, (3) detect and define pollution and supply problems, and (4) manage the resource.

Progress: Water-level measurements (1800) were made in 620 observation wells by the U.S. Geological Survey and State survey field offices; these measurements were processed for computer storage, along with 5,000 measurements made by other cooperating agencies. Continuous recorders were maintained on 65 observation wells, and records were processed. Data from nine recorder-equipped wells operated by other agencies were also processed. Well records and water-level data from two areal studies were reviewed and stored in computer files. Water-level data were analyzed for use in preparation of the annual data report and a report summarizing water-level changes throughout the State in 1984.

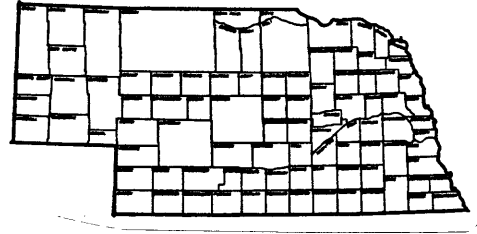
Plans for 1985 water year: Continue measurement of observation wells, maintenance of recorder-equipped wells and data processing of well records and water-level data. Prepare report summarizing water-level changes for the year. Evaluate and replace nonfunctional observation wells. Review recorder-well network and continue well-inspection program.

WATER QUALITY STATIONS
(NE003)

Project Leader: Richard A. Engberg

Project Period: Continuous since 1946

Location: Statewide



Objective: To provide a National bank of water-quality data for broad Federal planning and action programs and to provide data for Federal management of interstate and international waters.

Progress: Records of the physical, chemical, microbiological, or radiological quality of water were obtained according to schedule from 47 stream sites and 47 wells in 1984 water year. Preliminary records were evaluated, updated and prepared for publication in the annual data report. The Nebraska Department of Environmental Control is the principal cooperater in the State for collection of water-quality records. Ground water was sampled in the U.S. Bureau of Reclamation O'Neill and Elkhorn Units.

Plans for 1985 water year: Forty-seven stream sites will be sampled. Sampling frequency, measurement and schedules will be nearly unchanged for most sites. Samples of ground water from established networks of wells in the North Loup and Little Blue Units will be collected and analyzed.

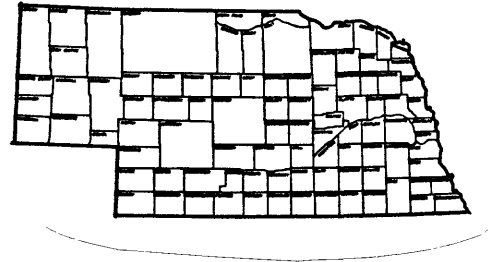
SEDIMENT STATIONS

(NE004)

Project Leader: Richard A. Engberg

Project Period: Continuous since 1946

Location: Statewide



Objective: To contribute to a bank of sediment data for use in broad Federal and State planning and action programs, and to aid in management of interstate and international waters.

Progress: Data were collected for seven alternate monthly or quarterly non-daily sediment stations and are being prepared for publication in the annual data report.

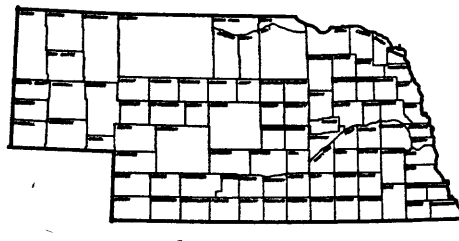
Plans for 1985 water year: Seven non-daily sediment stations will be operated in Nebraska.

FLOOD INVESTIGATIONS
(NE006)

Project Period: Started in 1975; stopped
in 1979; reactivated in 1984.

Project Leader: Glenn B. Engel

Location: Statewide



Objective: To conduct the necessary hydrologic and hydraulic studies of potential areas for flood insurance purposes assigned by Federal Emergency Management Agency (FEMA), and to develop efficient procedures to attain the accuracy specified by FEMA in the most appropriate format with minimum personnel requirements.

Progress: Evaluation of two counties in Nebraska for possible use of less detailed methods for conducting flood-insurance studies. Evaluation of methods and estimate of costs were completed for Deuel and Lincoln Counties in western Nebraska and submitted to Surface Water Branch.

Plans for 1985 water year: No funding available for further work.

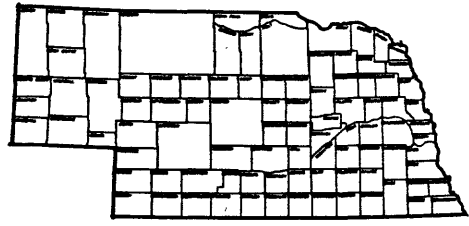
WATER-USE ACQUISITION FOR NEBRASKA

(NE007)

Project Period: Continuous since 1979

Project Leader: Eugene K. Steele, Jr.

Location: Statewide



Objective: To establish and operate a water-use data system for Nebraska that is responsive to the needs of users at both the State and national levels. The system will include the collection, storage, manipulation, and dissemination of data on water use from government agencies, industrial and commercial establishments, public utility systems, agricultural and irrigation entities, and private developments, incorporating data on both withdrawals and returns. For uses for which adequate data cannot be obtained, estimates and extrapolations will be made.

Progress: Report published on use of water in Nebraska for public supply, industrial, and power generation. Work continuing on completing estimates of irrigated acreage by surface and ground water during 1980, and of water used for livestock and rural domestic.

Plans for 1985 water year: Complete estimates of irrigated acreage by surface and ground water during 1980 for the remaining 40 counties. Determine water used for livestock and rural domestic. Explore the possibility of constructing a rainfall-runoff crop consumptive-use model for determining irrigation use of water.

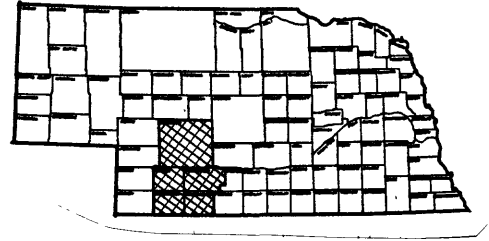
HYDROGEOLOGY OF THE PLATTE-REPUBLICAN WATERSHED IN FRONTIER, HAYES,
HITCHCOCK, LINCOLN, AND RED WILLOW COUNTIES, NEBRASKA

(NE040)

Project Period: 1977 to 1985

Project Leader: James W. Goeke,
Conservation and Survey Division,
University of Nebraska

Location: Southwest Nebraska



Objective: To describe the hydrology, define the hydrogeologic framework, and quantify the water balance of the hydrologic system in sufficient detail to analyze projections of the effects of various potential water-resources development and management alternatives on streamflows and ground-water levels. This study should enable resource managers to more fully understand quantitative relationships among components of the hydrologic cycle, help determine what the effects of water-resources development have been, provide a quantitative basis for establishing data collection and monitoring programs, and aid in maximizing utility of data in water-resources planning and development.

Progress: Model documentation report is in review. Main project report is nearly complete.

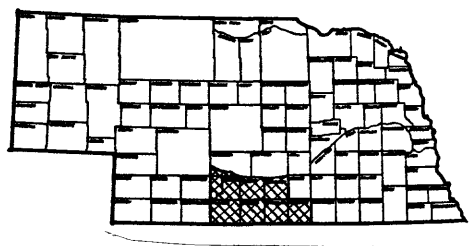
Plans for 1985 water year: Complete both reports and submit for approval.

HYDROGEOLOGY OF SOUTH-CENTRAL NEBRASKA
(NE042)

Project Period: 1980 to 1985

Project Leader: Jon M. Peckenpaugh

Location: South-central Nebraska



Objective: To describe the hydrology, define the hydrogeologic framework, and quantify the water balance of the hydrologic system of the study area. This information should assist water users, planners, and administrators to more fully understand the quantitative relationships among the components of the hydrologic cycle so that they may better assess the existing water resources, evaluate the effects of existing developments, estimate the effects of existing and potential developments, and test the effectiveness of management alternatives.

Progress: Water-level configuration maps were constructed for 1965 and for the spring of 1981. Forty-five cross sections delineating the lithologies between the land surface and upper bedrock surface were constructed using data from over 400 test holes. These cross sections were used to develop transmissivity and storage values for the study. Water-use data were compiled and work was begun on calibration of a finite-element ground-water flow model. A data report included geologic and geophysical logs of 23 test holes in the study area.

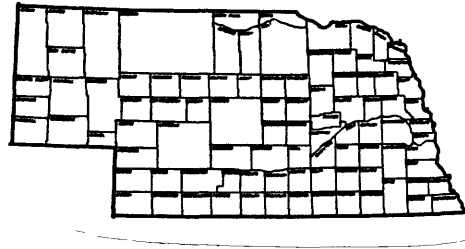
Plans for 1985 water year: Complete the calibration of the ground-water flow model. Run several predictive-management schemes using the calibrated model. Complete writing the interpretive and basic data reports and submit them for review and approval.

CENTRAL MIDWEST REGIONAL AQUIFER SYSTEMS ANALYSIS, NEBRASKA
(NE043)

Project Period: 1980 to 1985

Project Leader: Michael J. Ellis

Location: Nebraska and southeastern South Dakota



Objective: To describe the hydrologic system, including aquifer designation, hydraulic characteristics of the aquifers, and quality of water within the aquifers. Create a data base consisting of selected data describing water use, water levels, lithologic logs, geophysical logs, and chemical analyses of water samples. Describe historic, present, and future problems associated with use of water, such as contamination and lack of reliability of existing data. Evaluate aquifer and aquifer-system response to future conditions.

Progress: Mapping of hydrologic characteristics of soils directly influencing hydrology of the regional aquifer in the nine-state area was completed and a hydrologic atlas presenting the results is in publication. Collection and review of climatic and land-use data for regional soil-moisture modeling of the same nine-state area has been completed, and an interpretive report is being written. Maps were completed of the Nebraska portions of the 15 major hydrogeologic units. These maps describe structural configuration, thickness of shale, thickness of evaporite layers, potentiometric surfaces, and distribution of dissolved solids. Also, about 2,000 chemical analyses of water associated with petroleum production in Nebraska were reviewed, and the 570 that could be related adequately to location and producing formation were entered into the water-quality data base.

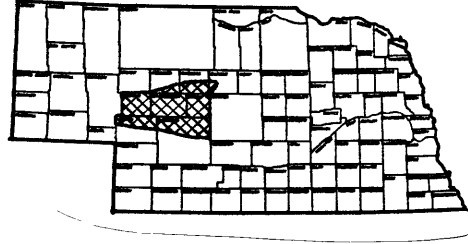
Plans for 1985 water year: Complete collection of supplementary data and write interpretive report describing the hydrogeology of the Dakota aquifer system in Nebraska.

HYDROLOGY OF THE SOUTHERN PART OF THE
SAND HILLS REGION OF NEBRASKA

(NEO44)

Project Period: 1981 to 1985

Project Leader: James W. Goeke,
Conservation and Survey Division,
University of Nebraska



Location: West-central Nebraska

Objective: To describe the hydrology, define the hydrogeologic framework, and quantify the water balance of the hydrologic system so projections of the effects of various development and management alternatives can be analyzed. The results will enable State and local agencies to more fully understand relationships among components of the hydrologic system and the effects of existing water-resources developments. Mathematical models will be useful in estimating probable effects of existing and potential developments, in providing rational bases for data collection and monitoring programs, and in otherwise maximizing the utility of this data.

Progress: Water-level and test-hole data were used to construct base-of-aquifer and potentiometric surface maps. An aquifer test was conducted and the results analyzed to determine aquifer coefficients. Rainfall data obtained from 23 local observers and 16 Weather Service stations were compiled. Water-use and climatic data for soil-zone model were compiled and digitized.

Plans for 1985 water year: Continue evaluation, interpretation, and digitization of data. Tabulate basic data for publication. Develop calibrate, and test digital-flow model. Prepare interpretive report.

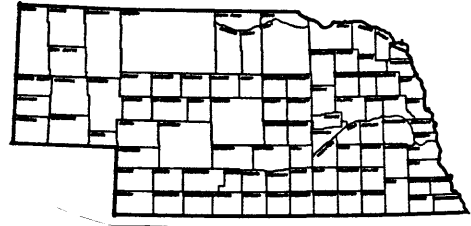
NEBRASKA SURFACE-WATER NETWORK EVALUATION
USING KALMAN FILTERING TECHNIQUE

(NE046)

Project Period: 1982 to 1984

Project Leader: Glenn B. Engel

Location: Statewide



Objective: The Water Resources Division operates 145 stream-gaging stations in Nebraska. The purpose of this project is to analyze the stream-gaging network to assure maximum cost effectiveness in conjunction with uses of the data, accuracy of the data, and the availability of other methods for providing the data.

Progress: One hundred forty-five stations in the Nebraska stream-gaging network were analyzed for accuracy of record, data use, and cost effectiveness. Flow-routing models and regression techniques were also investigated for providing the data. The project has been completed and a report has been published.

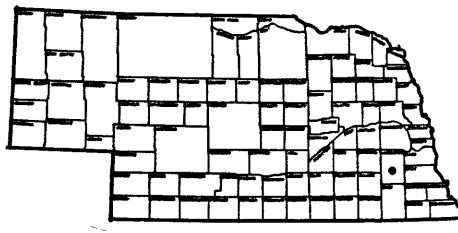
WATER-QUALITY VARIATIONS IN ANTELOPE CREEK AND DEAD MAN'S RUN,
LINCOLN, NEBRASKA

(NE047)

Project Period: 1983 to 1985

Project Leader: Lloyd C. Blackburn

Location: Eastern Nebraska



Objective: (1) Assess short-term event-oriented water-quality changes as related to areas of different land utilization; (2) determine what, if any, relationship exists between areal changes in water quality and industrial and storm sewer discharge; (3) determine reaches affected by saline ground-water seepage; (4) provide material suitable for use by planners and managers in preparing future development plans in the basin.

Progress: All data have been evaluated and a report summarizing and interpreting the data has been prepared.

Plans for 1985 water year: Review and publish report.

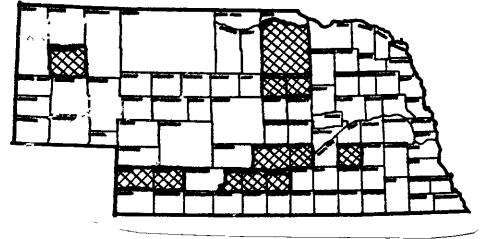
NONPOINT-SOURCE CONTAMINATION IN WATER FROM SELECTED AREAS
OF THE HIGH PLAINS AQUIFER IN NEBRASKA

(NE048)

Project period: December 1983 to March 1988

Project leader: Hsiu-Hsiung Chen

Location: Six areas statewide



Purpose: To identify and quantify nonpoint-source ground-water nitrate-nitrogen and organic-constituent contamination in the High Plains Aquifer System for several areas in Nebraska; to develop relationships between these constituents and climatic, hydrologic, hydrogeologic, and land-use factors; and to develop techniques that may be used to recognize and predict ground-water quality contamination or potential contamination in other areas of Nebraska and in other parts of the United States.

Progress: Work is in progress on reviewing literature, preparing annotated outline for preliminary report, and evaluating existing data. Work has begun on collecting data from about 90 wells in 6 study areas; assembly and quantification of climatic, hydrologic, hydrogeologic, and land-use data; and evaluation of reconnaissance data and network development.

Plans for 1985 water year: Continue evaluating existing data and prepare preliminary report.

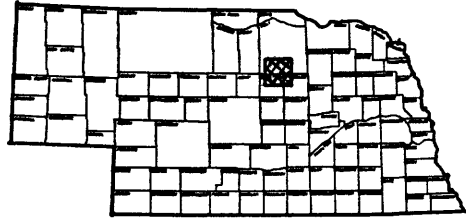
EVALUATION OF SURFACE GEOPHYSICAL METHODS
AS APPLIED IN THE NEBRASKA SAND HILLS

(NE049)

Project Period: 1984 to 1985

Project Leader: Michael J. Ellis

Location: Northeastern Nebraska



Objective: To determine whether hydrologic data collected by surface geophysical techniques near test holes in Garfield County are comparable to that obtained from test drilling. To supplement existing test-hole data by using surface geophysical techniques to determine aquifer thickness, hydrologic characteristics, and lithology between test holes, and to supply the cooperating agency more precise ground-water data for the area.

Progress:

All field work, data compilation, and analyses of data have been completed. Interpretive report has been written and is being reviewed.

Plans for 1985 water year: Submit report for Director's approval and publish.

REPORTS PUBLISHED BY NEBRASKA DISTRICT, 1980-84

DATA REPORTS

Johnson, M. S., and Pederson, D. T., 1981, Groundwater levels in Nebraska, 1980: University of Nebraska, Conservation and Survey Division, Nebraska Water Survey Paper Number 51, 65 p.

_____ 1982, Groundwater levels in Nebraska, 1981: University of Nebraska, Conservation and Survey Division, Nebraska Water Survey Paper Number 52, 65 p.

_____ 1983, Groundwater levels in Nebraska, 1982: University of Nebraska, Conservation and Survey Division, Nebraska Water Survey Paper Number 56, 65 p.

_____ 1984, Groundwater levels in Nebraska, 1983: University of Nebraska, Conservation and Survey Division, Nebraska Water Survey Paper Number 57, 67 p.

Engel, G. B., Engberg, R. A., and Johnson, M. S., 1984, Water Resources Data for Nebraska, Water Year 1982: U.S. Geological Survey Water-Data Report NE-82-1, 369 p.

_____ 1984, Water Resources Data for Nebraska, Water Year 1983: U.S. Geological Survey Water-Data Report NE-83-1, 399 p.

U.S. Geological Survey, 1981, Water Resources Data for Nebraska, Water Year 1980: U.S. Geological Survey Water-Data Report NE-80-1, 471 p.

_____ 1982, Water Resources Data for Nebraska, Water Year 1981: U.S. Geological Survey Water-Data Report NE-81-1, 469 p.

OPEN-FILE REPORTS

Ellis, M. J., 1981, Hydrogeologic reconnaissance of the Republican River Basin in Nebraska: U.S. Geological Survey WRI/Open-File Report 81-531, 3 sheets.

Hiergesell, R. A., 1984, Descriptive, geologic, and borehole geophysical logs for 23 test holes in south-central Nebraska: U.S. Geological Survey Open-File Report 84-073, 143 p.

Petri, L. R., 1984, Time-of-travel data for Nebraska streams, 1968 to 1977: U.S. Geological Survey Open-File Report 84-602, 63 p.

Pettijohn, R. A., and Chen, H-H., 1983, Geohydrology of the High Plains Aquifer System in Nebraska: U.S. Geological Survey Open-File Report 82-502, 3 sheets.

WATER-RESOURCES INVESTIGATIONS

- Ellis, M. J., 1981, Analysis of stream-aquifer interrelationships in the Big Blue and Little Blue River basins in Gage and Jefferson Counties, Nebraska: U.S. Geological Survey Water-Resources Investigations 81-29, 49 p.
- Engel, G. B., Wahl, K. L., and Boohar, J. A., 1984, Cost-effectiveness of the stream-gaging program in Nebraska: U.S. Geological Survey Water Resources Investigations 84-4098, 76 p.
- Kent, S. J., Engberg, R. A., and Ellis, M. J., 1981, Geohydrologic reconnaissance of the Crofton Unit, northeastern Nebraska: U.S. Geological Survey Water-Resources Investigations 81-58, 34 p.
- Lichtler, W. F., Stannard, D. I., and Kouma, Edwin, 1980, Investigation of artificial recharge of aquifers in Nebraska: U.S. Geological Survey Water-Resources Investigations 80-93, 112 p.
- Peckenpaugh, J. M., and Dugan, J. T., 1984, Hydrogeology of parts of the Central Platte and Lower Loup Natural Resources Districts, Nebraska: U.S. Geological Survey Water-Resources Investigations 83-4219, 100 p.
- Pettijohn, R. A., and Chen, H-H., 1983, Hydraulic conductivity, specific yield, and pumpage--High Plains Aquifer System, Nebraska: U.S. Geological Survey Water-Resources Investigations Report 82-4014, 3 sheets.
- _____ 1984, Hydrologic analysis of the High Plains aquifer system in Box Butte County, Nebraska: U.S. Geological Survey Water-Resources Investigations 84-4046, 59 p.

WATER-SUPPLY PAPERS

- Engberg, R. A., 1983, A statistical analysis of the quality of surface water in Nebraska: U.S. Geological Survey Water-Supply Paper 2179, 252 p.
- _____ 1984, Appraisal of data for ground-water quality in Nebraska: U.S. Geological Survey Water-Supply Paper 2245, 54 p.

WHERE TO OBTAIN GEOLOGICAL SURVEY PUBLICATIONS

New reports are announced in a monthly pamphlet, "New Publications of the Geological Survey," which may be obtained from:

Mailing List Unit
U.S. Geological Survey
582 National Center
Reston, VA 22092

Professional Papers, Bulletins, Water-Supply Papers, Techniques of Water-Resources Investigations, Circulars, and popular leaflets, pamphlets, and booklets may be purchased from:

Eastern Distribution Branch
Text Products Section
U.S. Geological Survey
604 South Pickett Street
Alexandria, VA 22304

Water-Resources Investigations reports published prior to May 1982 and annual Water Resources Data reports for Nebraska may be purchased from:

National Technical Information Service (NTIS)
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

Water-Resources Investigations reports and open-file reports for Nebraska are available for inspection at the Nebraska District Office. Most Water-Resources Investigations reports published after May 1982 and open-file reports for Nebraska may be purchased from:

Open-File Services Section
Western Distribution Branch
U.S. Geological Survey
Box 25425, Federal Center
Denver, CO 80225

Maps of flood-prone areas may be obtained from the Nebraska District Office.

Hydrologic-Investigations Atlases and geologic, topographic, and other maps may be purchased from:

Western Distribution Branch
U.S. Geological Survey
Box 25286, Federal Center
Denver, CO 80225

The Geological Survey National Center maintains a library with an extensive earth-sciences collection. Local libraries may obtain books, periodicals, and maps through interlibrary loan by writing to:

U.S. Geological Survey Library
950 National Center
Reston, VA 22092
Telephone: (703) 860-6671

OTHER INFORMATION AVAILABLE

Hydrologic data stations maintained at selected locations throughout Nebraska constitute a water-resources data network for obtaining records on stream discharge and stage, reservoir and lake storage, ground-water levels, and the quality of ground and surface water. The U.S. Geological Survey has both a current and historical file of these hydrologic data, which are filed in WATSTORE (National Water Data Storage and Retrieval System). Data from these files are available in machine-readable form or in computerized tables, statistical analyses, and digital plots. Assistance in the acquisition of these services or products can be obtained by contacting the Nebraska District Office.

NAWDEX, the National Water Data Exchange, was established to assist users of water data to identify, locate, and acquire needed data. It provides a nationwide service for indexing and describing the characteristics of data available from the entire spectrum of data-collection activities throughout the Federal and non-Federal water-data community.

NAWDEX maintains two data bases: (1) A Water-Data Sources Directory and (2) A Master Water-Data Index, which identifies and describes available water data. The Nebraska District Office is a designated Local Assistance Center for searching for and accessing water data held by NAWDEX members.