DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

HYDROLOGIC INVESTIGATIONS
ATLAS HA-694B (SHEET 1 OF 2)

WATER LEVELS IN BASIN-FILL DEPOSITS

EXPLANATION

- BASIN-FILL DEPOSITS
- CONSOLIDATED ROCKS
- BOUNDARY OF CARBONATE-ROCK PROVINCE
- LARGE LAKES THAT CONTROL BASIN-FILL GROUND-WATER LEVELS
- WATER-LEVEL CONTOUR—Shows altitude of water level in wells tapping principal aquifer in basin fill. Dashed where approximately located. Contour interval 100 feet, with supplemental 50-foot contours in some areas. Datum is sea level
- WELL USED FOR CONTROL IN CONTOURING WATER LEVELS
- WELL OUTSIDE AREA OF WATER-LEVEL CONTOURS—Number is water-level altitude, in feet above sea level
- AREA WHERE WELLS ARE TOO NUMEROUS TO SHOW
- BOUNDARY OF GREAT BASIN REGION AS USED IN THIS STUDY

SCALE 1:1 000 000

25 0 25 50 MILES

25 0 25 50 KILOMETERS

Figure 1.—Water-level contours in basin-fill deposits.

ALTITUDE DATUM

The term "National Geodetic Vertical Datum of 1929" replaces the formerly used term "mean sea level" to describe the datum for altitude measurements. The geodetic datum is derived from a general adjustment of the first-order leveling network of both the United States and Canada. For convenience on this atlas sheet, the datum also is referred to as "sea level."

A product of the Regional Aquifer-Systems Analysis of the Great Basin

CONVERSION FACTORS

"Inch-pound" units of measure used in this report may be converted to International System (metric) units by using the following factors:

Multiply	By	To obtain
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)

INTRODUCTION

The Great Basin Regional Aquifer-System Analysis (RASA) is the tenth study in a national program by the U.S. Geological Survey to analyze regional ground-water systems that compose a major part of the Nation's water supply. The main objectives of the RASA studies are to: (1) Describe the ground-water systems as they exist today, (2) analyze the changes that have led to the system's present condition, (3) combine the results of previous studies in a regional analysis, and (4) provide means by which effects of future ground-water development can be estimated (G.D. Bennett, U.S. Geological Survey, written commun., 1978).

The main purpose of this atlas sheet is to show the general distribution of hydraulic head in basin-fill deposits on a regional scale. The sheet can also be used to evaluate general directions of flow within valleys, to help identify hydrologically closed valleys, to determine hydraulic gradients between valleys, to identify areas of ground-water leakage into bedrock, and to help delineate multivalley flow systems and larger regional flow systems. Sheet 2 of this atlas shows the potentiometric surface of ground water in consolidated rocks of the Carbonate-Rock Province.

This atlas is Chapter B of a three-part series. Chapter A delineates and describes hydrogeologic units in the Great Basin region, and Chapter C shows inferred directions of ground-water flow and individual flow systems.

The writers appreciate the assistance of Gregg Berggren, Lori J. Connolly, Kenneth S. Pringle, Margaret K. Silva, and Richard D. Slates of the U.S. Geological Survey in compiling and plotting data for this atlas sheet.

GENERAL FEATURES

The study area includes approximately 140,000 square miles in parts of Nevada, Utah, California, Idaho, Oregon, and Arizona (fig. 1). The area is bordered on the east by the Wasatch Mountains, on the north by the Snake River Basin, on the west by the Sierra Nevada, on the southwest by the Panamint Range, and on the southeast by parts of the Colorado and Virgin Rivers. Land-surface altitudes range from about 280 feet below sea level in Death Valley to more than 14,000 feet above sea level in the White Mountains, both of which are along the southwestern margin of the study area.

Topography is typified by block-faulted basins bounded by mountains that extend as much as 6,500 feet above the adjacent basin floors. Consolidated rocks compose the surrounding mountains and underlie the basin fill. The region comprises some 240 hydrographic areas (Harrill and others, 1983). The region, most of which is internally drained, includes (1) seven large river systems (the Jordan, Bear, Sevier, Humboldt, Truckee, Carson, and Walker) (2) 14 hydrologically closed individual valleys (3) hydrologically closed areas consisting of several valleys linked by saturated basin fill, permeable bedrock, or large fractures, and (4) a multivalley area that drains to the Colorado River. The seven river systems occupy approximately 34 percent of the study area, the hydrologically closed single-valley and multivalley systems occupy about 58 percent of the study area, and the Colorado River drainage constitutes the remaining 8 percent.

GENERALIZED HYDROGEOLOGY

The Great Basin has had a complex geologic history of sedimentation, igneous activity, orogenic deformation, continental rifting, and, most recently, extensional block faulting. Extensional block faulting began about 17 million years ago and has been continual, forming north-trending mountains separated by alluvium-filled basins (Stewart, 1980, p. 5 and 110). These alternating basins and ranges occupy the Great Basin and are the most prominent characteristic of the region.

Lithologies within the study area may be grouped into two major units on the basis of their general hydrologic properties: basin-fill deposits and consolidated rocks. Basin-fill deposits form large ground-water reservoirs that store and transmit vast amounts of water and contain many productive aquifers. Consolidated rocks generally store and transmit little water compared to the basin-fill deposits; however, carbonate sedimentary rocks (limestone and dolomite) are subject to the development of secondary permeability and in parts of the study area form extensive deep aquifers (see sheet 2). In the study area, volcanic, granitic, and clastic sedimentary rocks are the major types of consolidated rocks that generally store and transmit only small amounts of water and commonly act as barriers to ground-water flow.

Volcanic, granitic, and clastic sedimentary rocks predominate in the western part of the study area, and carbonate rocks, overlain and intruded by volcanic rocks, predominate in the eastern part. The area containing predominately carbonate rocks is referred to as the Carbonate-Rock Province (see sheet 2). Noncarbonate rocks generally form poorly permeable units beneath and surrounding many of the valleys, resulting in closed hydrologic flow systems in the basin-fill deposits. These flow systems consist of single-valley circulation cells and, where basins are hydraulically interconnected, multivalley systems with ground water flowing between valleys through the saturated unconsolidated deposits. In contrast, the carbonate rocks are more permeable, and water flows through bedrock aquifers beneath and adjacent to the basin fill. Consequently, large areas containing several valleys can be hydraulically connected by way of the carbonate rocks, forming deep regional ground-water flow systems.

Basin-fill reservoirs are structural depressions that may contain as much as 10,000 feet of unconsolidated and partly consolidated deposits derived from erosion of adjacent mountains. They are typically elongate in a north-south direction and are generally 5 to 15 miles wide and 20 to 60 miles long. Most are bounded on the east and west by north-trending mountains and on the north and south by basin fill or low bedrock hills. Basin-fill deposits that underlie topographic divides between valleys extend below the water table in many places, allowing ground water in the unconsolidated deposits to flow between basin-fill reservoirs. Grain size of basin-fill deposits ranges from clay and silt in playa areas to cobbles and boulders in alluvial fans bordering mountain blocks. Basin fill was deposited by fluvial, lacustrine, eolian, and volcanic processes. It generally consists of Miocene and Pliocene deposits, overlain by deposits of late Pliocene and Quaternary age.

WATER-LEVEL CONTOURS

The contours in figure 1 are based on measurements in wells completed in basin-fill deposits and represent water levels of the principal aquifer (the interval of unconsolidated deposits in which the majority of wells are completed) in the basin fill. There is commonly a downward component of flow in recharge areas around the margins of the basins and an upward component of flow near discharge areas in the central parts of basins. Water levels in these areas vary with well depth and, consequently, measurements in individual wells may differ from the basin-wide water levels shown in this report by several tens of feet. Most of the data were compiled from reports published from 1960 to 1981, and were supplemented by miscellaneous measurements between 1980 and 1982. Most of the data were gathered over a period of 21 years; data for some undeveloped basins, however, date back to 1935. With the exception of areas of localized heavy pumping, net water-level changes between 1935 and 1981 are on the order of only several feet. The type of ground-water flow system in a given valley may be inferred from the configuration of the water-level contours because they indicate the general direction of ground-water flow. Ground water may flow beneath a topographic divide if a hydraulic gradient extends from one valley to another. The type of flow system is largely dependent on hydraulic characteristics of the consolidated rocks adjacent to and underlying the basin fill.

Water-level depressions depicted by closed water-level contours commonly indicate the terminus of a ground-water flow system. Water-level depressions are found at the terminus of single-valley, multivalley, and regional flow systems. Fourteen valleys in the study area are hydrologically closed; that is, virtually no ground water or surface water flows into or out of the valleys. These valleys contain a water-level depression that is indicated, where enough data exist, by closed contours. Recharge is supplied primarily by infiltration of precipitation and melting snow in mountains and on adjacent alluvial fans. Ground water is discharged by evapotranspiration, primarily from the valley floor. Hydrologically closed valleys are most common in areas of volcanic, granitic, and clastic sedimentary rocks and least common in areas of carbonate rocks. Smith Creek Valley in west-central Nevada is an example of a single-valley system in which the basin-fill reservoir is adjacent to and underlain by volcanic rocks. Figure 2 shows the locations of the different representative types of flow systems in the study area.

A hydraulic gradient extending through several valleys, depicted by open water-level contours in the basin-fill deposits, indicates intrabasin flow of ground water. The basin-fill reservoirs may be connected by (1) saturated basin fill, (2) permeable consolidated rocks, (3) fractures, or (4) a major river to form multivalley and even larger, regional ground-water flow systems. Recharge is supplied primarily by infiltration of precipitation and melting snow in mountains and on adjacent alluvial fans. Ground water is discharged by large springs, by evapotranspiration near terminal sink areas at the downgradient end of flow systems, and by ground-water flow into rivers and lakes.

Hydraulic gradients that extend through several valleys are in areas of:

1. Linked basin-fill reservoirs, such as the Dixie Valley area in west-central Nevada, in which ground water moves between basins through saturated unconsolidated deposits overlying less permeable consolidated rocks.
2. Permeable consolidated rocks, such as the White River flow system in the Carbonate-Rock Province (Eakin, 1966), in which ground water flows southward through both carbonate rocks and basin-fill deposits.
3. Highly-fractured, predominantly volcanic rocks that transmit water between basin-fill reservoirs along fracture zones, such as the south-central marsh area on the southwestern border of the study area.
4. Major rivers that flow through several valleys, such as the Humboldt River that flows westward across northern Nevada, in which ground water and surface water interact over the entire length of the river.

The specific ground-water flow systems listed above as examples are shown in figure 2.

SOURCE OF DATA

The data used for this map were compiled from: (1) Water Resources-Reconnaissance Reports 1 through 60 and Water Resources Bulletins 12, 13, 31, 32, 34, 35, 37, 38, 41, 42, 43, and 44 of the Nevada Department of Conservation and Natural Resources; (2) Technical Publications 14, 16, 17, 18, 23, 24, 28, 29, 30, 31, 33, 35, 36, 37, 38, 40, 41, 42, 43, 44, 45, 47, 51, 56, 59, 60, 61, 63, 64, 69, 71 and Basic-Data Releases 5, 9, 11, 12, 13, 15, 16, 17, 21, 23, 28, 30, and 35 of the Utah Department of Natural Resources; (3) U.S. Geological Survey reports by Bjorklund and Robinson (1968), Blankennagel and Weir (1973), Dinwiddie and Schroder (1971), Eakin (1966), Harrill (1982), Lines (1979), Miller (1977), Mower (1965), Mower and Feltis (1968), Moyle (1974), Olmsted and others (1975), Snyder (1963), Welch and others (1981), and Winograd and Thordarson (1975); (4) the U.S. Geological Survey Ground-Water Site Inventory Data File for Utah, which contains yearly water-level measurements from an observation well network; (5) Idaho Department of Water Resources Basic-Data Release 3; (6) U.S Geological Survey annual water-resources data report for Idaho, water year 1978 (vol. 1); (7) records of selected wells drilled for the MX Missile Project by Ertec Western, Inc. (Bunch and Harrill, 1984); (8) miscellaneous water-level measurements recorded by the U.S. Geological Survey between 1980 and 1982; and (9) water levels reported on well drillers' logs in areas otherwise having no water-level data.

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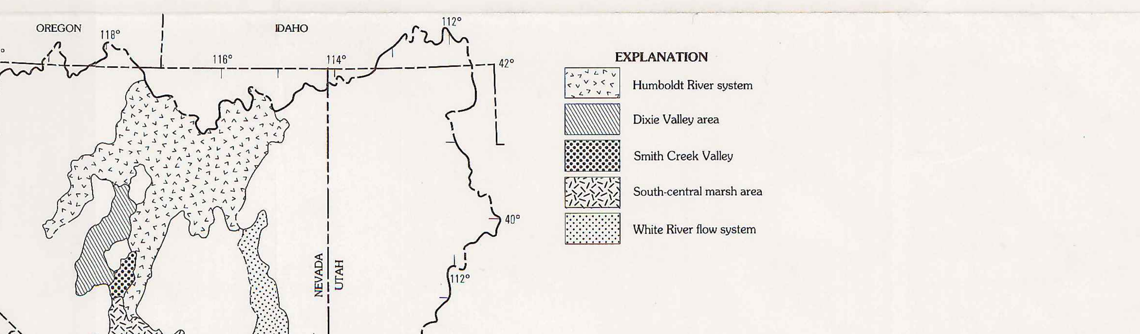

Figure 2.—Examples of single-valley systems (Smith Creek Valley), multivalley systems linked by saturated basin fill (Dixie Valley area), multivalley systems linked by fracture zones (South-central marsh area), and deep regional systems with ground water flowing through both basin fill and adjacent and underlying permeable rocks (White River flow system), in the study area (modified from Harrill and others, 1983, fig. 3).

Base from U.S. Geological Survey
State maps 1:1,000,000

GROUND-WATER LEVELS IN THE GREAT BASIN REGION OF NEVADA, UTAH, AND ADJACENT STATES

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and James D. Crabtree, Ertec Western Inc.

1986

Geology modified from C. W. Jennings (1977), G. W. Walker (1977), J. G. Bond (1978), J. H. Stewart and J. E. Carlson (1978), and L. F. Hintze (1980)

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POTENTIOMETRIC SURFACE IN CONSOLIDATED ROCKS OF THE CARBONATE-ROCK PROVINCE

INTRODUCTION

The atlas of which this sheet is a part is a product of the Great Basin Regional Aquifer-System Analysis (RASA) study. This sheet shows the potentiometric surface of ground water in consolidated rocks of the Carbonate-Rock Province as defined by Mifflin (1968, p. 15 and 16), Hess and Mifflin (1978, p. 1 and 2), and Harrill and others (1983, p. 16 and 24). The sheet also helps to delineate regional flow systems within the province (J. R. Harrill, U.S. Geological Survey, written commun., 1982). Sheet 1 of this atlas shows the general distribution of hydraulic head in basin-fill deposits throughout the RASA study area.

This atlas is Chapter B of a three-part series. Chapter A delineates and describes hydrogeologic units in the Great Basin region, and Chapter C shows inferred directions of ground-water flow and individual flow systems.

The writers express their appreciation to the U.S. Air Force for the release of data from their carbonate-rock exploration programs associated with the MX missile-siting investigation, to Richard Safkin of Gulf Oil Company for potentiometric-head data from drill-stem tests, and to Russell W. Plume and Mark Taylor of the U.S. Geological Survey for calculating potentiometric heads from drill-stem test data for oil and gas exploration wells.

GENERAL FEATURES

The Carbonate-Rock Province is in the eastern half of the Great Basin, and includes areas in eastern Nevada and western Utah, as well as the Death Valley area of California and small parts of Idaho and Arizona (fig. 1). In this report, the boundaries of the province generally correspond with geologic features—mainly faults—as described by Stewart (1980, p. 10). The province is bounded by: (1) the Willard, Charleston, Nebo, Blue Mountain, and Muddy Mountain thrust faults to the east; (2) the Death Valley shear zone to the south; (3) the Roberts Mountain thrust fault to the west; and (4) the Snake River drainage basin to the north (fig. 2). The study area includes a few valleys outside these structural boundaries in areas that contain outliers of—or are underlain by—carbonate rocks and are part of a major flow system that contained predominately in the province.

GENERALIZED HYDROGEOLOGY

The Carbonate-Rock Province of the Great Basin is named for the thick sequences of Paleozoic limestone and dolomite in the region. These carbonate rocks are underlain by Precambrian metamorphic and granitic rocks and upper Precambrian to Middle Cambrian clastic sedimentary rocks. They are overlain by upper Paleozoic to Mesozoic clastic sedimentary rocks, Cenozoic volcanic rocks, and Cenozoic basin-fill deposits. Rocks of the region are intruded by granitic rocks that range in age from late Mesozoic to Cenozoic. Several episodes of deformation have affected the study area, as indicated by regional thrust and strike-slip faults and block faulting that have created the present basin-and-range topography.

Carbonate rocks characteristically are more permeable than the adjacent noncarbonate rocks, because of secondary permeability developed by dissolution of carbonate minerals along faults, fractures, and bedding planes. Consequently, ground water generally moves more easily through the carbonate rocks than through the noncarbonate rocks. The ability of the carbonate rocks to store and transmit ground water differs from place to place; transmissivities range from less than 13 ft² per day in undeformed areas to more than 130,000 ft² per day where the rocks are intensely fractured and faulted (Eakin, 1966, p. 266; Winograd and Thordarson, 1975; and Ertec Western, Inc., 1982).

The Carbonate-Rock Province can be divided into three major hydrostratigraphic units: (1) carbonate rocks; (2) noncarbonate rocks; and (3) basin-fill deposits. Carbonate-rock units can form extensive aquifers that store and transmit large quantities of water along fault and fracture systems that extend through several basins and ranges. Discharge from these regional aquifers is manifested by large springs and, in some areas, extensive wetlands. Noncarbonate-rock units are generally less permeable than the carbonate rocks or basin-fill deposits, so they act as flow barriers to, or impermeable caps on, the regional aquifers. Basin-fill deposits are generally more permeable than the carbonate rocks and are capable of storing and transmitting vast quantities of water. In many places these deposits are hydraulically connected with adjacent and underlying carbonate rocks, resulting in one continuous ground-water flow system bounded by noncarbonate rocks or structural features (Ertec Western, Inc., 1981).

Recharge to regional aquifers within the Carbonate-Rock Province presumably occurs primarily in the mountains, with most of the recharge originating as precipitation or melting snow in the higher altitudes. Water entering carbonate rocks in the mountains may travel through or beneath several basins and ranges before being discharged. Some of the ground water may be discharged in a topographically low area along the flow path of the regional aquifer. Figure 3 shows a conceptual drawing of ground-water flow in a regional aquifer. Thus, a regional aquifer may contain several discharge areas along its flow path upgradient from the lowest discharge area in the flow system. The White River flow system (fig. 4), within the larger Colorado River system, is a good example of a regional aquifer with several ground-water discharge areas along its flow path (Eakin, 1966).

WATER-LEVEL CONTOURS

Water-level contours in figure 1 representing the regional potentiometric surface of ground water in consolidated rocks of the Carbonate-Rock Province were constructed using data from: (1) wells that penetrate mostly carbonate rocks, including those drilled for the MX missile project, for the Nevada Test Site, for oil and gas exploration, and for water supplies; (2) springs for which the discharge exceeds 100 gallons per minute and the water chemistry indicates a mostly carbonate rock source and a long ground-water flow time; and (3) flooded mine shafts in carbonate rocks.

Water-level contours shown on the map indicate the general direction of ground-water flow in the carbonate rocks. However, potentiometric-head data for volcanic rocks that overlie carbonate rocks are included on the map for Pahute Mesa, Yucca Mountain, and the Groom Lake area on the Nevada Test Site (Winograd and Thordarson, 1975), the Hot Creek Valley area in central Nevada (Dinwiddie and Schroder, 1971), and for some oil and gas exploration wells (the Pahute Mesa, Yucca Mountain, Groom Lake, and Hot Creek Valley areas are indicated by stipple pattern in fig. 1). Contours are shown as long dashed lines where their location is imprecise owing to insufficient water-level data. Water-level contours shown by short dashed lines can be used to infer the probable direction of ground-water flow in areas of carbonate rocks or in basins underlain by carbonate rocks where suitable water-level data are scarce or lacking. Locally, the configuration of dashed contours may be based on water levels in the overlying basin-fill deposits in areas that are assumed to have a good hydraulic connection between the carbonate rocks and basin fill.

SOURCES OF DATA

The data for this map were compiled from: (1) Ertec Western, Inc., reports (1981 and 1982); (2) Technical Publications 14, 18, 23, 25, 33, 42, 43, 45, 47, 51, 56, 59, 64, 69, and 71 of the Utah Department of Natural Resources; (3) U.S. Geological Survey reports by Bjorklund and Robinson (1968), Dinwiddie and Schroder (1971), Eakin (1966), Hewett (1956), Sass and Munroe (1974), Westgate and Knopf (1932), and Winograd and Thordarson (1975); (4) Desert Research Institute (University of Nevada) reports by Fiero and Illian (1969) and Mifflin (1968); (5) a mining engineer's report by Stuart (1955); (6) drill-stem tests of oil and gas wells (data from Nevada Division of Mineral Resources and Gulf Oil Company); (7) U.S. Geological Survey topographic maps (scales, 1:24,000, 1:62,500, and 1:250,000); (8) data for wells currently being drilled on the Nevada Test Site (D. H. Schaefer, U.S. Geological Survey, oral commun., 1982); (9) data for wells previously drilled on the Nevada Test Site (R. P. Snyder, U.S. Geological Survey, written commun., 1967); and (10) water levels reported in well logs on file with the Nevada State Engineer.

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CONVERSION FACTORS

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Multiply	By	To obtain
foot (ft)	0.3048	meter (m)
foot squared per day (ft²/d)	0.0929	meter squared per day (m²/d)
gallons per minute (gal/min)	0.06309	liter per second (L/s)

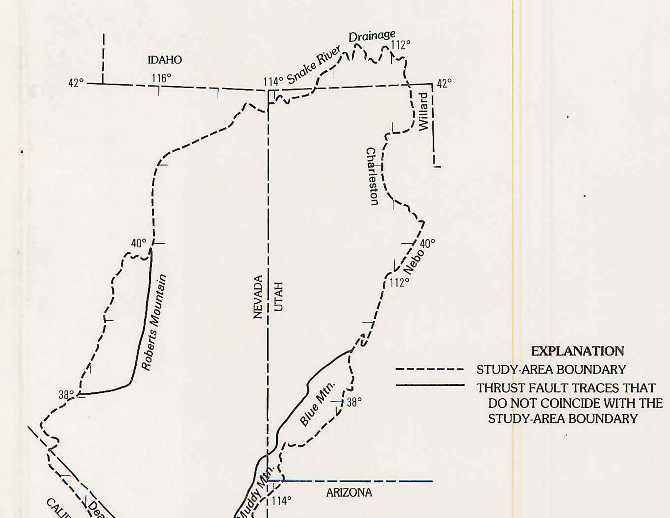
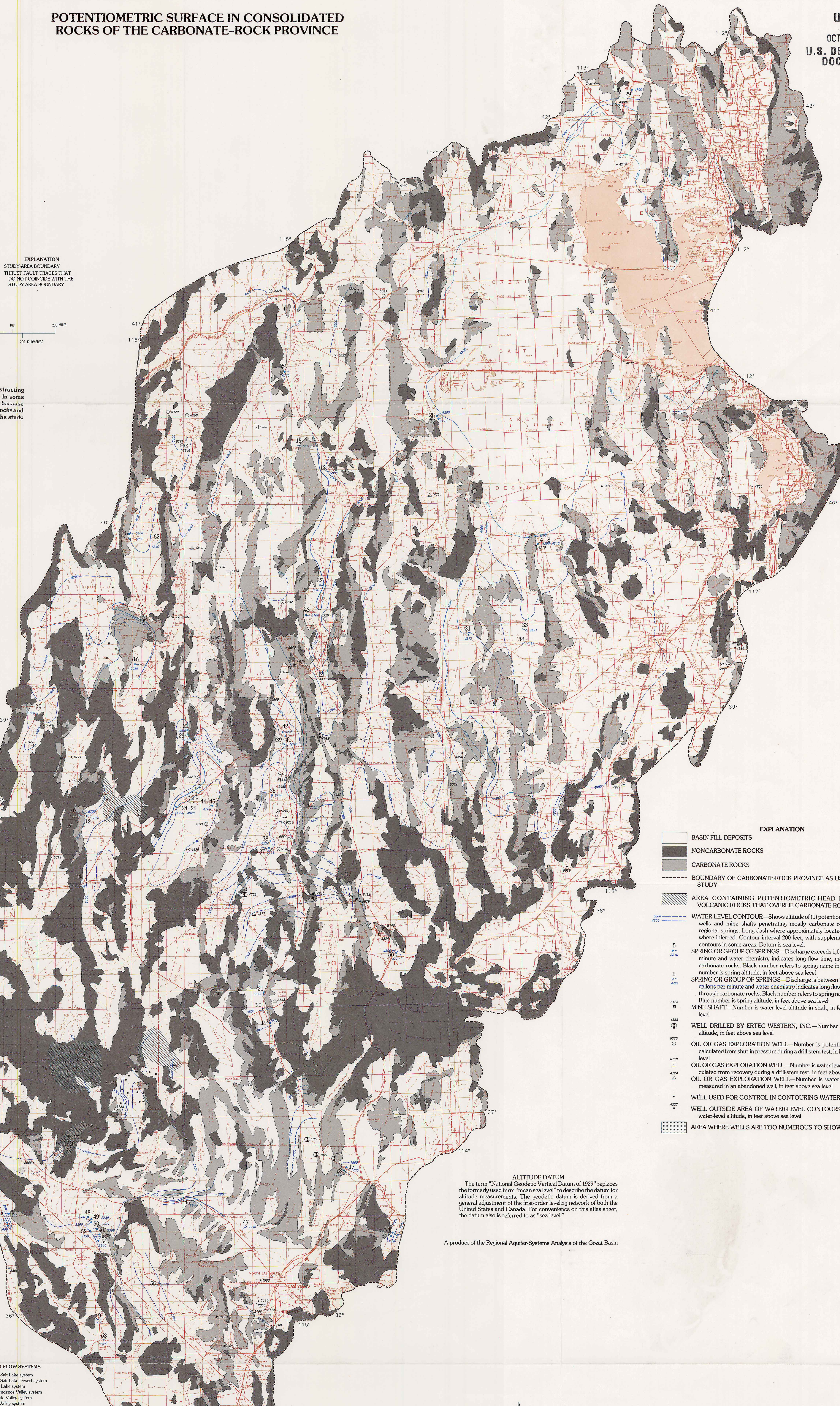


Figure 2.—Location of geologic features, mainly faults, used in constructing the Carbonate-Rock Province boundary (Stewart, 1980, p. 10). In some areas the boundary does not coincide with the geologic feature because valleys that contain outliers of—or are underlain by—carbonate rocks and are part of a major flow system in the province, are included in the study area.

TABLE 1.—*Springs for which (1) discharge exceeds 100 gal/min and (2) water chemistry indicates long flow time, mostly through carbonate rocks*

Reference no. (fig. 1)	Name	Reference no. (fig. 1)	Name
1	Klobe Spring	36	Mormon Hot Spring
2	Waterworks Spring	37	Moon River Spring
3	North Spring	38	Hot Creek Spring
4	Thomas Spring	39	Cold Spring
5	Middle Spring	40	Nicholas Spring
6	Lost Spring	41	Arnoldson Spring
7	South Spring	42	Preston Big Spring
8	Percy Spring	43	Campbell Ranch Spring
9	Shoshone Spring	44	Blue Eagle Spring
10	Old Dugan Place Hot Spring	45	Tom Spring
11	Upper Hot Creek Ranch Spring	46	Indian Springs
12	Hot Creek Ranch Spring	47	Corn Creek Springs
13	Nelson Spring	48	Fairbanks Spring
14	Warm Spring	49	Rogers Spring (Ash Meadows area)
15	Odger Ranch Spring	50	Long Street Spring
16	Fish Creek Spring		
17	Big Muddy Spring	51	Devils Hole
18	Iverson (Warm) Spring	52	Crystal Pool
19	Ash Spring	53	Point-of-Rock (King) Spring
20	Crystal Spring	54	Big Spring
21	Hiko Spring	55	Manse Springs
22	Duckwater Big Warm Spring		
23	Duckwater Little Warm Spring	56	Panaca Warm Spring
24	Lockes Big Spring	57	Rogers Spring (Muddy Mountain area)
25	Hay Corral Spring	58	Blue Point Spring
26	Reynolds Spring	59	Warm Springs
27	Little Salt Spring	60	Shipley Hot Spring
28	Blue Lake Spring		
29	Holbrook Springs	61	Bailey Spring
30	Diana's Punch Bowl	62	Thompson Ranch Spring
		63	Travertine Spring
31	Twin Spring	64	Texas Spring
32	Monte Neva Hot Spring	65	Nevares Spring
33	Coyote Spring		
34	North Tule Spring	66	Grapevine Spring
		67	Stainigers Spring
		68	Tecopa Hot Spring



EXPLANATION

- BASIN-FILL DEPOSITS
- NONCARBONATE ROCKS
- CARBONATE ROCKS
- BOUNDARY OF CARBONATE-ROCK PROVINCE AS USED IN THIS STUDY
- AREA CONTAINING POTENTIOMETRIC-HEAD DATA FOR VOLCANIC ROCKS THAT OVERLIE CARBONATE ROCKS
- 5000, 4300 — WATER-LEVEL CONTOUR—Shows altitude of (1) potentiometric head in wells and mine shafts penetrating mostly carbonate rocks and (2) regional springs. Long dash where approximately located, short dash where inferred. Contour interval 200 feet, with supplemental 100-foot contours in some areas. Datum is sea level.
- 5, 3810 — SPRING OR GROUP OF SPRINGS—Discharge exceeds 1,000 gallons per minute and water chemistry indicates long flow time, mostly through carbonate rocks. Black number refers to spring name in table 1. Blue number is spring altitude, in feet above sea level
- 6, 4421 — SPRING OR GROUP OF SPRINGS—Discharge is between 100 and 1,000 gallons per minute and water chemistry indicates long flow time, mostly through carbonate rocks. Black number refers to spring name in table 1. Blue number is spring altitude, in feet above sea level
- 6125 — MINE SHAFT—Number is water-level altitude in shaft, in feet above sea level
- 1858 — WELL DRILLED BY ERTEC WESTERN, INC.—Number is water-level altitude, in feet above sea level
- 5320 — OIL OR GAS EXPLORATION WELL—Number is potentiometric head calculated from shut-in pressure during a drill-stem test, in feet above sea level
- 6118 — OIL OR GAS EXPLORATION WELL—Number is water-level altitude calculated from recovery during a drill-stem test, in feet above sea level
- 4724 — OIL OR GAS EXPLORATION WELL—Number is water-level altitude measured in an abandoned well, in feet above sea level
- WELL USED FOR CONTROL IN CONTOURING WATER LEVELS
- 4327 — WELL OUTSIDE AREA OF WATER-LEVEL CONTOURS—Number is water-level altitude, in feet above sea level
- AREA WHERE WELLS ARE TOO NUMEROUS TO SHOW

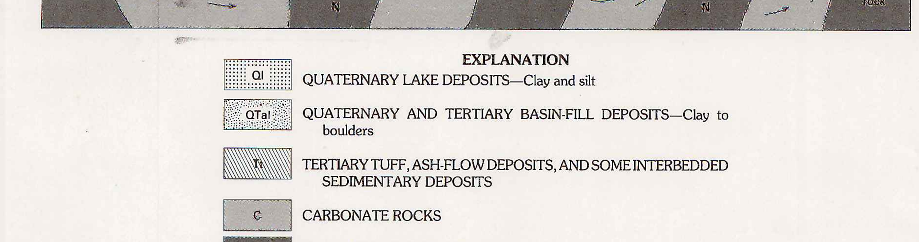
ALTITUDE DATUM

The term "National Geodetic Vertical Datum of 1929" replaces the formerly used term "mean sea level" to describe the datum for altitude measurements. The geodetic datum is derived from a general adjustment of the first-order leveling network of both the United States and Canada. For convenience on this atlas sheet, the datum also is referred to as "sea level."

A product of the Regional Aquifer-Systems Analysis of the Great Basin

SCALE 1:1 000 000
25 0 25 50 MILES
25 0 25 50 KILOMETERS

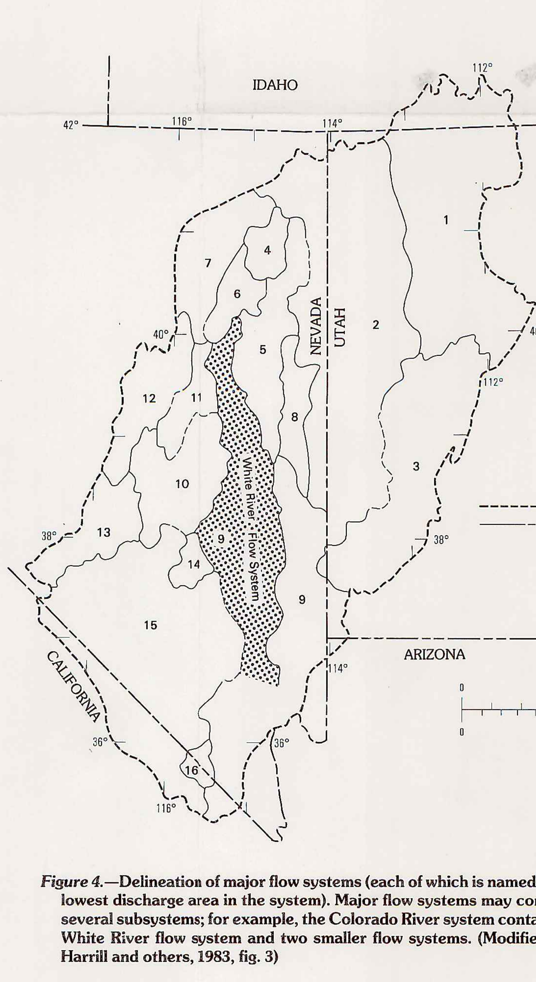
Figure 1.—Potentiometric surface in consolidated rocks of the Carbonate-Rock Province.



EXPLANATION

- Ql — QUATERNARY LAKE DEPOSITS—Clay and silt
- QTal — QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS—Clay to boulders
- Tt — TERTIARY TUFF, ASH-FLOW DEPOSITS, AND SOME INTERBEDDED SEDIMENTARY DEPOSITS
- C — CARBONATE ROCKS
- N — NONCARBONATE ROCKS
- ARROWS INDICATE GENERAL DIRECTION OF GROUND-WATER FLOW

Figure 3.—**Conceptualization of ground-water flow in a regional aquifer. (Modified from Harrill and others, 1983, fig. 9)**



MAJOR FLOW SYSTEMS

1. Great Salt Lake system
2. Great Salt Lake Desert system
3. Sevier Lake system
4. Independence Valley system
5. Goshute Valley system
6. Ruby Valley system
7. Humboldt River system
8. Spring Valley
9. Colorado River system
10. Railroad Valley system
11. Newark Valley system
12. Diamond Valley system
13. Clayton Valley system
14. Penoyer Valley
15. Death Valley system
16. Mesquite Valley

EXPLANATION

- STUDY-AREA BOUNDARY
- MAJOR FLOW-SYSTEM BOUNDARY—Dashed where uncertain

0 100 200 MILES
0 100 200 KILOMETERS

Figure 4.—**Delineation of major flow systems (each of which is named for the lowest discharge area in the system). Major flow systems may consist of several subsystems; for example, the Colorado River system contains the White River flow system and two smaller flow systems. (Modified from Harrill and others, 1983, fig. 3)**

Base from U.S. Geological Survey State maps 1:1,000,000

Geology modified from C. W. Jennings (1977), G. W. Walker (1977), J. G. Bond (1978), J. H. Stewart and J. E. Carlson (1978), and L. F. Hintze (1980)

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1986