STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
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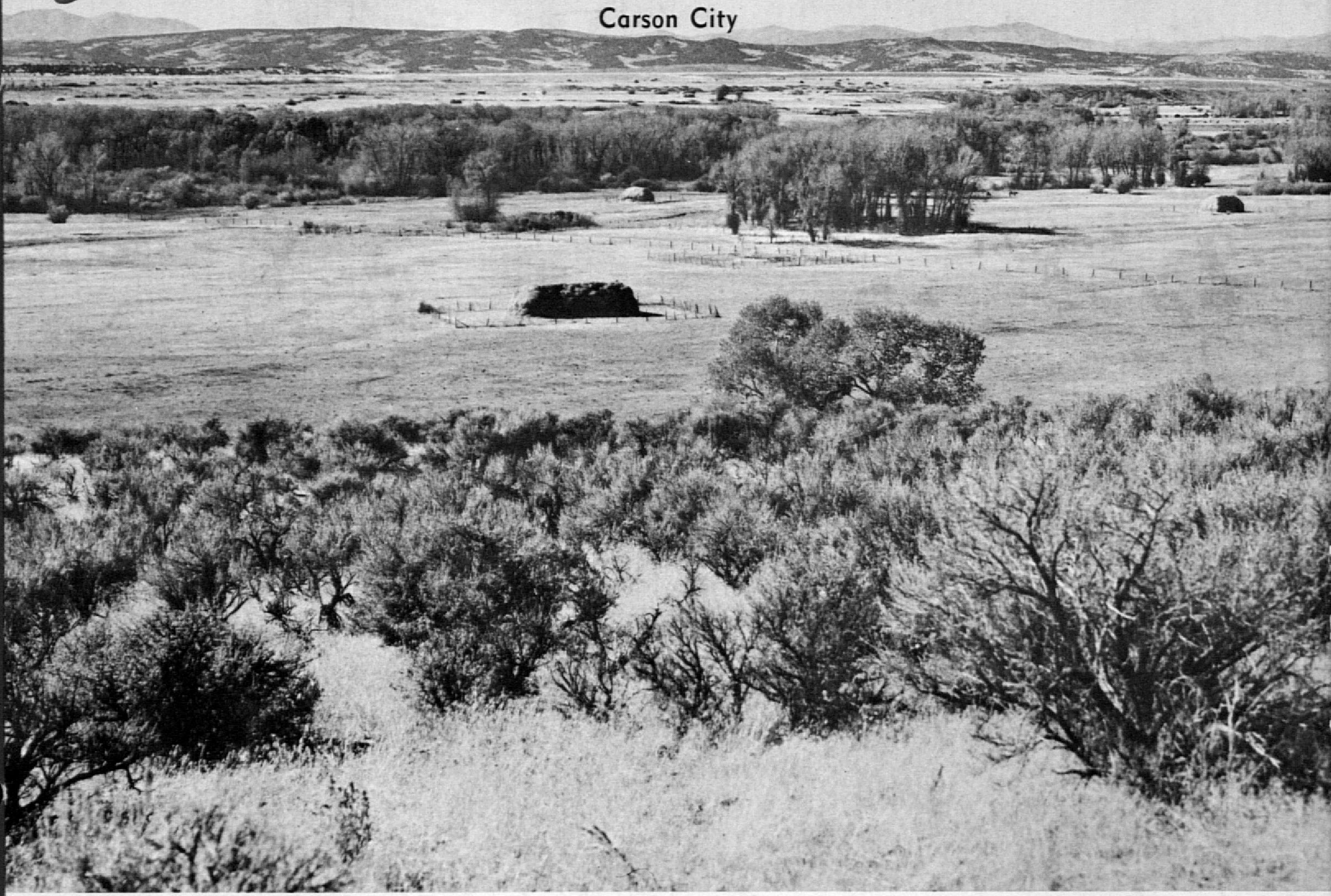

View of Huntington Valley looking westward near Lee.

WATER RESOURCES–RECONNAISSANCE SERIES
REPORT 35

WATER–RESOURCES APPRAISAL OF THE HUNTINGTON VALLEY AREA, ELKO AND WHITE PINE COUNTIES, NEVADA

By
F. Eugene Rush
Geologist
and
Duane E. Everett
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Prepared cooperatively by the
Geological Survey, U.S. Department of Interior

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WATER-RESOURCES APPRAISAL OF
THE HUNTINGTON VALLEY AREA

By
F. Eugene Rush and Duane E. Everett

SUMMARY

The Huntington Valley area is in northeastern Nevada in Elko and White Pine Counties, and has an area of about 1,280 square miles. The valley lowlands are semiarid; most of the precipitation that contributes to streamflow and to ground-water recharge falls on the mountains in the winter and subsequently melts in the spring. The younger and older alluvium, mostly clay, sand, and gravel, comprise the principal ground-water reservoir. The consolidated rocks in the mountains are a poor source of water; however, locally the carbonate rocks of the Ruby Mountains south of Harrison Pass may transmit large quantities from the mountain-block area to Ruby Valley, reducing the surface runoff in the area.

South Fork Humboldt River and Huntington Creek are the principal streams in the area. The total estimated average annual surface-water runoff in the report area is 148,000 acre-feet. The Ruby Mountains north of Harrison Pass, though comprising only 16 percent of the runoff area, yields about 73 percent of the area runoff.

About 28,000 acres of meadow, pasture, and cultivated land are irrigated. Diversions of streamflow and the associated water losses is estimated to be about 38,000 acre-feet per year; 20,000 acre-feet in the Huntington Creek subarea, 10,000 acre-feet in the South Fork Humboldt River subarea, and 8,000 acre-feet in the Dixie Creek - Tenmile Creek subarea. During dry years, irrigation wells are used to supplement some of the water needs.

The estimated average annual ground-water discharge is 30,000 acre-feet, 21,000 acre-feet of which is transpired by 39,000 acres of phreatophytes. The discharge of all wells was about 400 acre-feet in 1964. The remainder was by underflow.

The water budget shows that the average annual surface-water runoff contribution to ground-water recharge is about 18,000 acre-feet.

The minimum perennial yield of the hydrologic system is estimated to be about 60,000 acre-feet.

All the water samples from streams, springs, and wells were found to be suitable for irrigation. Most of the ground water in the area is a calcium bicarbonate type.

INTRODUCTION

Purpose and Scope of the Study

Prior to 1960 one of the greatest deficiencies in water knowledge in Nevada was the lack of hydrologic data in about half of the valleys in the State. In an effort to overcome this deficiency, legislation was enacted in 1960 to provide for reconnaissance studies of drainage basins in Nevada under the cooperative program with the U.S. Geological Survey. The purpose of these studies is to provide water-resources information to the public and to assist the State Engineer in the administration of the water law by making preliminary estimates of the average annual recharge to, the discharge from, and the perennial yield of the ground water in the valleys and basins. The scope of the report includes appraisals and information on (1) climate, (2) geologic environment, (3) extent of the hydrologic systems, (4) ground water in storage, (5) streamflow and runoff, (6) water quality, (7) areas of potential development, (8) existing and potential problems, and (9) needs for additional study.

This report is number 35 in the series of reconnaissance studies (fig. 1). The field work was done in a 2-week period in October 1964 to study the hydrologic conditions and the geologic environment of the area.

Location and General Features

The Huntington Valley area of this report includes Huntington Valley, Dixie and White Flats, and the Tenmile Creek drainage area. For the purposes of this water-resources appraisal, the area is divided into three hydrologic subareas, as shown on plate 1: the Huntington Creek drainage area, the South Fork Humboldt River drainage area upstream from Huntington Creek, and the Dixie Creek-Tenmile Creek drainage area. The area is a topographically open valley, draining to the Humboldt River valley. It is in northeastern Nevada and is enclosed by longitude 115°15' and 116°00' and latitude 39°45' and 41°00', as shown in figure 1. The report area is in southern Elko and northwestern White Pine Counties. It is about 70 miles long in a north-south direction, has a maximum width, measured near Lee, of 33 miles, and covers about 1,280 square miles.

Principal access to the area is by State Highway 46, which extends from Elko to Jiggs, a small community in Huntington Valley. Lee is the other community in the study area (fig. 2, pl. 1). Another paved road extends eastward from Route 46 across the northeastern part of the report area to the nearby town of Lamoille. Numerous graded and unimproved roads extend to most parts of the area.

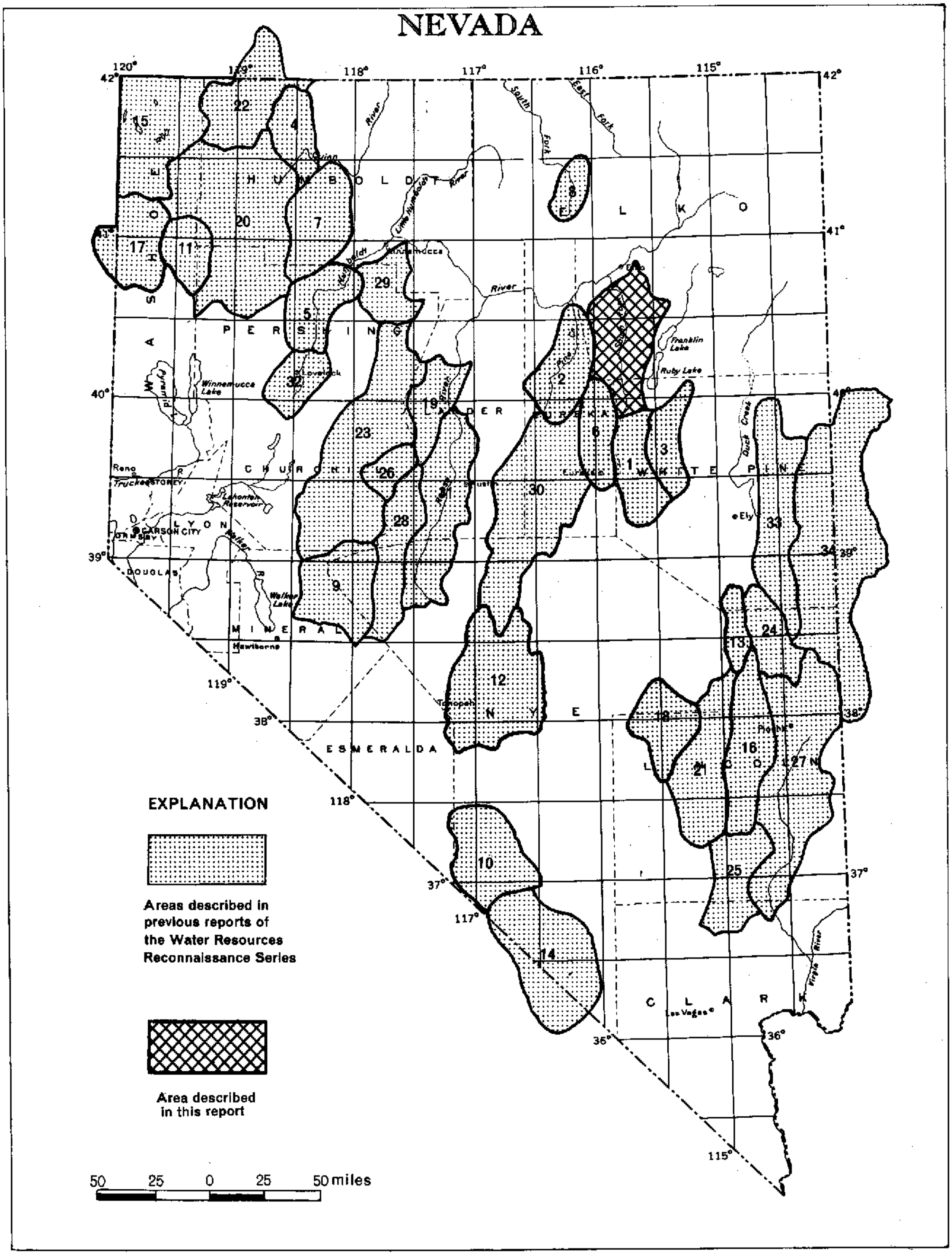


Figure 1.—Areas in Nevada described in previous reports of the Water Resources Reconnaissance Series and the area described in this report

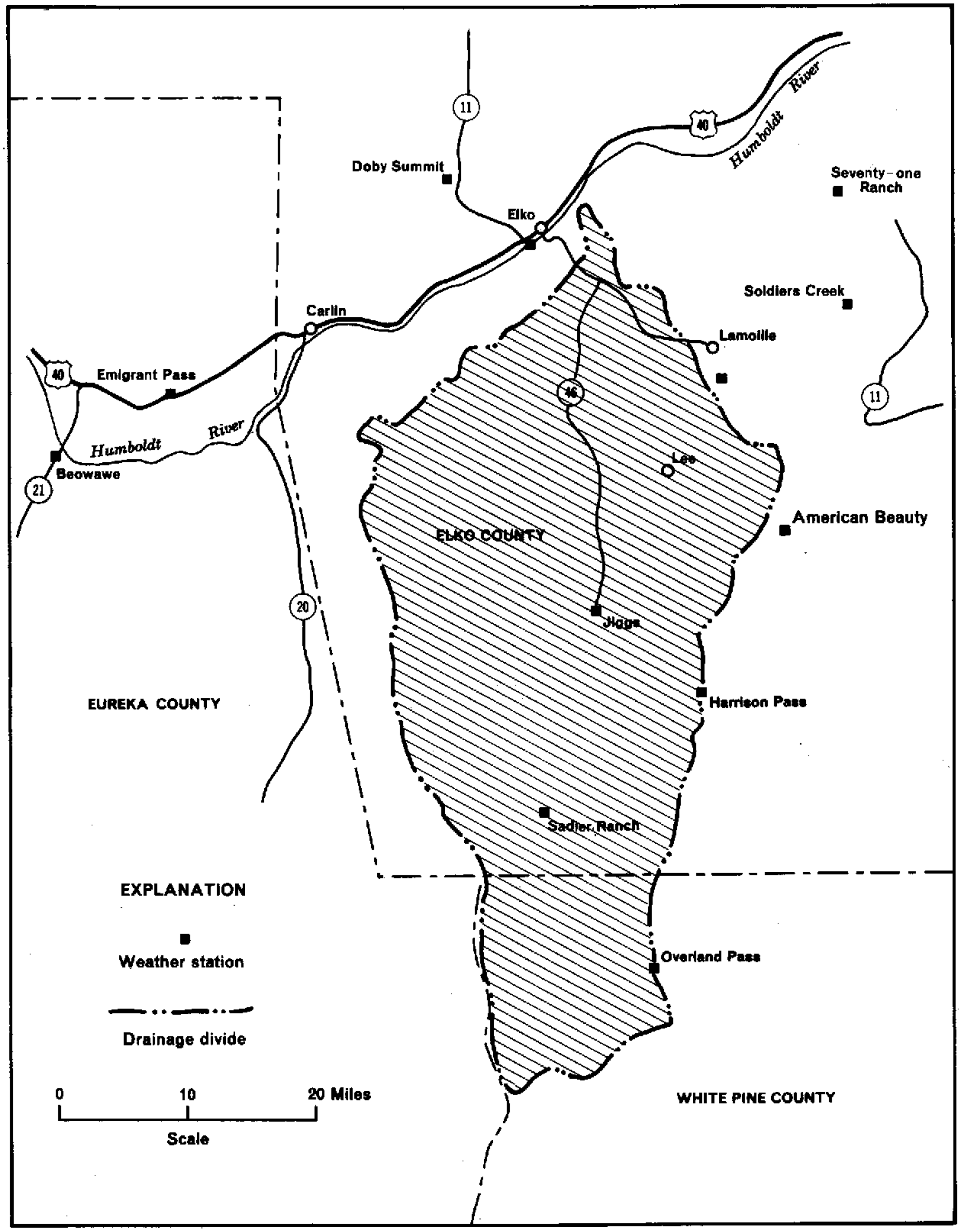


Figure 2.— Locations of paved roads and weather stations

Previous Work

Considerable interest in the geology and hydrology has existed from the late 19th century to the present. King (1877 and 1878) first described the basin deposits in the vicinity of Elko; later Sharp (1939a) described them in detail. More recently Regnier (1960) redefined and renamed similar deposits near Carlin, Nevada.

Sharp (1939b, 1940, and 1942) did extensive work in the Ruby Mountains and East Humboldt Range, describing their structure, stratigraphy, and associated geomorphology. A report dealing with the mineral resources, stratigraphy, and the geologic structure of Elko County was published by Granger and others (1957). This report also contains a reconnaissance geologic map of the county.

A cooperative survey of water and land uses of the Ruby Mountains subbasin was made by the Nevada Department of Conservation and Natural Resources and the U.S. Department of Agriculture (1963). The area covered by that report includes the entire area of this report. Compilations of surface-water records of streams in the report area were published by the U.S. Geological Survey (1960 and 1963).

Reports on the ground-water resources have been published on the following adjacent valleys: Newark (Eakin, 1960), Pine (Eakin, 1961), Diamond (Eakin, 1962), and Ruby (Eakin and others, 1951). The problems and priorty of Humboldt River water distribution are identified in a report by Hennen (1964), which includes the area of this report.

Climate

The air masses that move across northeastern Nevada are characteristically deficient in moisture. The valleys are semiarid, whereas the higher mountain areas are subhumid, receiving somewhat more precipitation, especially in the winter.

Precipitation has been recorded at twelve stations in and near the Huntington Valley area. The locations of these stations are shown in figure 2. The average annual precipitation at these stations ranges from about 7 to 17 inches. Further discussion of precipitation is included in the hydrology section of this report.

Temperature data have been recorded at Beowawe, Elko, Jiggs, Lamoille, and the Seventy-One Ranch. Since 1948, the Weather Bureau has been publishing freeze data; the information for these stations is given in table 1. Because killing frosts vary with the type of crop, temperatures of 32° F, 28°F, and 24°F are used to determine the number of days between the last spring minimum (prior to July 1) and the first fall minimum (after July 1).

The length of the growing season in large part is controlled by the altitude of the station in relation to the adjacent valley floor. The topography of the area favors the flow of heavy cold air toward the lower parts of the valley during periods of little or no wind movement, causing thermal inversions. The length of the growing seasons at Lamoille is relatively long. This station is on the alluvial apron above the valley lowlands. A crop experiencing a killing frost at 28°F would have an average growing season of about 140 days at Lamoille. At Jiggs and Elko, in valley lowlands, the average growing season is 88 and 116 days, respectively. From the available data it is concluded that in most parts of the report area, a crop experiencing a killing frost at 28°F probably will have a minimum average growing season between 80 and 120 days. At higher elevation on the alluvial apron, the average growing season probably is on the order of 140 days.

Table 1.--Number of days between the last spring minimum and the first fall minimum for weather stations near the Huntington Valley area
(From published records of the U.S. Weather Bureau)

Year	Beowawe			Elko			Jiggs			Lamoille			Seventy-One Ranch		
	24°	28°	32°	24°	28°	32°	24°	28°	32°	24°	28°	32°	24°	28°	32°
1948	-	-	-	139	126	67	-	-	-	141	136	68	-	-	-
1949	-	-	-	135	129	95	-	-	-	-	-	-	-	-	-
1950	142	94	85	125	95	80	-	-	-	187	132	82	132	101	43
1951	164	127	114	124	100	95	-	-	-	157	-	-	122	97	76
1952	186	90	89	188	92	90	-	-	-	205	185	82	240	149	72
1953	129	85	66	143	120	70	-	-	-	188	152	97	-	-	-
1954	101	41	41	109	98	66	-	-	-	-	-	-	-	-	-
1955	129	115	101	148	116	106	-	-	-	161	120	116	-	-	-
1956	157	124	80	166	109	48	-	-	-	199	131	105	-	-	-
1957	154	-	-	139	137	84	-	-	-	171	147	96	-	-	-
1958	148	146	122	146	131	96	-	-	-	201	151	132	-	-	-
1959	131	114	72	147	121	91	131	91	52	192	147	130	-	-	-
1960	96	63	63	148	63	63	63	63	56	177	110	62	-	-	-
1961	137	110	99	140	110	110	118	110	93	142	139	109	-	-	-
1962	-	101	77	159	131	85	132	78	76	149	98	96	-	-	-
1963	-	-	-	183	181	57	124	98	49	209	183	118	-	-	-
Average	140	101	84	146	116	81	114	88	65	177	141	99	165	116	64

Physiography and Drainage

The Huntington Valley area is in the eastern part of the Great Basin section of the Basin and Range physiographic province. The bordering mountains generally trend northward. The area is bounded on the west by the Diamond Mountains and the Sulphur Spring and Pinon Ranges, on the north by the Elko Hills, and on the east by the Ruby Mountains. At the south end of the area, a low divide (altitude 6,200 feet) separates Huntington Valley from Newark Valley. Huntington Valley is separated from Dixie and White Flats by the north-trending Cedar Ridge (pl. 1).

High peaks are along the east side of the report area in the Ruby Mountains. The highest peak is Ruby Dome (11,349 feet). Seven other peaks in the range exceed an altitude of 10,500 feet. In the Diamond Mountains adjacent to the report area the highest peak is Diamond Peak (8,970 feet). The Sulphur Spring Range rises to 8,736 feet, the Elko Hills to 6,465 feet, the Pinon Range to 8,400 feet, and Cedar Ridge to 7,151 feet.

The principal streams have their headwaters in the Ruby Mountains and flow generally westward toward the axis of the area where they join the northward-flowing segments of Huntington Creek and South Fork Humboldt River. The channel is deflected westward for several miles by the Elko Hills, but then cuts a gorge through the mountains to where it joins the Humboldt River. The drainage system on the west side of Huntington Valley is dry most of the year. Tenmile Creek and Dixie Creek join the main axial drainage near the north end of the report area (pl. 1).

The lowest point in the report area (altitude 5,100 feet) is the channel of the South Fork Humboldt River where it cuts through the Elko Hills to join the Humboldt River. The lowlands area of Huntington Valley ranges from an altitude of about 5,400 feet where Huntington Creek joins the South Fork Humboldt River to about 6,000 feet at the south end of the valley. The lowlands of Dixie and White Flats and the Tenmile Creek area range from an altitude of about 5,200 to about 6,000 feet. The Ruby Mountains generally rise to between 5,000 and 6,000 feet above the adjacent valley lowlands. The other ranges are lower, rising between 2,000 and 3,000 feet above the adjacent lowlands.

The lowlands of the Huntington Valley area are generally at a lower altitude than the corresponding areas in adjoining valleys, except for Pine Valley to the west and the Humboldt River valley to the north.

Numbering System for Wells and Springs

The numbering system for wells and springs in this report is based on the rectangular subdivisions of the public lands, referenced to the Mount Diablo base line and meridian. It consists of three units; the first is the township north of the base line. The second unit, separated from the first by a slant, is the range east of the meridian. The third unit is separated from the second by a dash, and designates the section number. The section number is followed by a letter that indicates the quarter section, the letters a, b, c, and d designating the northeast, northwest, southwest, and southeast quarters, respectively. Following the letter, a number indicates the order in which the well or spring was recorded within the 160-acre tract. For example, well 32/56-11b1 is the first well recorded in the northwest quarter of section 11, T. 32 N., R. 56 E., Mount Diablo base line and meridian.

Because of the limitation of space, wells and springs are identified on plate 1 only by the section number, quarter section letter, and number indicating the order in which they were located. Township and range numbers are shown along the margins of plate 1.

GENERAL HYDROGEOLOGIC FEATURES

Geologic Setting

The report area consists of two major parts, the lowlands, which are underlain by alluvial fill, and the mountains, which are underlain by consolidated rocks. The lowlands contain a series of unconsolidated continental deposits of Cenozoic age making up the Humboldt Formation of Sharp (1939a) as described by Fredericks and Loeltz (Eakin and others, 1951, p. 45-46) and what Regnier (1960) in an adjacent valley divided into several formations.

The Ruby Mountains are an uplifted fault block of igneous, metamorphic, and sedimentary rocks which were tilted westward by greater displacement on the east-boundary fault than on the west. The other bordering mountains are largely composed of volcanic rocks.

Geomorphic Features

The following brief discussion of the geomorphology is taken principally from Sharp (1940). On the west flank of the Ruby Mountains seven geomorphic surfaces have been recognized and mapped. The two highest surfaces are pediments; that is, sloping bedrock erosional surfaces making up part of the valley apron. The remainder of the apron is composed of alluvial fans and terraces. These surfaces range from about 100 to 500 feet above stream grade and have been extensively dissected by stages of rejuvenation of the Humboldt River drainage.

The five lower surfaces for the most part are cut terraces; that is, erosional surfaces similar to pediments, except cut in unconsolidated or semiconsolidated valley fill. The terraces, like the pediments, are also dissected. They range from about 20 to 200 feet above stream grade. These seven surfaces probably were developed during the latter half of the Pleistocene and the Recent Epochs. All these surfaces slope valleyward between 75 and 350 feet per mile.

Unlike the topographically closed valleys of Nevada, the report area has no flat, nearly level valley floor. Only narrow flood plains have developed along the principal streams in the valley lowlands. Most of the alluvial-fill area is in the form of terraces at various stages of dissection.

Lithologic and Hydrologic Features of the Rocks

The rocks of the report area are divided into four lithologic units: carbonate rocks, noncarbonate bedrock, and older and younger alluvium. This division is based largely on hydrologic properties. Surface exposures of the units are shown on plate 1. The geologic mapping is based on the work of Granger and others (1957), Sharp (1942), and fieldwork and aerial photo interpretation by the authors.

Carbonate rocks of Paleozoic age are abundant in the southern part of the Ruby Mountains and are described by Sharp (1942, p. 686) as more than 20,000 feet thick. Most of the Diamond Mountains, Sulphur and Pinon Ranges, Cedar Ridge, and the Elko Hills are carbonate rocks.

Limestone is the most abundant of the carbonate rocks. It can be dissolved slowly by ground water containing carbon dioxide. As a result, limestone commonly develops enlarged fissures and passageways capable of transmitting large quantities of ground water. The movement of water through these rocks is discussed in a later section of this report.

The northern part of the Ruby Mountains are mostly granite and related igneous, intrusive rocks, probably of Jurassic and Cretaceous age (pl. 1). They generally have a low permeability; hence, they are among the least economic sources of water in the area. Other rock types are exposed in the mountains in the northern and western parts of the area. They are chiefly volcanic flows and tuff of Tertiary age and locally are moderately permeable. The volcanic and intrusive rocks are here grouped as noncarbonate bedrock.

All the consolidated rocks, because of their topographic position in the mountains and because of their unknown depth and distribution beneath the valley fill, presently are considered not to be an economic source of water, except where ground water discharges from them as springs.

The older alluvium is debris derived from the adjacent mountains during the Cenozoic age. Most of this material is what Sharp (1939a) described as the Humboldt Formation, and is chiefly conglomerate, sandstone, mudstone, and shale deposited in lakes in early Humboldt time and along river courses and on flood plains by moderately large, permanent streams. In Pine Valley, near Carlin, Regnier (1960) describes similar deposits but assigns other formation names and ages to the valley fill. The total thickness of the older alluvium is unknown but probably reaches a maximum of several thousand feet.

The older alluvium characteristically is unconsolidated or poorly consolidated, extensively dissected, poorly sorted, and commonly deformed. Drillers' logs (table 10) indicate that the lithology encountered in wells varies from all clay and shale (34/56-14cl) to nearly all sand and gravel (29/56-4al). Generally about a fourth to a third of the deposits encountered in wells is sand and gravel, which yield water readily to wells. The beds usually are less than 10 feet thick. Some wells (30/55-29dl, 32/56-6cl, and 32/56-22bl) encountered beds of sand

and gravel ranging in thickness from 35 feet to about 270 feet, which should yield water in large quantities to irrigation wells. In general, the permeability of the older alluvium probably ranges from low to moderately high and is considered a fair to good source of water to wells where saturated.

The younger alluvium, which is a thin, flood-plain deposit along the principal drainageways, is generally a moderately well-sorted sand and gravel, has a high permeability, and is also a good source of ground water. It is generally unconsolidated, undissected, and relatively undisturbed.

Most of the economically available ground water is stored in the younger and older alluvium, which constitute the principal ground-water reservoir.

HYDROLOGY

Precipitation

As stated previously, precipitation has been measured at 12 stations in and near the Huntington Valley area (fig. 2 and table 2). Two stations are in Huntington Valley at Jiggs and Sadler Ranch, four are in the Ruby Mountains near the drainage divide, and the remaining six within 25 miles of the report area.

Long-term variations in the precipitation pattern are illustrated by the record for Elko, a few miles north of the area (fig. 2). Elko was selected because it has the longest record of the stations in the area, from 1870 to the present. A cumulative departure curve for Elko is shown in figure 3 and indicates three general drought periods. 1870-88, 1919-39, and 1950-62. The earliest of these droughts was severe, not only being the longest recorded at this station, but having an average annual deficiency of nearly 4 inches from the long-term average annual precipitation of 8.76 inches.

The average monthly and seasonal precipitation during the year varies greatly. Data for an intermediate altitude station at Lamoille (6,290 feet) and a lowland station at Jiggs (5,450 feet) are shown in figure 4 to illustrate the seasonal variations and station differences.

The distribution of precipitation during the year is similar; that is, the summers are dry, the winters wet, and the spring and fall are transitional periods. However, larger amounts of precipitation generally fall at the Lamoille station during the winter than at Jiggs. This is the period of regional storms, and their effect is felt to a greater extent at the higher altitudes. About 65 percent of the average annual precipitation falls during the 6-month period December through May at the Lamoille station whereas the same period produces 50 percent of the average annual amount at Jiggs.

Hardman (1936) shows that in gross aspect the precipitation distribution pattern in Nevada is related principally to the topography; the stations at the highest altitude generally receive more precipitation than those at lower altitudes. In the Huntington Valley area this pattern generally prevails, as shown in figure 5. From these data it is concluded that the valley lowlands (generally below 5,500 feet) on the average receives less than 10 inches per year; the higher alluvial areas (between 5,500 feet and about 6,500 feet) between 10 and 15 inches, and the mountains (above 6,500 feet) more than 15 inches and possibly ranging up to 30 inches.

For the purpose of estimating the total average annual precipitation in the Huntington Valley area, the distribution of average annual precipitation is delineated as follows: 12 inches at 6,000 feet, 15 inches at 7,000 feet, and 20 inches at 8,000 feet. Using four precipitation zones, the estimated precipitation is summarized in table 3.

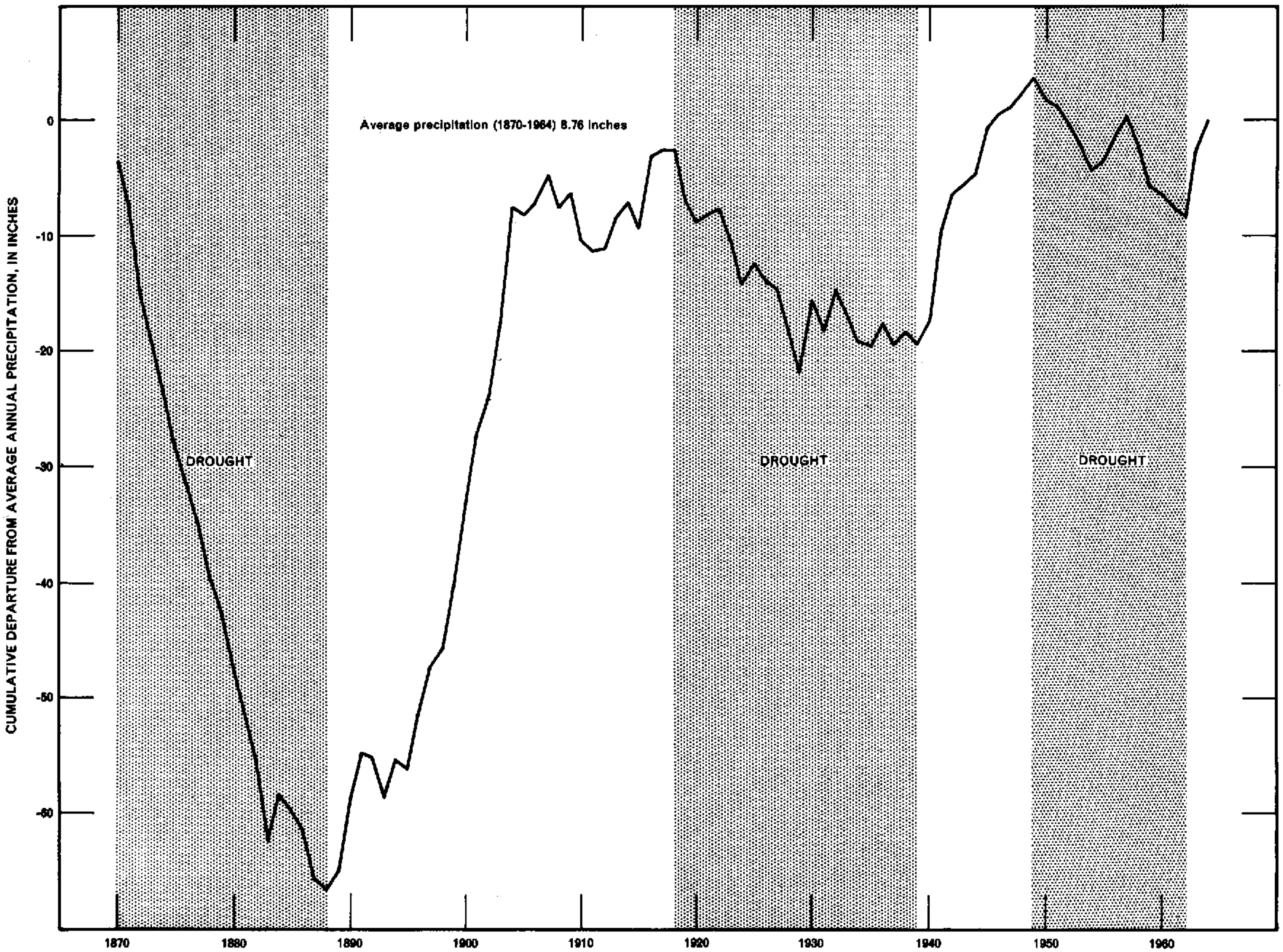


Figure 3.—Cumulative departure from average annual precipitation at Elko, 1870-1964

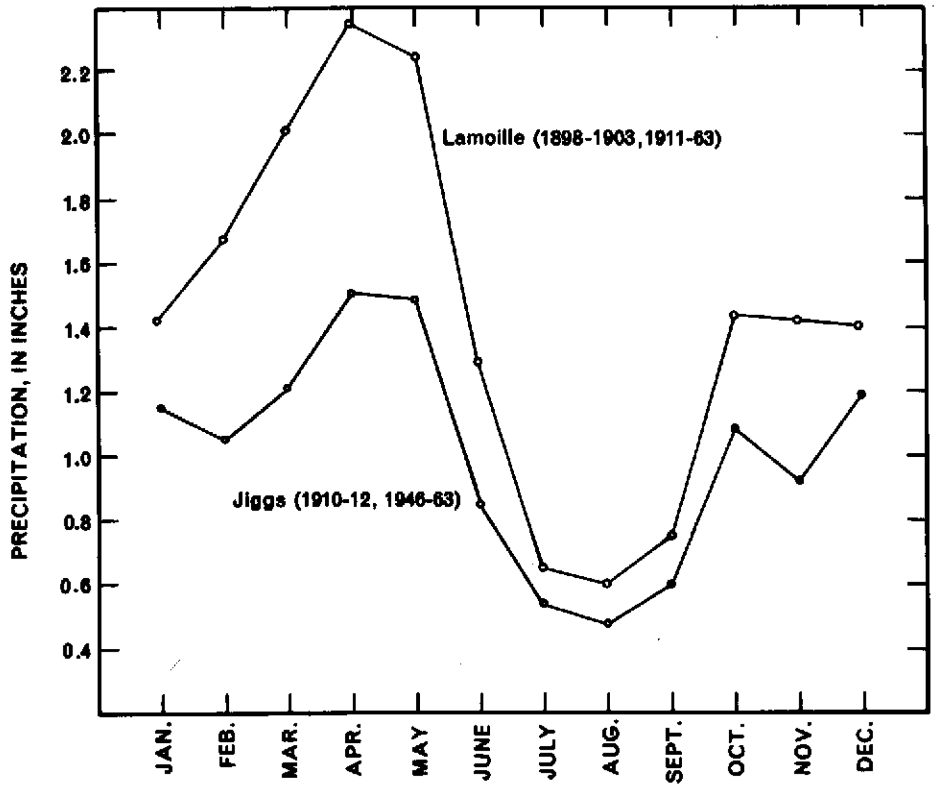


Figure 4.— Monthly distribution of the average annual precipitation at Jiggs and Lamoille

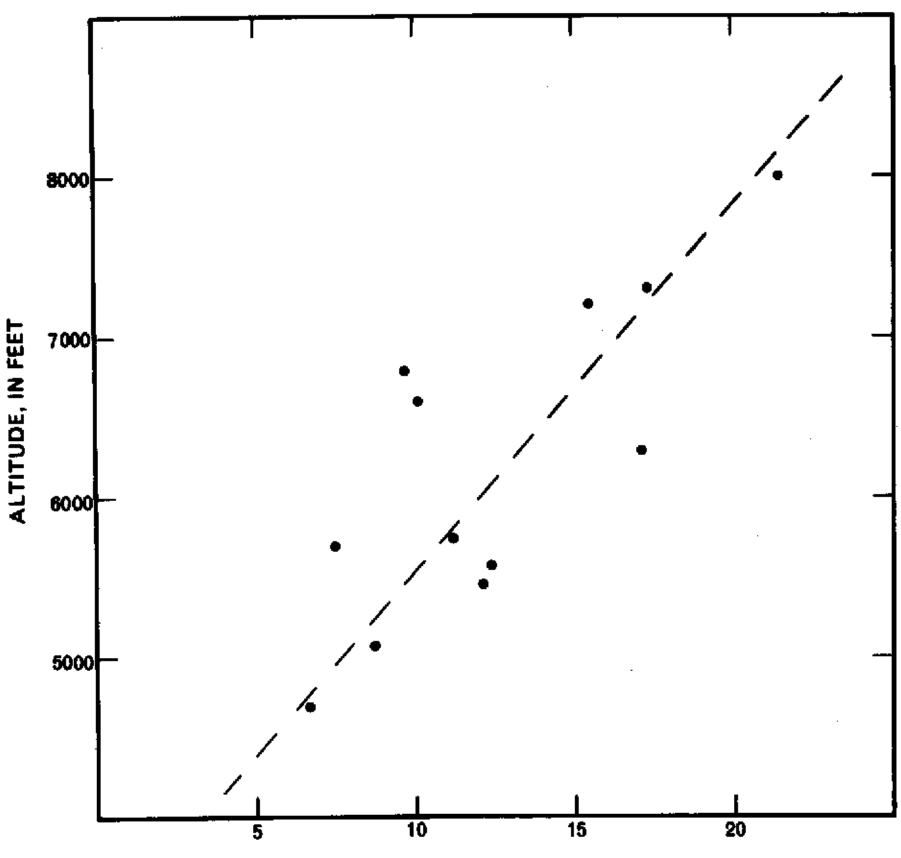


Figure 5.—Relation of station altitude to the measured amount of average annual precipitation

Table 2.—Average monthly and annual precipitation, in inches

[From published records of the U.S. Weather Bureau]

Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
American Beauty[1/]	--	--	--	--	--	--	--	--	--	--	--	--	21.50
Beowawe[2/]	.73	.63	.57	.67	.86	.57	.24	.21	.31	.51	.59	.77	6.66
Doby Summit[3/]	--	--	--	--	--	--	--	--	--	--	--	--	10.05
Elko[4/]	1.23	.95	.92	.70	.86	.66	.35	.28	.33	.66	.76	1.04	8.76
Emigrant Pass Highway Station[5/]	1.27	1.01	1.39	1.03	1.46	1.05	.39	.18	.34	.76	1.07	1.22	11.17
Jiggs[6/]	1.16	1.06	1.21	1.50	1.49	.85	.53	.49	.60	1.08	.92	1.18	12.07
Harrison Pass[7/]	1.82	1.81	2.03	1.86	1.90	1.01	.67	.66	.74	.78	1.26	1.84	16.38
Lamoille[8/]	1.43	1.65	1.98	2.34	2.23	1.29	.64	.60	.74	1.42	1.41	1.39	17.12
Overland Pass[9/]	--	--	--	--	--	--	--	--	--	--	--	--	9.66
Sadler Ranch[10/]	--	--	--	--	--	--	--	--	--	--	--	--	7.48
Seventy-One Ranch[11/]	1.28	1.10	1.16	1.80	1.70	1.30	.33	.41	.48	.88	1.02	.92	12.38
Soldier Creek[12/]	1.88	1.57	1.97	1.47	2.01	1.14	.69	.44	.59	.76	1.43	1.57	15.52

	Altitude	Location	Period of record	Remarks
1.	8,000 feet	Sec. 1, T. 30 N., R. 58 E.	1958-62	Storage gage
2.	4,695 feet	Sec. 5, T. 31 N., R. 49 E.	1870-1938, 1940-42, 1945-46, 1950, 1953-63	
3.	6,600 feet	Sec. 22, T. 35 N., R. 54 E.	1953-63	Storage gage
4.	5,077 feet	Sec. 16, T. 34 N., R. 55 E.	1870-1964	
5.	5,760 feet	Sec. 14, T. 32 N., R. 50 E.	1945-47, 1949-52, 1954-63	
6.	5,450 feet	Sec. 34, T. 30 N., R. 56 E.	1910-42, 1946-63	
7.	7,300 feet	Sec. 2, T. 28 N., R. 57 E.	1948, 1951-62	Storage gage
8.	6,290 feet	Sec. 6, T. 32 N., R. 58 E.	1898-1903, 1911-63	
9.	6,789 feet	Sec. 29, T. 25 N., R. 57 E.	1950-63	Storage gage
10.	5,690 feet	Sec. 26, T. 27 N., R. 55 E.	1950-63	Storage gage
11.	5,550 feet	Sec. 21, T. 35 N., R. 59 E.	1940-44, 1951-53, 1956-63	
12.	7,200 feet	Sec. 3, T. 33 N., R. 59 E.	1950-51, 1954-62	Storage gage

Table 3.--Estimated average annual precipitation

Precipitation zone (altitude feet)	Area (acres)	Estimated annual precipitation			
		Range (inches)	Average (inches)	Average (feet)	Average (acre-feet)
		HUNTINGTON CREEK SUBAREA			
Above 8,000	39,000	more than 20	24	2.0	78,800
7,000 to 8,000	57,700	15 to 20	17.5	1.46	84,200
6,000 to 7,000	186,000	12 to 15	13.5	1.12	208,000
Below 6,000	221,000	less than 12	10	.83	183,000
Total (rounded)	505,000				554,000
		SOUTH FORK HUMBOLDT RIVER SUBAREA			
Above 8,000	28,600	more than 20	24	2.0	57,200
7,000 to 8,000	10,300	15 to 20	17.5	1.46	15,000
6,000 to 7,000	12,000	12 to 15	13.5	1.12	13,400
Below 6,000	15,300	less than 12	10	.83	12,700
Total (rounded)	66,000				98,000
		DIXIE CREEK - TENMILE CREEK SUBAREA			
Above 8,000	4,320	more than 20	24	2.0	8,600
7,000 to 8,000	10,000	15 to 20	17.5	1.46	14,600
6,000 to 7,000	59,600	12 to 15	13.5	1.12	66,600
Below 7,000	175,000	less than 12	10	.83	145,000
Total (rounded)	249,000				235,000
Total for area (rounded)	820,000				890,000

Surface Water

By Donald O. Moore

The source of streamflow in the headwaters of Huntington Creek comes from a spring located on the east flank of the Diamond Mountains. This streamflow is increased from tributaries, mainly those draining the west flank of the Ruby Mountains, such as Smith, McCutcheon, Green Mountain, and Cottonwood Creeks, as Huntington Creek flows northward toward the outlet of the valley and to the Humboldt River. Many of the tributaries in the southern Ruby Mountains and in the western part of the valley draining the Sulphur Spring Range and Diamond Mountains only rarely and under the most favorable conditions develop sufficient flow to reach Huntington Creek. Still others, such as Brown and Pearl Creeks, reach Huntington Creek for short periods in most years.

The source of the South Fork Humboldt River is derived mainly from snow melt on the west flank of the Ruby Mountains. The streamflow in the South Fork Humboldt River is increased by tributaries and Huntington Creek as it flows northwest and joins the main stem of the Humboldt River. Some streams, such as Dixie and Tenmile Creeks, reach the South Fork Humboldt River during short periods in most years.

From the start of the runoff cycle, which is that part of the hydrologic cycle when the precipitation excess begins to discharge through stream channels, runoff is subject to loss by evapotranspiration and infiltration. In the Huntington Valley area this loss is generally greatest in the lower reaches of the stream channels. Also, as the streamflow is diverted onto the fields for irrigation, the evapotranspiration and infiltration increase.

Streamflow in the southern end of Huntington increases in discharge generally to the mountain front and then diminishes in discharge downstream. Streams in the central and northern parts of the valley generally increase in discharge throughout their reaches, but diversions for irrigation cause some of the streams to diminish in discharge at downstream ends at times.

The decrease in streamflow in the southern part of Huntington Valley may be related to the rock type. Carbonate rocks dominate in this area. They are susceptible to solution by natural waters, creating passageways through which large quantities of ground water can migrate. The occurrence of a large number of springs across the Ruby Mountains in Ruby Valley suggests that some of the expected runoff on the western slope of the mountains may be transmitted to the eastern side through solution openings.

Available Records

The South Fork Humboldt River and Huntington Creek are the two principal streams in the Huntington Valley area. Huntington Creek is gaged in the SW1/4 sec. 19, T. 31 N., R. 56 E., at a point about 5 miles upstream from the confluence with the South Fork Humboldt River. This gaging station, Huntington Creek near Lee, was installed in December 1948, and the streamflow record has been continuous to the present time. As there are diversions for irrigation of about 18,000 acres above the station, these streamflow data do not represent natural flow during the irrigation season.

The South Fork Humboldt River is gaged presently at two sites: One gage is in the NW1/4SW1/4 sec. 5, T. 32 N., R. 55 E., about 1 1/2 miles above Dixie Creek. This gaging station, South Fork Humboldt River above Dixie Creek near Elko, was installed in December 1948, and the streamflow record has been continuous to the present time. The other gage, South Fork Humboldt River near Elko, is in the NE1/4 NW1/4 sec. 30, T. 33 N., R. 55 E., about 8.8 miles upstream from confluence with the main stem of the Humboldt River. This gage has been in operation during many years between 1896 and 1932 and continuously from October 1936 to the present time. The records for the period 1950-64 indicate that in the reach between the two stations a loss of about 3,000 acre-feet per year occurred. However, the long-term average loss may be nearer 2,000 acre-feet per year, based on reference period 1912-63.

Streamflow records were obtained on the South Fork Humboldt River from January 1945 to September 195[illegible] at a gaging station listed as South Fork Humboldt River near Lee, in the SE1/4 sec. 16, T. 31 N., R. 57 E., 400 feet downstream from Kleckner Creek.

The State of Nevada obtained seasonal records on Mine Canyon Branch of the South Fork Humboldt at Bolton Ranch in 1937-42, North Branch of South Fork Humboldt at Lee in 1937-39, Rattlesnake Creek in 1952-54, Smith Creek at Twin Bridges in 1935, Smith Creek at Jiggs in 1952, and South Fork Humboldt River at Twin Bridges in 1935. These unpublished records, which were not used in this report, are available from the Nevada Department of Conservation and Natural Resources.

During the present investigation, measurements of streamflow were made on Tenmile, McCutcheon, Smith, Green Mountain, Pearl, Brown, Sherman, and Dixie Creeks, and the South Fork Humboldt River. Additionally, measurements and estimates of flow were made at several points along Huntington Creek and other tributaries. Gaging stations and measurement sites are shown on plate 1.

Estimated Runoff in the Huntington Valley Area

A method recently has been devised to estimate runoff in Nevada, particularly for application to areas where little or no streamflow records are available. The method still is in the development stage and is subject to further field checking and adjustment. It is a reconnaissance method only, and in no way should it be construed that the method necessarily produces results of equivalent reliability to those based on abundant data. This method is explained briefly by Riggs and Moore (1965).

Using the drainage areas supplying the natural flow to streams where gaging stations had been or are operated, recorded runoff is prorated by altitude zones (1,000-foot intervals) with due regard to the proportional areas of the several zones and with increasing unit values of runoff for increasing altitude.

As the different physical characteristics, such as vegetation, amounts of precipitation, geology, and types of soil, vary locally within the large areas, the runoff for each altitude increment is adjusted accordingly. The adjustment of the runoff coefficients for local conditions are based on streamflow measurements. The measurements are adjusted first to the average for the year then to a long-term average annual discharge.

The Huntington Valley area was found to have four different sets of runoff values, with the highest intensity of runoff in the northern half of the Ruby Mountains and the lowest intensity of runoff in the southern part of the area. Much of the runoff that might be expected to occur in the mountains south of Harrison Pass may be diverted naturally to Ruby Valley where it is discharged by springs at the foot of the Ruby Mountains. The structure of the carbonate rocks composing this part of the range favors such flow; according to Granger and others (1957) the bedding planes, which commonly form avenues of flow, dip to the east. For the purposes of this reconnaissance, the outflow to Ruby Valley is assumed to be 10,000 acre-feet per year.

Table 4 shows that the estimated average annual runoff in the Huntington Valley area, based largely on the recorded streamflow at South Fork Humboldt River near Elko (1896-1909, 1910-18, 1920-22, 1923-32. and 1936-63), is roughly 170,000 acre-feet per year. However, the long-term average flow, based on the reference period 1912-63, is about 148,000 acre-feet per year; of this amount 59,000 acre-feet occurs in the Huntington Creek subarea, 54,000 acre-feet in the South Fork Humboldt River subarea, and 35,000 acre-feet in the Dixie - Tenmile Creek subarea. About 90 percent is the runoff at the mountain front, and the remaining 10 percent is runoff generated on the valley uplands in the northern two-thirds of the area. Virtually all of the runoff on the valley uplands is believed to be consumed locally by evapotranspiration.

The gaged surface-water outflow from the area, as recorded at South Fork Humboldt River near Elko for the period of record described above, to the Humboldt River averaged 90,500 acre-feet per year. When adjusted to the long-term average flow for the period 1912-63, the outflow averaged about 78,000 acre-feet per year. The outflow for each subarea is: Huntington Creek subarea, 25,000 acre-feet; the South Fork Humboldt River subarea, 43,000 acre-feet; and Dixie - Tenmile Creek subarea, 78,000 acre-feet.

Additionally ground-water underflow, issuing from springs between the South Fork gage and the mouth of the South Fork, is estimated to average nearly 9,000 acre-feet per year (table 6). Thus, the combined annual outflow at the confluence of the South Fork and the Humboldt River averaged about 100,000 acre-feet for the period of record and about 87,000 acre-feet for the long-term average reference period 1912-63.

TABLE 4 -- Estimated average annual runoff

(Based on the years of record at South Fork Humboldt River near Elko: 1896-1909, 1910-18, 1920-22, 1923-32, 1936-63)

Mountain segment	Location	Area: Acres	Area: (percent of runoff area)	Estimated runoff: (Acre-feet per year)	Estimated runoff: (percent of total runoff)
Ruby Mountains	West flank of mountains north of Harrison Pass above 6,000 feet	120,000	16	124,000	73
Ruby Mountains	West flank of mountains south of Harrison Pass above 6,000 feet	69,000	9	13,000	8
Sulphur Spring Range & Diamond Mountains	East flank of mountains on west side of valley above 6,000 feet	144,000	20	17,000	10
Valley uplands	Valley uplands below 6,000 feet, which contributes to runoff only in northern two-thirds of valley	398,000	55	16,000	9
Total (based on years of record)		731,000	100	170,000	100
(Adjusted to long-term average period 1912-63)		731,000	100	a 148,000	--

a. Of this total, 134,000 acre-feet is the runoff at the mountain front and 14,000 acre-feet is generated on the valley uplands.

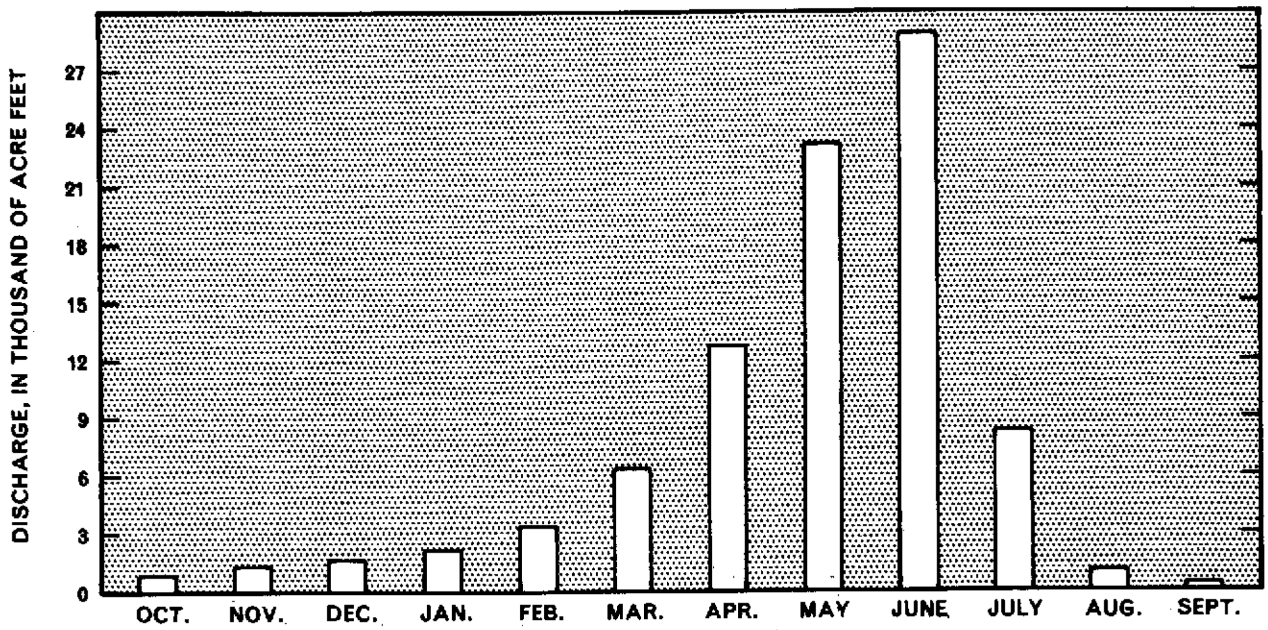
Characteristics of Streamflow

Runoff from snowmelt in the Ruby Mountains generates most of the surface water in the Huntington Valley area. Therefore, the amount of annual surface-water runoff is dependent upon the water content of the snow pack, which varies considerably from year to year. The water content on April 1, 1931, Lamoille number 1 snow course was 4.6 inches and at Lamoille number 2 snow course 4.8 inches, whereas the water content on April 1, 1945, at Lamoille number 1 was 17.4 inches and at Lamoille number 2 was 15.0 inches. For water years 1931 and 1945 the runoff of the South Fork Humboldt River near Elko was 11,800 acre-feet, the minimum of record, and 195,600 acre-feet, the maximum of record, respectively.

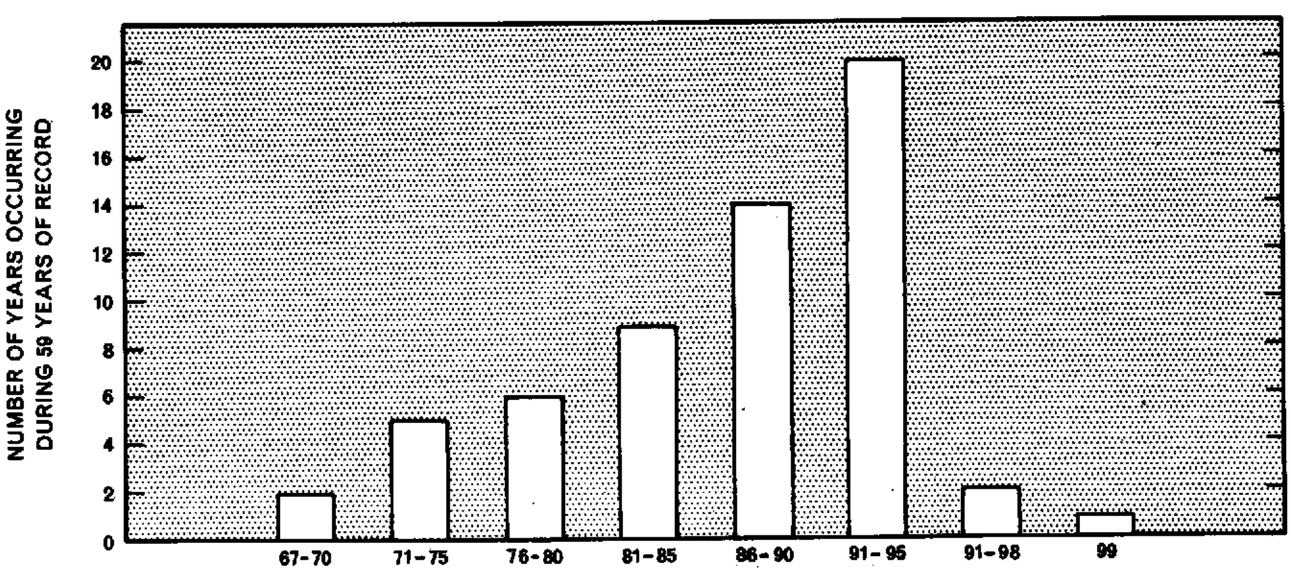
As the runoff is derived mainly from snowmelt, streamflow during the year reflects a dominant influence of snowmelt runoff. In figure 6, the upper graphs show the annual streamflow pattern for Huntington Creek near Lee and the lower graphs show the annual streamflow pattern for the South Fork Humboldt River near Elko. The monthly plot points are shown as a percentage of the average annual streamflow. The middle line of the graph represents the median distribution of the monthly mean discharge for each month; that is, for each month, 50 percent of the monthly flows of record were less than and 50 percent were more than the proportional amount shown by the graph. The upper line of the graph, the upper quartile, is a plot of the proportional monthly flow for which only 25 percent of the monthly flows of record were higher than and 75 percent were less than the proportions indicated. Similarly, the lower line of the graph, the lower quartile, is a plot of the monthly proportion of annual flow for which 75 percent of the monthly flows of record were greater than and 25 percent were less than the proportion indicated by the line.

Figure 7 shows that the principal runoff from snowmelt in the mountains occurs in the March to July period. The gage on the South Fork Humboldt River near Elko indicates that in 25 out of the 59 years of record, or about 42 percent of the time, 90 percent of the annual runoff occurred during the March 1 to July 31 period. The percent of annual runoff occurring during the March 1 to July 31 period for the 59 years of record ranged from 99 percent in 1932 to 67 percent in 1959. The 1931 water year was not included, as the snow pack was negligible.

At the gage on the South Fork Humboldt River near Elko, the maximum monthly discharge occurs in May or June--in 40 years it occured in June and 19 years in May. The maximum monthly discharge, whether May or June, has ranged from 24 to 57 percent of the annual discharge in the 59 years of record. In 30 of the 59 years, the maximum monthly discharge ranged between 33 and 39 percent of the annual discharge.



MEAN MONTHLY DISCHARGE AT SOUTH FORK HUMBOLDT RIVER NEAR ELKO
FOR PERIOD OF 1896-1909, 1910-18, 1920-22, 1923-32, 1936-64



PERCENT OF ANNUAL RUNOFF OCCURRING DURING MARCH 1 TO JULY 31

Figure 7.—Mean monthly discharge and number of years of occurrence, during 59 years of record, that different percents of annual runoff occurred during the period March 1 to July 31 at the gage on South Fork Humboldt River near Elko

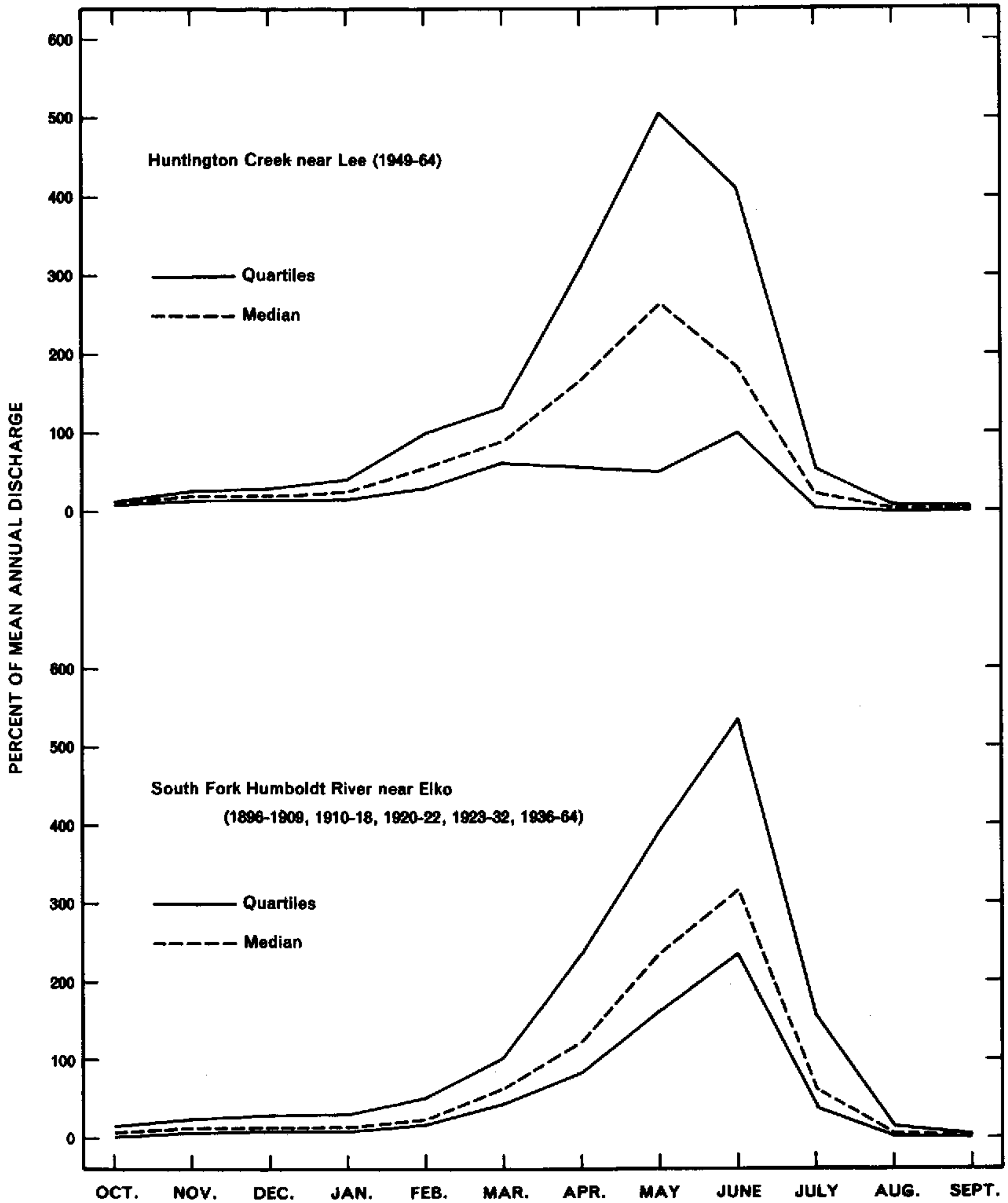


Figure 6.—Monthly discharge in percent of mean annual discharge of South Fork Humboldt River and Huntington Creek

Development

Irrigated land in the Huntington Valley area is primarily meadow and pasture land and hay is the principal crop. Most of this irrigated land is on the east side of the area between the Sestanovich Ranch and Lee (pl. 1). Water used to irrigate the land is generally obtained directly from streams draining the Ruby Mountains.

Acreages for the different types of irrigated land in the Huntington Valley area in 1936 and 1937 were given by Hardman and Mason (1949), as follows:

Type of irrigated land		Acres
Meadow		17,394
Cultivated		2,606
Pasture		8,764
	Total	28,764

The total acres irrigated probably has not changed much since 1936, as a field inspection in the fall of 1964 indicated that about 29,000 acres were irrigated. A total of 39,697 acres has been adjudicated in connection with water rights in the Huntington Valley area.

Diversion of streamflow and associated losses resulting from evapotranspiration are estimated to total about 38,000 acre-feet per year; 20,000 acre-feet in the Huntington Creek subarea, 10,000 acre-feet in the South Fork Humboldt River subarea, and 8,000 acre-feet in the Dixie Creek - Tenmile Creek subarea. About 10 percent of the quantities is assumed to be direct losses from the streams before the diverted water reaches the irrigated fields.

Ground Water

Occurrence and Movement

Ground water occurs under both confined (artesian) and unconfined (water-table) conditions in the Huntington Valley area. Hydrostatic heads in at least one well and all springs are at or above land surface, and occur principally along the terraces at the foot of the Ruby Mountains. The one known flowing well is the Indian Well (well 31/56 - 13d1, table 9).

The thickness of the ground-water reservoir is not known, because no wells penetrate the entire thickness of the alluvium. Bedrock was reached in four wells, all on the alluvial apron adjacent to the Ruby Mountains. The bedrock, reported in the logs (table 10) as either granite or limestone, was reached at depths of 172 to 360 feet. The alluvial thickness in the central parts of the valleys probably is greater. The deepest well known in the report area was drilled to a depth of 499 feet and is about 8 miles west of Jiggs (30/55-29d1, table 10). At its maximum depth the sediments were clay; it produced little water and was abandoned.

In all parts of the report area ground-water movement is in the general direction of surface-water flow; that is, from the mountain areas toward the axes of the valleys where some of it is discharged by evapotranspiration and some is discharged to the streams by springs and seepage along the banks. Water-level data indicates that the movement is then generally northward where the South Fork Humboldt River flows through a canyon toward the Humboldt River. Subsurface flow occurs principally in the alluvium, the water passing through the intergranular spaces. Where ground water flows through consolidated rocks, the passageways are fractures, joints, or solution channels. Only a small amount of underflow beneath the flood plain of the South Fork Humboldt River enters the Dixie Creek - Tenmile Creek drainage area from the two upstream subareas. The amount of underflow, based on estimates of transmissibility and water-table gradients is estimated to be on the order of 1,000 acre-feet per year -- 400 from the Huntington Creek subarea and 600 from the South Fork Humboldt River subarea.

Discharge

Prior to development by man, all the ground water in the Huntington Valley area was discharged by evaporation, transpiration, and surface and subsurface outflow from the area to the Humboldt River. With the advent of mining and agriculture, springs and streamflow were diverted and wells were pumped to satisfy industrial, stock, and irrigation needs. The net result has been a small increase in the draft on the ground-water reservoir. The estimated total natural discharge is about 30,000 acre-feet per year; about 14,000 acre-feet in the Huntington Creek subarea, 3,000 acre-feet in the South Fork Humboldt River subarea, and 13,000 acre-feet in the Dixie Creek - Tenmile Creek subarea.

Evapotranspiration--

Most of the ground water is discharged by evapotranspiration from the phreatophyte areas shown on plate 1. These plants grow along the principal stream channels and include meadow grass, rabbit brush, saltgrass, and greasewood. Cottonwood, willow, aspen, and tule grow along the banks of the principal streams.

Table 5 lists phreatophyte acreages and summarizes estimates of evapotranspiration, which are based on rates of ground-water consumption in other areas as described by Lee (1912), White (1932), Young and Blaney (1942), and Houston (1950). The area of ground-water discharge covers about 39,000 acres of the flood plain, and the estimated evapotranspiration is 21,000 acre-feet per year. Of this total, about 17,000 acre-feet per year is used by meadow grass and 4,000 is used by nonbeneficial phreatophytes.

Table 5 -- Estimated average annual evapotranspiration of ground water by phreatophytes

Phreatophyte	Area (acres)	Depth to water (feet)	Evapotranspiration (acre-feet per acre)	Evapotranspiration Acre-feet (rounded)	Note
		HUNTINGTON CREEK SUBAREA			
Meadow, moderately wet to wet, cottonwood, willow, aspen, and tule along stream channels	16,100	0 to 5	.75	12,000	Much of this acreage is irrigated during growing season. Ground-water discharge is for the remaining part of the year.
Rabbitbrush and greasewood in various proportions	3,540	5 to 20	.3	1,100	
Rabbitbrush and big sage mixed	5,230	20 to 40	.2	1,000	
Subtotal (rounded)	24,900			14,000	
		SOUTH FORK HUMBOLDT RIVER SUBAREA			
Meadow, moderately wet to wet, cottonwood, willow, aspen, and tule along stream channels	4,020	0 to 5	.75	3,000	Much of this acreage is irrigated during growing season. Ground-water discharge is for the remaining part of the year.
Subtotal (rounded)	4,020			3,000	

(Cont. on next sheet)

Table 5 (Cont.)

Estimated average annual evapotranspiration of ground water by phreatophytes

Phreatophyte	Area (acres)	Depth to water (feet)	Evapotranspiration (acre-feet per acre)	Evapotranspiration Acre-feet (rounded)	Note
DIXIE CREEK - TENMILE CREEK SUBAREA					
Meadow, moderately wet to wet, cottonwood, willow, aspen, and tule along stream channels	1,330	0 to 5	.75	1,000	Much of this acreage is irrigated during growing season. Ground-water discharge is for the remaining part of the year.
Meadow grass and rabbitbrush, mixed	1,910	0 to 10	.5	950	
Rabbitbrush and greasewood in various proportions	6,300	5 to 20	.3	1,900	
Rabbitbrush and big sage, mixed	490	20 to 40	.2	100	
Subtotal (rounded)	10,000			4,000	
Total (rounded)	38,900			21,000	

Springs: A large number of springs are along the terraces at the foot of the Ruby Mountains. Most of the large springs of the area are shown on plate 1. From midsummer till the first snow of the winter, most of the streamflow is from springs, seeps, and bank storage. The ground water that enters the streams maintains the continuous flow in many segments of the drainage system. Table 6 lists estimates and a few measurements of streamflow made on October 21, 1964. The principal areas of flow from these ground-water sources are southern Huntington Valley and the Jiggs and Lee areas. In the Lee and Jiggs areas, ground water enters the streams from the consolidated rocks of the stream-cut mountain canyons of the Ruby Mountains. In southern Huntington Valley most surface flow is from the unnamed spring at the foot of Diamond Peak (sec. 34, T. 25 N., R. 55 E.). At its source, the estimated flow was 1.5 cfs (table 6, site 2), but 2 miles downstream the flow had increased to about 6 cfs (site 3). This increase is due to ground-water contribution from the same source that feeds the spring.

A large increase in flow of the South Fork Humboldt River occurs where it flows out of the study area as indicated by the measurements at sites 39 and 40 (table 6). The increase is about 12 cfs, or nearly 9,000 acre-feet per year. Additional ground water may be transmitted through the bedrock divide from the Dixie Creek - Tenmile Creek subarea to the Humboldt River; however, this possibility is not supported by available data.

Because the flow of springs can be accounted for as phreatophyte discharge or surface-water and ground-water outflow from the area, no attempt was made to measure the discharge of the many springs.

Table 6. -- Estimates of streamflow from ground-water sources, October 21 and 22, 1964

Map[1/] no.		Location			Dis-charge (cfs)
		Sec.	Town-ship	Range	
1.	Conners Creek	12	24 N.	55 E.	0
2.	Unnamed spring	34	25 N.	55 E.	1.5
3.	Huntington Creek	26	25 N.	55 E.	6
4.	Huntington Creek	23	25 N.	55 E.	5
5.	Willow Creek	31	26 N.	55 E.	.03
6.	Tributary to Huntington Creek	28	25 N.	55 E.	0
7.	Huntington Creek	22	25 N.	55 E.	5
8.	The Dumps Spring	22	27 N.	54 E.	0
9.	South Fork Twin Creek	6	27 N.	56 E.	2
10.	Huntington Creek	11	28 N.	55 E.	0
11.	Springs	28	28 N.	56 E.	.2
12.	Springs	21	28 N.	56 E.	.1
13.	Huntington Creek	6	29 N.	56 E.	0
14.	Unnamed tributary to Huntington Creek	6	29 N.	56 E.	2
15.	Smith Creek	4	29 N.	56 E.	4
16.	Unnamed tributary to Huntington Creek	24	30 N.	55 E.	0
17.	Unnamed tributary to Cottonwood Creek	22	30 N.	56 E.	.04
18.	Huntington Creek	12	30 N.	55 E.	2
19.	Willow Creek	33	31 N.	56 E.	2
20.	Huntington Creek at gaging station	19	31 N.	56 E.	a 6
21.	Huntington Creek at mouth	30	32 N.	55 E.	7
22.	South Fork Hunboldt River	15	31 N.	57 E.	2.5
23.	Kleckner Creek	15	31 N.	57 E.	2
24.	Pearl Creek	28	31 N.	57 E.	.05
25.	South Fork Humboldt River	19	31 N.	57 E.	10
26.	Rattlesnake Creek	33	31 N.	57 E.	2
27.	Lee Creek	18	31 N.	57 E.	0
28.	Unnamed tributary to Lee Creek	7	31 N.	57 E.	0
29.	Tributary to South Fork Humboldt River	5	31 N.	56 E.	0
30.	South Fork Humboldt River	5	31 N.	56 E.	2
31.	South Fork Humboldt River	25	32 N.	55 E.	2
32.	South Fork Humboldt River	10	32 N.	55 E.	3
33.	Chimney Creek	31	32 N.	57 E.	.01
34.	Tenmile Creek	23	33 N.	56 E.	.2
35.	Tenmile Creek	35	33 N.	55 E.	1

1. Site identification number shown on plate 1.
a. Measured

(cont. on next sheet)

Table 6 (cont.)

Estimates of streamflow from ground-water

October 21 and 22, 1964

Map[1] no.		Location			Dis-charge (cfs)
		Sec.	Town-ship		
36.	South Fork Humboldt River at gaging station	5	32 N.	55 E.	a 8
37.	Dixie Creek	32	31 N.	54 E.	.5
38.	Dixie Creek	26	32 N.	54 E.	1
39.	South Fork Humboldt River at gaging station	30	33 N.	55 E.	a 6
40.	South Fork Humboldt River	14	33 N.	54 E.	a 18

1. Site identification number shown on plate 1.
a. Measured.

Subsurface outflow. -- As described in the preceding section of this report, estimated subsurface outflow from the Huntington Valley area is 9,000 acre-feet per year. This is also the outflow from the Dixie-Tenmile Creek subarea. Subsurface outflow from the Huntington Creek and South Fork Humboldt River subareas is estimated by use of a form of Darcy's Law: $Q = 0.00112TIW$; where T is the coefficient of transmissibility, in gallons per day per foot; I is the hydraulic gradient, in feet per mile; W is the width of the underflow section, in miles; and 0.00112 is a factor for converting gallons per day to acre-feet per year. For both subareas, a transmissibility of 50,000 gpd (gallons per day per foot) is assumed.

Estimated subsurface outflow from the Huntington Valley subarea is the product of the assumed transmissibility, a hydraulic gradient of about 25 feet per mile, and an underflow width of 0.25 mile, which is about 400 acre-feet per year. Similarly, the estimated outflow from the South Fork Humboldt River subarea is the product of a gradient of about 25 feet per mile, and an underflow width of 0.4 mile, which is about 600 acre-feet per year.

Discharge from wells. -- A few wells utilize small amounts of ground water. Although stock and domestic wells are numerous, their combined discharge is small, probably not exceeding 100 acre-feet per year. About 6 irrigation wells are used in the valley and are listed in table 9. Their use generally is limited to supplementing the diversions from streams during years of below normal runoff. During 1964 an estimated 300 acre-feet of water was pumped to irrigate about 300 acres of alfalfa and meadow grass.

Recharge

Ground water in the Huntington Valley area, like the surface water, is derived from precipitation within the drainage basin. On the valley lowlands, where precipitation is small, little precipitation infiltrates to the ground-water reservoir. Greater precipitation in the mountains and on the alluvial apron provides most of the recharge.

Snow and rain in the mountains in part infiltrate the rock material and in part collect into streams which flow from the mountains. Much of this water is evaporated before and after infiltration, some adds to soil moisture, and some percolates to the water table and recharges the ground-water reservoir; the remainder flows out of the report area.

The amount of precipitation and runoff in the Huntington Valley area is greater than the general conditions found in most areas covered to date by the Reconnaissance Series reports. Moreover, the amount of infiltration is limited because the alluvium near most of the streams is saturated to land surface and most potential recharge, therefore, is either rejected or enters storage for only a short period of time and then drains back to the stream. The rejected recharge leaves the area as streamflow. Because of these conditions, the method described by Eakin and others (1951, p. 79-81) to compute recharge from precipitation, is not used in this report.

Over the long term, when no net change of ground water in storage occurs, recharge is equal to ground-water discharge. Using this basic principle and using the estimates of discharge derived in the preceding section of the report, recharge is computed to be equal to the sum of the estimated discharge by evapotranspiration of 21,000 acre-feet per year (table 5) and by subsurface outflow of 9,000 acre-feet per year, or a total of 30,000 acre-feet per year. Of this total, about 14,000 acre-feet is discharged from the Huntington Creek subarea, 4,000 acre-feet in the South Fork Humboldt River subarea, and 13,000 acre-feet in the Dixie-Tenmile Creek subarea.

Storage

The amount of recoverable ground water in storage in the younger and older alluvium in the Huntington Valley area is equal to the volume of saturated material multiplied by the specific yield of the material. Specific yield is the ratio of the volume of water that will drain by gravity from the zone of saturation to the volume of the saturated material drained, commonly expressed as a percentage.

The specific yield of the uppermost 100 feet of saturated alluvium in the area is at least 10 percent. The estimated area underlain by 100 feet or more of saturated material is about 500,000 acres, which is about 90 percent of the 570,000 acres mapped as younger and older alluvium (pl. 1). Accordingly, the amount of ground water in storage in the uppermost 100 feet of the zone of saturation in the report area is:

Subarea	Storage (acre-feet per 100 feet of saturated alluvium)
Huntington Creek	3,200,000
South Fork Humboldt River	240,000
Dixie-Tenmile Creek	1,600,000
Total (rounded)	5,000,000

The amount of usable ground water in storage, which is available on an economic basis, depends in part on the distribution of water-storing deposits, the distribution and range in chemical concentration of the ground water, the number and distribution of wells, and the quantities of water withdrawn.

Development

Spring discharge in the Huntington Valley area in part has been developed and utilized for irrigation and stock watering. The unnamed spring (site 2, pl. 1) in the southern part of Huntington Valley supplements streamflow which in part is utilized for the irrigation of hay and pasture along Huntington Creek in Tps. 27 N., and 28 N. (shown as meadow on pl. 1). Other ground-water sources that add to the streamflow are discussed in the discharge section of this report. Six irrigation wells (table 9) were pumped to supplement creek flow during dry years. As an example, the Tenmile Ranch has two irrigation wells, but only one was used during 1964 to irrigate 45 acres of oat hay with a reported gross pumpage of about 100 acre-feet of water. In 1965 the owner reportedly plans to use both wells and enlarge the irrigation to about 150 acres of hay.

At present only a very small part of the ground-water resources of the valleys are developed. An estimated 4,000 acre-feet of ground water is consumed by greasewood, rabbitbrush, and big sage (table 5), and therefore is wasted. This water might be used for more beneficial purposes. To determine the most suitable areas of ground-water development, many factors, such as soil type, topography, drainage, water quality, effect on streams, water rights, and pumping lift, should be considered.

Water Quality

Twenty-seven water samples were analyzed as part of the present study, and the results are shown in table 7. These analyses provide the basis for a generalized appraisal of the suitablility of the water for agricultural use and to help define potential water-quality problems.

Suitability for Agricultural Use

According to the Salinity Laboratory Staff, U. S. Department of Agriculture (1954, p. 69), the most significant factors with regard to the chemical suitability of water for irrigation are dissolved-solids content, the relative proportion of sodium to calcium and magnesium, and the concentration of elements and compounds that are toxic to plants. Dissolved-solids content commonly is expressed as "salinity hazard" and the relative proportion of sodium to calcium and magnesium as "alkali hazard."

Sampling sites were chosen in the Huntington Valley area to achieve the widest possible areal coverage. The analyses of samples collected from wells, springs, and streams; indicate that water from all sources sampled generally is suitable for irrigation. Because no analyses were made of the boron content, the suitability of the water for irrigation with respect to this constituent was not determined.

Table 7.--Chemical analyses, in parts per million, of water from wells, springs, and streams

[Field analyses by the U.S. Geological Survey]

Location (well no., spring no., or stream)	Sec.	Township	Range	Date of collection	Temperature (°F)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)[1]	Bicarbonate (HCO_3)	Carbonate (CO_3)	Chloride (Cl)	Sulfate (SO_4)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: noncarbonate	SAR[2]	RSC (epm)	Specific conductance (micromhos at 25°C)	pH
WELLS																		
27/55- 4d1				10-20-64	--	38	9.7	45	208	0	20	32	135	0	1.7	0.71	461	7.5
32/55-14d1				10-21-64	58	77	24	37	428	0	6.0	12	292	0	.9	1.18	678	7.2
SPRINGS																		
25/55-14d1				10-22-64	48	53	17	28	164	0	14	105	202	68	.9	.00	572	7.9
25/55-34d1				10-20-64	63	52	9.6	9.2	196	0	7.9	17	169	9	.3	.00	361	7.6
27/56- 5c1				10-20-64	--	49	13	10	215	0	7.2	12	176	0	.3	.00	373	8.0
28/56-28c1				10-20-64	--	50	10	22	232	0	7.5	14	167	0	.7	.46	399	7.9
STREAMS	Location: Sec.	Township	Range															
Huntington Creek nr. Railroad Pass	22	26 N.	55 E.	5-13-64	58	46	11	19	192	0	12	27	162	5	.6	.00	343	7.7
do.		do.		9-15-64	59	37	12	6.0	157	0	7.7	16	143	15	.2	.00	277	8.0
McCutcheon Creek	36	30 N.	56 E.	5-13-64	55	7.8	1.6	7.8	37	0	4.0	6.8	26	0	.7	.09	85	6.9
do.		do.		8-25-64	54	10	1.9	7.6	50	0	1.8	6.0	33	0	.6	.16	96	7.7
Corral Creek at Jiggs	3	29 N.	56 E.	5-13-64	53	19	4.7	11	91	0	4.8	8.4	67	0	.6	.15	174	7.1
do.		do.		8-25-64	55	55	11	27	256	4	9.2	12	184	0	.9	.65	440	8.4
Smith Creek	30	30 N.	57 E.	5-13-64	52	4.9	1.5	6.0	23	0	3.1	7.2	18	0	.6	.02	57	6.8
do.		do.		8-25-64	59	11	2.3	8.7	60	0	2.2	4.0	37	0	.6	.24	108	7.5
Huntington Creek at gaging station	19	31 N.	56 E.	5-13-64	70	27	7.7	38	160	0	18	24	99	0	1.7	.64	354	7.6
do.		do.		6- 3-64	70	32	9.7	46	192	12	15	20	120	0	1.8	1.15	423	8.5
do.		do.		9- 3-64	64	42	11	89	303	11	25	39	149	0	3.2	2.36	658	8.5
South Fork Humboldt River above Lee	16	31 N.	57 E.	10-22-64	47	22	1.7	7.8	84	0	2.0	6.8	62	0	.4	.14	149	7.6
Rattlesnake Creek	33	31 N.	57 E.	10-22-64	44	11	2.1	3.0	44	0	1.8	4.0	36	0	.2	.00	81	7.4
South Fork Humboldt River above Huntington Creek	36	32 N.	55 E.	5-13-64	60	22	2.4	7.4	82	0	3.8	8.0	65	0	.4	.04	150	7.5
do.		do.		10-21-64	40	47	4.3	19	184	0	6.2	16	135	0	.7	.32	329	7.8
Tenmile Creek at State Highway 46	19	33 N.	56 E.	5-13-64	68	48	7.8	41	241	0	14	24	152	0	1.5	.91	452	7.6
do.		do.		9-15-64	61	31	8.9	32	172	0	14	21	114	0	1.3	.54	337	7.6
South Fork Humboldt River above Dixie Creek at gaging station	5	32 N.	55 E.	6- 3-64	49	29	4.0	20	136	0	6.8	31	89	0	.9	.45	251	8.0
do.		do.		9- 3-64	52	24	10	37	169	0	15	23	103	0	1.6	.71	379	8.2
Dixie Creek near mouth	12	32 N.	54 E.	5-13-64	66	22	5.1	12	96	0	6.5	15	76	0	.6	.05	190	7.3
South Fork Humboldt River below Dixie Creek at gaging station	30	33 N.	55 E.	6- 4-64	58	28	4.4	17	132	0	6.0	8.8	88	0	.8	.40	240	7.8

1. Sodium computed by difference.

2. SAR values are approximate, because sodium was computed by difference.

Variations in Water Quality

The quality of ground water varies from place to place; however, in general, the dissolved-solids content is low in the recharge areas in the mountains and increases as it moves toward the area of discharge in the lower parts of the valleys. For example, water from spring 27/56-5cl has a specific conductance value of 373 micromhos per centimeter. Downgradient, water from well 27/55-4dl has a specific conductance of 461 micromhos. The source of this water probably is recharge derived from precipitation on the nearby Ruby Mountains. As the ground water moves northward, it dissolves additional mineral matter, and the specific conductance of water from well 32/55-14dl is 678 micromhos. Although some of the chemical constitutents in the water in this area probably are derived from ground-water underflow from the south, the comparatively low specific conductance value indicates that much of the water is derived from recharge resulting from the infiltration of precipitation on those parts of the Ruby Mountains east of the well.

Most of the ground water in the area is a calcium bicarbonate type. However, water from well 27/55-4dl is a mixed sodium calcium bicarbonate type.

Water quality of streams in the area varies with time and also varies as the water moves downstream. Chemical analyses of water collected from Huntington Creek, 5 miles above its mouth (sec. 19, T. 31 N., R. 56 E.), show that the specific conductance varies inversely with streamflow. Base flow, or low sustained flow, of a stream generally is water that has entered the stream from the ground-water reservoir. This water has been in contact with rock and soil particles and has leached soluble minerals. At high stages the more mineralized ground water entering the stream is diluted by large volumes of surface runoff. Water samples collected during May and June had specific conductance values of 354 and 423 micromhos, respectively. These were months in which the stream was fed by snowmelt. During September, when the stream was fed by water from the ground-water reservoir, the specific conductance increased to 658 micromhos. Sodium and bicarbonate ions account for the largest increase in chemical constituents.

Chemical analyses of water from four locations on the South Fork Humboldt River show that the water becomes more mineralized as it moves downstream. The specific conductance increased from 149 micromhos at a sampling site near Lee to 379 micromhos at a sampling site 1 and 1/2 miles above Dixie Creek (sec. 12, T. 32 N., R. 54 E.). Again, sodium and bicarbonate account for most of the increase.

Water Budget

The surface-water and ground-water flow systems in the Huntington Valley area have been modified only to a small extent by the activities of man. As previously mentioned, the principal change has been the diversion of about 38,000 acre-feet of surface water in the area, including 20,000 acre-feet in the Huntington Creek subarea, 10,000 acre-feet in the South Fork Humboldt River subarea, and 8,000 acre-feet in the Dixie Creek-Tenmile Creek subarea. In effect this diversion has modified the system only to the extent of putting to local beneficial use water that formerly was either consumed by native vegetation or flowed from the report area into the Humboldt River. Accordingly, a water budget, showing the gross hydrologic components of the flow system, has been prepared and is given in table 8.

The budget is useful in evaluating two previously unresolved hydrologic elements of the system: the estimated average annual surface-water runoff contribution to the ground-water recharge and the estimated average annual ground-water recharge from underflow from the mountain areas. The first amounts to 18,000 acre-feet of the total estimated average annual recharge of 30,000 acre-feet. The recharge from underflow is the remaining 12,000 acre-feet.

In the water budget many quantities are only approximations, and the larger quantities may be in error as much as the smaller quantities. The fact that there is a general interbalance should not be interpreted as an indication of exactness. For example, no recharge is shown to occur from runoff in the South Fork Humboldt River subarea; all of the recharge is shown to be from underflow from the mountain areas. Because this is an approximation and because both these quantities are small in relation to the other elements of the budget, these and the other indirectly obtained quantities may be in error by a few to several thousand acre-feet.

Perennial Yield

The perennial yield of a hydrologic system is the maximum amount of water of usable chemical quality that can be consumed economically each year for an indefinite period of time. If the perennial yield is continually exceeded, groung-water levels will decline until the ground-water reservoir is depleted of water of usable quality or until the pumping lifts become uneconomical to maintain. Perennial yield cannot exceed the natural replenishment to an area indefinitely and ultimately is limited to the maximum amount of natural discharge that can be salvaged for beneficial use.

For the Huntington Valley area the discharge that is not being utilized for the irrigation of crops is about 90,000 acre-feet per year, which is comprised of 78,000 acre-feet of surface-water outflow, 9,000 acre-feet of subsurface outflow, and about 4,000 acre-feet of nonbeneficial phreatophyte use (tables 5 and 8). In addition, 38,000 acre-feet per year of surface water is diverted for use (surface-water development section) and 17,000 acre-feet per year of ground water subirrigates meadow-land crops (table 5), or a total of about 55,000 acre-feet per year. The upland water losses of 14,000 acre-feet per year (table 8) are not considered to be available for use. Thus, the total water supply to be considered in estimating the yield is on the order of 150,000 acre-feet per year.

For the purpose of this reconnaissance, it is assumed that (1) any substantial increase in surface water diversions or total water use in the area would decrease the surface-water outflow to the main stem of the Humboldt River, which in turn could result in an invasion of downstream water rights; (2) moderate to large-scale pumping throughout the area would not affect appreciably the ground-water outflow; (3) estimated current water use within the area of 55,000 acre-feet per year could be supplied either by the present methods or by pumping from ground water, which would be more costly; and (4) nonbeneficial use by phreatophytes of about 4,000 acre-feet per year could be salvaged by replacement of the vegetative cover, supplemented by pumping, if necessary. Using these limiting assumptions and the foregoing estimates, the minimum yield of the Huntington Valley area is the sum of items (3) and (4), above, or roughly 60,000 acre-feet per year. This is only 40 percent of the total water supply, as defined above.

Table 8.--Preliminary water budget, in acre-feet per year

Budget elements	Huntington Creek subarea	South Fork Humboldt River subarea	Dixie-Tenmile Creek subarea	Total area
SURFACE WATER:				
Runoff from mountains	59,000	54,000	35,000	148,000
Inflow from upstream subareas	+ 0	+ 0	+68,000	--
Subtotal	59,000	54,000	+103,000	--
Diversions for irrigation	-20,000	-10,000	- 8,000	- 38,000
Upland losses	- 7,000	- 1,000	- 6,000	- 14,000
Gaged outflow	-25,000	-43,000	- 78,000	- 78,000
Subtotal	-52,000	-54,000	- 92,000	-130,000
Ground-water recharge from runoff[1/]	7,000	a 0	11,000	18,000
GROUND WATER:				
Evapotranspiration (table 5)	14,000	3,000	4,000	21,000
Subsurface outflow	400	600	9,000	9,000
Pumpage	+ 100	+ 100	+ 200	+ 400
Total discharge (which is equal to total recharge)	14,000	4,000	13,000	30,000
Recharge from runoff[2/]	- 7,000	a- 0	-11,000	- 18,000
Inflow from upstream subareas	- 0	- 0	- 1,000	--
Recharge from underflow from mountains[3/]	7,000	4,000	1,000	12,000
OUTFLOW:				
Surface water	25,000	43,000	78,000	78,000
Ground water	+ 400	+ 600	+ 9,000	+ 9,000
Total	25,000	44,000	87,000	87,000

1. Determined by difference between the inflow and outflow elements.

2. From last entry under "Surface water", above.

3. Determined by difference: Total discharge minus recharge from runoff and inflow from upstream subareas.

a. Although computations suggest no recharge from streams, the actual recharge may be a few thousand acre-feet per year.

Table 9.--Records of selected wells

Owner and/or name: BLM, Bureau of Land Management
Altitude: Estimated from topographic maps
Measuring point: TC, top of casing;
HC, hole in casing
HPB, hole in pump base
PC, plug in casing; F, flowing

Water level: M, measured; R, reported
Use: PS, public supply; D, domestic;
I, irrigation; O, observation;
S, stock; Ind, industrial; U, unused
Remarks: Number is log number in files of Nevada State Engineer

Well number and location	Owner and/or name	Date drilled	Depth (feet)	Diameter of casing (inches)	Principal water-bearing zone (feet)	Altitude (feet)	Measuring point: Description	Measuring point: Above land surface (feet)	Water level: Below measuring point (feet)	Water level: M or R	Water level: Date	Temperature (°F)	Use	Remarks
24/55-36a1	BLM	--	--	6	--	6,160	TC	1.0	156.3	M	10-20-64	--	S	Windmill
24/56-20b1	BLM	--	100	8	--	6,020	--	--	65	R	--	--	S	Windmill
25/56-17c1	BLM, Lee No. 7	1963	--	5	--	6,080	TC	1.2	73.5	M	10-20-64	--	S	Windmill
25/56-32d1	BLM, Lee No. 5	--	--	5	--	6,030	TC	2.0	73.8	M	10-20-64	--	S	Windmill
26/55-12a1	BLM	10-1959	287	6	255-265	5,840	--	--	120	R	10- 1-59	cold	S	4956
27/55-4d1	Ross Young	6-1950	104	6	80-104	5,560	--	--	10	R	6-24-50	--	S	1363
27/56-4b1	BLM, Lindsay Creek Well	5-1955	200	6	185-200	5,980	--	--	186	R	5-28-55	cold	S	3054
							TC	2.0	170.0	M	10-20-64			
27/56-11d1	Goyeneche Ranch	8-1954	178	12	169-172	6,390	--	--	2.5	R	9-10-54	--	I	2732
27/56-11d2	Goyeneche Ranch	5-1954	78	6	26-62	6,390	--	--	22	R	5-20-54	--	S	2573
27/56-11d3	Goyeneche Ranch	9-1953	118	12	70-76	6,390	--	--	77	R	10-18-53	--	I	2394 Bailed 75 gpm at 55 feet. Located 200 feet west of house.
27/57-17a1	Goyeneche Ranch	8-1949	45	8	32-45	5,600	--	--	27	R	8- 5-49	--	S	1041
27/57-18d1	Goyeneche Ranch	9-1950	62	6	35-40	7,200	--	--	35	R	10- 5-50	--	S	1450 About 2 miles up south fork canyon from ranch house.
28/55-11c1	El Jiggs Ranch	8-1949	115	6	10-25	5,510	--	--	10	R	8-27-49	--	S	1068 Windmill
28/55-15a1	--	--	--	10	--	5,515	TC	1.5	5.8	M	10-20-64	--	U	Hand pump
28/56-9d1	Sestenovich Ranch	8-1949	48	6	28-30	5,800	--	--	13	R	8-19-49	--	S	1043
28/56-12b1	Corta Ranch	8-1957	130	6	124-129	5,940	--	--	13	R	8-29-57	cold	D	3866
29/55-19a1	Old Porter Ranch	8-1949	100	6	28-35	5,840	--	--	12	R	9-10-49	--	S	1042
29/56-4a1	Martin and Alfred Arnestoy	3-1955	101	6	12-94	5,680	--	--	12	R	3-16-55	--	D	2890 At Jiggs
29/56-6a1	Circle L Ranch	3-1949	136	5	92-136	5,420	--	--	20	R	3-19-49	--	D	857
29/56-23b1	Barnes Ranch	8-1963	140	8	136-140	5,680	--	--	40	R	8-24-63	cold	S	7374
30/54-1c1	BLM	7-1957	261	--	--	--	--	--	215	R	1957	--	S	In Crane Spring Canyon
30/55-4b1	BLM	--	233	6	--	5,560	TC	+1.5	176.3	M	8- 5-53	--	S	
30/55-15c1	BLM	10-1954	328	6	285-328	5,660	--	--	271	R	10- -64	cold	S	
30/55-26c1	BLM	12-1956	125	6	80-125	5,500	--	--	60	R	12-28-56	--	S	3627
30/55-29d1	BLM	8-1963	499	6	(none)	5,900	--	--	(dry)	-	9- -63	--	U	7450 Dry at 499 feet
30/55-33d1	BLM	10-1963	363	6	(none)	5,600	--	--	(dry)	-	10- -63	--	U	7451 Dry at 363 feet
30/56-16a1	Hansel Ranch	5-1961	274	17,13	130-274	5,510	--	--	38.5	R	5-26-61	58	I	6160 Test pumped 773 gpm at 171 feet
30/56-16a2	Hansel Ranch	8-1959	160	6	127-154	5,500	--	--	19	R	8-12-59	cold	D	5525
30/56-16a3	Hansel Ranch	11-1959	450	16,12,8	54-298	5,500	--	--	5	R	2- -60	cold	I	5522 Test pumped 1,000 gpm at 200 feet
30/56-22d1	Zunino Ranch	8-1959	132	6	107-112	5,590	--	--	15	R	8- 5-59	cold	D	4783
30/56-32a1	El Jiggs Ranch	8-1947	106	6	28-106	5,430	--	--	28	R	9- 7-49	--	S	1066
30/56-32d1	El Jiggs Ranch	9-1948	55	5	9-30	5,450	--	--	9	R	9-10-49	--	D	1065
30/56-34c1	Roy Young	7-1948	108	4	90-108	5,460	--	--	7	R	7-16-48	--	D	591
30/56-36c1	Merkley Ranch	9-1959	99	6	71-80	5,720	--	--	38	R	9-18-59	cold	D	4835
30/57-30b1	Rierdon Ranch	8-1959	61	6	15-40	6,000	--	--	8	R	8-13-59	cold	D	4782
31/55-30d1	Indian Well	--	--	--	--	5,680	--	--	F	-	--	--	-	
31/56-13d1	U.S. Indian Service	--	13.5	60 in.	--	5,720	TC	0.0	9.19	R	11-30-49	--	U	
31/56-16a1	--	--	--	6	--	5,650	TC	1.3	89.65	M	10-21-64	--	S	Gasoline engine
31/56-16c1	--	--	--	6	--	5,700	TC	0.7	91.1	M	10-21-64	--	S	Gasoline engine
31/56-25b1	Tom Kane	9-1949	238	6	205-215	5,830	--	--	185	R	9-20-49	--	D,S	1076
31/57-16d1	Haxen Exetar	10-1959	52	6	42-52	6,000	--	--	9	R	10- 5-49	cold	D	4986
31/57-18c1	Upper South Fork School District	4-1955	112	6	42-49	5,770	--	--	12	R	5- 2-55	--	PS	2970 At Lee
31/57-30d1	L. E. Sleeman	9-1959	298	6	150-172	6,030	--	--	120	R	7-31-59	cold	D	4832
32/55-1b1	Magnuson Ranch	4-1964	180	6	135-180	5,280	--	--	135	R	5- 2-64	cold	S	7887
32/55-14d1	--	--	20	--	--	5,240	--	--	15	R	10-21-64	58	-	
32/56-6c1	BLM	8-1963	370	6	316-370	5,380	--	--	309	R	9-11-63	cold	S	7376
32/56-11b1	BLM, Seacrist Well	11-1960	230	6	202-230	5,540	--	--	164	R	10-14-60	cold	S	5562
32/56-22b1	BLM, South Fork Well	9-1959	250	6	210-245	5,560	--	--	201	R	9-25-59	cold	S	4957
32/56-32c1	LDS Church	2-1960	120	6	3-30	5,360	--	--	4	R	2-24-60	cold	D	5091
33/56-1d1	BLM, Faught Well	10-1960	258	6	179-258	5,600	--	--	179	R	10- -60	cold	S	5541
33/56-8d1	Tenmile Ranch	--	11.5	3½ ft.	--	5,290	TC	.5	8.2	R	10-28-46	--	D	
									9.1		10-28-48			
									8.0		10-28-50			
									9.6		9-28-52			
									9.1		10-28-54			
									6.7		10-28-56			
									9.7		9- 6-58			
									11.48		8-16-60			
									9.6		10-21-64			
33/56-16b1	Tenmile Ranch	--	--	6	--	5,310	TC	+1.0	13.4	M	10-21-64	--	S	
33/56-16b2	Tenmile Ranch	5-1959	404	14	268-404	5,310	--	--	12	R	7- 9-59	cold	I	4763 Test pumped 1,000 gpm at 110 feet
33/56-16d1	Tenmile Ranch	5-1955	450	12,10	160-395	5,320	--	--	14	R	6-24-55	cold	I	3035 Test pumped 680 gpm at 120 feet
33/56-21c1	BLM, Tenmile Well	11-1960	177	6	162-177	5,380	--	--	70	R	11-14-60	cold	S	5589
							TC	1.7	81.4	M	10-21-64			

Table 9.--(continued)

Well number and location	Owner and/or name	Date drilled	Depth (feet)	Diameter of casing (inches)	Principal water-bearing zone (feet)	Altitude (feet)	Measuring point: Description	Measuring point: Above land surface (feet)	Water level: Below measuring point (feet)	M or R	Date	Temperature (°F)	Use	Remarks
33/56-26a1	BLM	9-1963	122	6	58-122	5,460	--	--	65	R	9-14-63	cold	S	7377
33/56-31b1	TeMoak Indian Reservation	11-1960	129	6	110-129	5,320	--	--	40 42.8	R M	11- 7-60 10-21-64	cold	S	5563
33/56-33b1	BLM, TeMoak Well	5-1956	156	6	115-156	5,370	TC	1.5	79.3	M	10-21-64	--	S	Windmill
33/56-35b1	TeMoak Indian Reservation	10-1960	78	6	41-78	5,430	--	--	40	R	10-27-60	cold	S	5536
33/57-6d1	BLM	8-1951	210	6	174-202	5,480	--	--	125	R	8-23-51	--	S	1726
33/57-8c1	Fred Hogrelius	7-1950	88	4	53-88	5,500	--	--	50	R	7-18-50	--	D	1388
33/57-22d1	Sutacha	--	59.7	18	--	5,780	TC	1.2	39.1 39.9 39.3 41.8		9-24-48 10-28-50 10-28-52 10-28-54	--	D	
33/57-30d1	Fay E. Detwriler	7-1953	150	6	80-96	5,580	TC	0.0	11.3	M	10-21-64	--	D	2331
34/56-14c1	BLM, Burn Basin Well	6-1948	375	6	296-325	5,460	--	--	200	R	6- -48	--	S	435
34/56-26b1	BLM	4-1960	265	6	95-253	5,400	--	--	95	R	4-23-60	--	S	5357

Table 10 -- Selected Drillers' Logs of Wells

Material	Thickness (feet)	Depth (feet)
26/55-12a1		
Soil	1	1
Gravel, cemented	3	4
Clay and gravel	106	110
Gravel, coarse and clay	15	125
Clay and sand	130	255
Gravel, coarse and clay	10	265
Clay and gravel, fine	22	287
27/55-4d1		
Gravel	15	15
Clay, sandy	65	80
Sand	24	104
27/56-4b1		
Boulders and clay	45	45
Gravel and clay	12	57
Boulders and clay	78	135
Gravel and clay	50	185
Gravel	15	200
27/56-11d1		
Clay	14	14
Rocks	16	30
Clay, yellow	32	62
Boulders	1	63
Clay, yellow	16	79
Boulders	1	80
Clay, yellow	89	169
Gravel, loose rocks	3	172
Limestone, hard	6	178
28/55-11c1		
Clay	10	10
Sand and gravel	15	25
Clay, sandy	14	39
Gravel	1	40
Clay, sandy	47	87
Sand and gravel	28	115
28/56-12b1		
Clay	25	25
Sand	5	30
Clay, yellow and gravel, mixed	55	85
Sand	10	95
Clay, sandy	29	124
Sand and gravel	5	129
Clay, yellow	1	130
29/55-19a1		
Clay, yellow	17	17
Gravel and clay	11	28
Gravel	7	35
Clay, yellow	10	45
Gravel and clay mixed	22	67
Gravel	8	75
Clay	7	82
Gravel	5	87
Gravel and clay mixed	13	100
29/56-4a1		
Clay	2	2
Boulders and gravel	10	12
Sand, yellow	82	94
Sand, gray	7	101

Material	Thickness (feet)	Depth (feet)
29/56-23b1		
Topsoil	8	8
Gravel, water-bearing	4	12
Clay	50	62
Gravel, non-water-bearing	4	66
Clay	68	134
Hardpan	2	136
Gravel, water-bearing	4	140
30/55-15c1		
Gravel and clay	22	22
Sandstone, brown	42	64
Gravel and clay	221	285
Sandstone, brown, soft	43	328
30/55-29d1		
Clay, brown and gravel	38	38
Rock, brown	3	41
Clay, brown	7	48
Rock, brown	3	51
Gravel, dirty, water-bearing	262	313
Gravel, brown, dirty	7	320
Clay, brown and gravel	70	390
Bentonite, white	17	407
Clay, brown, sticky	92	499
30/55-33d1		
Topsoil	3	3
Clay, brown	57	60
Clay, gray, hard	303	363
30/56-16a3		
Topsoil, sandy	7	7
Sand and gravel	2	9
Sand, clay, and gravel	21	30
Sand and clay	64	94
Sand and gravel	3	97
Clay, sandy	13	110
Sand and gravel	4	114
Clay and gravel strips	21	135
Sand, white	2	137
Sand and gravel	11	148
Clay, brown and sand	17	165
Sand and gravel	3	168
Clay and sand	2	170
Gravel	3	173
Clay	7	180
Gravel and sand	4	184
Clay and sand	30	214
Gravel and sand	4	218
Clay and sand	7	225
Gravel and sand	2	227
Clay	1	228
Gravel and sand	3	231
Clay, white	4	235
Clay and sand	10	245
Gravel and sand	3	248
Clay and sand	5	253
Clay and gravel	2	255
Gravel, clean	8	263
Gravel and sand	7	270
Clay and gravel streaks	26	296
Sand and gravel	4	300
Silt and sand	47	347
Sand and gravel	4	351
Clay and sand	19	370
Sand and gravel	6	376
Clay, sandy	22	398
Sand	4	402
Clay and sand	13	415
Sand	3	418
Silt and sand	32	450

Table 10 Cont.

Material	Thickness (feet)	Depth (feet)
31/56-25bl		
Clay, hard	15	15
Boulders	3	18
Gravel	54	72
Clay, yellow	10	82
Gravel	9	91
Clay	7	98
Gravel and clay, mixed	55	153
Clay	15	168
Gravel	9	177
Clay, sandy	28	205
Sand and gravel	10	215
Clay, sandy	23	238
31/57-30dl		
Topsoil, rocky	7	7
Sand	18	25
Clay, sandy	35	60
Granite, decomposed	45	105
Clay, sandy	17	122
Granite, decomposed	33	155
Clay, water-bearing	17	172
Granite, decomposed	118	290
Granite, hard	8	298
32/56-6cl		
Clay, gray, sandy	316	316
Sand, brown, fine, water-bearing, becomes coarser toward bottom	54	370
32/56-11bl		
Clay, gray and sand	124	124
Sand	4	128
Clay, gray and sand	47	175
Clay, brown and sand	27	202
Gravel and sand	28	230
32/56-22bl		
Clay and sand	100	100
Clay and gravel	40	140
Clay and sand	70	210
Sand and gravel	35	245
Clay and gravel	5	250
33/56-1dl		
Sandstone, soft	132	132
Sandstone, blue	70	202
Sandstone, brown	56	258
33/56-16dl		
Clay, yellow	20	20
Sand and gravel	35	55
Clay, yellow	105	160
Clay, blue	166	326
Sand and gravel	2	328
Clay, blue, sandy	67	395
Clay, blue	55	450
33/57-30dl		
Clay, yellow, hard	13	13
Clay, yellow, soft, sandy	19	32
Clay, blue	23	55
Clay, yellow	25	80
Gravel and clay	16	96
Clay, blue	54	150

Table 10 Cont.

Material	Thickness (feet)	Depth (feet)	Material	Thickness (feet)	Depth (feet)
34/56-14c1					
Clay, hard and gravel	30	30			
Clay, greenish, sandy	12	42			
Clay, yellow and gravel	63	105			
Clay, white	10	115			
Clay, red	2	117			
Clay, yellow	14	131			
Shale, gray, sandy	24	155			
Shale, blue, soft	20	175			
Shale, black	83	258			
Shale, brown	10	268			
Shale, light gray	28	296			
Shale, brown, sandy	29	325			
Shale, light gray, sandy	15	340			
Shale, light gray, sticky	14	354			
Shale, brown, hard	6	360			
Lime, sandy	15	375			

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UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

PLATE 1.—GENERALIZED HYDROGEOLOGIC MAP OF THE HUNTINGTON VALLEY AREA, ELKO AND WHITE PINE COUNTIES, NEVADA