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Geology and Ground-Water Resources of Quinn River Valley, Humboldt County, Nevada

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FOREWORD

This is the fourteenth in a series of bulletins prepared by the Geological Survey, United States Department of the Interior, under cooperative agreement with the State of Nevada.

The Quinn River Valley, Humboldt County, Nevada, has for many years supported a well-established agricultural economy, based on irrigation from numerous streams which flow into and through the valley. An expanded agricultural economy is now developing from the use of ground water.

This publication should be of interest and value to various administrative bodies and the public, as it provides much of the basic information needed to carry on an orderly program for maximum development of the area by use of this new ground-water resource.

EDMUND A. MUTH,
State Engineer.

August 12, 1958

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ABSTRACT

The Quinn River Valley is a northerly trending intermontane trough about 90 miles long and from 12 to 40 miles wide. Most of it is in the northeastern part of Humboldt County, Nevada, but the northern end extends into Malheur County, Oregon. The climate is arid to semiarid. Precipitation ranges from somewhat less than 9 inches on the valley floor to more than 20 inches in the vicinity of the highest peaks. The valley is bounded on the east by the Santa Rosa Range, and on the south by unnamed hills extending westward from Winnemucca Mountain. The southern part of the western boundary is formed by the Slumbering Hills, and the northern part by the Quinn River Mountains and the White Horse Mountains. Low hills joining the Santa Rosa Range and White Horse Mountains form the northern boundary.

Two major streams, McDermitt Creek and the East Branch of the Quinn River, enter the valley near its north end. These streams combine with Washburn Creek and the drainageways from Oregon to form the Quinn River, which then flows southerly to its exit from the valley, the gap between the Slumbering Hills and the Quinn River Mountains.

The mountain ranges are composed of rocks in which ground water generally does not circulate freely. These rocks are indurated and metamorphosed sediments, igneous intrusives, and lava flows. The valley fill is composed largely of unconsolidated or poorly consolidated sediments, some of which are important aquifers. These sediments consist of clay, silt, sand, and gravel.

The aquifers within the valley fill are recharged mainly by the infiltration of water from streams and from the percolation of irrigation water below the root zone. It is estimated that the annual recharge to the ground-water reservoir averages about 24,000 acre-feet.

Under natural conditions ground water is discharged mainly by evaporation from the land surface and by the transpiration of phreatophytes. The phreatophytes include greasewood, saltgrass, rye grass, rabbitbrush, willows, buckbrush, and alfalfa. It is estimated that the natural discharge of ground water is about 25,000 acre-feet annually. About 5,000 acre-feet of ground water was discharged from 18 irrigation wells in 1955. This water was in addition to the water discharged by evapotranspiration.

The amount of ground water that can be developed on a perennial basis depends largely on the amount of the natural discharge that can be diverted to wells that presently is being evaporated or transpired by phreatophytes having little or no economic value. In the McDermitt area, near the northern end of the valley, this potential development amounts to about 2,000 acre-feet per year. In the Home Ranch area, in the west-central part of the valley, about 8,000 acre-feet of ground water could be salvaged annually by lowering and maintaining the water table and the capillary fringe above it below the root zone.

Native vegetation having a low economic value uses about 7,000 acre-feet of water annually in the Orovada area in the east-central part of the valley. In order to salvage all this water the water table throughout that area would have to be lowered to a level below the valley floor. In the Davey Town area, the potential development is negligible.

Except for being somewhat hard, all the water that was analyzed appeared to be satisfactory for stock and domestic use. Most of the water was satisfactory for irrigation also. Several samples, however, had a high salinity which would require special practices for salinity control and the selection of salt tolerant crops.

GEOLOGY AND GROUND-WATER RESOURCES OF QUINN RIVER VALLEY, HUMBOLDT COUNTY, NEVADA

By F. N. Visher

INTRODUCTION

Purpose and Scope of the Investigation

This investigation of the geology and ground-water resources of Quinn River Valley (fig. 1) is part of the Statewide program of the U. S. Geological Survey in cooperation with the State Engineer of Nevada for evaluating the ground-water resources of the State. The U. S. Geological Survey is represented in the joint program by O. J. Loeltz, District Engineer for the Ground Water Branch in Nevada, and the State by Edmund A. Muth, State Engineer.

O. J. Loeltz and D. A. Phoenix began a study of the area in 1947, at which time most of the available hydrologic data were compiled. Some additional hydrologic data were gathered between 1947 and 1954 by O. J. Loeltz, J. L. Poole, T. W. Robinson, and C. P. Zones. In July 1954 the author began a program of intensive field work which included the gathering of the remaining significant hydrologic data and reconnaissance mapping to show the bedrock-alluvium contact, the contact between the younger and older alluvium, and the approximate toe of the alluvial fans. The mapping was done on aerial photographs at a scale of 1 inch to the mile and later was used in the preparation of plate 1. The field work included also the examination of a sufficient number of bedrock exposures to confirm the observations of previous investigators. Field work was completed in the fall of 1955.

The greater part of the report is devoted to a discussion of ground water—its occurrence, recharge, movement, discharge, chemical quality, and utilization. The geology and water-bearing characteristics of the rocks also are discussed, inasmuch as the geology controls the occurrence and movement of ground water.

Acknowledgment

The cooperation of all the residents of the valley in supplying data concerning their wells and allowing measurements and tests to be made is very much appreciated.

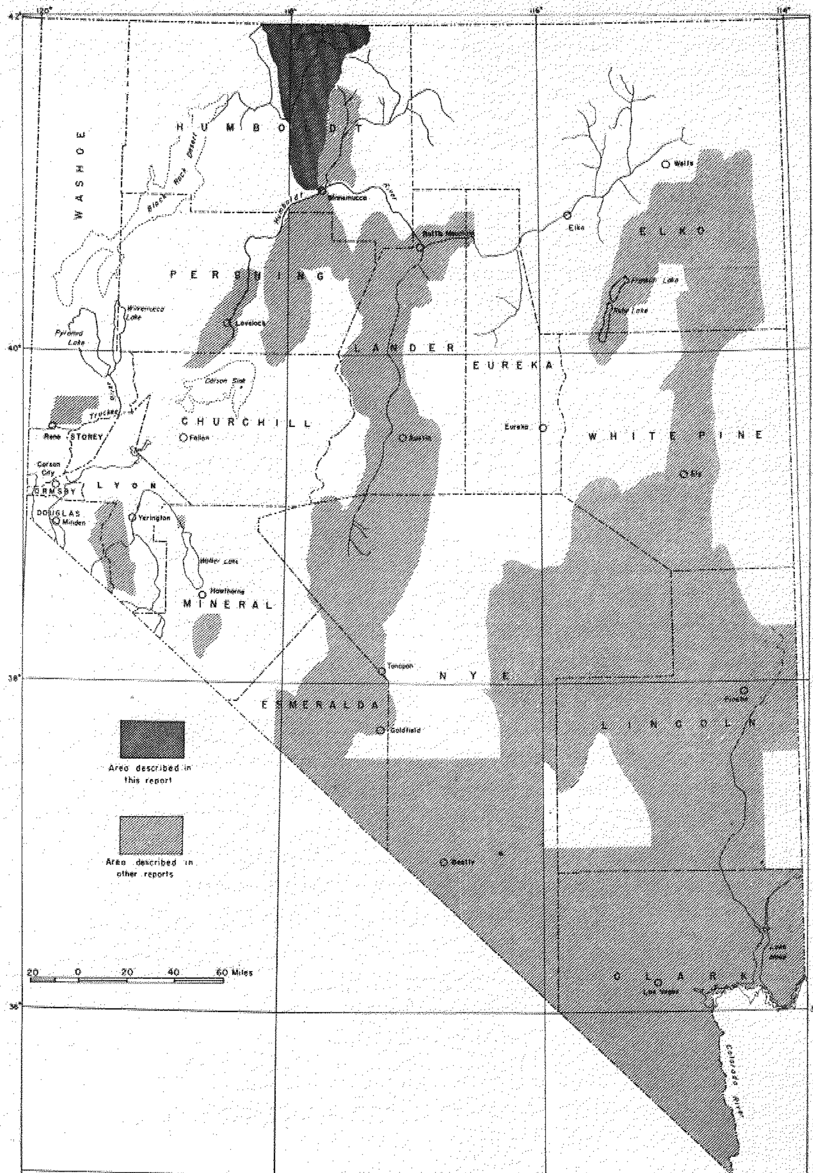

FIGURE 1. Map of Nevada showing areas described in other ground-water reports and in the present report.

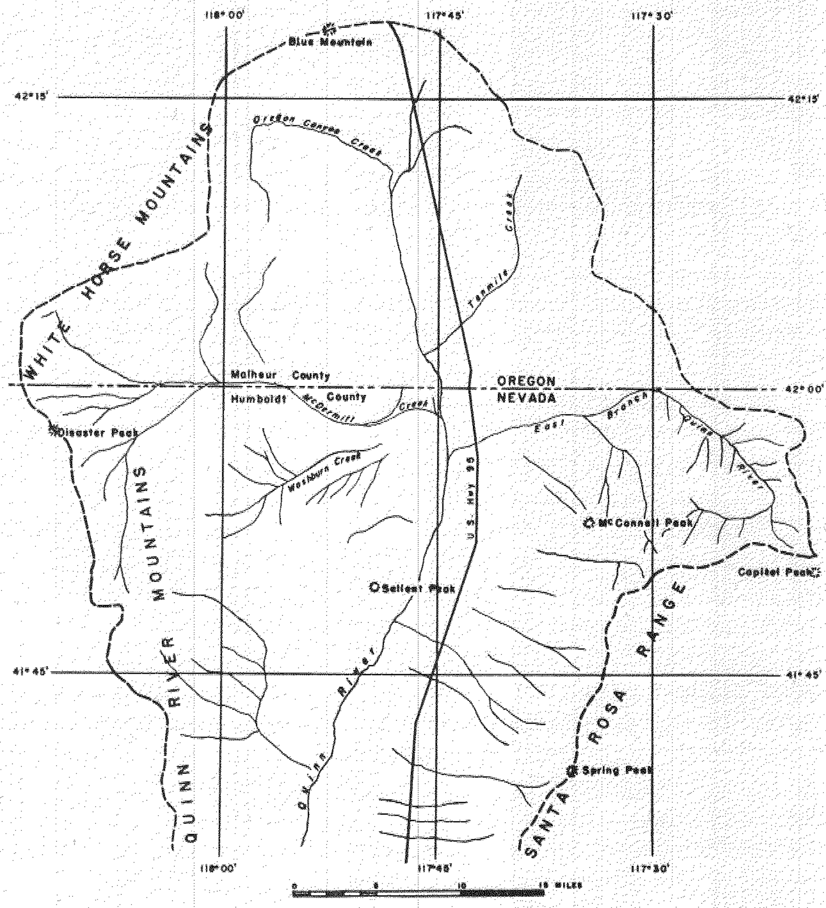

FIGURE 2. Map of the headwaters of the Quinn River in Malheur County, Oregon, and Humboldt County, Nevada.

Geographical Sketch

Most of Quinn River Valley is in Humboldt County in northern Nevada (see fig. 1), but a small part extends into Malheur County in Oregon (see fig. 2). The valley is a northerly trending intermontane trough about 90 miles long which ranges in width from 12 miles at the south end to 40 miles at the Nevada-Oregon boundary. It has an area of about 2,300 square miles. It is bounded on the east by the Santa Rosa Range and on the south by unnamed hills extending westward from Winnemucca Mountain. The southern part of the western boundary is formed by the Slumbering Hills, and the northern part by the Quinn River Mountains in Nevada and the White Horse Mountains in Oregon. Locally the southern part of the Quinn River Mountains is called the Double "H" Mountains. The northern boundary is formed by low hills between the Santa Rosa Range and the White Horse Mountains.

The Quinn River is formed about 4 miles south of the Nevada-Oregon boundary by the union of the East Branch of the Quinn River, and McDermitt, Washburn, and other creeks. The river flows in a southerly direction for a distance of about 40 miles and then flows westward through a narrow gap between the Quinn River Mountains and the Slumbering Hills.

McDermitt, a small community on the Nevada-Oregon boundary, is a local supply center for the ranchers and miners in the area. The only other commercial establishment is a general store and filling station at Orovada, about 30 miles south of McDermitt. Davey Town, in the southern part of the valley, is a newly reactivated mining camp. Sod House, which is in the gap where the Quinn River leaves the area, is a former way station on the old stage line through the area. On the basis of the 1950 census and the subsequent growth in population it is estimated that there are about 600 inhabitants in the valley.

U. S. Highway 95, which connects Winnemucca and southeastern Oregon and southwestern Idaho, enters the area via a low pass in the Santa Rosa Range about 25 miles north of Winnemucca. It then continues northward along the east side of the valley until it leaves the valley via Blue Mountain Pass. State Highway 8A branches from U. S. Highway 95 at a point about 7 miles north of where U. S. Highway 95 enters the valley and then extends westward across the valley through the gap at Sod House. The nearest railroads are the Southern Pacific and the Western Pacific, both of which pass through Winnemucca.

Previous Investigations

Liberal use has been made by the author of the published results of a number of previous investigations in the area. The first of these investigations was made by Russell (1885). His published report describes in considerable detail the geologic history of Lake Lahontan, a Quaternary lake of northwestern Nevada. Lindgren (1915) studied the National Mining district, which lies on the west side of the north-central section of the Santa Rosa Range. In addition to the detailed description of the district, there is also an excellent general description of the geology and structure of the Santa Rosa Range.

A reconnaissance study of ground-water conditions in Quinn River Valley was made by Bryan (1923). A report by Calkins (1938) on the gold deposits of the Slumbering Hills includes a general description of the rocks in the area.

Yates (1941) reported on the quicksilver deposits west of McDermitt. His report describes the geology of the area and includes a geologic map of much of the McDermitt Creek drainage area. Pertinent parts of this map, with some modifications, were used in the preparation of plate 1.

Numbering System for Wells

The number assigned to a well in this report both identifies and locates the well. The number is based on the Bureau of Land Management system of land division. A typical number consists of three units. In Nevada the first is the township number north of the Mount Diablo base. The second unit, separated from the first by a slant, is the range number east of the Mount Diablo meridian. The third unit, preceded by a dash, is the section number. This is followed by an uppercase letter to denote the quarter section in which the well is located. The letters A, B, C, and D designate, respectively, the northeast, northwest, southwest, and southeast quarter sections. The consecutive numbers beginning with 1 show the order in which the well was recorded in the quarter section. For example, the number 44/37–9D2 designates the second well recorded in the SE¼ sec. 9, T. 44 N., R. 37 E., Mount Diablo base and meridian. In Oregon, the first number is the township number south of the Willamette base. The second number followed by an E is the range number east of the Willamette meridian.

On plate 1 only that part of the number designating the quarter section and the order in which the well was recorded in the quarter section is shown. The section number can be ascertained from the corresponding section number in T. 37 N., R. 36 E. Township and range numbers are shown on the edges of the plate.

CLIMATE

Quinn River Valley has an arid to semiarid climate. Precipitation on the valley floor is somewhat less than 9 inches annually, whereas the evaporation rate is probably between 40 and 50 inches a year. However, in the bordering mountains precipitation rates are higher, generally increasing with altitude. For example, in the vicinity of the highest peaks the precipitation has been estimated to exceed 20 inches a year (Hardman, 1936).

Most of the precipitation in the mountains occurs as snow, although occasionally rain in the spring or fall contributes substantially to the total precipitation. Because only a small percentage of the total precipitation occurs during the late spring and summer months, it is usually necessary to irrigate all crops, even those having low moisture requirements. The relative humidity is normally low, and there is an abundance of sunshine. The prevailing wind is from the west and is strongest during late spring and early summer.

The U. S. Weather Bureau records precipitation at only two localities in the area—Orovada and McDermitt. The station at Orovada has been in operation since 1912 and the one at McDermitt since 1950. Table 1 shows the average monthly precipitation at Orovada, at McDermitt, and at Quinn River Crossing, which is about 40 miles west of the area.

TABLE 1

Average monthly precipitation, in inches, at selected climatological stations

	Orovada (Altitude, 4,300 feet; period of record, 1912–1950)	McDermitt (Altitude, 4,427 feet; period of record, 1950–1955)	Quinn River Crossing (Altitude, 4,087 feet; period of record, 1929–1955)
January	1.05	1.06	.94
February	1.12	.91	.74
March	.99	.70	.55
April	1.21	.63	.36
May	1.32	.99	.46
June	1.12	.84	.40
July	.28	.19	.18
August	.24	.13	.20
September	.43	.57	.34
October	1.08	.13	.43
November	.93	.43	.38
December	.95	1.26	.66
Totals	10.72	7.84	5.64

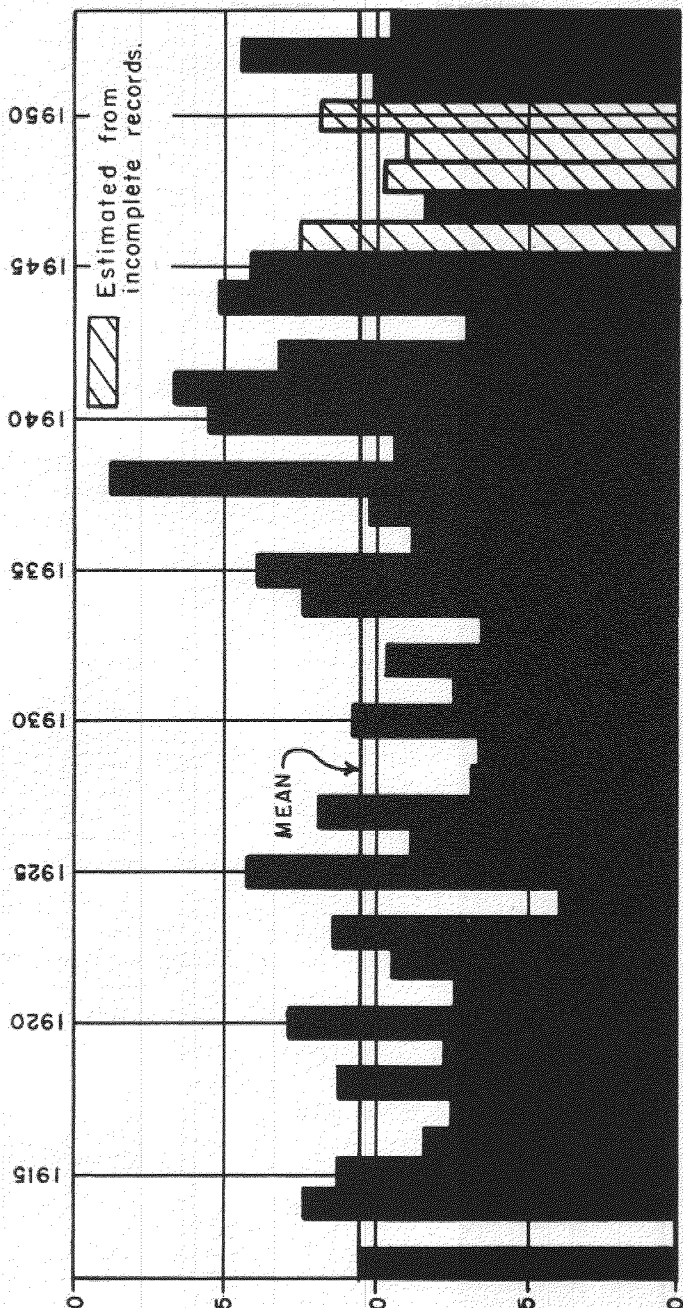

FIGURE 3. Precipitation at Orovada, Nevada, 1912–1953.

At Orovada the months of July, August, and September are considerably drier on the average than the other months. The record at McDermitt probably is too short to show the true monthly pattern.

Figure 3 shows the annual precipitation, in inches, at Orovada, as recorded by the U. S. Weather Bureau for the period 1912 to 1953, inclusive.

Temperature records have been kept at Orovada since 1932 and at Quinn River Crossing since 1924. The average monthly and the average annual temperatures are given for these stations in table 2. The range of the daily temperature is about 20 degrees in the winter and about 40 degrees in the summer. The average growing season is 105 days, June 3 to September 16 (Houston 1950, p. 13).

TABLE 2

Average temperature, in degrees Fahrenheit, at Orovada, and Quinn River Crossing, Nevada

	Orovada (Period of record, 1932–1950)	Quinn River Crossing (Period of record, 1924–1950)
January	28.0	25.2
February	33.8	31.6
March	39.9	40.0
April	47.0	46.8
May	55.2	54.0
June	61.8	61.6
July	72.1	69.6
August	69.2	67.2
September	60.0	57.6
October	50.1	46.6
November	38.7	36.7
December	30.8	26.9
Annual	48.9	47.0

PHYSIOGRAPHY AND DRAINAGE

Most of Quinn River Valley is in the northern part of the Basin and Range physiographic province. The northern part of the Santa Rosa Range, however, is a plateau and lies in the Columbia Plateau physiographic province.

Mountains

The Santa Rosa Range, which borders the east side of Quinn River Valley, is the highest mountain range in the area. For most of its length the range is less than 9 miles wide. However, about 4 miles north of Spring Peak the range broadens into a high lava plateau. The highest and most rugged portion of the range is east of Orovada where altitudes of more than 9,000 feet above mean sea level are common. Santa Rosa Peak, the highest peak in the range, is more than 9,600 feet above mean sea level and more than 5,000 feet above Orovada. Spring Peak, 7 miles north of Santa Rosa Peak, is 9,400 feet above mean sea level. Other prominent landmarks in this range, but considerably lower in altitude, are Bloody Run Peak and Winnemucca Mountain, both of which are in the southern part of the range. North of Winnemucca Mountain, the range crest is formed by low hills locally covered by sand dunes. The range crest then rises abruptly to the summit of Bloody Run Peak, northwest from which altitudes generally above 7,000 feet prevail for a distance of 10 miles. The crest then falls to the lower altitude of Paradise Hill Pass, but it rises to altitudes generally greater than 8,000 feet north of the pass to the vicinity of Santa Rosa and Spring Peaks. From Spring Peak northward the range broadens into a lava plateau at somewhat lower altitudes. Several prominent peaks such as Buckskin Peak, McConnell Peak, and Capitol Peak, rise above this plateau.

The Slumbering Hills, which form the southern part of the western boundary of the valley, are a subdued mountain range, the crest of which is slightly more than 6,000 feet above sea level. Sombrero Peak, the highest peak in the range, has an altitude of more than 6,400 feet and is about 2,050 feet above the floor of the valley.

The Quinn River Mountains rise and broaden from a low cuesta north of Sod House, where the Quinn River flows from the area, to a plateau, the highest parts of which are almost 3,000 feet above the floor of the valley and more than 7,000 feet above mean sea level. The range culminates at the Nevada-Oregon boundary in a small mesa that is more than 8,200 feet above mean sea level. South of this mesa is Disaster Peak, an outlier whose maximum altitude is about 7,500 feet. The Quinn River Mountains generally are rather subdued and rise gradually from the floor of the valley. However, near the northern end of the valley for a distance of about 10 miles the edge of the plateau rises abruptly to a height of almost 2,000 feet above the floor of the valley. At the south end of this section is a prominent point which has been named Salient Peak.

Streams

The two major streams that enter the Quinn River Valley are McDermitt Creek and the East Branch of the Quinn River. McDermitt Creek enters the valley near the Nevada-Oregon boundary about 6 miles southwest of the town of McDermitt.

The East Branch of the Quinn River enters the valley about 6 miles southeast of the town of McDermitt. The drainage basin of McDermitt Creek includes 270 square miles in the Quinn River Mountains. The East Branch of the Quinn River drains about 150 square miles of the plateau at the northern end of the Santa Rosa Range. These streams combine with Washburn Creek and other drainageways from Oregon to form the Quinn River.

The Quinn River then flows southerly to its exit from the valley, the gap between the Slumbering Hills and the Quinn River Mountains. The river eventually discharges onto the playa of the Black Rock Desert, some 30 miles distant, where all flows evaporate. However, the river seldom flows beyond Sod House. Trout Creek, which is sometimes referred to as Crowley Creek, is the only tributary from the west to the Quinn River below its headwaters. The principal tributaries from the east in downstream order are Eight Mile Creek, Twelve Mile Creek, Canyon Creek, Pole Creek, and Flat Creek. Farther south the streams are not tributary to the Quinn River, but rather discharge onto playas east of the river. From north to south these streams are Willow, Rebel, and Rock Creeks, as well as many smaller creeks. As shown on plate 1 all the major streams are perennial in their headwaters and become intermittent or ephemeral in their lower reaches.

Alluvial Fans and Valley Floor

Alluvial fans have been built along the base of the ranges bordering Quinn River Valley. The largest fans are on the east side of the valley on the western slope of the Santa Rosa Range where they extend as much as 7 miles from the mouths of the canyons. The profile of the slope normal to the range front in the upper part of these fans may be slightly convex, slightly concave, or straight; however, in the lower parts of the fans the slopes are uniformly concave upward and in most places they merge imperceptibly with the valley floor. The line showing the toe of the fans on plate 1 is necessarily only an approximation of the true location of the toe of the fans.

In the northern part of the area the fans are cut by numerous fault scarps which parallel the mountain front. Some of these fault scarps are shown on plate 1. The fans generally are deeply incised, often to depths of 50 to 100 feet, by streams that cross these fault scarps. The apexes of the fans in other parts of the area also are incised somewhat, but it is thought that this erosion is not related to faulting.

The valley was inundated by Lake Lahontan. Bars and beaches are common features especially in the central part of the valley where the lake was deepest. The highest discernible shoreline, at an altitude of about 4,350 feet, is best defined on the fans along the east side of the valley, and is shown as a solid line on plate 1. Below this line are numerous other shoreline features, most of which are more prominent than the high shoreline.

The valley floor varies from a simple flood plain less than a mile wide east of Salient Peak to a gently sloping lake bed nearly 10 miles wide where State Highway 8A crosses the valley. The Nevada portion of the valley floor is 66 miles long and has an area of about 270 square miles. A belt of sand dunes traverses the valley through T. 37 N. The shape of the dunes and their direction of migration indicate they were formed by prevailing westerly winds.

GEOLOGY

Late Tertiary and Quaternary Geologic History

Knowledge of the late Tertiary and Quaternary geologic history of Quinn River Valley is important for a clear interpretation of the occurrence of ground water in the area. The geologic processes involved in the development of the valley explain the presence of the important water-bearing materials underlying the valley floor and help to indicate their distribution. On the basis of published literature and of general field relationships, it is believed that the geologic history is as follows:

1. During early Miocene time basalt and other types of flow rock were distributed over a large part of north-central Nevada.
2. During the late Miocene and Pliocene epochs these flow rocks were faulted and folded, producing the present general form of Quinn River Valley. The faulting was accompanied by continued volcanism and the deposition of tuffaceous fan and lake sediments with local interbedded lava flows. Perhaps several thousand feet of these sediments were deposited.
3. In late Pliocene and early Pleistocene time intensification of faulting was accompanied by a reduction in volcanism and a regional tilting toward the west. These were accompanied by continued deposition of sediments over much of the area. The basin was one of internal drainage and a lake probably existed.
4. In the middle Pleistocene epoch the valley overflowed to the west and the Quinn River incised itself into the basin fill. The material eroded from the valley was deposited in the basin to the west eventually causing a rise in the base level of the Quinn River and the consequent alluviation of the lower part of

the inner valley. During this time faulting and alluvial fan development continued.

5. In late Pleistocene time there were several advances and retreats of Lake Lahontan, which resulted in the deposition of a thin veneer of lake sediments on the floor of the valley and the carving of shoreline features at higher elevations.

Stratigraphy and Structure of the Ranges

The only published material on the general geology of the Santa Rosa Range is the work of Lindgren (1915). The following is quoted from his report (p. 10–12):

> Geologically the Santa Rosa Range is really a "terra incognita." The maps of the Fortieth Parallel Survey extended only as far north as Winnemucca, at latitude 41°. The outcrops on the north side of the river close to Winnemucca are, on these maps, indicated as "Jurassic (?)."
>
> Considered geologically . . . . the range may be divided into two parts. The northern and northeastern parts consist of Tertiary basalt, in many flows, one superimposed upon another, after the manner of the Miocene Columbia River basalt, with which these flows should, in fact, be correlated. A few flows of rhyolite are intercalated in the flows of basalt, which is also intersected by dikes of rhyolite. Flows of latite and trachyte form minor parts of the series.
>
> This Tertiary part of the range begins abruptly just north of Canyon Creek, where the basalts lie on lustrous clay slates. North of this point no older rocks are seen. The contact runs southeastward from the head of Canyon Creek, and probably the whole northeastern part of the range northeast of Spring Peak and Thimble Peak is built up mainly of basalt. The flows as a whole dip northeastward at angles ranging from 8° to 15°. A certain dependence of topography on geology is manifest in this part of the range. Although the western slope is rough and steep, the eastern side tends to form a dissected plateau, sloping gently from the summit; for instance, at the head of Eightmile Creek and at the State line, as noted above, the range has changed into a plateau with a western scarp.
>
> Lava flows are seen again on the west side of Quinn River valley, in the steep slope of Salient Creek [Peak]. The persistent northeasterly dip of the lavas indicates doming, and it is probable that the upper part of the Quinn River valley in the latitude of National represents a sunken slice of this dome. It is difficult to interpret the structure of this northern part of the range without assuming doming and faulting, although the western slope of the range now shows no topographic indications of a fault.
>
> The southern and larger end of the range is free from volcanic rocks except a few small basaltic flows close to the Humboldt River near Winnemucca. The narrow ridge is topographically symmetrical down to the line where the older rocks are covered by the wash, and there are no topographic indications of faulting.

> The range is built up of clay slates, calcareous slates, and some limestone. These sedimentary rocks trend north, parallel to the range, and are strongly folded and compressed.
>
> At the south end of Winnemucca Mountain, at the Pride of the West mine, there are calcareous slates, in part metamorphosed to hornfels, with strata of gray limestone. On the west side of the mountain there are clay slates of varying strike and dip. A very similar series of rocks occupies the larger part of the southern range as far north as Flynn station. [Near the east end of the pass through which U. S. Highway 95 enters Quinn River Valley.]
>
> Well-preserved fossils found at the Pride of the West mine were identified by T. W. Stanton as *Pseudomonotis subcircularis* Gabb, which is characteristic of the Upper Triassic. There is little doubt that the greater part of the sedimentary rocks of the range are of Triassic age. No intercalated Triassic lavas similar to those of the Humboldt Range were observed.
>
> Lustrous clay slates form the most common "float" along the western foot of the range. Along Canyon Creek a few miles south of National the smooth clay slates strike north and dip 50°–80° E.
>
> The sedimentary rocks are intruded and metamorphosed by at least five stocks of granodiorite or quartz monzonite, all of which are probably of post-Triassic age.
>
> A small mass of intrusive diorite occurs on Winnemucca Mountain and is especially conspicuous on its steep eastern slope. A second much larger intrusive mass lies near Bloody Run Peak. A third mass is found in the southern part of the range north of Flynn Station. A fourth and fifth stock lie near Rebel Creek and on Spring Mountain. None of these stocks was investigated in detail.

Evidences of faulting in the northern part of the area which Lindgren did not note are readily apparent on aerial photographs. These faults add credence to his theory concerning the structure. The field work done by the author was insufficient to evaluate further or to add substantially to the work of Lindgren.

The geology of the Slumbering Hills is summarized by Calkins (1938, p. 9–11) as follows:

> The Slumbering Hills lie in a region whose geology is little known. Their southern end is several miles north of the area mapped by the Fortieth Parallel Survey, and they were not included in any of the areas examined by the several geologists of the United States Geological Survey who have worked in Nevada . . . .
>
> The rocks forming the northern part of the range are, in order of age: (1) a thick sedimentary formation, which has been moderately metamorphosed; (2) quartz monzonite intrusive into this formation; (3) lacustrine (?) beds, of small areal extent; and (4) lava flows. The old sedimentary rocks are carved into mature erosion forms of moderate steepness; the granite intrusive is, on the whole, less resistant to erosion, and the central portion of the range, in which it crops out, is the lowest. The lacustrine (?) beds

are soft, deeply eroded, and poorly exposed. The most rugged erosion forms, including prominent buttes on the summit and west slopes of the hills, are carved from the lavas . . . .

The southern part of the range was not visited, but from a distance it can be seen to consist mainly of dark, resistant rocks that are probably lavas, though some have a massive appearance and may be intrusive.

The geology of the area west of McDermitt is described by Yates (1941, p. 323–327) as follows:

The steeply scarped, plateaulike character of the Southern White Horse Mountains is the result of block faulting in a thick sequence of nearly horizontally bedded Miocene lavas, and the basin-like drainage area of McDermitt Creek, which includes most of the Opalite district, roughly coincides with a down-faulted block of lavas. No rocks older than Tertiary are exposed in the area mapped, but immediately to the southwest the lavas rest upon the eroded surface of a granitic complex. The lavas, which range from rhyolite to basalt in composition, are locally interbedded with tuffs. The lavas are overlain by thin-bedded upper Miocene lake sediments, which contain the Opalite and Bretz ore bodies. These sediments probably accumulated in a depression that was being deepened from time to time by faulting, and were faulted down to their present position during the Pliocene. . . .

The dominant rocks of the area consist of over 3,000 feet of lava flows, which range in composition from basalt to rhyolite. Intrusive rocks appear to be scarce, but some of the rocks mapped as extrusive may be intrusive—for example, the rhyolites near the Disaster Peak prospect. The rocks in the western part of the area are in general more basic than those in the eastern part. The silicic lavas range from obsidian to porphyritic rhyolite and in general exhibit well-developed flow banding. They are locally associated with tuffs. The basaltic and andesitic lavas are darker than the rhyolite and are generally in thinner flows. They are characterized by vesicularity, columnar structures, flow brecciation, and porphyritic texture. The flows are either horizontal or nearly so, except where they have been locally tilted by faulting. Individual flows are from a few feet to more than 100 feet thick. . . .

Late Miocene lake sediments are distributed over a considerable part of the McDermitt Creek Basin . . . and they probably once extended over a much larger area from which they have been removed by erosion. In places they are more than 200 feet thick. They consist mainly of well-bedded tuffs, shales (including clayey, carbonaceous, tuffaceous, and diatomaceous varieties), and sandstones, but include small lenses of conglomerate. They are mostly light-colored, varying from white to light brown, except that the carbonaceous shales are dark chocolate brown. The constituent fragments are dominantly of volcanic origin. Some beds contain carbonaceous plant fragments and fossil wood; and fossil leaves, fish, and fresh-water gastropods were collected at several places.

On the basis of the fossils these beds have been correlated with the Miocene Trout Creek beds of Malheur County, Ore. . . .

The structure of the Opalite district is simple. Flat-lying lavas have been displaced, with little tilting, along steep normal faults, of which the steep scarps that outline the flat-topped Southern White Horse Mountains are a direct expression. Direct evidence of this faulting is given by the presence of fault breccia, drag warps, and silicified rocks along the scarp bases; similar features at various distances outward from the scarps indicate that the displacements were distributed on step faults. The throw on any single break cannot be measured, but the aggregate displacement, which accounts directly for much of the relief in the area, was more than 2,000 feet.

The Quinn River Mountains south of the McDermitt Creek basin consist predominantly of lavas. No outcrops of sedimentary rocks were observed by the author at the few places that he visited during the present investigation.

Valley Fill

The rocks of the valley fill consist of Tertiary lake sediments and fanglomerate, and the overlying Quaternary stream deposits, alluvial-fan debris, lake sediments, and dune sand. Where saturated, the more permeable sediments yield water at rates sufficient for irrigation.

Lake sediments of late Miocene and Pliocene age are distributed over a considerable part of the McDermitt Creek drainage basin, and they probably underlie most of the Quinn River Valley floor. According to Yates (1941, p. 325–326), they consist mainly of well-bedded tuffs, shales (including carbonaceous, tuffaceous, and diatomaceous varieties), and sandstones but include small lenses of conglomerate. They are mostly light-colored, ranging from white to light brown. The constituent fragments are dominantly of volcanic origin. Some beds contain carbonaceous plant fragments and fossil wood.

East of McDermitt the fanlike surface leading up to the mountains is dissected by a trellis-type drainage pattern rather than the usual distributary drainage pattern. Therefore the rocks underlying this surface probably are of a different character than those underlying the other surfaces along the mountain front. Inasmuch as the only exposure of the material underlying this surface that was observed during the present investigation consisted of tuffaceous fanglomerate, the entire area was mapped simply as rocks of Tertiary age. This Tertiary fanglomerate evidently does not lie sufficiently near the land surface south of the

East Branch of the Quinn River to affect the drainage pattern, and therefore none of this area was mapped as Tertiary age. However, rocks of Tertiary age probably are near the surface in most of the McDermitt area.

Alluvial-fan deposits fringe the valley at the base of the mountains. It is believed that these deposits have been accumulating throughout much of the Tertiary and all of the Quaternary period. They are the result of the upward movements of the mountains with respect to the valleys during all that time.

The sediments contained in the alluvial fans generally are crudely bedded and poorly sorted, although both the bedding and the degree of sorting vary with the place of deposition on the fan slope. Near the apex of the fan the materials are generally coarse textured. Farther down the slope the sediments gradually change to more evenly sorted and finer material until they merge with the material of the valley floor. The dips of the bedding planes become flatter as the toe of the fan is approached. Generally, the dips approximate the profile of the fan.

Little is known about the depth to which the Tertiary deposits have been buried beneath Quaternary deposits in different parts of the valley. There is no known abrupt change in the character of the sediments deposited at the close of the Tertiary epoch as compared with those deposited at the beginning of the Quaternary epoch. However, on the assumption that the Tertiary sediments might be somewhat more cemented than the Quaternary, one might suspect from the drillers' logs (see table 9) that the Tertiary sediments are buried 74 feet at well 42/37–3B1; 324 feet at well 42/37–18A1; 70 feet at well 42/37–33C1; 143 feet at well 43/37–17A1; 200 feet at well 43/37–28A2; 82 feet at well 43/37–32D1; 118 feet at well 43/37–34C1; and so forth. Obviously much better evidence is needed to determine with reasonable certainty the depth to which Tertiary deposits have been buried.

A large part of the valley floor is underlain by deposits laid down by the Quinn River. The exact position of these deposits, which include sand and gravel, is not known as the deposits are covered by a mantle of lake sediments. An extensive drilling program would disclose their position and also yield valuable information as to their thickness and their water-bearing characteristics.

Sediments of Lake Lahontan cover a larger part of the valley floor. They are generally quite thin and consist predominantly of silt and clay. However, they also include sand and gravel deposits near former shorelines.

Water-bearing Characteristics of the Rocks

PRE–TERTIARY ROCKS

The pre-Tertiary sediments and intrusives that underlie the Slumbering Hills and the Santa Rosa Range south of Spring Peak as previously noted, consist predominantly of strongly folded and compressed slates, with interbedded quartzite and limestone. As far as is known, the rocks have not been explored for water. However, the physical properties of the rocks are believed to be such that the rocks probably do not transmit water freely except locally in fractured zones near faults. No mention is made in the literature of solution openings in the limestone so presumably such openings as may exist are insignificant. It is believed therefore that the pre-Tertiary rocks generally act as barriers rather than conduits for the movement of ground water.

TERTIARY AND QUATERNARY ROCKS

Lava Flows

Lava flows of Tertiary age are widespread. They compose the Santa Rosa Range north of Spring Peak, the Quinn River Mountains, and parts of the Slumbering Hills. They also underlie the valley fill in many parts of the valley. The composition of these flows, which has been described in an earlier section of this report, is such that under favorable conditions the flows might transmit water quite freely. However, as pointed out by Bryan (1923, p. 5), any attempt to explore the volcanic rocks for water beneath the valley fill probably would necessitate drilling to great depth to reach the top of the flows and then drilling through an overlying massive layer of lava in order to determine if the lava beneath would yield much water. The only known instance of exploratory drilling into the lava flows underlying the valley fill is the drilling of well 44/36–15C1. More than 100 feet of lava was penetrated without encountering a good aquifer.

Thus it appears that although the lava flows underlying the valley fill in some localities may transmit large quantities of water, it may not be economically feasible to explore these rocks to determine their water-bearing characteristics.

Older Valley Fill

The physical properties of the lake sediments of late Miocene and Pliocene age that are exposed over a considerable part of the McDermitt Creek drainage basin and that probably underlie much of the Quinn River Valley floor indicate that these sediments will not transmit water easily. It seems unlikely, therefore, that moderate to high yields can be obtained from wells tapping only these sediments.

The physical characteristics of the valley fill east of McDermitt are not well enough known to enable estimating the water-bearing properties of the sediments that were mapped as Tertiary. The only exposure that was noted consisted of a tuffaceous fanglomerate that probably would not transmit water freely.

Alluvial Fans of Tertiary and Quaternary Age

Alluvial-fan deposits are important water-bearing sediments. As stated in an earlier section of this report, it is generally impossible with the data available to differentiate between Tertiary and Quaternary alluvial-fan deposits. The following discussion on the prospects for obtaining water from alluvial fans therefore applies to deposits of either age.

Although a large part of the alluvial fans may be saturated with ground water, it may not be possible to develop a satisfactory supply of water from all parts of the saturated zone. At the upper end of the fans, near the apexes, the material commonly is so poorly sorted that it will not readily yield water to wells. The material near the toes of the fans, especially in fans that have been built up by perennial streams, is a much better medium for transmitting water. It is from these sediments that the majority of the successful irrigation wells in Quinn River Valley derive their water. Interfan areas and alluvial fans at the mouths of normally dry canyons ordinarily contain little material that will transmit water freely. Only small yields can be expected from wells developed in them.

The water-bearing characteristics of the alluvial fan sediments of Tertiary age and Quaternary age presumably can be inferred from performance data on wells that tap alluvial-fan deposits of either or both ages. Such data are given in the second section which follows.

Quaternary Deposits

The sediments of the Quinn River that underlie a large part of the valley floor include highly permeable sand and gravel strata. On the basis of performance of existing wells that tap these deposits (see table 3), it is believed that yields comparable to or better than the best yields thus far obtained from the alluvial fan deposits can be obtained from deposits of the Quinn River.

Sediments of Lake Lahontan which cover much of the valley floor have poor water-bearing properties. Although the clay and silt that make up the greater part of the sediments may be saturated, these sediments will yield little, if any, water to wells. Should the beach and shoreline deposits of sand and gravel extend into the zone of saturation, such deposits probably would yield water to wells freely. The areas where such conditions might exist are not known, but it is believed that they are quite small.

The water-bearing properties of the sand in the dune area are not known. Undoubtedly the sand will transmit water at reasonable rates. However, it is believed that the saturated zone of the sand is so thin that it would be generally impractical to develop water from the dune area.

WELL-PERFORMANCE DATA AND TRANSMISSIBILITY DETERMINATIONS

The yield, drawdown, and specific capacity of wells for which performance data are available are listed in table 3. Most of the wells penetrate alluvial-fan deposits but some penetrate the stream deposits of the Quinn River. The drawdown figures given to the nearest foot and the corresponding yields are from drillers' reports. Inasmuch as the conditions under which the data were obtained are not known, the values shown in the table should be considered only approximate. The computed specific capacities indicate wells from which large yields can be obtained with a reasonable drawdown.

A further indication of the water-transmitting characteristics of an aquifer can be obtained by analysis of time-drawdown and time-recovery data under controlled pumping conditions when geologic and hydrologic conditions are favorable. Several attempts to obtain such data during the investigation were made but were not entirely successful. However, the data that were obtained indicate that the formations tapped by the following wells had coefficients of transmissibilities of 50,000 gpd per foot or more: 41/37–29D1, 41/37–33A2, 43/37–28A2, and 44/36–22D1. Wells 41/37–33A1, 43/37–34C1, and 43/37–34C3 showed transmissibilities of 20,000 gpd per foot or more. Well 43/36–14A1 showed a transmissibility of about 5,000 gpd per foot. With the exception of wells 44/36–22D1 and 43/36–14A1, which tap stream deposits of the Quinn River, the wells are believed to tap alluvial-fan deposits.

TABLE 3

Yield, drawdown, and specific capacity of wells in Quinn River Valley, Humboldt County, Nevada

(Probable water-bearing sediments: A, alluvial-fan deposits; S, stream deposits of Quinn River.)

Well number and location	Yield (gpm)	Drawdown (feet)	Specific capacity (gpm per foot of drawdown)	Probable water-bearing sediments
41/37-29D1	530	....	....	A
41/37-33A1	75	6.9	11	A
41/37-33A2	650	12	54	A
42/36-11B1	600	22	27	S
42/37-3B1	410	92	4.5	A
42/37-18A1	970	34	28	A
42/37-22D1	15	1.5	10	A
42/37-33C1	570	41	14	A
43/36-2A1	5	5	1.0	S
43/36-14A	10	9	1.1	S
43/37-8D1	50	4	12	A
43/37-17A1	1,800	70	26	A
43/37-28A1	450	9.6	47	A
43/37-28A2	1,800	78	23	A
43/37-32D1	600	35	17	A
43/37-34C1	720	37	20	A
43/37-34C3	885	57	16	A
43/37-35B2	6	6	1.0	A
44/36-15C1	100	65	1.5	A
44/36-22D1	18	0.5	36	S
44/37-5B1	1,400	87	16	S
45/38-33A1	20	80	0.2	A
47/37-28D2	15	35	0.4	?

The coefficient of transmissibility as given above is defined as the number of gallons of water per day, at the prevailing temperature of the water, that will be transmitted through a section of the aquifer 1 mile wide for each foot per mile of hydraulic gradient normal to that section. Ordinarily, a well yielding enough water for irrigation must tap an aquifer having a coefficient of transmissibility of 20,000 gpd per foot or more. The specific capacity of such wells, if properly constructed, ordinarily exceeds 10 gpm per foot of drawdown.

From the values given in table 3 and the transmissibility figures it is seen that the water-bearing characteristics of the rocks of the valley fill vary greatly in short distances. Nevertheless, wells satisfactory for irrigation have been obtained over a distance of more than 20 miles along the alluvial apron paralleling the front of the range on the east side of the valley. It seems probable that wells having moderate to high yields can be developed in favorable areas in other parts of the valley.

SURFACE WATER

Streamflow

The three principal streams of the area, McDermitt Creek, the East Branch (Fork) Quinn River, and the Quinn River itself have been measured since the fall of 1948. McDermitt Creek is measured at a section in the SE¼ SE¼ sec. 8, T. 47 N., R. 37 E., near the mouth of the canyon where it leaves the mountains. East Branch Quinn River is measured at a section in sec. 9, T. 47 N., R. 39 E., near the mouth of the canyon where it leaves the mountains. The Quinn River is measured at a section in the SW¼ sec. 15, T. 45 N., R. 37 E., 15½ miles south of McDermitt. Monthly and annual flows for these stations are given in the following table for the period of record.

It is apparent that the flow of the streams is highly variable. The flow of the East Branch Quinn River during the low year of 1954 was only one-tenth the flow in the flood year of 1952. Relative ratios for corresponding years were one-eighth for McDermitt Creek, and one-twentieth for Quinn River.

Precipitation records at McDermitt and at Orovada, although incomplete for the period of record, indicate a fair balance between years of above-average and below-average precipitation. Consequently, the median flows of the streams as determined from the short period of record probably are a good indication of the median flows over a longer period of time.

There is some runoff each year above the Quinn River gaging station. However, the area below the Quinn River gaging station receives no runoff during dry years. No surface water flows out of the area in most years of above-average runoff. In years of extremely high runoff the flood flows that leave the area represent water that was rejected as recharge to the ground-water reservoir.

GROUND WATER

Ground-Water Areas

Because of the great differences in recharge to and discharge from the ground-water reservoir in different parts of the valley, it seems advisable to divide the area occupied by the alluvium into five subareas and to treat each separately in discussing the ground-water resources of the valley. Accordingly, the following subareas are designated: (1) the Oregon area; (2) the McDermitt area; (3) the Orovada area; (4) the Home Ranch area; and (5) the Davey Town area. (See pl. 1.)

TABLE 4

Monthly and yearly runoff, in acre-feet, of McDermitt Creek, East Fork Quinn River, and Quinn River

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
McDermitt Creek near McDermitt, Nevada													
1949	186	245	286	198	425	1,100	5,610	3,630	1,210	249	63	75	13,280
1950	193	245	152	139	910	2,410	3,440	2,680	1,460	520	166	151	12,470
1951	217	327	852	572	4,000	4,680	6,660	3,640	961	308	120	86	22,420
1952	203	271	427	461	1,030	5,970	35,690	15,510	5,240	2,190	448	328	67,770
1953	313	340	514	2,330	1,960	2,130	2,780	4,110	5,220	1,020	255	155	21,130
1954	268	399	456	548	823	1,930	1,460	1,430	516	214	76	83	8,200
Median	210	299	441	504	970	2,270	4,525	3,635	1,335	414	143	118	17,205
East Fork Quinn River near McDermitt, Nevada													
1949	168	233	236	239	304	1,520	7,810	5,950	1,520	244	76	77	18,380
1950	195	254	239	767	796	2,560	4,210	3,290	1,050	209	79	87	13,740
1951	187	284	1,340	654	4,220	3,230	6,570	3,360	900	160	54	56	21,020
1952	142	250	305	372	1,270	4,270	26,570	13,820	5,090	1,300	294	266	53,950
1953	249	232	311	818	951	1,170	1,070	2,430	2,840	297	90	64	10,520
1954	118	319	342	248	692	1,010	1,490	664	317	110	55	59	5,420
Median	177	252	308	513	874	2,040	5,390	3,325	1,285	226	78	70	16,060
Quinn River near McDermitt, Nevada													
1949	72	72	51	47	48	44	2,930	6,030	1,770	77	40	42	11,220
1950	46	42	43	47	72	222	1,570	2,120	238	55	48	39	4,540
1951	52	47	57	51	1,880	4,380	8,850	5,200	514	73	53	47	21,200
1952	51	58	62	59	254	3,640	59,290	37,100	10,360	2,940	225	122	114,200
1953	119	128	173	446	800	498	367	2,340	5,070	160	50	50	10,200
1954	56	49	49	51	53	68	59	55	47	28	25	28	568
Median	54	54	54	51	163	360	2,250	3,770	1,142	75	49	44	10,710

The Oregon area includes all the alluvial area in Oregon except that irrigated by water from McDermitt Creek. The McDermitt area lies between the Oregon area and the Quinn River gaging station. The Orovada area includes the alluvial fans and adjacent valley floor on the east side of the valley between the McDermitt area and State Highway 8A. It is bounded on the west by a line that approximates the western limit generally reached by surface water that originates in the mountains to the east. The Home Ranch area is that part of the alluvial fill west of the Orovada area that lies between the Quinn River gaging station and State Highway 8A. Inasmuch as the Oregon area is outside Nevada, no evaluation of recharge or potential development in that area was made.

Occurrence

Most of the available ground water occurs in the alluvial fan deposits and the stream-laid sand and gravel underlying the floor of the valley. The water in these deposits occurs under confined (artesian), semiconfined (semiartesian), and unconfined (water-table) conditions. In a few wells the water is under sufficient artesian head to flow small amounts of water at the land surface.

The amount of confinement generally increases toward the center of the valley and with the depth of the aquifer. In most places the artesian heads are small and the condition of the ground water would be best described as semiconfined. It is thought that long-term pumping will result in the ultimate drainage of some of the water-bearing strata within the cone of influence of such pumping and will thus effect a change from artesian to water-table conditions.

The water levels in most of the wells on the alluvial fans are less than 60 feet below the land surface. The depth to water below the surface of the fans usually becomes greater with increasing distances from the toe of the fan toward the mountains. Locally, however, there are abrupt changes in the depth to water below the surface of the fan. One of these abrupt changes was observed southwest of Orovada. West of the highway the depth to water gradually decreases to 20 feet or less and then abruptly increases to 60 feet or more, after which it gradually decreases again to 20 feet or less at the toe of the fan. The largest observed difference is in section 22, T. 42 N., R. 37 E., where the depth to water is 63 feet only a quarter of a mile west of a north-south line of seeps and springs. It is thought that this abrupt change in water levels is due to the truncation by faulting of the aquifers within the fan. This condition may exist in other parts of the valley also but at present there are not sufficient wells to document it. On the floor of the valley the depth to water in wells generally is less than 10 feet below the land surface.

Recharge

The source of the ground water in Quinn River Valley is the precipitation within its drainage basin. Recharge to the ground-water reservoir in the valley from this source is effected largely in two ways: (1) Infiltration of water from streams, and (2) percolation of irrigation water beyond the root zone.

Two other possible sources of recharge to the valley fill are direct precipitation on the alluvial fill and underground inflow from the bedrock. It is believed that the average annual precipitation, which is about 9 inches both at McDermitt and at Orovada, is not sufficient to contribute materially to the ground water in the valley. The greater part of the precipitation is believed to be utilized in supporting the growth of native vegetation or is lost by evaporation. Consequently, the average annual recharge to the ground-water reservoir from direct precipitation on the valley fill is believed to be negligible. The contribution to the ground-water supply from the bedrock also is believed to be relatively unimportant.

INFILTRATION OF WATER FROM STREAMS

A substantial part of the water in the valley fill is derived from infiltration of water from streams. Infiltration is greatest in the McDermitt and Orovada areas. Of the many factors that influence the rate of infiltration for any given reach of a stream, the rate of flow is one of the more important. In general, higher rates of flow result in larger rates of infiltration, up to the point where the maximum rate of infiltration is reached and all additional flow is rejected.

The amount of ground-water recharge resulting from the infiltration of water from streams in the McDermitt area can be approximated by an analysis of the streamflow record for that area. During the month of January, when no water is diverted for irrigation and when losses by evapo-transpiration are negligible, the difference between the inflow to the area and the outflow from the area can be assumed to have infiltrated into the stream beds. In January for the years 1949–1952 an average of 889 acre-feet of water entered the valley from McDermitt Creek and the East Branch Quinn River. Of this amount an average of only 51 acre-feet of water left the area as surface flow of the Quinn River; thus an average of slightly less than 838 acre-feet, or 94 percent of the water entering the valley during January infiltrated into the stream beds and recharged the ground-water reservoir. This high rate of infiltration is not maintained throughout the year, however, as normally the spring runoff fills the ground-water reservoir, thus preventing further infiltration. As soon as the ground-water reservoir in the area is filled, the water flows practically undiminished to the Quinn River. In flood years the bulk of the flow enters the Quinn River and eventually leaves the McDermitt area as surface flow. In years of low flow very little of the water entering the area reaches the Quinn River.

That the infiltration of stream water crossing the alluvial fans is also an important method of recharge to the ground-water reservoir is indicated by the following set of measurements made on Horse Creek in the Orovada area. One measurement was made near the mountains and the other at a point where the creek crosses U. S. Highway 95, about 2¼ miles downstream from the upper point of measurement. A reduction in flow from 856 to 79 gpm was noted on July 11, 1947.

It is estimated that evaporation and transpiration losses did not exceed 80 gpm so a total loss of 697 gpm due to downward seepage within the 2¼-mile distance is indicated. This loss of about 300 gpm per mile is but an indication of the magnitude of the rate of infiltration in this particular reach of the stream at the rates of flow that were measured. At other times and at other rates of flow the rate of infiltration may be considerably different. Likewise, the rate of infiltration on other streams may be considerably more or less than the rates of infiltration that were computed for this particular reach of Horse Creek.

Where the sediments of Lake Lahontan consist of sand and gravel they undoubtedly offer a better medium for the infiltration of water than the alluvial fan deposits. However, because of the relatively small areal extent of the coarser sediments of Lake Lahontan and the limited time during which water is available for infiltration, it is probable that they do not significantly affect the average annual recharge to the ground-water reservoir.

DOWNWARD PERCOLATION OF IRRIGATION WATER

Another large source of recharge to the underground reservoir is excess irrigation water that percolates downward to the water table. During the irrigation season almost all the streamflow reaching the valley is diverted and spread for irrigation. About 26,500 acres of land in the valley have surface-water rights for irrigation. The common method of irrigation is by flooding, a practice which almost invariably results in the application of considerably more water to the land than is necessary for the crop requirements. The excess water that is neither evaporated nor transpired is available for recharge to the ground-water reservoir. The amount of recharge is much greater than it would be if less irrigation water were used.

AVERAGE ANNUAL RECHARGE

Over long periods of time the ground-water recharge to a basin is equal to the discharge from the basin. Therefore, when making a study of the ground-water resources of a basin, it is desirable to determine both the average annual recharge and the average annual discharge in order to see whether they are in essential agreement. It was impractical to obtain exact figures for the average annual contribution to the ground-water reservoir from each of the sources of recharge. Nevertheless, it is believed that a fair estimate of the average annual recharge can be made by first determining the amount of runoff and then deducting from it all losses that occur before the water reaches the water table.

An estimate of the amount of runoff in the Nevada portion of the valley was based on the records of streamflow for the gaging stations maintained by the U. S. Geological Survey on East Branch Quinn River, McDermitt Creek, and Quinn River for the period of record (1949–1954), and on estimates by ranchers as to the average rate and duration of flow of such other streams in the valley with which they were familiar.

The average annual runoff thus determined is about 50,000 acre-feet for the part of the valley that is in Nevada. Except in years of extremely high flow, practically all the runoff at some time or other infiltrates into the ground. The water that does not enter the ground directly from stream channels and ditches is diverted for irrigation. Any excess irrigation water in turn is collected and again diverted until all the runoff has been utilized. Evaporation from the streams and ditches is comparatively small.

Water that enters the ground either is used consumptively or recharges the ground-water reservoir. Thus the difference between the runoff and the consumptive use is a measure of the average annual recharge. The consumptive use of irrigation water in the Quinn River area as computed by Houston (1950,

p. 11) is 15 inches for pasture and 17 inches for alfalfa. These amounts are for ideal conditions under which the plants have all the water they need.

Of the 26,500 acres of irrigated land in the valley about 19,000 acres, mostly in the McDermitt area, receives enough water through direct irrigation and subirrigation to supply the crops with the amount of water they require throughout the growing season. It is estimated that about 75 percent of the moisture requirements for this 19,000 acres comes from surface irrigation water and 25 percent from subirrigation. If the average use of water is 16 inches, the use of surface water would then be about 12 inches, or 19,000 acre-feet.

In the remaining 7,500 acres of irrigated land water is available for less than half of the irrigation season and the plants are assumed to get only two-thirds of the water required for maximum growth. Thus, about 6,700 acre-feet of surface water is used on this land.

The difference between the total runoff of 50,000 acre-feet and the part of it that is consumptively used, or 25,700 acre-feet, is a measure of the average annual recharge which thus would be about 24,000 acre-feet.

Discharge

In the Quinn River Valley the principal way in which ground water is discharged is by the processes of evaporation and transpiration, although locally considerable amounts of ground water are discharged into streams and by wells. Ground water is discharged by evaporation where the water table is sufficiently shallow so that the capillary fringe extends to the land surface. It is also discharged by the transpiration of water-loving plants, called phreatophytes, which obtain their water supply from the water table or from the overlying capillary fringe. Most of this discharge occurs where the depth to water is less than 25 feet below the land surface. The principal kinds of phreatophytes in the Quinn River Valley are greasewood, saltgrass, rye grass, rabbitbrush, willows, buckbrush, and alfalfa.

In the Nevada portion of the Quinn River Valley there is about 90,000 acres of greasewood and associated vegetation of low density, whose use of ground water is estimated to be about 0.15 foot per year, or 13,500 acre-feet annually. In addition there is 5,400 acres of greasewood of medium density for which the use is estimated to be about 0.3 foot of ground water per year, or about 1,600 acre-feet annually. There is approximately 7,600 acres of saltgrass, for which the rate of use is believed to be about 0.5 foot of ground water per year, or 3,800 acre-feet annually. Finally there is some 19,000 irrigated acres in the valley that in part is subirrigated. It is estimated that the draft on the ground-water reservoir from subirrigation on this acreage amounts to about a third of a foot per year, or 6,300 acre-feet annually. Thus the total amount of ground water that is discharged by evapotranspiration processes is about 25,000 acre-feet annually. Both this figure and that for recharge, 24,000 acre-feet, are highly approximate, but they are similar as they should be.

Wells—About 5,000 acre-feet of ground water was discharged by wells in 1955, of which all but a few acre-feet was for irrigation. Under present conditions this water is largely in addition to the water discharged by evaporation and by transpiration of native vegetation.

Springs—There are many small springs and seeps in the area, many of which are shown on plate 1. Although none of these are large, they form valuable watering places for livestock. In addition to the springs shown on plate 1, there is a seepage area in secs. 15, 22, and 27, T. 42 N., R. 37 E., that is thought to be caused by faulting of the fan deposits. In the vicinity of wells 41/37–33A1 and A2 there is a group of springs with a combined flow of about 30 gpm. This water is used for irrigating a garden patch. The nearby wells were drilled in order to develop more water from the area.

The total discharge of springs in the valley is probably less than 200 acre-feet annually. As most of the discharge from springs is eventually transpired by native vegetation, the area of phreatophytes supported by ground-water discharge from springs and seeps was included in the area of phreatophytes used to estimate the total discharge of ground water by evapotranspiration.

Fluctuations of Water Levels

The water levels in wells do not remain stationary but rise and fall in response to changes in the rates of recharge to and discharge from the ground-water reservoir. If the discharge from the ground-water reservoir exceeds the recharge, the water level will decline, and vice versa.

Periodic measurements of water level in four wells in the Orovada area were made during the investigation. Hydrographs of these wells are shown in figure 4.

During the early years of record the annual recharge was less

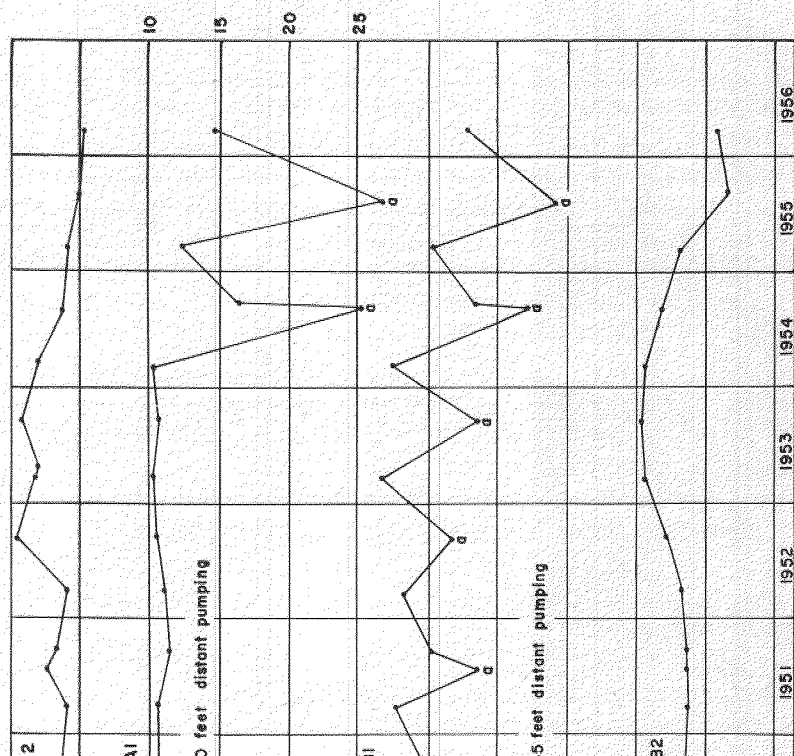

FIGURE 4. Hydrographs of four wells in the Orovada area of the Quinn River Valley.

than the annual discharge, causing a general year-to-year decline of water levels. In 1952, in response to very heavy precipitation, the annual recharge exceeded the annual discharge and water levels generally rose significantly. Since the latter part of 1953 the annual recharge generally has been deficient owing to subnormal precipitation, and consequently the water levels have declined from year to year. This decline has been hastened somewhat by pumping for irrigation in the vicinity of wells 43/37–28A1 and 42/37–3B1, and since 1953 also in the vicinity of well 42/37–33B2. Some of the more pronounced irregularities in the hydrographs of these wells are due to pumping in nearby wells at the time measurements were made.

QUALITY OF WATER

The results of the chemical analysis of water from seven wells in Quinn River Valley are given in table 5.

Except for hardness, which locally is high, the ground water in the area is satisfactory for domestic and stock use. The discussion of the chemical quality of the water in the area will therefore be confined to the effect of the quality on crops and soils.

The following discussion of chemical characteristics and classification of waters is based in large part on previous ground-water reports for Nevada and on Agriculture Handbook No. 60 by the U. S. Salinity Laboratory Staff (1954). Natural water varies greatly in the concentration and composition of dissolved constituents and correspondingly in its suitability for irrigation. Some of the constituents are beneficial to plants; others seem to have little or no effect on either plants or soils; and still others either impair plant growth or have a harmful effect on soil, or both. The major constituents include the cations—calcium, magnesium, and sodium—and the anions—bicarbonate, sulfate, and chloride—and silica, which is generally considered to be un-ionized. Constituents usually present only in relatively low concentrations include potassium, carbonate, nitrate, fluoride, manganese, iron, and boron. Other constituents in low concentration may be present but usually are not determined.

The characteristics of water that appear to be most important in determining its quality for irrigation are: (1) total concentration of soluble salts, (2) relative proportion of sodium to other cations, (3) concentration of boron or other elements that may be toxic, and (4) under some conditions, the bicarbonate concentration as related to the concentration of calcium plus magnesium.

TABLE 5

Chemical analyses and classification of waters in Quinn River Valley, Humboldt County, Nevada

Analyses by U. S. Geological Survey unless otherwise noted. Chemical constituents in parts per million.

Well number and location	Depth (feet)	Temperature (°F)	Date collected	Specific conductance (micromhos at 25°C)	Dissolved solids	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	pH	Sodium-adsorption ratio	Residual sodium carbonate (epm)	Classification for irrigation
41/35-22D1	27	53	10-29-54	1,130	720	59	0.04	1.6	83	29	120	12	369	114	118	0.9	2.4	----	326	24	7.2	2.9	0.00	C3-S1
41/37-29D4	121	----	4-24-52	355	241	39	.07	.0	44	6.6	23	2.9	167	27	15	.2	1.1	0.05	137	0	7.7	.9	.00	C2-S1
43/37-5C1	50	56	4-25-52	960	608	39	.08	.0	84	21	88	4.7	181	155	125	.1	1.5	.05	296	148	7.2	2.2	.00	C3-S1
43/37-33D2	100+	----	4-25-52	335	223	28	.09	.0	42	6.6	15	2.3	117	29	18	.2	24	.01	132	36	7.2	.6	.00	C2-S1
43/37-34C3	488	57	4-22-53	189	131	30	.00	----	19	3.6	14	1.5	90	9.2	8.5	.1	.5	.01	62	0	7.7	.8	.23	C1-S1
*47/37-28D1	442	140	----	†500	365	57	Tr	----	36	10	62		195	56	34	----	----	----	131	----	----	2.4	.58	C2-S1
48/38-32D2	100	----	10-15-54	985	599	67	.03	.0	103	21	53	6.5	109	104	185	.2	5	----	344	254	7.0	1.2	.00	C3-S1

*Analyst not known. †Not determined, approximated from total dissolved solids.

The total concentration of soluble salts in irrigation waters can be adequately expressed for purposes of diagnosis and classification in terms of electrical conductivity. Waters are divided into four classes with respect to conductivity, the dividing points between classes being at 250, 750, and 2,250 micromhos/cm. (See fig. 5.)

Low-salinity water (C1) can be used for irrigating most crops on most soils with little likelihood that soil salinity will develop. Some leaching is required, but this occurs under normal irrigation practices except in soils of extremely low permeability.

Medium-salinity water (C2) can be used if a moderate amount of leaching occurs. Plants of moderate salt tolerance can be grown in most cases without special practices for salinity control.

High-salinity water (C3) cannot be used on soils of restricted drainage. Even with adequate drainage, special management for salinity control may be required and only plants of good salt tolerance should be selected.

Very high salinity water (C4) is not suitable for irrigation under ordinary conditions but may be used occasionally under very special circumstances. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching, and very salt-tolerant crops should be selected.

In order to obtain better coverage of salinity hazard of the water, 11 samples were collected from shallow wells in different parts of the area and were tested with a field resistivity bridge. Four of these samples showed a low salinity hazard, six showed a medium salinity hazard, and one showed a high salinity hazard. The location and salinity hazard of these samples are given in the following table.

TABLE 6

Salinity hazard of water from selected shallow wells in Quinn River Valley, Humboldt County, Nevada

Location			Conductivity (Micromhos at 25° C.)	Salinity hazard
T.	R.	Section		
40	37	9	834	High
43	36	33	568	Medium
43	37	8	190	Low
43	37	20	326	Medium
43	37	29	413	Medium
44	36	25	413	Medium
46	38	19	240	Low
47	38	20	242	Low
48	37	36	353	Medium
48	38	32	197	Low

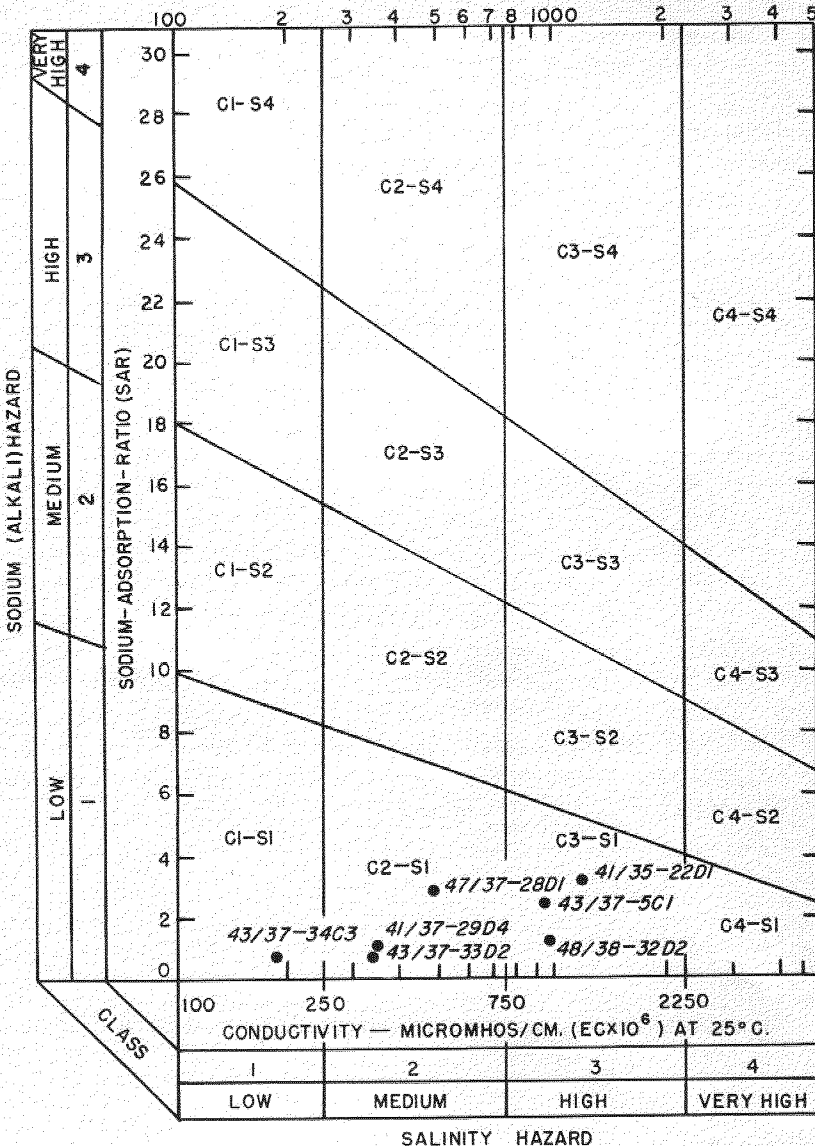

FIGURE 5. Classification of ground water in Quinn River Valley for irrigation (after U. S. Salinity Laboratory Staff).

These data and those in table 5 and figure 5 indicate that there is a considerable range in the salinity hazard within the valley. The salinity hazard of the water from aquifers in the alluvial fans and under the irrigated part of the valley floor is low to medium, whereas the salinity hazard of the water from the aquifers underlying the part of the valley floor that is not irrigated is high.

Sodium, like other cations, reacts with certain base-exchange materials in clay soils, resulting in a change in both the physical and chemical characteristics of the soil.

When sodium is the predominant cation in the soil water or irrigation water, certain unfavorable conditions may develop in the soil. The soil, when wet, deflocculates or "runs together" and becomes sticky and impermeable; upon drying, it becomes hard and large cracks appear. So-called "slick spots" and black alkali (sodium carbonate) conditions may appear in irrigated fields.

Inasmuch as the adverse effect on the soil is related more closely to the ratio of sodium ions to the total cations in equivalents per million than to the absolute concentration of sodium, the sodium concentration has, in the past, been expressed as percent sodium.

Recent study of the effect of the relative proportion of sodium to that of other cations indicates certain advantages in the use of the sodium-adsorption ratio (SAR) as an index of the sodium or alkali hazard of water. This ratio is defined by the equation:

$$SAR = Na^{+}/\sqrt{(Ca^{++} + Mg^{++})/2}$$

where Na^{+}, Ca^{++}, and Mg^{++} represent concentrations in equivalents per million.

The classification of irrigation water with respect to SAR is based primarily on the effect of exchangeable sodium on the physical condition of the soil.

Low-sodium water (S1) can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium.

All the samples of water that were collected from the area covered by this report were within the limits of the low sodium (S1) class. (See fig. 5.) Therefore, the limiting conditions for the use of water with higher sodium hazards will not be discussed.

Although a small amount of boron is essential to the normal growth of all plants, a slight excess of boron can be exceedingly toxic to certain plant species. It is therefore important that the concentration of this constituent be determined for waters that are to be used for irrigation. The concentration of boron in each of the four samples of water for which boron was determined was 0.05 part per million or less. These concentrations are considerably less than the toxic level for the most sensitive plants.

In waters having high concentrations of the bicarbonate ion, there is a tendency for calcium and magnesium to precipitate as carbonates as the soil solution becomes more concentrated. This reaction does not go to completion under ordinary circumstances, but insofar as it does proceed, the concentrations of calcium and magnesium are reduced and the relative proportion of sodium is increased. Under some circumstances the increase may be sufficient to result in an excessive SAR value. This may produce alkali soil conditions.

Residual sodium carbonate (RSC) may be defined as follows: $RSC = (CO_3^{--} + HCO_3^{-}) - (Ca^{++} + Mg^{++})$ in which the ions are expressed as equivalents per million. Tentative limits for "residual sodium carbonate" are as follows: Water having more than 2.5 epm of residual sodium carbonate is not suitable for irrigation; water having 1.25 to 2.5 epm is marginal; and water containing less than 1.25 epm probably is safe.

Five of the samples analyzed had no residual sodium carbonate and the two remaining samples had residual sodium carbonate values well within the limits considered safe for irrigation.

DEVELOPMENT OF GROUND WATER

Status of Development as of 1954

There are about 150 wells in the valley, data for 117 of which are given in table 7 at the end of this report. Most of the wells were constructed in order to obtain satisfactory and adequate supplies of water for domestic use or for watering stock.

The first development of ground water for irrigation took place in the 1920's. The wells were dug or bored with a community-owned rig and the maximum depth of the wells was only 100 feet. Pumping costs proved prohibitive for all the farmers who had to depend upon ground water as their only source of supply, and so practically all the original projects were abandoned.

The present development of ground water for irrigation began in the late 1940's. Some of the old wells were equipped with more modern pumps and power plants, and many new wells were drilled. This development, like the first, is largely in the Orovada area. The new wells range in depth from a few feet to more than 600 feet, according to the depth at which satisfactory aquifers are penetrated. By the end of 1954 there were 18 serviceable irrigation wells in the valley. At the rate of development in 1954 the number of irrigation wells could easily double in 2 or 3 years.

Potential Development

An important consideration in the future development of ground water is the amount of water available. Theoretically it is possible to withdraw on a sustained basis an amount of water equal to the recharge, provided all the natural discharge is stopped. Practically, it is seldom possible to stop the natural discharge entirely, and therefore the amount of water that can be withdrawn on a sustained basis is usually somewhat less than the recharge.

In developing the maximum yield on a sustained basis, it is necessary to divert water to wells that otherwise would be discharged under natural conditions. Water levels therefor must be lowered sufficiently to eliminate or to reduce the natural discharge of ground water to the greatest extent that is practicable. The water obtained as a result of this lowering is derived from ground-water storage and its amount is dependent on the area beneath which the decline occurs, the amount of water released from storage per unit area per unit decline of water level, and the amount of the decline. In Quinn River Valley the quantity of ground water in storage in each foot of saturated material underlying the 270 square miles of valley floor is estimated to be about 26,000 acre-feet. This estimate is based on the assumption that the quantity of water released from storage per square foot per foot of lowering of water level would be 0.15 cubic foot. The assumption is believed to be reasonable although it is recognized that the value could be anywhere between 0.10 and 0.20.

Thus it appears that should water levels generally be lowered by an average of, say, 20 feet, the quantity of water involved in the lowering would be in the hundreds of thousands of acre-feet. Although the estimate is impressive when compared to the estimated maximum rate of withdrawal on a sustained yield basis, it should be recognized that the water is being mined and thus is available only once.

McDERMITT AREA

Wells having high yields probably can be developed in the McDermitt area. However, the Quaternary material, which contains some of the best aquifers in other parts of the valley, is thin in this area so it may be necessary to drill a considerable distance into the Tertiary sediments to obtain satisfactory yields.

The ground-water discharge from the McDermitt area that is not now used beneficially is about 2,000 acre-feet annually. This amount of water is an indication of the upper limit of the development that can be made in the area without adversely affecting existing water rights. Inasmuch as most of the nonbeneficial use is due to the transpiration of noncommercial water-loving plants on the west side of the river, any future development that would not affect existing rights would have to be planned to rob these plants of their water supply.

One effect of development would be to lower the water table below the level it now normally attains in the spring. The ground-water reservoir would thus have more room in which to store runoff than it has now. The runoff reaching the Quinn River would thus be reduced by the amount of the additional recharge to the ground-water reservoir, and this additional water would be available for use.

HOME RANCH AREA

Former channels of the Quinn River underlie parts of the valley floor in the Home Ranch area and locally it should be possible to obtain good wells at moderate depths. These channels can best be located by pumping test wells and existing wells to determine places where the specific capacity of wells is high.

Vegetation of low economic value uses about 8,000 acre-feet of ground water annually in the Home Ranch area. As wells could be located directly in the present discharge areas, it should be possible to salvage much of this waste by lowering the water table below the root zone. The shallow water in the area has a high salinity hazard, which probably is due to the partial solution of salts that have accumulated at or near the land surface as a result of the evaporation and transpiration of ground water. It is possible, however, that the water at depth would have a lower salinity hazard.

OROVADA AREA

The wells in the Orovada area obtain water from fan deposits of Tertiary and Quaternary age. The best aquifers are likely to be found in the fans of the larger streams. The potential development is limited largely by the recharge to the area, which is about 7,000 acre-feet a year. If pumping is continued at the present rate of about 5,000 acre-feet a year, the average water levels in wells in the area will eventually stabilize at levels that will be somewhat less than 2/7 of their present height above the present level of the water table beneath the floor of the valley, at which level the hydraulic gradient would be sufficient to carry to the valley floor the 2/7 of the water that is not pumped. The phrase "somewhat less" allows for the facts that the water levels in the wells will be lower than the water levels between wells, and that the water level in the valley also will decline as the flow from the Orovada area decreases. If the pumping rate is increased to 7,000 acre-feet a year, the water levels will eventually stabilize somewhat below the present level of the water table underlying the floor of the valley. (See fig. 6.) If pumping exceeds 7,000 acre-feet, the water levels will continue to decline until the ground-water reservoir is eventually depleted, unless sufficient additional water to balance the withdrawals in excess of 7,000 acre-feet is diverted to the area, either naturally, by underflow from adjacent areas, or artificially.

DAVEY TOWN AREA

The prospects for developing large amounts of water in the Davey Town area are poor. The fan deposits built by the small streams of the area are not likely to include many suitable aquifers, and the amount of recharge in the area is extremely limited. Most of the runoff probably is used to replenish soil moisture on the fans in the area. The salinity hazard for well 40/37–8B1 was high, an indication that the ground water in other parts of the area also may be moderately to highly mineralized.

ARTIFICIAL RECHARGE

Only on the alluvial fans is there unfilled potential storage capacity in the ground-water reservoir and thus an opportunity to salvage some of the flood flows. Ordinarily all the runoff is used for irrigation, thus part of it is given an opportunity to recharge the ground-water reservoir. Additional ground-water recharge could be effected by the use of spreading grounds to distribute the surplus waters in flood years. This surplus could also be diverted to ground-water recharge by channeling the excess flow into the many borrow pits in the area.

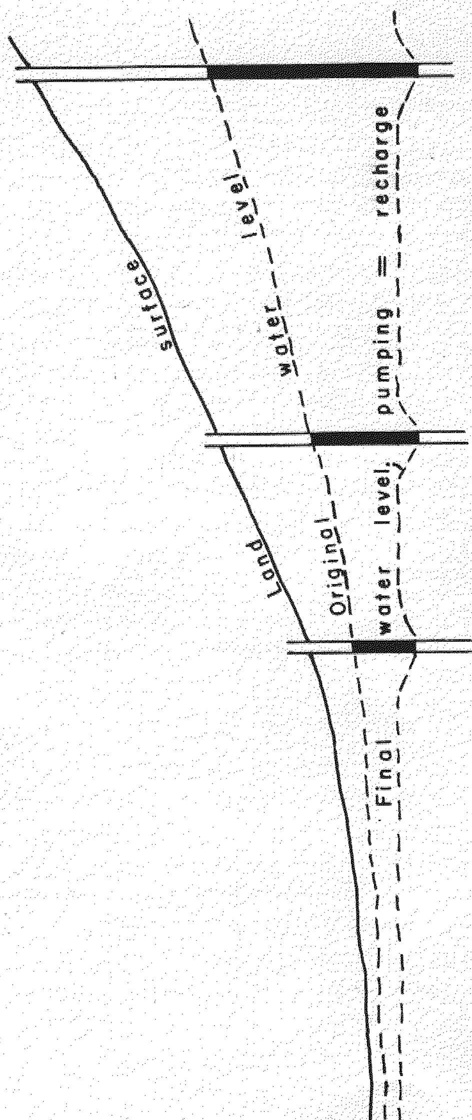

FIGURE 6. Cross section showing the ultimate effect of development on the water level in the Orovada area when the amount of water pumped is equal to the average annual recharge.

TABLE 7

Record of wells in Quinn River Valley, Humboldt County, Nevada

(Location of wells is shown on pl. 1)

(Type of well—Dg, dug; Dr, drilled; B, bored; J, jetted.)

Use of Water: D, domestic; I, irrigation; M, mining; N, unused; Q, quasi-municipal; S, stock.

Well number and location	Owner	Type of well and year completed	Diameter (inches)	Depth (feet)	†Land surface altitude (feet)	Measuring Point: Above land surface (feet)	Measuring Point: Description	Depth to water level below measuring point (feet)	Date	Use	Remarks
38/36-35A1	Southern Pacific R.R.	Dr	8	62	4,165	1.0	Top of casing	42.64	9-28-47	S	
38/37-30D1	U. S. Government	Dr	6	60	4,165	.8	Top of casing	39.32	9-28-47	S	Temp. 57°F.
39/36-5D1	U. S. Government	Dr	8	68	----	1.4	Top of casing	20.55	10-13-54	N	
39/36-12A1	U. S. Government	B, 1916	24	77	----	1.0	Top of casing	37.94	10-12-54	N	
40/36-35C1	U. S. Government	Dg, Dr, 1912	12	109	4,168	.1	Top of 6- by 6-inch pipe clamp	46.10	9-28-47	D, M	
40/36-35D1	U. S. Government	Dr	5	27	----	----	----	*	10-12-54	N	Dry.
40/37-9B1	U. S. Government	Dr	8	----	----	1.2	Top of casing	32.32	9-29-53	S	
41/35-1C1	John Marcuerquiaga	Dr	14	100	----	.8	Top of casing	12.47	8-12-54	N	
41/35-1D1	John Marcuerquiaga	Dr	10	42	----	----	----	*	8-12-54	D, S	Reported depth to water 8 to 10 feet.
41/35-2B1	U. S. Government	Dr	8	155	----	1.3	Top of casing	135.4	9-26-47	S	
41/35-11A1	U. S. Government	Dr	6	29	----	.5	Top of casing	12.26	10-26-54	S	Temp. 55°F.
41/35-14C1	U. S. Government	Dr	8	28	----	1.0	Top of casing	11.48	10-26-54	S	
41/35-22D1	John Marcuerquiaga	Dr	6	27	4,110	1.4	Top of 4- by 4-inch pipe clamp	9.75	9-28-47	S	Temp. 53°F; analysis.
								9.56	9-29-53		
41/36-5D1	U. S. Government	Dr	6	----	----	.5	Top of casing	8.13	10-26-54	S	
41/36-17D1	U. S. Government	Dr, 1930	8	63	4,113	.9	Top of casing	9.60	9-28-47	S	
41/37-3A1	U. S. Government	Dr	6	----	4,342	.5	Top of casing	130.05	9-12-47	S	
41/37-4A1	Walter Potter	Dg	----	37	----	----	----	----	----	N	
41/37-8C1	U. S. Government	Dr	----	46	4,173	1.0	Top of concrete block	9.63	9-11-47	S	
41/37-9C1	Riley Potter	B	18	54	4,202	1.0	Top of casing	20.20	9-11-47	N	
41/37-9C2	Riley Potter	B	18	20	4,200	.0	Top of concrete pump base	19.00	9-11-47	N	
41/37-29D1	Lyle Frey	B	18	100	4,219	.7	Bottom edge of plug hole in pump shell	52.72	9-11-47	I	Temp. 58°F.
41/37-29D2	Lyle Frey	Dr	6	55	4,217	.8	Top of casing	49.56	9-11-47	D	
41/37-29D3	Lyle Frey	Dr, 1946	6	52	4,215	1.0	Top of casing	46.65	9-11-47	S	
								46.16	11- 5-54		
41/37-29D4	Lyle Frey	Dr, 1948	6	121	----	.0	Land surface	53.	11-20-48	D	Analysis; log.
								50.79	11- 5-54		
41/37-33A1	Chas. Prentiss	Dr, 1953	16	13	----	2.0	Top of casing	1.78	8- 7-53	I	Temp. 57½°F; log.
41/37-33A2	Chas. Prentiss	Dr, 1953	16	28	----	1.0	Top of casing	7.00	8- 7-53	I	Log.
41/37-33D1	Eldorado Mining Co.	Dg	36	22	4,280	.5	Top of concrete platform	16.55	8-11-47	D	
41/37-34D1	Eldorado Mining Co.	Dr, 1947	6	90	4,340	.0	Land surface	*	----	D	Flow, 3 gpm estimated.
42/36-11B1	H. Marcuerquiaga	Dr, 1954	14	140	----	.0	Land surface	5.	----	I	Log.
42/36-25D1	U. S. Government	B	19	11	4,136	.6	Top of casing	6.95	9-15-47	N	
42/37-3B1	Geo. Reed	Dr, 1949	12	160	----	1.2	Top of casing collar	18.00	9-15-49	I	Log.
42/37-4B1	Stewart Marshall	Dg, 1947	42	58	4,219	.0	Land surface	48.	----	D	
42/37-5D1	Everett N. Harris	Dg	60	43	4,220	.0	Land surface	*	----	N	Dry.
42/37-7C1	L. R. Persson	Dg	----	20	4,190	.0	Top of concrete block	20.17	9-17-47	S	
								19.75	9-29-53		
42/37-10D1	John Lartigue	Dg, Dr	8	43	4,293	.0	Top of plank cover	26.41	9-17-47	D	
42/37-15B1	Crescent Land & Cattle Co.	Dr, J	3	18	----	.0	Top of casing	8.18	9-15-47	N	
42/37-17D1	Bob Mararity	Dg	48	46	4,220	.0	Land surface	45.3	9-15-47	N	
42/37-18A1	T. E. Taggert	Dr, 1953	12	327	----	1.5	Bottom edge of slot in side of casing	42.06	9-29-53	I	Log.
42/37-22D1	Crescent Land & Cattle Co.	J	3	38	4,255	.0	Land surface	.0	9-15-47	S	
42/37-22D2	Crescent Land & Cattle Co.	Dr	6	----	4,250	.0	Top of casing	63.35	9-15-47	S	
42/37-30A1	Crescent Land & Cattle Co.	Dr	6	32	4,170	.5	Top of concrete block	17.73	9-15-47	S	
42/37-33A1	J. J. Kern	B	30	75	4,254	.0	Land surface	57.78	9-13-47	N	Log.
42/37-33A2	J. J. Kern	Dg, Dr, 1931	6	80	4,254	.0	Top of concrete platform	62.90	9-12-47	D, S	
42/37-33A3	J. J. Kern	Dr, 1922	12	80	4,226	.1	Top of plank cover	43.72	9-13-47	N	
42/37-33B1	H. A. Drees	Dg, Dr, 1926	12	34	4,195	.0	Top of board cover	28.44	9-13-47	N	
42/37-33B2	H. A. Drees	Dr, 1948	18	95	----	2.0	Top edge of slot in casing	38.54	4-21-48	I	Log.
42/37-33B3	H. A. Drees	Dr, 1926	6	39	4,195	.0	Top of casing	26.45	9-13-47	N	
42/37-33C1	T. C. Barber	Dr, 1950	16	200	----	1.2	Top of casing	43.88	3-29-51	I	Temp. 58°F; log.
								43.68	3-28-52		
43/36-2A1	Lyle L. Ellison	Dr	12	22	----	2.1	Top of casing	7.92	10-14-54	N	
43/36-9A1	M. E. Jackson	Dr	6	45	----	.5	Top of pipe clamp	8.95	9-19-47	S	
43/36-10C1	U. S. Government	Dr, 1954	10	32	----	1.5	Top of plate over casing	8.31	10-14-54	S	
43/36-14A1	Unknown	Dr	8	70	----	.2	Top of plate over casing	10.87	10-29-55	S	Temp. 53°F.
43/36-33C1	H. Marcuerquiaga	Dr	10	50	----	.0	Land surface	8.	----	D, S	
43/37-4C1	C. S. Collins	Dr, 1941	6	56	4,215	.0	Top of casing	17.74	7-16-47	S	

TABLE 7—*Continued*

Well number and location	Owner	Type of well and year completed	Diameter (inches)	Depth (feet)	†Land surface altitude (feet)	Measuring Point: Above land surface (feet)	Measuring Point: Description	Depth to water level below measuring point (feet)	Date	Use	Remarks
43/37-4C2	Norris & Collins	Dr	6	42	4,230	.4	Top of casing	32.45	9-18-47	N	
43/37-5C1	Bessie L. Ellison	Dr, 1950	10	50		.0	Land surface			S	Temp. 56°F; analysis.
43/37-8D1	H. B. Voights	B	6	60	4,205	.0	Land surface	22.		D, S	
43/37-17A1	C. E. Leseberg	Dr	16	247		.0	Land surface	28.		I	Temp. 59°F; log.
43/37-18C1	U. S. Government	Dr	6	69	4,185	.4	Top of pipe clamp	10.94	9-17-47	S	
43/37-19A1	U. S. Government	Dr, 1940	6	73		.7	Top of casing collar	9.30	10-29-54	S	Log.
43/37-20A1	T. E. Ecklund	Dr			4,215	2.3	End of discharge pipe	36.00	9-17-54	I	
43/37-28A1	J. H. Brant	Dg, Dr	12	58	4,234	.0	Top of timber curb	9.69	5-23-46	N	Temp. 56°F.
43/37-28A2	J. H. Brant	Dr	16	320		2.4	Top of casing	11.45	3- 9-54	I	Log.
43/37-29D1	Herman Loest	Dg	48	31	4,205	.0	Top of concrete curb	30.02	9-18-47	N	
43/37-32D1	A. E. Hosack	Dr, 1949	12	678		2.3	Top of casing collar	23.70	1-20-50	I	Log.
43/37-32D2	A. E. Hosack	Dr, 1949	6	117		.5	Top of casing	46.19	1-20-50	D	
43/37-33C1	A. E. Hosack	Dr, 1953	12	236		.7	Top of casing collar	58.96	10-29-53	I	Log.
43/37-33D1	A. E. Hosack	Dr, 1933	6	95		.6	Top of casing	64.32	5-23-46	S	
43/37-33D2	A. E. Hosack	Dr	8	100+		.0	Land surface	60.		D	Analysis.
43/37-34C1	A. E. Hosack	Dr	12	515		.6	Top of casing collar	20.60 21.17	6-27-50 3-18-53	I	Temp. 58°F; log.
43/37-34C2	A. E. Hosack	B, 1922	6	100	4,245	1.0	Edge of pipe flange	18.18	11- 5-47	N	
43/37-34C3	A. E. Hosack	Dr, 1949	12	488		.6	Slot in casing collar	19.23 19.11	9-15-49 3- 9-54	I	Temp. 57°F; analysis; log
43/37-34D1	A. E. Hosack	Dg, Dr	12	52	4,270	.0	Bottom of board cover	40.08	9-16-47	N	
43/37-35B1	Nevada Department of Highways	Dr, 1941	6	140	4,340	.6	Top of concrete floor	95.05	9-16-47	D	
43/37-35B2	Orovada School	Dr, 1952	6	122		.0	Land surface	65.	11-52	D	Log.
43/37-35B3	Orovada School	Dr	10	80		.2	Top of casing	75.70	10-29-54	N	
44/36-3D1	U. S. Government	Dr, 1954	10	48		.5	Plate covering casing	17.15	10-13-54	S	Log.
44/36-8C1	Raimundo Erquiaga	Dr, 1948	6	50		.0	Land surface	10.		D	Log.
44/36-14A1	Lyle L. Ellison	Dr	12	76		.0	Top of casing	13.20	10-14-54	S	
44/36-15C1	U. S. Government	Dr	16	413		.0	Land surface	55.		S	Log.
44/36-22B1	U. S. Government	Dr	16	420		1.0	Top of casing	32.37	7-18-54	N	Log.
44/36-22D1	Lyle L. Ellison	Dr	10	35		1.0	Top of casing	11.57	10-14-54	S	Log.
44/36-25C1	Lyle L. Ellison		12	19	4,150	.0	Lower edge of pipe tee	7.16	9-23-47	S	
44/36-33B1	Raimundo Erquiaga	Dr	6	95		.0	Land surface	3.		S	Log.
44/37-4D1	H. J. Valenta	Dr	12	44		.0	Land surface	34.12	10-27-47	D	
44/37-5B1	Lyle L. Ellison	Dr, 1954	16	498		.0	Land surface	20.		I	Log.
44/37-9D1	U. S. Government	Dr, 1940		66		.0	Land surface	20.6	9-26-40	S	Log.
44/37-9D2	U. S. Government	Dr	10	46	4,249	.0	Top of casing	46.30	9-24-47	N	
44/37-20C1	C. S. Collins	Dg	48	25		.0	Land surface	24.46	10-29-47	N	
44/37-25B1	John Tallman	Dr	6	44		.2	Top of casing	35.99	8-11-54	N	
45/38-1A1	U. S. Government	Dg	48	35	4,929	.0	Nail in stringer	34.50	9-25-47	N	
45/38-28D1	H. J. Valenta	Dg, 1931	36	17	4,684	.0	Top of wood cover	9.78	9-24-47	S	
45/38-33A1	Leo Burke	Dr, 1950	12	460		.0	Land surface	40.		S	Log.
45/38-34B1	H. J. Valenta	Dg	36	20	4,787	.5	Top of wood cover	12.26	9-24-47	D, S	
46/38-7A1	Frank McCleary Cattle Co.	Dr	12	32		.3	Top of casing	4.82	10-29-47	S	
46/38-16A1	U. S. Government	Dr, 1947	6	54	4,456	.2	Top of casing	7.87	7-16-47	S	Log.
46/38-19B1	Frank McCleary Cattle Co.	B	12	26	4,312	1.0	Top of casing	7.20	9-26-47	D	
46/38-33C1	U. S. Government	Dr, 1950	6	100		.0	Land surface	78.	9- 1-50	S	Log.
47/37-3C1	Ash Fork Livestock Co.	Dr, 1939	6	600							Reportedly did not completely penetrate valley fill.
47/37-28D1	Cordero Mining Co.	Dr, 1941	6	442		.0	Land surface	200.	8-54	M	Temp. 140°F; analysis.
47/37-28D2	Cordero Mining Co.	Dr, 1943	7	510		.0	Land surface	165.	8-54	M	Temp. 125°F; log.
47/38-4B1	U. S. Government	Dg	36	14	4,448	1.5	Top of platform	15.20	10-29-47	N	
47/38-5D1	Tomasa Albisia	Dg	60	13	4,414	.0	Land surface	11.70	7-15-47	N	
47/38-8C1	U. S. Government	Dr	8	18		1.0	Top of platform	6.46	7-27-54	S	
47/38-16B1	Harry English	Dg, Dr	6	40		0.1	Top of casing	29.82	10-29-47	D	
47/38-20D1	U. S. Government	Dg	72	15		.0	Top of platform	12.83	10-29-47	N	
48/37-33C1	Victor Albisu	Dr	6	41		1.8	Top of casing	16.00	10- 1-53	N	
48/37-35C1	U. S. Government	Dr, 1945	6	40	4,452	2.0	Top of casing	20.18	10-28-47	N	
48/37-36C1	Ash Fork Livestock Co.	Dr, 1945	6	40		.8	Top of casing	13.42	10-29-47	S	
48/38-32D1	Thomas Alcorda	Dg	72	25	4,428	1.0	Top of pipe clamp	12.22	10-29-47	D, S	
48/38-32D2	Batista Albisu	Dr	8	100		.0	Land surface	20.	10-54	Q	Analysis.
48/38-32D3	C. Olavarria	Dg	48	37	4,425	.0	Bottom edge of stringer	14.71	3-20-51	N	
48/38-32D4	C. Olavarria	Dr	6	132	4,425	.5	Top of casing collar	16.84	3-20-51	N	
48/38-35D1	Geo. W. Wilkinson	Dr, 1945	6			.0	Bottom edge of a hole in casing	6.22	10-29-47	D	
36/41E-36D1	State of Oregon	Dr, 1940	8	283	4,200	.0	Land surface	215.	9-14-54	D	
39/42E-2C1	U. S. Government	Dr	6		4,730	.0	Land surface	267.1	7-10-54	N	
41/42E-15D1	Lucky Seven Ranch	Dg	120	12	4,428	.0	Floor of pump shed	9.02	9-26-47	S	

*See remarks column. †Determined from altimeter readings.

TABLE 8

Water levels in observation wells in Quinn River Valley, Humboldt County, Nevada, 1946–1956

42/37–3B1.

Water level, in feet, below land-surface datum

Date	Water level	Date	Water level	Date	Water level
Sept. 15, 1949	16.80	Sept. 17, 1951	20.35	Sept. 10, 1954	*27.34
Jan. 20, 1950	16.55	Mar. 27, 1952	18.20	Sept. 24	23.30
June 28	*19.35	Sept. 10	*21.74	Mar. 17, 1955	20.38
Sept. 16	19.80	Mar. 18, 1953	16.68	Sept. 7	*29.55
Mar. 29, 1951	17.84	Sept. 16	*23.60	Mar. 22, 1956	22.87
July 26	*23.60	Mar. 9, 1954	17.30		

*Well 43/37–34C2 pumping.

42/37–33B2.

Water level, in feet, below land-surface datum

Date	Water level	Date	Water level	Date	Water level
Apr. 21, 1948	36.54	Sept. 13, 1948	37.57	Sept. 18, 1951	38.67
June 20	37.33	Oct. 5	37.22	Mar. 27, 1952	38.28
June 27	38.42	Mar. 17, 1949	37.53	Sept. 10	37.20
July 4	37.75	May 16	37.98	Mar. 18, 1953	35.70
July 11	40.00	July 20	39.08	Sept. 16	35.42
July 18	40.42	Sept. 15	38.00	Mar. 9, 1954	35.74
July 25	39.75	Jan. 20, 1950	38.23	Sept. 10	36.86
Aug. 1	39.83	Mar. 24	38.31	Mar. 17, 1955	38.08
Aug. 8	39.00	Sept. 16	38.64	Sept. 6	41.66
Aug. 15	38.00	Mar. 29, 1951	38.72	Mar. 22, 1956	40.78
Aug. 22	37.83	July 26	38.60		

43/37–4C2.

Water level, in feet, below land-surface datum

Date	Water level	Date	Water level	Date	Water level
Sept. 18, 1947	32.05	Mar. 24, 1950	33.76	Mar. 18, 1953	31.68
Apr. 21, 1948	32.70	June 28	32.80	Apr. 23	31.90
Aug. 26	31.96	Sept. 16	33.65	Sept. 16	30.84
Oct. 5	32.37	Mar. 29, 1951	34.11	Mar. 9, 1954	31.82
Mar. 17, 1949	33.06	July 26	32.65	Sept. 24	33.60
May 16	32.94	Sept. 18	33.37	Mar. 17, 1955	34.03
July 20	32.59	Mar. 27, 1952	34.15	Sept. 8	34.93
Sept. 15	33.13	Sept. 10	30.41	Mar. 22, 1956	35.22
Jan. 20, 1950	33.67				

43/37–28A1.

Water level, in feet, below land-surface datum

Date	Water level	Date	Water level	Date	Water level
May 23, 1946	9.69	July 20, 1949	10.05	Mar. 18, 1953	10.20
Oct. 9	9.55	Sept. 15	10.00	Apr. 23	10.21
Mar. 18, 1947	9.40	Jan. 20, 1950	9.79	Sept. 16	10.67
Nov. 5	8.13	Mar. 24	10.13	Mar. 9, 1954	10.14
Jan. 5, 1948	9.10	June 28	10.39	Sept. 10	*25.29
Apr. 21	9.36	Sept. 16	10.74	Sept. 24	16.43
June 16	9.78	Mar. 29, 1951	10.70	Mar. 17, 1955	12.29
Aug. 26	10.07	Sept. 18	11.53	Sept. 7	*26.92
Oct. 5	9.62	Mar. 27, 1952	10.97	Mar. 22, 1956	14.69
Mar. 17, 1949	9.42	Sept. 10	10.52		

*Well 43/37–28A2 pumping.

TABLE 9

Drillers' logs of wells, Quinn River Valley, Humboldt County, Nevada

(See Table 7 for additional information on the following wells.)

	Thickness (feet)	Depth (feet)
41/37-29D4.		
Soil	4	4
Clay and gravel	56	60
Gravel and sand (water bearing)	12	72
Clay	8	80
Clay, gravel, and boulders	3	83
Gravel and sand (water bearing)	38	121
Casing perforated from 88 to 121 feet.		
41/37-33A1.		
Soil	7	7
Gravel (water bearing)	9	16
Casing perforated from 8 to 16 feet.		
41/37-33A2.		
Soil	7	7
Gravel, small (water bearing)	17	24
Boulders (water bearing)	4	28
Casing perforated from 16 to 28 feet.		
42/36-11B1.		
Clay	15	15
Sand, fine	65	80
Sand, coarse, and gravel, fine	60	140
Casing perforated from 0 to 140 feet.		
42/37-3B1.		
Soil	4	4
Sand, gravel, and silt	14	18
Clay, gray	5	23
Sand and gravel, brown and muddy (water bearing)	11	34
Clay, sandy, brown	22	56
Clay, sandy, gray	14	70
Gravel and sand (water bearing)	1	71
Clay, sandy, gray	3	74
Sandstone, hard	2	76
Clay and stringer of gravel	14	90
Clay, brown	17	107
Sand and gravel (water bearing)	5	112
Clay, brown	27	139
Clay, gray	13	152
Clay, brown	8	160
42/37-18A1.		
Soil	10	10
Sand	2	12
Sand and clay	23	35
Sand and gravel	47	82
Sand	12	94
Gravel, sandy	24	118
Sand	18	136
Gravel, sandy	13	149
Sand, hard	51	200
Gravel, sandy	13	213
Clay, sandy	18	231
Gravel, sandy	8	239
Clay, sandy	16	255
Gravel, sandy	5	260
Clay, sandy	18	278
Gravel, sandy	9	287
Clay, sandy	37	324
Sandstone, hard	3	327
Cased to 295 feet.* Casing perforated from 25 to 295 feet.		
*Casing depths are given only where the well is not cased to the bottom.		
42/37-33A1.		
Soil	5	5
Gravel, sand streaks	65	70
Clay, hard	1.5	71.5
Gravel, coarse, and boulders, clean	3.5	75
Test hole, not cased.		

TABLE 9—*Continued*

	Thickness (feet)	Depth (feet)
42/37-33B2.		
Soil	3	3
Gravel, fine to coarse	10	13
Soil	2	15
Sand and gravel, fine	2	17
Soil	1	18
Sand, gravel, and soil	4.5	22.5
Soil	3.5	26
Gravel, fine to coarse	4	30
Clay	1	31
Gravel, fine (water bearing)	7	38
Quicksand	1	39
Sand and gravel, dirty	8	47
Clay	3	50
Sand, coarse, and fine gravel	8	58
Clay	11	69
Sand and gravel	19	88
Clay	7	95
Cased to 68 feet.		
42/37-33C1.		
Soil	1	1
Gravel, sand and silt	35	36
Gravel, muddy (water bearing)	9	45
Sand, muddy (water bearing)	18	63
Clay, gray, and gravel	7	70
Gravel, cemented (water bearing)	6	76
Clay, brown	9	85
Clay, brown, sticky	8	93
Clay, sandy, and pea gravel	7	100
Clay, sandy, brown	4	104
Clay, sandy, and pea gravel	8	112
Sandstone	6	118
Clay, sandy	7	125
Sandstone, soft	4	129
Sand and gravel, muddy (water bearing)	26	155
Clay with some gravel	7	162
Clay, sandy	8	170
Clay with some gravel	18	188
Clay, brown	12	200
Cased to 188 feet.		
43/37-17A1.		
Soil	8	8
Gravel and clay	2	10
Clay, gray	10	20
Gravel and red clay	2	22
Clay	3	25
Clay, sticky	10	35
Clay	11	46
Gravel (water bearing)	6	52
Clay	8	60
Clay, sandy, red	15	75
Gravel (water bearing)	3	78
Clay, brown	9	87
Gravel, hard	3	90
Clay, brown	5	95
Gravel, hard	5	100
Clay and gravel	8	108
Gravel	12	120
Clay	10	130
Clay, brown	13	143
Gravel and hard sandstone	5	148
Gravel, clay, and sandstone	10	158
Gravel, hard	6	164
Clay, soft	7	171
Gravel, hard	1	172
Clay, soft	3	175
Gravel, hard	10	185
Clay, brown	20	205
Gravel, hard	3	208
Clay, brown	10	218
Gravel, hard	2	220
Clay, tough, gray	8	228
Gravel (water bearing)	4	232
Clay	5	237
Gravel (water bearing)	3	240
Gravel and clay	7.5	247.5
Casing perforated from 12 to 241 feet.		

	Thickness (feet)	Depth (feet)
43/37-19A1.		
Soil	3	3
Clay, gray, medium hard	21	24
Gravel, gray medium hard	4	28
Gravel, blue, medium hard (water bearing)	24	52
Clay and gravel, gray, hard	21	73
43/37-28A2.		
Soil	12	12
Gravel (water bearing)	26	38
Clay	38	76
Gravel, fine, muddy	6	82
Clay, brown	22	104
Sand, muddy	14	118
Clay and gravel	38	156
Clay, sandy, hard	18	174
Gravel	2	176
Clay	24	200
Sandstone	8	208
Gravel and sand (water bearing)	2	210
Clay	10	220
Gravel and sand (water bearing)	2	222
Clay, some gravel	49	271
Gravel, cemented	7	278
Clay, soft	8	286
Gravel and clay	2	288
Clay	8	296
Sandstone and clay	8	304
Clay	6	310
Clay with sand stringers (water bearing)	10	320
Cased to 295 feet. Casing perforated from 12 to 383 feet.		
43/37-32D1.		
Soil	8	8
Clay, brown	40	48
Sand, brown, muddy	34	82
Sandstone	13	95
Sand, brown, muddy (water bearing)	21	116
Sandstone, brown	14	130
Sand, muddy (water bearing)	23	153
Sand and pea gravel (water bearing)	2	155
Sand, muddy (water bearing)	24	179
Clay, grey	7	186
Sand and pea gravel	3	189
Sand, muddy (water bearing)	11	200
Sand and pea gravel (water bearing)	2	202
Clay, brown	16	218
Gravel, cemented	4	222
Clay, sandy	12	234
Sand, coarse, muddy (water bearing)	6	240
Clay, brown, sandy	64	304
Sand, dry	6	310
Clay, brown	103	413
Sand, coarse, and pea gravel (water bearing)	6	419
Clay, brown	25	444
Sand and pea gravel (water bearing)	6	450
Clay	118	568
Gravel, cemented	7	575
Clay, brown	20	595
Gravel, cemented	5	600
Clay, brown	12	612
Sandstone and clay	20	632
Clay	23	655
Gravel, fine, and sand (water bearing)	5	660
Clay, brown	5	665
Gravel, fine, and sand (water bearing)	11	676
Clay, brown	2	678
Cased to 677 feet.		
43/37-33C1.		
Soil	6	6
Hardpan	5	11
Silt	39	50
Clay, brown	32	82
Gravel, muddy (water bearing)	22	104
Clay with gravel	16	120
Sand, coarse, and gravel (water bearing)	3	123
Silt with sand and gravel	22	145
Sand, coarse, and gravel (water bearing)	3	148
Clay, sandy	22	170
Clay, sandy, with gravel	10	180
Clay, sandy	56	236
Cased to 215 feet. Casing perforated from 51 to 206 feet.		

43/37–34C1.

	Thickness (feet)	Depth (feet)
Soil	7	7
Sand and silt	21	28
Sand and pea gravel, muddy	45	73
Clay, brown	21	94
Clay, sandy	6	100
Sand and gravel, muddy (water bearing)	18	118
Gravel, cemented	8	126
Gravel, muddy (water bearing)	8	134
Clay, hard, gray	18	152
Clay, brown	25	177
Gravel, cemented	7	184
Clay, brown, with gravel	69	253
Gravel, cemented	5	258
Sand and gravel (water bearing)	2	260
Gravel, cemented	2	262
Clay, brown	39	301
Gravel, cemented	3	304
Clay, brown	30	334
Gravel (water bearing)	14	348
Clay, brown	47	395
Gravel, cemented	10	405
Gravel and sand (water bearing)	3	408
Clay	17	425
Sand and gravel (water bearing)	1	426
Clay, gray	20	446
Gravel, cemented	2	448
Clay, gray, with gravel	17	465
Clay, gray-blue	10	475
Gravel, cemented	5	480
Clay, brown	35	515

Casing perforated from 0 to 505 feet.

43/37–34C3.

	Thickness (feet)	Depth (feet)
Soil	16	16
Soil and silt	52	68
Gravel, fine, muddy	8	76
Clay, brown	14	90
Clay, brown, sticky	8	98
Sand, muddy	24	122
Sandstone, hard	6	128
Gravel, fine, muddy (water bearing)	15	143
Gravel and clay	9	152
Sand, muddy	5	157
Sandstone	5	162
Clay, brown	8	170
Gravel, cemented	8	178
Clay, brown	6	184
Sand and gravel, cemented	10	194
Clay, hard, blue	10	204
Clay, soft, blue	19	223
Gravel, cemented (water bearing)	6	229
Clay, soft, white	2	231
Sandstone, hard	3	234
Clay, gray	9	243
Sandstone, hard	3	246
Clay, brown	39	285
Gravel, cemented	3	288
Clay, gray	4	292
Gravel, cemented	8	300
Clay, brown	14	314
Clay, gray	20	334
Gravel, cemented (water bearing)	36	370
Clay, brown	20	390
Gravel, cemented	5	395
Clay, brown	18	413
Sandstone	3	416
Clay, gray, sandy	4	420
Sand, coarse, firm	5	425
Clay, gray	15	440
Sand and pea gravel (water bearing)	4	444
Clay	2	446
Sand and gravel, firm	5	451
Sand and pea gravel (water bearing)	4	455
Sandstone	5	460
Sand and gravel (water bearing)	10	470
Gravel, cemented	3	473
Sand and pea gravel	6	479
Clay, gray	9	488

Casing perforated from 0 to 480 feet.

43/37-35B2.	Thickness (feet)	Depth (feet)
Soil	12	12
Gravel, cemented	48	60
Clay, gray	50	110
Gravel, cemented, brown (water bearing)	25	135

Cased to 128 feet. Casing perforated from 112 to 120 feet.

44/36-3D1.

Soil	18	18
Gravel (water bearing)	7	25
Clay	2	27
Gravel (water bearing)	6	33
Clay	3	36

Cased to 36 feet.

44/36-8C1.

Clay and gravel	10	10
Gravel with clay (water bearing)	8	18
Rock	32	50

Cased to 22 feet. Casing perforated from 5 to 22 feet.

44/36-15C1.

Soil	1	1
Gravel	12	13
Clay with gravel	61	74
Clay with broken lava	37	111
Clay and gravel (water bearing)	154	265
Lava, broken, and clay	15	280
Lava, gray	25	305
Lava, red	20	325
Lava, gray	27	352
Lava, brown	5	357
Lava, black	25	382
Gravel, cemented (agglomerate)	31	413

Cased to 270 feet. Casing perforated from 156 to 258 feet.

44/36-22B1.

Soil	9	9
Gravel, coarse (water bearing)	13	22
Clay, brown	66	88
Clay and gravel	57	145
Clay, blue	70	215
Clay and gravel	123	338
Clay, blue	82	420
Gravel	—	420

44/36-22D1.

Soil	22	22
Gravel (water bearing)	6	28
Clay	1	29
Gravel (water bearing)	5	34
Clay	2	36

44/36-33B1.

Clay	8	8
Gravel and boulders with clay	22	30
Clay and gravel	25	55
Gravel and clay (water bearing)	40	95

Casing perforated from 5 to 95 feet.

44/37-5B1.

Soil	17	17
Gravel (very little water)	54	71
Clay with some gravel	94	165
Clay	15	180
Clay with some gravel	75	255
Clay	205	460
Sand with some pea gravel (water bearing)	7	467
Clay	28	495
Gravel (water bearing)	3	498

Cased to 281 feet.

44/37-9D1.

Soil, brown, soft	2	2
Gravel, gray-brown, medium hard	6	8
Clay, brown, soft, sandy	20	28
Clay, yellow, medium hard, sandy	10	38
Hardpan, brown	6	44
Clay, yellow, soft, sandy	6	50
Hardpan, brown	16	66

	Thickness (feet)	Depth (feet)
45/38-33A1.		
Soil	3	3
Silt and gravel	7	10
Clay, yellow	30	40
Gravel, cemented	5	45
Clay, yellow	65	110
Clay and coarse gravel	27	137
Gravel, clean, coarse (water bearing)	8	145
Gravel, coarse, and reddish clay	15	160
Gravel, coarse, hard (water bearing)	15	175
Gravel, coarse, and reddish clay	68	243
Gravel, coarse, muddy	7	250
Gravel, cemented	20	270
Gravel, coarse, clean	12	282
Gravel, coarse, muddy	11	293
Gravel, coarse, clean	25	318
Gravel, coarse, muddy	142	460
Cased to 228 feet. Casing perforated from 0 to 228 feet.		
46/38-16A1.		
Soil	1	1
Gravel, cemented	50	51
Sand, hard packed	3	54
46/38-33C1.		
Gravel	7	7
Rock, hard, blue	43	50
Clay	38	88
Gravel (water bearing)	62	150
47/37-28D2.		
Overburden with brown to pink clay	40	40
Clay, varicolored	115	155
Basalt and felsite	90	245
Clay, pink and gray	55	300
Clay and opalite	15	315
Felsite, brown and red	30	345
Opalite, black	155	500

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O R E G O N
N E V A D A
R. 40 E.
R. 41 E.
R. 42 E.
R. 43 E.
R. 44 E.
R. 35 E.
R. 36 E.
R. 37 E.
R. 38 E.
R. 39 E.
T. 41 S.
T. 48 N.
T. 47 N.
T. 46 N.
T. 45 N.
T. 44 N.
T. 43 N.
T. 42 N.
T. 41 N.
T. 40 N.
T. 39 N.
T. 38 N.
T. 37 N.
T. 36 N.
118° 00'
117° 50'
117° 40'
42° 00'
41° 50'
41° 40'
41° 30'
41° 20'
41° 10'
QUINN RIVER MOUNTAINS
SANTA ROSA RANGE
TOIYABE NATIONAL FOREST
US 95
NEVADA 8A
McDermit
Orovada
Sod House
Davey Town
Home Ranch
Sawtooth Peak
McConnell Peak
Buckskin Peak
Spring Peak
Santa Rosa Peak
Paradise Peak
Galligher Flat
Sombrero Peak
Bloody Run Peak
Winnemucca Mt.
Highest Shoreline of Lake Lahontan
Orovada Area
Davey Town Area
EXPLANATION
Sand dune area
Younger valley fill
Includes unconsolidated gravel, sand, silt, and clay.
QUATERNARY
Older valley fill
Includes tuffaceous shale, sandstone, and fanglomerate.
TERTIARY
Bedrock
Includes sedimentary, igneous, and metamorphic rocks of Paleozoic and Mesozoic age, and volcanic rocks of Tertiary age.
PALEOZOIC TO TERTIARY
Approximate drainage divide
U
D
Fault
Approximate toe of fan
Irrigation well
Non-Irrigation well
Spring
Gaging station
MAP OF
QUINN RIVER VALLEY
HUMBOLDT COUNTY
NEVADA
Showing general geologic and hydrologic features, and location of wells and springs.
September 1956
0 1 2 3 4 5 Miles
Base from 1953 Bureau of Land Management map.
Mapping from areal photographs south of T. 41 N. by C. P. Zones