Ground-Water Resources of Riverton Irrigation Project Area, Wyoming

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With a section on

CHEMICAL QUALITY OF GROUND WATER

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GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1375

Prepared as part of a program of the Department of the Interior for development of the Missouri River basin

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1959

UNITED STATES DEPARTMENT OF THE INTERIOR

FRED A. SEATON, *Secretary*

GEOLOGICAL SURVEY

Thomas B. Nolan, *Director*

The U. S. Geological Survey Library has cataloged this publication as follows:

Morris, Donald Arthur, 1918–
Ground-water resources of Riverton irrigation project area, Wyoming, by D. A. Morris [and others] With a section on Chemical quality of ground water, by W. H. Durum. Washington, U. S. Govt. Print. Off., 1958.
vi, 206 p. maps (3 fold., 1 col. in pocket) diagrs., tables, 24 cm. (U. S. Geological Survey. Water-supply paper 1375)
Prepared as part of a program of the Dept. of the Interior for development of the Missouri River Basin.
Bibliography: p. 97–99.
1. Water-supply — Wyoming — Riverton area. 2. Water, Underground—Wyoming—Riverton area. 3. Water—Composition. I. Durum, Walton Henry, 1917– II. Title. III. Title: Riverton irrigation project area, Wyoming. (Series)
TC801.U2 no. 1375 551.49097876 G S 59–172
——— Copy 2. GB1025.W8M6

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C.

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GROUND-WATER RESOURCES OF THE RIVERTON IRRIGATION PROJECT AREA, WYOMING

By D. A. MORRIS, O. M. HACKETT, K. E. VANLIER, and E. A. MOULDER

ABSTRACT

The Riverton irrigation project area is in the northwestern part of the Wind River basin in west-central Wyoming. Because the annual precipitation is only about 9 inches, agriculture, which is the principal occupation in the area, is dependent upon irrigation. Irrigation by surface-water diversion was begun in 1906; water is now supplied to 77,716 acres and irrigation has been proposed for an additional 31,344 acres.

This study of the geology and ground-water resources of the Riverton irrigation project, of adjacent irrigated land, and of nearby land proposed for irrigation was begun during the summer of 1948 and was completed in 1951. The purpose of the investigation was to evaluate the ground-water resources of the area and to study the factors that should be considered in the solution of drainage and erosional problems within the area.

The Riverton irrigation project area is characterized by flat to gently sloping stream terraces, which are flanked by a combination of badlands, pediment slopes, and broad valleys. These features were formed by long-continued erosion in an arid climate of the essentially horizontal, poorly consolidated beds of the Wind River formation. The principal streams of the area flow southeastward. Wind River and Fivemile Creek are perennial streams and the others are intermittent. Ground-water discharge and irrigation return flow have created a major problem in erosion control along Fivemile Creek. Similar conditions might develop along Muddy and lower Cottonwood Creeks when land in their drainage basins is irrigated.

The bedrock exposed in the area ranges in age from Late Cretaceous to early Tertiary (middle Eocene). The Wind River formation of early and middle Eocene age forms the uppermost bedrock formation in the greater part of the area. Unconsolidated deposits of Quaternary age, which consist of terrace gravel, colluvium, eolian sand and silt, and alluvium, mantle the Wind River formation in much of the area.

In the irrigated parts of the project, water for domestic use is obtained chiefly from the sandstone beds of the Wind River formation although some is obtained from the alluvium underlying the bottom land and from the unconsolidated deposits underlying the lower terraces along the Wind River. Although adequate quantities of water for domestic use are available from the Wind River formation, these quantities are not considered to be large enough to warrant pumping of ground water for irrigation. Only a few wells are in the nonirrigated part of the area. When this new land is irrigated, a body of ground water will gradually form in the terrace deposits and the alluvial and colluvial-alluvial deposits. Eventually, the terrace deposits may yield adequate quantities of water for domestic and stock use, but only locally are the alluvial and colluvial-alluvial deposits likely to become suitable aquifers.

In the Riverton irrigation project area, ground water occurs under water-

table conditions near the surface and under artesian conditions in certain strata at both shallow and greater depths. Irrigation is the principal source of recharge to the shallow aquifers; the water level in wells that tap these aquifers fluctuates with irrigation. The depth to water in the shallow wells ranges from less than 1 foot to about 30 feet below the land surface, depending on the season of the year and on the length of time the land has been irrigated. The water level in wells that tap the deep confined aquifers, which receive recharge indirectly from surface sources, fluctuates only slightly because the recharge and discharge are more constant. In most places the depth to water in wells penetrating the deep confined aquifers is much greater than that in shallow wells, but in certain low areas water from the deep aquifers flows at the surface from wells. Ground water moves from the area of recharge in the direction of the hydraulic gradient and is discharged either by evapotranspiration; by inflow into streams, drains, or lakes; by pumping or flow of wells; or by flow of springs.

Waterlogging and the associated development of saline soils are common in parts of the Riverton irrigation project and adjacent irrigated land. The waterlogging is in part the result of the infiltration of irrigation water in excess of the capacity of the aquifers to store and transmit this added recharge. The solution of the drainage problems involves the consideration of a number of factors, some of which are inadequately known in some parts of the area and require further investigation before fully effective drainage measures can be designed.

The results of an aquifer test to determine the hydrologic characteristics of the Wind River formation at Riverton indicate a transmissibility of 10,000 gallons per day per foot (10,000 gpd per ft) and a storage coefficient of 2×10^{-4}. The results of the test provide a part of the necessary foundation for the solution of present and future water-supply problems at Riverton and throughout the project area.

Water from shallow aquifers in irrigated tracts in the Riverton irrigation project area generally contains large amounts of dissolved solids that were leached from the soil and rocks by infiltrating irrigation water. However, wells tapping beds that receive considerable recharge from influent canal and drain seepage yield water of relatively low mineralization. Dilute water is obtained also from some shallow wells in the alluvial bottom lands and on low stream terraces that border the Wind River. Water from deep aquifers generally is more dilute than that from shallow aquifers. However, ground water from the deeper aquifers, unmixed with irrigation water, geneally has a percent sodium greater than 80.

Analyses of salt crusts on the ground surface in low areas that are affected by effluent seepage and a high water table show predominance of sodium sulfate salinity, and from determinations of the water-soluble and acid-soluble substances in several samples of soil and shale it is apparent that harmful concentrations of salts are being deposited in poorly drained areas. Although most of the soil in the Midvale irrigation district is of the normal arid type, analyses of soil samples show that saline, nonsaline alkaline, and saline alkaline types also are present.

INTRODUCTION

LOCATION AND EXTENT OF AREA

The area described in this report comprises the Riverton irrigation project, the irrigated land adjacent to the project, and nearby land proposed for irrigation. It is in Fremont County in west-central Wyoming (fig. 1) and lies in the northwestern part of

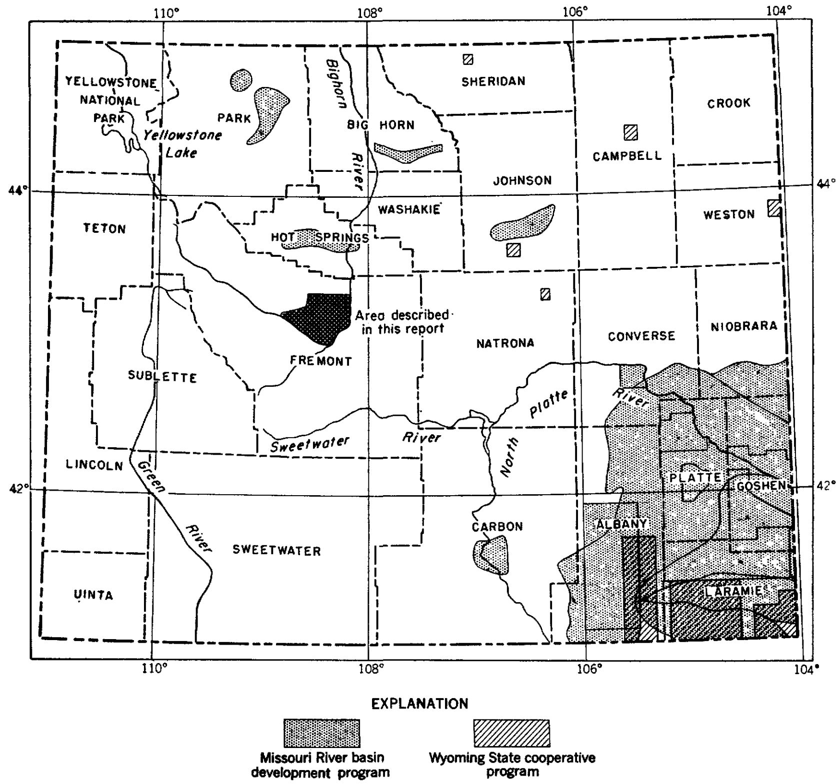

FIGURE 1.—Map of Wyoming showing areas in which ground-water studies have been made under the program for the development of the Missouri River basin and the Wyoming State cooperative program.

the Wind River basin between the south flank of the Owl Creek Mountains and the Wind River.

The maximum length of the area, from the Wind River diversion dam at the extreme western end to Boysen Reservoir at the extreme eastern end, is about 40 miles and the maximum width, from Cottonwood Creek on the north to the big bend of the Wind River on the south, is about 25 miles. (See fig. 2.) The area comprises

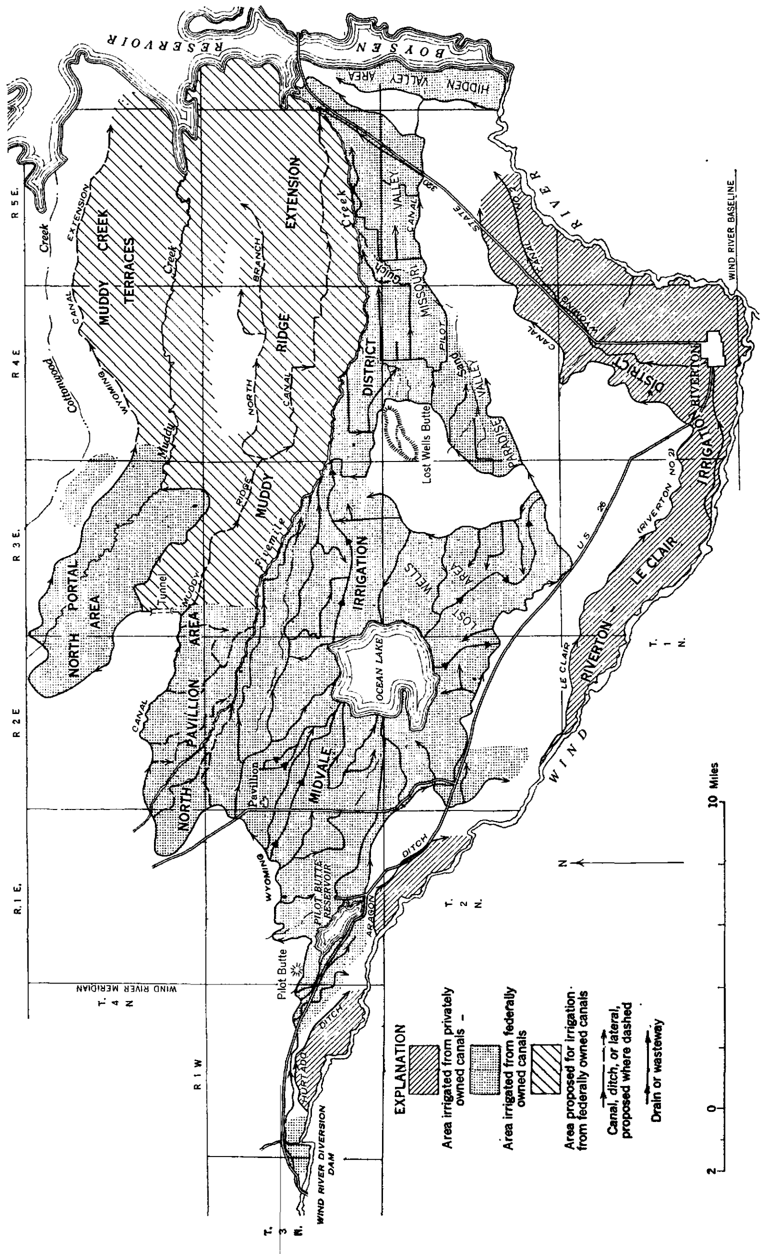

FIGURE 2.—Map of Riverton irrigation project and adjacent lands, showing subdivision into agricultural areas.

about 300,000 acres of which, according to the U. S. Bureau of Reclamation and the office of the Wyoming State Engineer, a total of 77,716 acres was under irrigation in 1951. An additional 31,344 acres has been proposed for irrigation under the development program.

PURPOSE AND SCOPE OF INVESTIGATION

The purposes of this investigation were to determine (1) the location of available water supplies for farms and towns within the area, (2) the chemical quality of the ground water, (3) the effects of irrigation on ground- and surface-water supplies, (4) the water-bearing properties of the aquifers, (5) where drainage problems exist or may occur, and (6) the geologic and hydrologic factors that must be considered in the design of adequate and effective drainage facilities.

The field investigation on which this report is based was made by the writers between June 1948 and November 1951. A study was made of the geologic history, physiography, structure, and stratigraphy of the area, and a geologic map having particular emphasis on ground-water conditions was prepared. The hydrologic properties of the Wind River formation were determined by the pumping-test method. Every well in the area was examined and pertinent available data were recorded. Measurements of the water level were made periodically in selected wells throughout the area. Samples of water were collected from wells and surface sources at key locations in the area, and a chemical analysis of the water was made in the laboratory of the United States Geological Survey at Lincoln, Nebr.

The investigation was under the general supervision of A. N. Sayre, chief of the Ground Water Branch, and of G. H. Taylor, regional engineer. F. A. Swenson, district geologist, Billings, Mont., directly supervised the field investigation. The study of the quality of the water was under the general direction of S. K. Love, chief of the Quality of Water Branch, and under the direct supervision of P. C. Benedict, regional engineer.

PREVIOUS INVESTIGATIONS

Little detailed work related to ground water had been done previously in the report area. The geology of the Boysen area, which includes the northern part of the Riverton project, was described by Tourtelot and Thompson (1948). The results of the mapping of the remander of the Riverton area by the Fuels Branch of the Geological Survey during the 1949, 1950, and 1951 field seasons have not yet been published.

The report by Tourtelot and Thompson (1948) and other reports dealing with general regional geology, which have been very useful to the authors, are listed in a bibliography at the end of this report.

METHODS OF MAPPING

The geology of the area was mapped on aerial photographs and the data transferred to a base map prepared by the Topographic Division of the Geological Survey from aerial photographs. The scale of the map was 1:24,000.

Altitudes of wells were estimated from Bureau of Reclamation topographic maps of the area or were determined by third-order leveling from benchmarks of either the Geological Survey or the Bureau of Reclamation. The terraces were correlated by use of an altimeter or topographic maps. During the mapping the thickness of the gravel in the terrace deposits was measured roughly by hand level wherever the top and bottom of the gravel were exposed at the terrace edge. However, in most places a lack of clean exposures and the large amount of mantling material on almost all terrace faces interfered with the determination of the exact thicknesses of the overburden, and estimates had to be made.

Precise location of the contact between colluvial-alluvial or alluvial deposits and bedrock proved to be very difficult. Consequently, the units that were mapped indicate the predominant rock type; other rocks or sediments present were not considered mappable. A description of the kind and amounts of mantling deposits is given later in this report.

ACKNOWLEDGMENTS

The writers are indebted to the many persons who contributed information and assistance in the field and to those who aided in the preparation and review of this report. Earl Sullivan, James Mariner, Edward O'Hara, Martin Norman, and Homer Harry, well drillers, furnished information pertaining to wells they had drilled in the area. The Farmers Home Administration also made available much information on wells. The Bureau of Reclamation supplied maps and furnished basic data relating to ground water and drainage. The Soil Conservation Service and the Bureau of Indian Affairs likewise were of assistance. The wholehearted cooperation of the residents of the area greatly assisted the field studies.

WELL-NUMBERING SYSTEM

Each well in the area covered by this investigation is numbered according to its location within the Bureau of Land Management system of land subdivision. (See fig. 3). The first letter (a capital) of a well number indicates the quadrant of the meridian and baseline system in which the well is located; the quadrants are lettered A, B, C, and D in a counterclockwise direction beginning

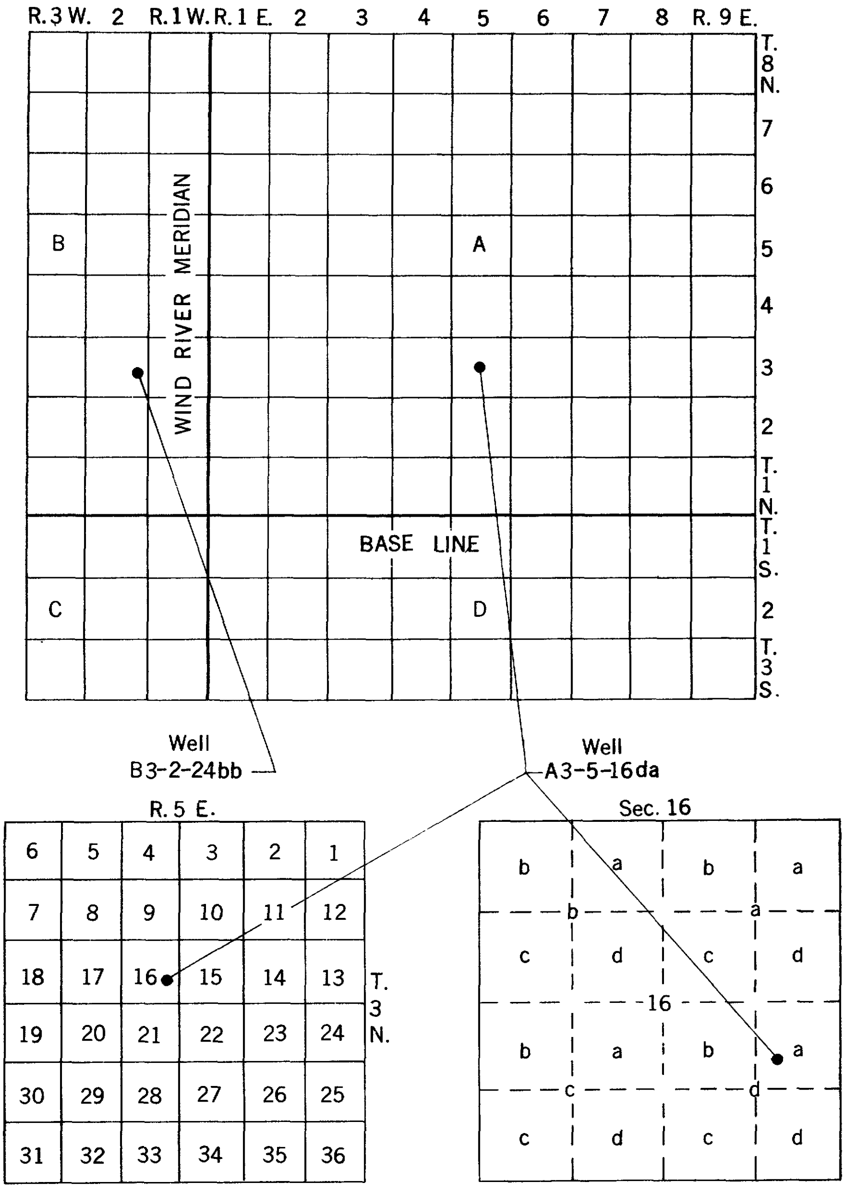

FIGURE 3.—Sketch illustrating well-numbering system used in this report.

with A in the northeast quadrant. The wells in the Riverton project area are in the northeast (A), the northwest (B), or the southeast (D) quadrants of the Wind River principal meridian and baseline system. The first numeral of a well number indicates the township, the second the range, and the third the section. The lowercased letters following the section number indicate the location of the well within the section; the first letter denotes the quarter section and the second the quarter-quarter section, or 40-acre tract. The lowercase letters also are assigned in a counterclockwise direction and begin in the northeast quarter or quarter-quarter section. If two or more wells are in a 40-acre tract, they are differentiated by consecutive numbers (beginning with 1) that are added to the well number.

GEOGRAPHY

CLIMATE

The climate of the Riverton irrigation project area is semiarid to arid and is characterized by great deviations from normal precipitation. United States Weather Bureau stations at the Wind River diversion dam and at Pavillion and Riverton have complete records for 28- to 31-year periods. (See table 1.) During the past 31 years at the Wind River diversion dam, at the extreme western end of the area, the annual precipitation has ranged from 5.05 to 16.28 inches and has averaged 9.83 inches. During the past 28 years at Pavillion, in the northwestern part of the area,

TABLE 1.—*Annual precipitation, in inches, at Wind River diversion dam and at Pavillion and Riverton*

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

Year	Wind River diversion dam	Pavillion	Riverton
1919			11.25
1920			
1921	9.14		
1922	7.03		
1923	15.08		18.43
1924	9.02	9.28	10.57
1925	7.93	8.36	9.50
1926	5.05	7.52	8.94
1927	11.72	12.12	9.86
1928	10.91	7.71	10.03
1929	8.25	5.20	7.10
1930	12.78	13.67	10.90
1931	10.32	7.16	7.56
1932	6.71	5.57	6.05
1933	7.76	8.27	9.06
1934	6.93	6.68	7.08
1935	9.44	6.77	8.97
1936	9.61	8.00	8.49
1937	9.94	10.04	10.65
1938	7.99	7.90	9.22
1939	5.83	6.81	7.00
1940	10.49	8.73	8.20
1941	13.57	13.65	14.74
1942	9.39	9.30	11.59
1943	5.53	5.74	7.79
1944	14.36	15.61	12.19
1945	12.97	12.89	11.52
1946	9.78	10.49	10.02
1947	16.28	14.44	12.45
1948	10.08	7.78	6.69
1949	10.87	9.50	7.11
1950	10.98	9.03	9.39
1951	8.99	10.64	7.76

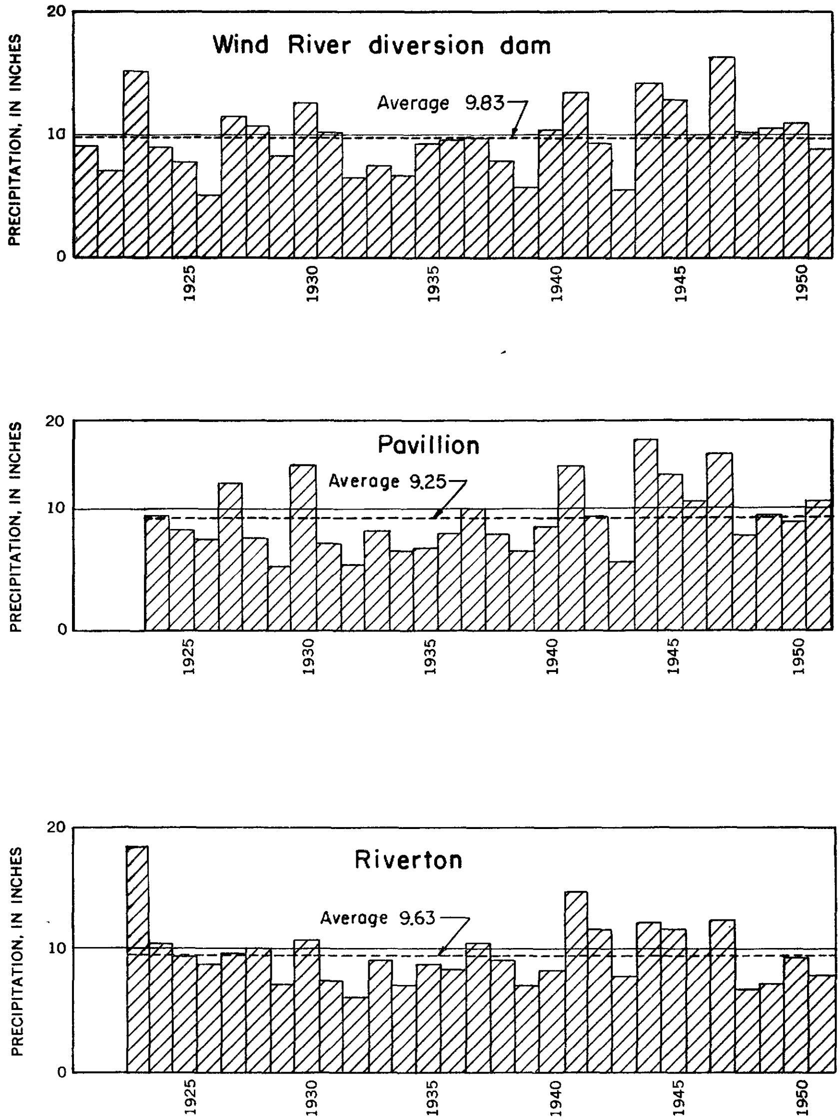

FIGURE 4.—Annual precipitation at three stations in the Riverton irrigation project area.

the annual precipitation has ranged from 5.20 to 15.61 inches and has averaged 9.25 inches. During the past 29 years at Riverton, at the southern tip of the area, the annual precipitation has ranged from 6.05 to 18.43 inches and has averaged 9.62 inches. The yearly distribution of precipitation at these three stations is generally similar, although the dry and wet years do not always coincide. (See fig. 4.)

The graphs of cumulative departure from average precipitation at the Wind River diversion dam and at Pavillion and Riverton (fig. 5) illustrate the periods of generally above-average and below-average precipitation. The periods of above-average precipitation are shown by a rising line, and the periods of below-average precipitation by a declining line. At the Wind River diversion dam the periods of generally below-average precipitation were from 1920 through 1926, from 1931 through 1939, and from

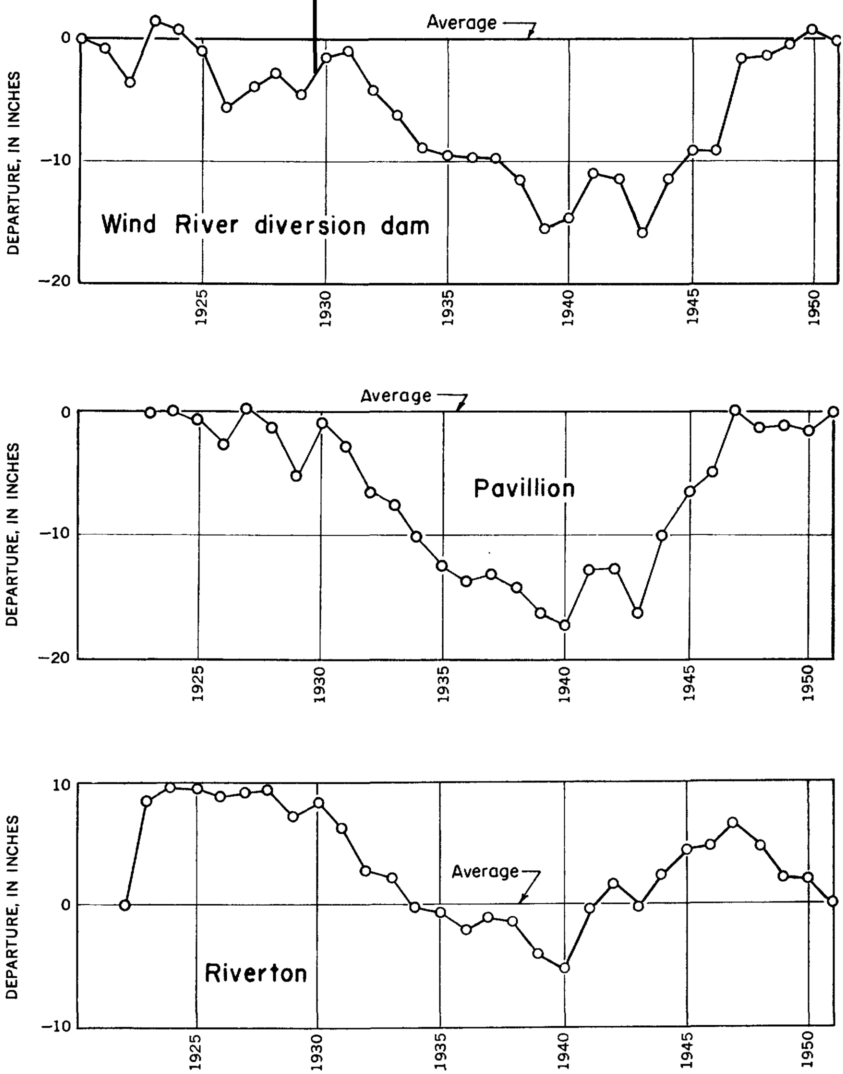

FIGURE 5.—Cumulative departure from average precipitation at three stations in the Riverton irrigation project area.

1941 through 1943; the periods of generally above-average precipitation were from 1926 through 1931, from 1939 through 1941, and from 1943 through 1951. At Pavillion precipitation was about average in 1924, generally below average from 1924 through 1940, and generally above average from 1940 through 1951. At Riverton the precipitation was above average in 1923, about average from 1923 through 1930, below average from 1930 through 1940, above average from 1940 through 1947, and below average from 1947 through 1951. At all three stations the yearly variations do not always conform with the general trend of the periods.

About 45 percent of the annual precipitation falls during April, May, and June, and 22 percent falls in September and October.

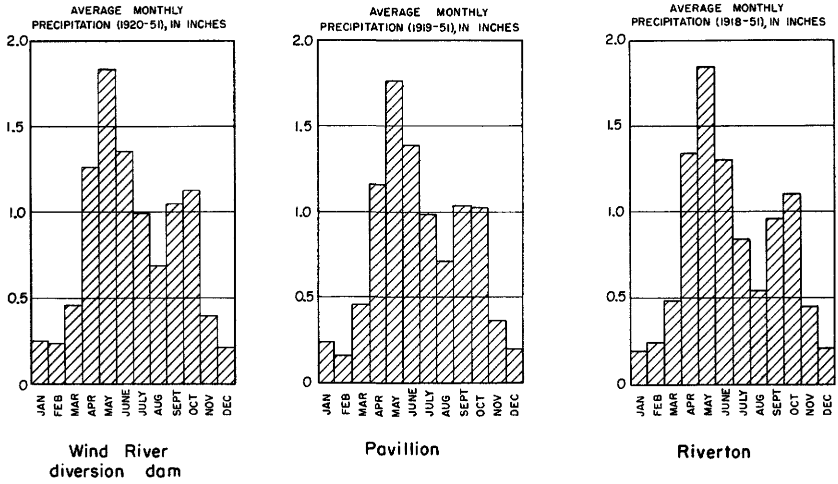

FIGURE 6.—Average monthly precipitation at three stations in the Riverton irrigation project area.

About 19 percent of the annual precipitation falls in May. The winter months are driest at all stations. (See fig. 6.) The wet period in the spring usually comes too early and the wet period in the fall too late for the growing season of most crops. At times the fall precipitation is a handicap to the harvesting of crops and causes some loss. In the middle of the growing season the precipitation is scanty and the flow of streams is low. This deficiency is alleviated somewhat by the use for irrigation of about 182,000 acre-feet of water from Bull Lake and Pilot Butte Reservoirs; the water is stored during the spring months when snowmelt and runoff are at a maximum.

The frost-free season has ranged from 75 to 163 days and averages about 128 days.

AGRICULTURE AND INDUSTRY

The principal crops in the Riverton irrigation project area are beans, beets, potatoes, oats, and alfalfa hay; alfalfa and clover (for seed), wheat, and barley also are raised. In 1951 the Bureau of Reclamation reported 52,026 acres under cultivation on the Riverton irrigation project. The total value of crops was $2,233,209, which is an average return of $42.92 per acre.

Oats, the major crop, were grown on 9,096 acres, and alfalfa hay and alfalfa for seed were grown on 7,778 and 5,375 acres, respectively. The total return from the alfalfa-seed crop was $302,400; the returns from oats and alfalfa hay ranked second and third and were $255,759 and $240,614, respectively. The highest average return per acre, $568.75, was for seed from 32 acres of tall wheat grass; the second highest return was $374.02 per acre from potatoes; and the third was $123.81 per acre for sugar beets.

No mining is done in the area, although coal of poor quality has been mined near Pilot Butte in the western part of the area.

The oil industry is of considerable importance in the Riverton irrigation project area. Two oil fields, Steamboat Butte and Pilot Butte, are in T. 3 N., R. 1 W., at the western end of the area. Both produce oil from the Tensleep sandstone. A recently drilled well at the Pilot Butte field has also encountered oil at a shallow depth in the Muddy sandstone member of the Thermopolis shale. Numerous other oil fields are adjacent to the area; the Riverton Dome oil field is the closest and is about 7 miles southeast of Riverton. Four wells have been drilled in this field since its discovery in 1948. Production here is also primarily from the Tensleep sandstone.

HISTORY OF IRRIGATION

The land in the Riverton irrigation project was ceded by the Indians of the Shoshone Reservation to the United States Government on March 3, 1905. After a preliminary survey by the State of Wyoming, the area was opened for settlement in 1906. At that time construction was started on the first irrigation canal. This canal, which was built by the Wyoming Central Irrigation Co. and which is known as the Wyoming No. 2 canal, was completed in April 1907. (See fig. 2.) Water from the canal irrigates lowlands that are mainly north and east of Riverton. In 1914, the settlers formed the Riverton Ditch Co., which constructed the Le Clair (Riverton No. 2) canal. The intake of this canal is about 15 miles northwest of Riverton, and the canal supplies water to lowlands to the west along the river and also to land above the Wyoming No. 2 canal. Two small private canals, the Hurtado and Aragon ditches, irrigate the lowlands west of the Le Clair canal.

The Bureau of Reclamation assumed responsibility for the present Riverton irrigation project in 1918 and began active construction in 1920. The Wind River diversion dam, in the northwest corner of the area, was completed in 1923. Pilot Butte Reservoir, which has a capacity of 30,000 acre-feet, and Pilot Butte power plant, at the intake of Pilot Butte Reservoir, were completed in 1926. Bull Lake Reservoir, completed in 1938, is about 5 miles southwest of the Wind River diversion dam and has a usable capacity of 152,000 acre-feet. The main Wyoming canal was completed from the Wind River diversion dam to Pavillion in 1925; since that time, the Pilot canal and numerous laterals have been constructed, and in 1950 the northward extension of the main Wyoming canal brought irrigation to the North Pavillion area. (See fig. 2.) A further extension of the main Wyoming canal has now been completed, which supplies water to additional acreage north of Fivemile Creek; a tunnel, which was completed in 1949, through Indian Ridge—a prominent high divide lying between Fivemile Creek and Muddy Creek—carries water to the North Portal area and Muddy Creek terraces. The North Portal area (fig. 2) was irrigated for the first time in 1951. Irrigation water was applied in 1951 to 77,716 acres in the Riverton area, of which 53,897 acres were either a part of or associated with the Bureau of Reclamation Riverton project and 23,819 acres were privately irrigated from the Le Clair (Riverton No. 2) canal, the Wyoming No. 2 canal, and the two small canals in the western part of the area. Plans for the irrigation of an additional 31,344 acres of land south and east of the North Portal area (Muddy Ridge extension) are now being considered.

PHYSIOGRAPHY

The Riverton irrigation project area is in the northwestern part of the Wind River basin. This basin is a large sediment-filled, northwest-trending structural trough, which is bounded on the southwest by the anticlinal Wind River Mountains, on the north by the anticlinal Owl Creek Mountains, and on the south and east by the deeply eroded Sweetwater uplift and related structures. The most striking topographic features of the area are the prominent stream terraces, pediment slopes, and broad valleys that have been formed in the easily eroded Tertiary deposits.

The terraces are a series of gently sloping surfaces along each stream and they range from a few feet to several hundred feet above the present level of the stream. They parallel and are principally on the north side of the parent streams. The terraces form steps to the north from the alluvial bottoms of the streams; along Muddy Creek they are interrupted by broad troughs in which closed, wind-scoured depressions have been formed. The terraces are underlain by thick deposits of well-rounded gravel. The uppermost terrace in most places forms the interstream divide and is flanked to the north by a combination of pediment slopes, badlands, and lower-terrace remnants. In places the more resistant sandstone beds that were formerly overlain by terrace deposits have retarded erosion and formed rock-capped buttes.

Highly dissected bedrock slopes flank terraces throughout the area. They form the floors of the smaller valleys between terraces but are best developed on the south sides of the broad valleys formed by the main streams of the area. (See pl. 4.) Colluvial-alluvial deposits derived from the weathering of the bedrock exposed in the higher terraces and buttes mantle much of the bedrock slope. Alluvium occurs as valley fill along the drainageways through the area. Knobs and hills of bedrock project above the colluvial-alluvial mantle in many places.

GEOLOGIC HISTORY

The details of the physiographic history of the area are imperfectly known; however, it is generally agreed that the following events occurred in the Wind River basin region in the late Mesozoic and the Cenozoic eras.

The ancestral Wind River basin and adjacent mountain structures were formed essentially during the Laramide revolution in Late Cretaceous and early Tertiary time. Erosion of the mountains and highlands resulted in the deposition of much rock debris in the basin. Much of it was deposited in sheets or as channel fill. By middle or late Tertiary time the basin was completely filled with sediments, which covered the Owl Creek Mountains and which either covered or graded into peneplaned surfaces, or pediments, on the adjacent higher Wind River Mountains. In late Tertiary time, owing either to uplift or to climatic change, active aggradation in the Wind River basin ceased and active degradation began. Erosion has been the dominant geologic process in the region since late Tertiary time; the poorly consolidated sediments in the basin are still being removed. The removal of Tertiary sediments again exposed the more erosion-resistant mountain ranges that had been buried. The present course of the Wind River was superimposed on the area from its position on the Tertiary sediments. Minor interruptions in the long cycle of erosion are reflected by the present topography of the basin.

GEOMORPHOLOGY

The topography of the area has been formed principally by erosion. The main factors that determine the rate of erosion are the climate and the lithologic character and attitude of the bedrock. The arid climate of the area is not conducive to chemical weathering. However, because vegetation is sparse, even the small quantity of water— either in streams, as sheet flood and rill wash, or in direct precipitation—is a very effective erosive agent. The attitude and lithologic character of the strata of the Wind River formation favor erosion because the formation is essentially horizontal and consists of poorly consolidated sandstone, siltstone, and shale. Several thousand feet of sediments have been removed by repeated cycles of erosion. At the start of such a cycle streams flowing from the flanks of the mountains become entrenched; when such streams approach a graded condition or reach a local temporary base level, they meander from side to side and both widen and level their valley floors. As the valleys are widened and leveled, the streams deposit gravel. It is the gravel deposited in this part of the cycle that now underlies the surface of each of the terraces. Repetition of the cycle of downcutting and subsequent valley widening resulted in the development of the terraces.

The position of the terraces in relation to the present streams of the area indicates that the ancestral streams constructed the terraces. Each terrace represents a period of relative stability when the stream enlarged its flood plain. The scarps between terraces indicate periods of instability and accelerated erosion during which the stream entrenched itself before again expanding its flood plain. The broad extent of the terraces and their more gentle slope, the large size of the gravel pebbles in the terrace deposits, and the uniform thickness of the deposits indicate that the terrace-forming streams were perennial and were relatively large in comparison to the present streams. Each terrace marks a major change in the regimen of the stream. The possible basic factors that, singly or in combination, may have been responsible for the changes are: regional uplift or tilting, climatic change, changes in the size of the area being drained by the stream, and changes in the factors controlling the local base level.

The climatic changes that would be necessary to produce terrace development would be of the magnitude of those that are associated with the alternation of glacial and interglacial stages or substages.

A change in the size of the drainage area, such as would result from the capture of one stream by another, would increase the flow and erosive power of the capturing stream.

The Wind River is assumed to have been the local base level for all its tributaries during the period of terrace development. Any downstream or upstream drainage changes in the Wind River altered the flow of the river, affected its cutting ability, and caused a change in the base level of the tributary streams. Likewise, any downvalley obstructions, such as the more resistant formations cropping out in the Wind River Canyon, created at that point a temporary base level that affected the upstream part of the river and the tributary streams. Therefore, the tributary streams of the Wind River formed terraces that correspond to those formed by the Wind River. (See pl. 1.)

In general, during the period of terrace formation, Fivemile, Muddy, and Cottonwood Creeks moved progressively to the south. A natural tendency for a stream flowing parallel to the front of a mountain range is to shift its course farther from the main source of water, the mountains. The principal tributaries rise on the mountain front and by building fans of alluvial material they force the major stream away from the mountains. Another factor that may contribute to the migration of the main stream is the "jetting action" of the tributary streams upon entering the main stream at right angles. The inflow of water from the tributaries forces the current of the major stream against the opposite bank and the stream migrates away from the mountain front, which is the source of the larger tributaries. The shorter tributaries on the other side of the main stream seldom flow; hence, they are unable to compete with the larger tributaries from the mountain front. Through the combined influence of these factors Fivemile, Muddy, and Cottonwood Creeks have migrated away from the Owl Creek Mountains.

The precise ages of the terrace surfaces have not been determined, but the volcanic material which was derived from the Absaroka Mountains and which is present in the gravel of the uppermost terraces indicates that these and all lower surfaces are younger than the mountains, which were formed in Eocene or early Oligocene time (Tourtelot and Thompson, 1948). Inasmuch as the uppermost terrace (terrace T_{13}, or Lost Wells Butte) is considered to be the Black Rock surface of Blackwelder (1915, p. 312-316), and because that surface was correlated by him as pre-Kansan (pre-Buffalo in Wyoming), terrace T_{13} probably is of Aftonian age. This then suggests a post-Aftonian age for all lower or more recent terraces within the area.

Concurrent with the action of major streams, direct precipitation —by contributing to ephemeral side streams and by causing rill wash and sheet flood—has produced extensive badlands and, by contributing to escarpment retreat, has been a factor in the formation of pediments at the base of the escarpments. Contemporaneous with each stage of terrace development, erosion modified the escarpments of the interstream divides and formed for each terrace —which represents a temporary base level—a complementary slope on bedrock extending southward from the streams to the divides.

After terrace T_2 had been formed, the streams of the area were rejuvenated; the principal streams cut a trench in the bedrock 50 to 75 feet below the terrace, and the intermittent tributaries became incised in the pediment slopes. A period of alluviation, during which the principal alluvial terrace (terrace T_1) along the main streams is believed to have been formed, followed the period of downcutting. Then, owing to the continued changes in climatic conditions, the streams cut their present channels and alluvial fans spread over much of the pediments and, in some places, along the streams.

Three pronounced troughs cross the divide between Muddy and Cottonwood Creeks. (See pl. 1; shown as *Tw* in secs. 6 and 7, T. 4 N., R. 3 E.; secs. 22 and 27, T. 4 N., R. 4 E.; and in secs. 11, 13, and 14, T. 4 N., R. 4 E.) These are wind-modified channels of former tributaries of Muddy Creek that flowed southward off the flanks of the Owl Creek Mountains. Headward erosion by Cottonwood Creek has progressively pirated these Muddy Creek tributaries and left the old channels through the terraces as a series of wind gaps. The geologic map (pl. 1) reveals this progressive piracy. The easternmost trough probably was a through drainage course at least until terrace T_3 was formed, the central trough until terrace T_2 was formed, and the westernmost trough until after terrace T_2 was formed. The Cottonwood drain has exposed the old channel gravel in the lower part of the easternmost trough. Although gravel is lacking in the upper part of this trough, it may have been removed by stormflows that have been concentrated in this natural drainageway during torrential downpours. The other two troughs are considered to have comparable histories. The position of the Cottonwood tributaries in relation to the position of the postulated abandoned valleys also substantiates this conclusion. The study of adjacent areas further supports the above explanation of the development of the transverse valleys. For example, along the east flank of the Maverick Springs and Little Dome structures, the headwaters of Muddy Creek appear to have captured the headwaters of the Fivemile Creek tributary that flows southward in Hurley Draw.

Associated with the piracy of Muddy Creek tributaries by Cottonwood Creek, and offering still further evidence of this piracy, is the progressive increase in gradient of Muddy Creek during the period of terrace formation and the consequent increase in height above the creek of the downstream part of any terrace. Such an increase in gradient would have been necessitated by the loss of water in Muddy Creek due to piracy.

Locally, wind action has been an effective agent of erosion. The wind has scoured out closed depressions in the soft sediments that are exposed in abandoned drainageways and also has modified these by local deposition. Silt and sand from these areas as well as from slopes and level surfaces have been removed by the wind and deposited to form hummocks and dunes in sheltered places or where vegetation is present. The removal of sand and silt from deposits that also contain gravel has left a residual concentration of pebbles, which is known as "desert pavement." The abrasive action of sand-bearing wind on resistant gravel has produced many faceted pebbles (ventifacts) and the present form of the many rounded pedestals, pinnacles, and bowllike openings in easily eroded sandstone.

Precipitation has produced a complex pattern of solution sculpturing on pebbles of impure limestone which mantle the higher terraces of the area.

DRAINAGE SYSTEM

The principal streams of the area flow southeastward parallel to the trend of the structural trough of the Wind River basin. The Wind River heads in the Absaroka Mountains at the extreme northwestern corner of the basin and is fed by streams flowing off the Wind River and Owl Creek Mountains. It flows southeastward to its confluence with the Popo Agie, where it turns sharply northeastward and thence flows north through the Wind River Canyon, which cuts across the axis of the Owl Creek Mountains, beyond which point it is known as the Bighorn River. The principal tributaries within the Riverton project are Fivemile Creek, Muddy Creek, and Cottonwood Creek—also named Dry Muddy Creek on some maps. Fivemile Creek heads on the Circle Ridge anticline, flows through the central part of the area, and enters the Wind River at a point about 20 miles downstream from the confluence of the Popo Agie and Wind Rivers. Muddy Creek, which drains a larger area than either Cottonwood or Fivemile Creeks, heads in the Owl Creek Mountains and flows through the northern part of the area; it enters the Wind River about 7 miles downstream from the mouth of Fivemile Creek. Cottonwood Creek flows along the north boundary of the area, is fed by streams that flow southward from the flanks of the Owl Creek Mountains, and empties into the Wind River about 6 miles downstream from the mouth of Muddy Creek.

STREAMFLOW

WIND RIVER

The Wind River is the master stream in the area. It is perennial and is the primary source of irrigation water for the area as well as for the Bighorn Basin to the north.

The Geological Survey maintains a gaging station on the Wind River at Riverton. The discharge figures for this station for the 23-year period 1929 through 1951 are given in table 2. However, these figures do not represent the natural discharge because numerous diversions for irrigation are made upstream from Riverton during the summer months.

TABLE 2.—*Mean discharge of Wind River at Riverton, in cubic feet per second*

Water year	Mean discharge	Water year	Mean discharge	Water year	Mean discharge
1929	888	1937	863	1945	917
1930	1,190	1938	757	1946	737
1931	911	1939	607	1947	1,262
1932	992	1940	417	1948	917
1933	944	1941	779	1949	775
1934	511	1942	985	1950	978
1935	925	1943	1,282	1951	1,243
1936	937	1944	1,005		

FIVEMILE CREEK

Before the abnormally wet year of 1923, Fivemile Creek was reported to be little more than a large gully and was dry much of the year. The flood of 1923, which is reported to have reached a maximum flow of 3,500 cfs, greatly enlarged the stream channel and, since the opening of the Riverton irrigation project, a perennial flow has been maintained through the middle and lower course of the creek.

Discharge measurements of Fivemile Creek near its mouth were made by the Geological Survey from May 1941 to September 1942; measurements were resumed in the fall of 1948. The mean discharge for each month during the two periods of record is summarized in table 3.

The large increase in discharge between the periods 1941-42 and 1948-51 is due mainly to return flow from irrigation, which in the meantime had been extended considerably. Gaging stations also have been established on the middle and lower courses of Fivemile Creek.

TABLE 3.—*Mean discharge of Fivemile Creek, in cubic feet per second, at station three-fourths of a mile upstream from mouth of creek*

Month	Mean discharge	Month	Mean discharge	Month	Mean discharge
May 1941 through September 1942					
May 10–31, 1941	44.4	November 1941	14.8	May 1942	28.1
June	97.4	December	8.25	June	136
July	174	January 1942	2.60	July	155
August	177	February	6.24	August	160
September	88.4	March	17.8	September	95.3
October	18.0	April	12.7		
October 1948 through September 1951					
October 1948	75.3	October 1949	64.4	October 1950	55.3
November	39.3	November	48.5	November	58.1
December	32.4	December	29.5	December	47.6
January 1949	29.7	January 1950	[1]18.5	January 1951	35.9
February	32.2	February	34.3	February	39.3
March	54.1	March	40.4	March	42.3
April	31.3	April	44.9	April	32.4
May	87.8	May	115	May	117
June	167	June	253	June	193
July	189	July	319	July	294
August	214	August	277	August	275
September	164	September	198	September	228

[1] This and all subsequent measurements are preliminary, previously unpublished figures and are subject to revision.

The average discharge for the water year ending September 30, 1942, was 54.8 cfs, and for the water years ending September 30, 1949, 1950, and 1951, was 93.0, 121.0, and 119.0 cfs, respectively. The average discharge during the 1949, 1950, and 1951 irrigation seasons (May 1 to September 30) was 164.4, 232.4, and 221.7 cfs, respectively; most of the water during this period originated as return flow from irrigation on the Riverton project. The average flow during the remaining part (October 1 to April 30) of the same years was 42.0, 40.1, and 44.4 cfs, respectively. The average discharge during November, December, January, and February was 34.4, 32.7, and 47.2 cfs, respectively; this is considered to be the base flow and to represent approximately the mean total ground-water inflow to Fivemile Creek during this period. The maximum measured discharge was 3,200 cfs on August 7, 1941. The minimum discharge during the period of record was 1.0 cfs for January 4-6, 1942.

The artificial rejuvenation of Fivemile Creek in its middle and lower course is a result of irrigation on the Riverton project. The increased flow is caused by surface runoff from irrigated lands, by waste water from irrigation, and by increased discharge of ground water from the project lands. The principal effects of the rejuvenation have been the increased activity of the stream as an agent of erosion and the consequent increase in the silt load carried by the creek to the Wind River. (See pl. 5*A*.) The erosion is destroying farmland adjacent to the creek, and the heavy load of sediment delivered to the Wind River has created a siltation problem at Boysen Reservoir.

The problem of minimizing erosion by Fivemile Creek can best be solved after a careful analysis has been made of the cause and effect relation of the contributing factors, among which is ground water. Although its relative importance has not yet been thoroughly evaluated, observations indicate that ground water, by saturating the materials in the stream banks, accelerates basal sapping and lowers the resistance of creek banks to flood erosion.

MUDDY CREEK

Muddy Creek, like Fivemile Creek, was greatly enlarged by the flood of 1923. A slope-area measurement made soon after this flood indicated a maximum discharge of 16,300 cfs. Since this time Muddy Creek has been dry throughout much of the year, and at present it is intermittent across the project area. Discharge measurements of the flow of Muddy Creek near its mouth have been made by the Geological Survey since March 1, 1949. These figures represent average flow during the respective months and do not necessarily indicate continuous flow; a fairly large flow is possible during part of a month, and no flow may occur the remainder of the month. The monthly mean discharge of Muddy Creek for the period March 1949 to September 1951 is given in table 4.

TABLE 4.—*Mean discharge of Muddy Creek, in cubic feet per second, at station 5 miles upstream from mouth of creek*

Month	Mean discharge	Month	Mean discharge	Month	Mean discharge
March 1949	11.8	February 1950	2.58	December 1950	1.69
April	11.6	March	11.4	January 1951	.21
May	4.38	April	8.31	February	3.72
June	16.3	May	6.06	March	6.58
July	17.1	June	7.33	April	5.37
August	0	July	[2]41.0	May	51.9
September	.07	August	18.2	June	47.2
October	4.70	September	18.0	July	82.7
November	3.24	October	3.58	August	50.7
December	.25	November	4.02	September	40.9
January 1950	[1]0				

[1] This and all subsequent measurements are preliminary, previously unpublished figures and are subject to revision.
[2] Waste irrigation water first appeared.

The greatest streamflow normally occurs during the summer months and, except for the relatively large amounts of waste water discharged into the creek during the irrigation season of 1950 and 1951, these figures essentially represent the runoff originating upstream from the report area.

Muddy Creek is now in a state of adjustment to its new normal flow, load, and gradient. The banks appear to be stabilized by a protective vegetative cover, and there is little evidence that normal flow accomplishes much lateral erosion or much downcutting. This condition of adjustment is temporarily interrupted during flood flows, which erode more actively and which carry greater amounts of sediment. The sediment load transported at these times either is deposited lower in the course of the creek, where the lesser gradient favors aggradation, or is emptied into the Wind River; the sediment constitutes a large portion of the total load carried by the creek. Of importance, then, is the increase in flow that will result when additional land is irrigated in the drainage basin of Muddy Creek. The addition of waste irrigation water and ground-water discharge to the present normal flow will rejuvenate the creek, and with continued irrigation it will become perennial and will develop erosion problems similar to those along Fivemile Creek. Obviously, erosion-control measures will be most effective the earlier they are undertaken.

COTTONWOOD CREEK

Because little or no land is irrigated at the present time in the area drained by Cottonwood Creek, the flow of the creek is both low and intermittent. (See table 5.)

TABLE 5.—*Mean discharge of Cottonwood Creek, in cubic feet per second, at station near Bonneville*

Month	Mean discharge	Month	Mean discharge	Month	Mean discharge
March 1949	0.04	October 1949	0	April 1950	0
April	0	November	0	May	.01
May	.18	December	0	June	.18
June	3.81	January 1950	[1]0	July	.11
July	.55	February	0	August	0
August	0	March	.01	September	1.01
September	0				

[1] This and all subsequent measurements are preliminary, previously unpublished figures and are subject to revision.

The irrigation of land adjacent to Cottonwood Creek and the discharge of irrigation waste water into Cottonwood Creek have been proposed. In the making of such plans, due consideration should be given to the expected increase of the normal flow of Cottonwood Creek and the consequent erosion problems in the lower part of the creek.

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

Rocks ranging in age from Late Cretaceous to Recent are exposed in the Riverton project area and adjacent lands included in this investigation. The oldest rocks are exposed only at the western end of the area in the vicinity of the Pilot Butte and Steamboat Butte oil fields. The Cody shale is exposed on the crest of both the Pilot Butte and Steamboat Butte anticlines and the overlying Mesaverde and Meeteetse formations form hogbacks on the flanks of these oil structures. Younger rocks underlie the remainder of the area; they consist of the Wind River formation of Tertiary age and of alluvial, colluvial, and eolian deposits of Quaternary age.

CRETACEOUS SYSTEM

UPPER CRETACEOUS SERIES

CODY SHALE AND MESAVERDE FORMATION, UNDIFFERENTIATED

Areal extent.—In the area of investigation, rocks of the Cody shale and Mesaverde formation, undifferentiated, are exposed principally in a narrow band about three-fourths of a mile wide along the northeast flank of the Pilot Butte anticline. They are exposed also along the edge of the escarpment between terrace T_5 and the alluvial plain of the Wind River where it crosses the Pilot Butte anticline.

Description.—The Cody shale and Mesaverde formation consist of soft gray to black shale and fine-grained light-colored massive to thin-bedded sandstone containing numerous coal beds (Love, 1948, p. 111). The thin beds of rusty sandstone, coaly gray shale, and coal exposed along the Pilot Butte anticline probably are only the upper part of the sequence. The dip of the beds away from the crest of the structure is about 15° to 40° (Matter, 1948) and the more resistant beds form hogbacks. In places the beds are complexly faulted.

Occurrence of ground water.—No wells are known to penetrate the Mesaverde formation in the investigated area; consequently, the quality and quantity of water in this formation are unknown.

Two wells penetrate rocks of the sequence, presumably lenticular sandstone in the upper part of the Cody shale. These yield moderate quantities of water, but the quality is poor.

TERTIARY SYSTEM

EOCENE SERIES

WIND RIVER FORMATION

Areal extent.—The Wind River formation underlies all the investigated area except the western part where older rocks are exposed.

Description.—The Wind River formation was first named and described by Hayden (1862, p. 125-127) from exposures in the Wind River valley. He applied this name to sediments that lie with slight discordance on the lignite beds of the Fort Union formation of Paleocene age and that are overlain by deposits of the White River formation of Oligocene age. The contact of the Wind River formation with the Fort Union or White River formations was not observed by the writers within the investigated area. The Fort Union has been described, however, in the Shotgun Butte area west and north of the investigated area (Keefer and Troyer, 1956) and several isolated remnants are exposed between Conant and Canyon Creeks in the east-central part of Fremont County (about 25 miles east of Riverton). The White River is known to be present along the southern margin of the Absaroka Range and in southeastern Fremont County on Beaver Rim of the Sweetwater uplift.

The Wind River formation consists of a complex series of interbedded lenticular sandstone, siltstone, shale, claystone, conglomerate tuff, and fresh-water limestone. (See pl. 5*B*.) Tourtelot and Thompson (1948) have identified two facies in this formation: one brightly colored, the other drably colored. The brightly colored facies consists of red, violet, blue, yellow, and white hard fine-grained sandstone and siltstone; fresh-water limestone; and a basal conglomerate containing sporadic roundstones of foreign quartzite and volcanic rock. The drably colored facies consists of gray and greenish-gray claystone and siltstone and channel deposits of yellow to brown coarse-grained sandstone. Locally, the drably colored facies contains dull variegated beds and carbonaceous sequences. The division of the formation into two facies is primarily on the basis of color and lithologic character; it has little time-stratigraphic significance because these facies interfinger and their lithologic types and colors intermingle. Fossil vertebrates have been used by Tourtelot and Thompson to date the drably colored facies as chiefly of "Wasatchian" (early Eocene) age, and fossil vertebrates and plants have been used to date the brightly colored facies as chiefly of "Bridgerian" (middle Eocene) age, or as transitional between "Wasatchian" and "Bridgerian." However, the presence of "Bridgerian" fossils and plants in the upper part of the drably colored facies and the presence of "Wasatchian" fossils in the lower part of the brightly colored facies indicates that a "Wasatchian" and "Bridgerian" age should be ascribed to both facies. In this area the brightly colored facies underlies the north margin of the Wind River basin and interfingers with the drably colored facies toward the center of the basin. Toward the Owl Creek Mountains, which are north of the area under investigation, both facies are overlain by green and brown andesite tuff and fresh-water limestone which grade laterally along the mountain front into nontuffaceous red siltstone and conglomerate.

Tourtelot and Thompson (1948) mapped the drably colored facies of the Wind River formation in the northern part of the report area; this facies probably underlies the entire area described in this report. Except locally, the beds are essentially horizontal or dip gently toward the center of the basin; on the west flank of the Pilot Butte structure the dip of the Wind River formation is about 7° W., and in sec. 5, T. 4 N., R. 6 E., the apparent dip is as much as 20° toward the Owl Creek Mountains.

The outcrops consist of sandstone, siltstone, shale, claystone, and sediments gradational between these. Shale and thin-bedded to massive siltstone and sandstone are the commonest rock types. The sandstone beds are predominantly yellow and brown, but some are gray and grayish green. They generally are fine- to medium-grained, micaceous, poorly sorted, and loosely cemented. They were deposited generally as lenticular sheets or channel deposits and are commonly crossbedded. The shale, siltstone, and claystone are generally gray, greenish gray, or grayish green; some dull-red to purple shale is exposed in the lower part of the outcrops. Shale and claystone generally are fairly soft; siltstone is typically blocky and poorly cemented. Most of the sediments are poorly consolidated, but firmly cemented lenses of rather coarse grained sandstone or conglomerate or concretions of sandstone are present in some places, particularly in the channel deposits. The cemented lenses are irregular, elongate masses, some of which are more than 3 feet thick; they resist erosion and form ledges or ridges. The concretions are very hard, somewhat irregular but commonly smoothly rounded, and generally more than 2 feet in diameter. They litter the landscape in places where softer surrounding materials have been removed by erosion. Limestone nodules also are common in the sediments. Beds of carbonaceous shale, some of which contain plant remains and which are associated with beds of bentonitic clay and some tuff, occur in places throughout the area but are exposed mainly along east-central and eastern Muddy Creek and in sec. 17, T. 4 N., R. 6 E., along buttes that border the Wind River. Petrified wood is commonly associated with this carbonaceous sequence. Numerous joints and other fractures, many of which are filled with calcareous or ferruginous material, traverse the rocks. Two large faults in the area were mapped by Tourtelot and Thompson (1948). (See pl. 1.) Small faults are common.

The thickness of the drably colored facies in the area described in this report is not definitely known. A thickness of 1,500 to 2,500 feet of the Wind River formation reportedly was penetrated by several old oil tests within the area, but the information possibly is unreliable. The formation is known to be less than 100 feet thick in the Steamboat Butte oil field and more than 2,000 feet thick in several old oil tests northeast of Shoshone, which is considered to be in the deepest part of the Wind River basin. The maximum exposed thickness of the formation in the Boysen area to the north is reported to be 913 feet (Tourtelot and Thompson, 1948). Southeast of Riverton, at the Riverton dome, oil wells are reported to have penetrated about 1,500 feet of the Wind River formation. Therefore, the thickness of the formation within the report area probably is 1,000 to 2,000 feet.

Occurrence of ground water.—Most wells in the area obtain water from the lenticular beds of sandstone in the Wind River formation. The water in the sandstone beds generally is under artesian pressure and rises in wells when the confining beds are penetrated; in some parts of the area water flows at the land surface from wells on low ground.

Infiltrating irrigation water is the source of most of the recharge to the artesian aquifers, and the water level in shallow wells rises during the irrigation season. Because the irrigation water leaches minerals from the soil and carries them down to the zone of saturation, the quality of water in the shallow aquifers generally is unsatisfactory for domestic use except where the shallow aquifers are recharged by infiltration from streams or canals.

Surface water probably is the principal source of recharge to the deeper artesian aquifers also; however, owing to their distance from the outcrop, and their low transmissibility, and also to the fairly constant discharge from them, the water level in wells tapping these aquifers fluctuates only slightly throughout the year, and the quality of the water is relatively uniform and generally satisfactory for domestic use.

Some water is under water-table conditions in the upper, badly weathered part of the Wind River formation. This occurrence is described in the discussion of surficial deposits mantling the Wind River formation.

Although wells penetrating the Wind River formation do not yield large quantities of water, this formation is the best present and potential source of water for domestic use in this area. At the present time, the largest quantity of water produced from any well drilled into the Wind River formation is a little more than 200 gpm; a larger quantity of water probably can be obtained only by drilling wells into deeper aquifers in the formation. Water from

View northward showing the bedrock slope between Indian Ridge and Muddy Creek.

A. View eastward showing banks eroded by basal sapping along the lower part of Fivemile Creek.

B. Interbedded shale and sandstone beds of the Wind River formation.

A. Terrace deposits underlying terrace T_5 near Riverton.

B. View northward showing the western part of the Missouri Valley.

such deeper sources probably would be of satisfactory quality.

Influence on drainage.—Waterlogging in this area generally is attributed to direct recharge of the surficial deposits by seepage from irrigation. However, it is possible that under certain conditions shallow artesian water may be contributing to waterlogging. Under favorable topographic and hydrologic conditions, leakage through confining beds to the overlying unconfined aquifer may occur, and waterlogging may be accelerated by the addition of this water. The possibility of such a contribution to waterlogging should be fully investigated.

QUATERNARY SYSTEM

PLEISTOCENE AND RECENT SERIES, UNDIFFERENTIATED

TERRACE DEPOSITS

In the area described in this report, the 13 distinct terraces along the principal lines of drainage, as well as several interstream terrace remnants, are underlain by deposits of roughly angular to subrounded gravel, presumably of Quaternary age and derived from sources to the west and north. (See table 6.) The gravel derived from the Owl Creek Mountains to the north contains angular pieces of dolomite, limestone, and igneous rocks, whereas the gravel derived from the mountains near the head of the Wind River consists mainly of rounded fragments of pre-Cambrian igneous and metamorphic rocks and Tertiary volcanic materials.

TABLE 6.—*Summary of terraces*

Terrace	Height above drainage (feet)	Location of principal remnants	Thickness of gravel (feet)	Remarks
T_1	15–22	Near Riverton and in T. 2 N., R. 6 E	7–20	
T_2	28–65	Near Riverton, in Tps. 2 and 3 N., R. 6 E., and along Muddy and central Cottonwood Creeks.	2–20	In Riverton area, terrace is mantled by 1 to 25 feet of alluvial-fan deposits. In Tps. 2 and 3 N., R. 6 E., terrace is mantled by 4 to 70 feet of alluvial-fan deposits.
T_3	65–118	Along eastern Muddy and western Cottonwood Creeks.	3–12	Epsomite occurs in places in basal part of terrace gravel.
T_4	98–110	Along eastern and east-central Fivemile, Muddy, and Cottonwood Creeks.	4–12	
T_5	100–160	Along Wind River, east-central Fivemile Creek, and Muddy Creek.	8–20	Gypsum occurs in terrace deposits.
T_6	140–180	Along western and southeastern Wind River and central Muddy Creek.	8–25	Highest irrigated terrace.
T_7	220–240	Along east-central Fivemile Creek.	4–5	
T_8	300–380	Along western Wind River and western and east-central Fivemile Creek.	7–22	
T_9	420–480	Tps. 1 and 2 N., R. 4 E., and T. 2 N., R. 5 E.	6–18	
T_{10}	500–550	Tps. 1 and 2 N., Rs. 2 and 4 E.	7–18	
T_{11}	580–620	Tps. 1 and 2 N., Rs. 3 and 4 E.	4–18	
T_{12}	680	T. 1 N., R. 3 E.	?–18	
T_{13}	800–825	T. 2 N., Rs. 3 and 4 E.	4–10	

The principal terraces have been correlated only tentatively; their relationship and relative position are shown on plate 1.

Areal extent and description of terraces.—Terrace T_1 is present only along the big bends of the Wind River at Riverton and in T. 2 N., R. 6 E. It is a relatively flat surface about 7 miles long and 1/4 to 1 1/4 miles wide in the Riverton area and about 2 1/2 miles long and less than half a mile wide in T. 2 N., R. 6 E. Terrace T_1 ranges in height above the Wind River from 15 feet at its upstream end to 22 feet at its downstream end and is underlain by 7 to 20 feet of gravel capped by 1 to 2 feet of finer material. The average thickness of gravel is about 12 feet in the Riverton area, but it is more nearly 20 feet in T. 2 N., R. 6 E. This terrace is believed to correlate with the highest of three low alluvial surfaces, which are mapped as alluvium along Fivemile, Muddy, and Cottonwood Creeks. (See pl. 1.)

Terrace T_2 is one of the most extensive terraces in the area. It is present in places along the entire course of the Wind River, along Fivemile Creek in its western and eastern parts, and along Muddy and Cottonwood Creeks in their central and eastern parts. Terrace T_2 generally is highly dissected and consists of a series of isolated remnants that are less than 1 mile long and one-fourth of a mile wide. However, along the big bends of the Wind River at Riverton and in T. 2 N., R. 6 E., and along Muddy and Central Cottonwood Creeks this terrace is 3 to 14 miles long and about 1/8 to 2 miles wide. Its height ranges from 40 to 65 feet along the Wind River, Muddy, and Cottonwood Creeks but from 28 to 33 feet above Fivemile Creek where available evidence indicates greater alluviation of the creek channel after terrace T_2 was formed. The terrace gravel, which ranges in thickness from 2 to 20 feet, generally is about 12 feet thick in the Riverton area and about 20 feet thick in T. 2 N., R. 6 E. The terrace surface is mantled locally by alluvial-fan deposits, which range in thickness from 1 to 25 feet in the Riverton area and from 4 to 70 feet in Tps. 2 and 3 N., R. 6 E. In T. 3 N., R. 6 E., all surficial evidence of the terrace is obscured by the alluvial-fan deposits.

The most extensive remants of terrace T_3 are along the eastern course of Muddy Creek and along the western course of Cottonwood Creek where they consist of a flat to gently rolling surface. Along Muddy Creek they are about 8 miles long, and along Cottonwood Creek they are about 2 miles long. These remnants are 1/2 to 2 miles wide. Terrace T_3 is less extensive along central Fivemile Creek, western and central Muddy Creek, and central and eastern Cottonwood Creek. In these places it consists of a series of highly dissected remnants that generally are 1/2 to 3 miles long and half a mile wide or less. The height of terrace T_3 above Muddy Creek ranges from 65 feet in the western part to 118 feet in the eastern part, and above Fivemile and Cottonwood Creeks it ranges from 70 to 80 feet. The terrace gravel ranges in thickness from 3 to 12 feet, and the overlying finer material is 1 to 2 feet thick. On the outer edge of this terrace, sec. 8, T. 4 N., R. 3 E., layers of epsomite ($MgSO_4 \cdot 7H_2O$) are present in several places along the contact of the gravel with the underlying shale; the epsomite probably was deposited by ground water.

Terrace T_4 is present along the eastern course of Fivemile Creek as an elongate irregular remnant three-fourths of a mile in length; parallel to east-central Muddy Creek it is a fairly broad, gently rolling remnant 5 miles long; and along central and eastern Cottonwood Creek it is present as a series of small remnants ½ to 1 mile long. The maximum width of terrace T_4 is a little more than 1 mile and its height above creek level ranges from about 98 to 110 feet. The thickness of the underlying gravel is rather difficult to determine, but apparently it ranges from 4 to 12 feet; overlying the gravel is a layer of fine-grained material 1 to 2 feet thick. The remnant along Muddy Creek terminates in depressions at both ends, and its inner edge is marked by a series of blowouts.

Terrace T_5 is well represented along all the major drainages of the area, but it is most extensive along the western and eastern course of the Wind River, along the east-central part of Fivemile Creek, and along Muddy Creek; it is the most prominent terrace along Fivemile and Muddy Creeks. The terrace remnants are flat to gently rolling and are 7 to 8 miles long and ⅛ to 1¼ miles wide. Elsewhere along the Wind River and along Fivemile, Muddy, and Cottonwood Creeks, the terrace is absent or exists as a series of highly dissected, isolated remnants less than 3 miles long and no wider than 1¼ miles. In many places the only evidence that the terrace once was present is a line of small gravel-capped knolls. The height of terrace T_5 above Muddy Creek ranges from 100 feet in the western part to 155 feet in the eastern part, and from 100 to 160 feet above the Wind River and Fivemile and Cottonwood Creeks. The terrace is underlain by about 8 to 20 feet of gravel and about 1 to 2 feet of finer material (pl. 6*A*); the average thickness of the gravel is about 13 feet. In sec. 36, T. 5 N., R. 2 E., along the southern edge of this terrace north of the main Wyoming canal, layers of gypsum are present at the base of and within the gravel.

Terrace T_6 is present in places along the Wind River and Fivemile Creek but is best represented along Muddy Creek. It exists primarily as a series of highly dissected long and narrow remnants, which are 1 to 6 miles long and are less than half a mile wide. The largest remnants are along the western and southeastern course of the Wind River and along central Muddy Creek. The height of the terrace above Muddy Creek ranges from 140 feet in the western part to 175 feet in the eastern part and from 140 to 180 feet along the Wind River and Fivemile Creek. The thickness of the terrace gravel is 8 to 25 feet and the average thickness is about 14 feet. About 1 to 2 feet of finer material overlies the gravel.

Terrace T_7 is present along the central and eastern course of Fivemile Creek as widely scattered remnants that are as much as half a mile wide; it also occurs to a very limited extent along the Wind River in T. 2 N., R. 5 E. Terrace T_7 is highly dissected and is 220 to 240 feet above Fivemile Creek and the Wind River. Only a thin mantle of gravel and soil, 4 to 5 feet thick, caps these highly eroded remnants.

Terrace T_8 is represented principally by three large remnants—one at the extreme western end of the area and the other two in the western and east-central parts of Fivemile Creek valley—but several smaller isolated remnants also are present along the Wind River. The eastern part of the largest remnant along western Fivemile Creek is highly dissected. This remnant consists of two surfaces, one about 20 feet lower than the other. These two levels are indicated, but not separated, on plate 1. The height of the terrace above Fivemile Creek ranges from about 375 feet in the western part to 300 feet in the eastern part and above the Wind River from 340 to 380 feet. The terrace gravel is 7 to 22 feet thick and is overlain by 1 to 2 feet of fine-grained material. This terrace, along western and east-central Fivemile Creek, and terrace T_7, along eastern Fivemile Creek, constitute Indian Ridge (sometimes called Muddy Ridge), the natural divide between Fivemile and Muddy Creeks.

Terrace T_9 is present only as isolated remnants in Tps. 1 and 2 N., R. 4 E., and in T. 2 N., R. 5 E. These remnants are highly dissected and are less than half a mile wide. They are 420 to 480 feet above the Wind River and are underlain by 6 to 18 feet of gravel and 1 to 2 feet of finer material.

Terrace T_{10} is present only along the Wind River. Several isolated remnants from ½ to 1½ miles wide are in Tps. 1 and 2 N., Rs. 2 and 4 E. The terrace is rather flat and fairly extensive, especially in T. 2 N., R. 4 E., where one remnant is about 2 miles long. The height of the terrace above the Wind River ranges from 500 to 550 feet. The gravel underlying the terrace is 7 to 18 feet thick and is overlain by 1 to 2 feet of finer material.

Terrace T_{11} occurs as a relatively flat and extensive series of connected remnants in Tps. 1 and 2 N., and Rs. 3 and 4 E. The series of remnants is about 6 miles long and ⅛ to 1¼ miles wide. Its height above the Wind River ranges from 580 to 620 feet. The terrace gravel ranges in thickness from 4 to 18 feet and is overlain by 1 to 2 feet of finer material.

The only remnant of terrace T_{12}, in T. 1 N., R. 3 E., is about a mile long and half a mile wide. It is highly dissected, and its height above the Wind River is about 680 feet. The underlying gravel, which is 18 feet thick at the west end of the terrace, is mantled by about a foot of soil.

Terrace T_{13}, which is represented by Lost Wells Butte (pl. 6*B*), is the highest terrace in the area and is about 800 to 825 feet above the Wind River. Erosion has removed all but four very highly dissected remnants in T. 2 N., Rs. 3 and 4 E., all of which are less than one-eighth of a mile wide. These small remnants are underlain by a loosely cemented conglomerate containing cobbles as much as 8 inches in diameter. The thickness of the conglomerate ranges from about 4 to 10 feet.

A number of small terrace remnants border small arroyos in the interstream areas. Three terrace remnants along Antelope Gulch between Fivemile and Muddy Creeks, two remnants in T. 2 N., Rs. 1 and 2 E., southeast of Morton, and another somewhat larger remnant between Fivemile and Muddy Creeks at the extreme northwestern corner of the area have been mapped; however, the other remnants are too small to warrant mapping. Most of these remnants are less than a mile long and less than one-fourth of a mile wide. They range in height from 40 to 240 feet above the tributary drainages and are underlain by less than 5 feet of gravel.

Occurrence of ground water.—Permanent bodies of ground water have developed within the lower terrace deposits along the Wind River in areas that have been irrigated for some time. These deposits now yield satisfactory water for domestic use.

In the terrace deposits that underlie the newly irrigated terraces T_1 and T_2 in Tps. 2 and 3 N., R. 6 E., ground-water bodies are developing and apparently have become permanent after only two seasons of irrigation. Satisfactory water may be obtained from these deposits if irrigation is continued and drainage is good. If this source of supply is to be developed, the wells should be located a considerable distance from the outer terrace margin and deep enough to penetrate the full thickness of the terrace deposits. As the higher terraces along the Wind River are not irrigated at the present time and are not likely to be irrigated in the future because of their high altitude and relatively small areal extent, the gravel underlying these terraces is not likely to become a source of water supply.

Except for a few small areas, the terraces along Fivemile and

Cottonwood Creeks are not irrigated at present nor is extensive irrigation planned for them in the near future. Probably little or no ground water has accumulated beneath these terrace remnants, as no springs issue from the base of the gravel along the terrace edges. Moreover, because most of the remnants are isolated and of small areal extent, it is unlikely that the application of irrigation water would result in the accumulation of significant supplies of ground water.

Irrigation of the Muddy Creek terraces was begun in 1951. Bodies of ground water are forming in the terrace deposits, and these will become permanent if irrigation is continued; after several years, wells penetrating the terrace deposits probably will yield adequate quantities of water for domestic use. At first, the water probably will be highly mineralized, but eventually the quality of the water will become satisfactory if the soluble salts that have accumulated in the surficial deposits during long periods of aridity are leached out by continued infiltration of irrigation water and if the ground water is discharged from the area by springs along the slope at the terrace edges. On any terrace the best location for a well is as far away as possible from the terrace margins and from any depressions or valleys. Wells that penetrate the full thickness of the terrace deposits are the most likely to encounter water.

Field observations do not indicate the presence of water in the gravel deposits underlying the small interstream terraces.

Drainage.—Where the lower terraces along the Wind River have been irrigated for some time, waterlogging has occurred along or near the base of the slope between terraces, along the outer edge of the higher terrace, and in some places within the terraces. Water from irrigation infiltrates to the zone of saturation, percolates laterally toward the Wind River in a downvalley direction, and then is discharged at the lower, outer edge of the terrace. In some places the water is intercepted by drains that conduct the water to the bottom land or to the Wind River. In most places, however, the water is allowed to pass onto the next lower terrace, which becomes progressively waterlogged near its upper edge if more water is moving into the terrace deposits of this lower terrace than can be transmitted by the deposits. This situation is common where water is discharged at the terrace edges. However, the outer edge of the lower terraces along the Wind River generally is mantled by colluvial-alluvial debris, which greatly retards the discharge of water at the terrace margin. The surface of the terrace gravel also is covered locally with a considerable thickness of relatively impermeable fine-grained material. Because the discharge of ground water from the terrace gravel is retarded, the water table rises and the capillary fringe above the water table extends to the land surface.

Where waterlogging occurs, evaporation of the ground water results in the deposition of salts in the soil, which in time may destroy the soil structure and decrease its permeability. Continued recharge in excess of the capacity of the terrace deposits to discharge the ground water creates a condition of almost permanent waterlogging. This has already occurred in parts of terrace T_2 in the Riverton area, which has been irrigated for some time. The same condition also probably will develop after continued irrigation of the newly irrigated parts of terrace T_2 in Tps. 2 and 3 N., R 6 E. (Hidden Valley). In both areas the alluvial-colluvial mantle of terrace T_2 is thick; at its northern extremity in T. 3 N., R. 6 E., the terrace is wholly obscured by the mantling deposits.

The most effective method of alleviating the poor drainage of terrace T_2 would be the construction of interception drains at the outer edge of the terrace; the exposure in the drains of as much of the total thickness of gravel as possible would effect the maximum discharge of water from the gravel. Another effective method would be the construction within the terrace deposits of interception drains perpendicular to the direction of ground-water flow and penetrating the full thickness of the gravel section. If detailed study indicated that the water in the gravel was under hydrostatic pressure, similarly located shallow drains would serve the same purpose if within them a series of relief wells penetrating the full thickness of gravel were installed. The necessary spacing of the wells would have to be determined by means of aquifer tests in each area to be drained.

The lowering of pressure or, where water-table conditions exist, dewatering of the gravel by gravity drainage would effect drainage of the overlying soil. Although the soil is fine grained and would yield water very slowly, the large size of the contributing area and the increased hydraulic gradient would result in a lowering of the water table to a depth that would relieve the waterlogged condition of the soil. Chemical treatment of the soil to improve the structure and to increase the permeability then would be effective.

Except in areas where the soil has been dispersed by sodium salts and consequently should not be irrigated, the high permeability of the surface materials mantling the Muddy Creek terraces necessitates the application of large amounts of irrigation water. Although the underlying terrace gravel seems to afford good subsurface drainage now after only a short period of irrigation, under certain conditions a high water table may develop in some parts of the terraces, especially along and near the base of the slopes between terraces where bedrock is at or near the surface and also where sodium-dispersed soils may create a local perched water table. Unless intercepting drains prevent the ground water of a higher terrace from entering the next lower terrace, progressive waterlogging of the lower terrace near its upper edge may occur. This will be especially true if the water moving into the lower terrace cannot be carried away through these deposits as rapidly as it is discharged from the higher terrace. The problem of soil dispersion warrants thorough consideration, too, because it may be impossible or impractical to improve this condition.

Waterlogging may occur also in the colluvial-alluvial materials, which are less permeable than the terrace deposits and which completely mantle the slope between terraces in many places. If the flow of ground water from a higher to a lower terrace is retarded by colluvial-alluvial materials, the water table will rise to the surface near the contact of the colluvial-alluvial material.

As irrigation continues, the three channels crossing the divide between Muddy and Cottonwood Creeks will serve as natural ground-water and surface-water drains and may contain flowing water during part, if not all, of the year. Until these drains adjust to the new conditions of flow, erosion is likely to be a problem and measures to prevent gullying may be needed.

In the areas to be irrigated, if observation wells penetrating the entire thickness of the terrace deposits were installed at carefully selected sites, measurements of the water level in these wells would indicate at an early date any tendency toward high-water-table conditions. These observation wells should be installed along cross-valley profiles and along the outer and inner margins of each terrace; on wide terraces, observation wells should be installed also in the central areas. At least one line of wells should transect the eastern, central, and western parts of the terrace system; the line should cross where the terrace is widest.

Most of the excess irrigation water that is applied to terraces T_3 to T_6 probably could be intercepted by two drains. One, Cottonwood drain, already has been constructed through the series of blowout depressions; the other should be constructed along the outer margin of terrace T_3 and, throughout its length, should cut through the terrace deposits into the underlying bedrock. The feasibility of this second drain would depend on the location and character of the bedrock surface, which could be determined by test drilling. The large depression in the southeast part of T. 4 N., R. 5 E., which now is an outlet for Cottonwood drain, could also serve as an outlet for the proposed drain.

The terraces along Fivemile and Cottonwood Creeks are similar to those along Muddy Creek. However, because the individual terraces likely to be irrigated are isolated and exposed, drainage problems are not imminent in these two areas.

Owing to their very limited areal extent, neither the small interstream terraces nor the other small terrace remnants are likely to be irrigated and, hence, are unlikely to present drainage problems.

COLLUVIAL-ALLUVIAL DEPOSITS, UNDIFFERENTIATED

Mixed colluvial-alluvial deposits mantle the Wind River formation throughout most of the area. As it is impossible to delineate these deposits without very detailed study, they do not appear on plate 1. The areal extent and character of these deposits, however, are described in the following paragraphs.

Areal extent.—Deposits of colluvium and alluvium mantle many of the scarps between terraces and most of the broad bedrock slopes, or pediments, that flank the terraces and buttes throughout the area.

Description.—Both colluvium and alluvium consist of material derived from the weathering of rocks. Colluvial material, typically formed in an arid climate, moves principally by gravity from its place of origin to its place of deposition and, in the Riverton area, it mantles the terrace scarps or slopes at the base of terraces or buttes in the form of diversified rock debris. Typically unsorted, the colluvium contains particles that range in size from silt to boulders. The alluvial part consists of sand, silt, and clay, which mantle terrace scarps and the bedrock slopes at the base of terraces and buttes, and which have been transported principally by running water but for only short distances. The alluvium occurs also as fans that spread out over the slopes and coalesce in places to form flat surfaces contiguous with alluvial deposits underlying the bottom land. These alluvial deposits are fairly well sorted and grade from coarse to fine particles with greater distance from the parent source.

In most places where they are present the colluvial-alluvial deposits generally are 5 to 10 feet thick. However, locally greater sedimentation has occurred either because the material was deposited in a small basin or the adjacent contributing area was large or because of the alluviation of buried channels of older drainages that passed through the locality. In the central part of Paradise Valley, T. 2 N., R. 4 E., and the northeastern part of the North Pavillion area, T. 4 N., R. 2 E., for instance, thicknesses of more than 20 feet of colluvial-alluvial deposits have been reported. Fan deposits up to 70 feet in thickness have already been described in the discussion of terrace T_2 (see p. 28).

Formation of the colluvial-alluvial deposits involved relatively little action by running water; consequently, the deposits in many places are not stable when saturated. As a result, when irrigation water is first applied to the relatively thick, fine-grained deposits, compaction and settlement occur in proportion to the total thickness of the deposits. Since irrigation water was first applied in the North Pavillion area settlement in sec. 36, T. 4 N., R. 2 E., has reached a total of more than 5 feet. This settlement is the greatest that has occurred in the Riverton area and probably is due to the relatively great thicknesses of colluvial-alluvial deposits in the buried drainage channels underlying that locality.

Occurrence of ground water.—The colluvial-alluvial deposits are relatively impermeable and lack uniformity in thickness and lateral extent. However, appreciable quantities of water accumulate in those parts of the area that have been irrigated for several years. The yield of wells tapping these deposits is inadequate for domestic use, and unless the colluvial-alluvial deposits are recharged directly by canal seepage, the water is not satisfactory for domestic use nor is it likely to improve significantly.

Drainage.—The low average permeability of the colluvial-alluvial deposits and of the underlying bedrock make it certain that drainage problems will arise. The problems will be spotty because of the variation in the thickness and lateral extent of the deposits and of their heterogeneity. In some areas little or no colluvial-alluvial material overlies the bedrock, whereas in other areas a considerable thickness is present. The change in thickness generally is progressive, but in some places it is abrupt—as, for example, in the vicinity of older drainage courses that have been alluviated.

Inasmuch as these colluvial-alluvial deposits include material transported both by soil creep and by running water, they are characterized by a wide variation in the sorting and size of particles. The lack of homogeneity causes differences in the permeability of the deposits. Although the permeability of transported materials generally decreases with increasing distance from their source, impermeable materials are present in many places without respect to distance from the source. In places the permeability of the deposits has been reduced as a result of their high salt content, particularly the high sodium content. Differences in the permeability are important because they necessitate differences in the depth and spacing of ditches if drainage is to be effective.

Another variable to be considered is the underlying bedrock formed by the Wind River formation. Because the bedrock surface ranges from gently sloping to undulating and irregular, the overlying surficial deposits are irregular in thickness. In addition, the permeability of the bedrock is low, but somewhat variable. Water moves into the Wind River formation through fractures and the more permeable zones, but the movement is slow. These factors greatly influence the drainage of the overlying deposits. As pointed out previously, in some places the surficial deposits may be recharged by leakage from underlying confined aquifers in the Wind River formation.

Because of the above characteristics of the colluvial-alluvial material and the underlying bedrock, waterlogging has occurred or will occur where (1) the colluvial-alluvial deposits thin or wedge out and thus force water to the surface; (2) a local irregularity or an abrupt change in slope of the underlying bedrock surface reduces the cross-sectional area through which the water can move; (3) the permeability of the surficial deposits and the underlying bedrock is so low that discharge from the deposits is less than recharge to them; and (4) artesian water from the underlying Wind River formation rises and enters the surficial deposits.

As the above conditions, either singly or in combination, exist in much of the area covered by the colluvial-alluvial deposits, drainage problems have developed or are likely to develop in such areas as the newly irrigated North Portal area in Tps. 3 and 4 N., Rs. 2 and 3 E. In order to foretell any tendency toward waterlogging, observation wells penetrating the full thickness of the colluvial-alluvial material mantling bedrock should be installed along two or three cross-valley lines. In the areas already waterlogged there is some question whether drainage is economically feasible. Rigid control of water use should be exercised in all areas mantled by colluvial-alluvial deposits, and measures should be taken to reduce seepage of water from canals. A detailed study of the hydrology and geology of each affected area should be made before corrective measures are attempted.

Detailed geologic and hydrologic studies, with special emphasis on the origin and nature of the surficial deposits and underlying bedrock formations, should be made in all areas of colluvial-alluvial deposits that are considered for future irrigation. The factors related to drainage perhaps are more important than any others in determining whether a given tract is suitable for irrigation; thus, these investigations logically should precede any others proposed to evaluate the land for agriculture. Certainly, any plan for the future agricultural utilization of areas of bedrock mantled by colluvial-alluvial deposits should be undertaken only after due consideration of the nature of these materials and their drainability.

ALLUVIAL DEPOSITS

Alluvial deposits occur as valley fill along the principal streams and their tributaries.

Areal extent.—The alluvial deposits are most extensive along the Wind River where they are commonly a mile or more wide. Along Fivemile, Muddy, and Cottonwood Creeks they generally range in width from less than a quarter of a mile to about three-quarters of a mile, but in places they are as much as a mile wide. The width of the bottom land along each drainage course is relatively uniform, with certain exceptions: the alluvial deposits along the Wind River are narrower than average near the west flank of the Pilot Butte anticline, and the alluvial deposits along Fivemile and Muddy Creeks are somewhat irregular in width and more extensive in the east-central and eastern reaches than along the upper reaches of the creeks.

Alluvial deposits are present along the numerous small tributaries to the principal streams, but their areal extent is too small to warrant mapping. Consequently, only the more extensive alluvial deposits are shown on plate 1.

Description.—The alluvium consists mostly of sand, silt, and clay, but in some places it contains considerable coarse sand and gravel.

The thickness of alluvium along the principal streams ranges from a featheredge to about 67 feet. The Bureau of Reclamation has reported a maximum thickness of 67 feet along Fivemile Creek and a maximum thickness of 35 feet along Muddy Creek. The logs of numerous test holes and water wells indicate that along Fivemile Creek the average thickness of the alluvium is about 40 feet and along Muddy Creek about 30 feet. The thickness of the alluvium along the Wind River and Cottonwood Creek is not known, but it probably is about the same as that along the other principal drainage courses in the area.

The alluvial deposits, especially those along the Wind River, Muddy Creek, and upper Fivemile Creek, contain a large proportion of gravel. The deposits along Muddy Creek are reported by the Bureau of Reclamation to be remarkably uniform; about 10 feet of gravel was cored below stream level. It is estimated that the alluvial deposits along upper Fivemile Creek contain about 10 feet of gravel.

The alluvial deposits along small tributary drainages of the area were not studied in detail. Although of local origin and less thick, they probably are similar to the deposits of the principal streams.

Occurrence of ground water.—The lower part of the alluvial deposits bordering the Wind River contains a permanent body of ground water, which probably is due to recharge both from irrigation and the Wind River. Although this aquifer has not been utilized extensively for water supply, dug wells in some places yield water that is suitable for domestic, stock, or irrigation use. The old Shoshone town well, on the east side of the Wind River in sec. 16, T. 3 N., R. 6 E., and soon to be flooded by water in Boysen Reservoir, provided a hard water used for municipal supply. Three interconnected dug wells in the same area have also provided an adequate quantity of water suitable for irrigation. The quality of water in the alluvium along the Wind River seems to depend on the source of recharge. In areas where alluvium and adjacent deposits are not irrigated and where the Wind River is the principal source of recharge, the quality of water is satisfactory for domestic use. Conversely, in areas where the recharge is principally from irrigation and where ground water is being discharged into the Wind River, the water generally is highly mineralized and suitable only for stock use. In such areas the pumping of ground water from wells located near the Wind River probably would induce recharge directly from the river and thus improve the quality of the water.

The alluvial deposits along Fivemile, Muddy, and Cottonwood Creeks contained some ground water before these lands were irrigated, but owing to subsequent irrigation along portions of the creeks, considerable water locally has been added to storage and the water table has risen. The creeks in these areas have become or are becoming effluent; that is, they are receiving water from the zone of saturation. A good example of this is Fivemile Creek, along which the water table has risen owing to the extensive irrigation of adjacent alluvial and other deposits. As the water in Fivemile Creek, probably also in Muddy and Cottonwood Creeks, is highly mineralized, the water in the alluvial deposits along these creeks is likely to be unsatisfactory for domestic use.

Drainage.—The alluvial bottom land is waterlogged in many places along the Wind River, especially in the eastern part of the report area. The waterlogging is caused (1) by infiltration of irrigation water applied to the alluvial and adjacent colluvial-alluvial deposits, (2) by uncontrolled return flow from irrigation higher terraces, or (3) by ground water discharged from higher terrace deposits. In many places the alluvial deposits are relatively impermeable and the hydraulic gradient is low. The relative impermeability is due in part to the presence of very fine grained materials in the upper part of the alluvium, and in part to dispersal of the soil by sodium in the infiltrating water. The hydraulic gradient of the water table to the Wind River is low because of the width of the deposits and the shallowness of the Wind River channel. The water table rises, but the rise is insufficient to increase the hydraulic gradient to the point that the discharge equals recharge. Thus, excess irrigation water either accumulates in topographic depressions or, by contributing to ground-water storage, causes the water table to rise close to the land surface. As a result, long-continued evaporation of the water has left a heavy accumulation of salts in the soil, and the alluvium has become progressively more impermeable and the waterlogging more extensive. In areas where the principal source of recharge to the alluvium is from higher lying terraces, the problem of waterlogging could be solved in part by constructing drains along the terrace edges. The drains should be incised to bedrock throughout their length. Interception of surface-water runoff from the terraces also would help and, in addition, would improve the drainage of the terraces themselves. In some areas where waterlogging is caused solely by seepage of irrigation water applied to the alluvium and adjacent colluvial-alluvial deposits, the waterlogging could be remedied or alleviated by more careful application of irrigation water.

Irrigation along Muddy and Cottonwood Creeks has not been practiced long enough to cause much waterlogging of the alluvial deposits. However, in small areas along the middle and lower reaches of Fivemile Creek, some waterlogging has occurred, mainly as a result of irrigation of the alluvium and adjacent colluvial-alluvial deposits. Although some improvement has resulted from the construction of open drains through some of the waterlogged areas, these areas probably will be difficult to maintain in a condition suitable for extensive agriculture. If waterlogging in these areas is to be prevented or remedied, the amount of irrigation water applied to the land must be rigidly controlled.

EOLIAN DEPOSITS

Areal extent.—Eolian deposits are present throughout the area, especially along the streams and in areas adjacent to badlands and steep escarpments; they are more common along Muddy and Cottonwood Creeks. The areal extent of eolian deposits can be accurately mapped only by very detailed work; for this reason, only the larger accumulations of eolian sand are shown on plate 1.

Description.—Eolian deposits consist mostly of sand and silt. These are deposited wherever the sand-laden wind encounters land forms or vegetation that decrease its velocity and carrying ability. The deposits accumulate and sometimes form hummocks and dunes. If the wind is steady and blows mostly from one direction, barchans, or crescentic sand dunes, are formed. A well-developed active barchan in sec. 18, T. 4 N., R. 6 E., indicates a wind direction from the southeast. Dunes are the most obvious eolian deposits; however, a large part of the area is mantled by a thin deposit of eolian material.

Occurrence of ground water.—The eolian materials are not important as ground-water reservoirs. They are mostly of fair to high permeability, however, and so may be effective in some places in absorbing rainwater and transmitting it to underlying deposits.

PLAYA DEPOSITS

Areal extent.—Playa deposits are present in the lower parts of the larger closed depressions between Muddy and Cottonwood Creeks.

Description.—During periods of heavy precipitation, silt- and clay-laden inflow spreads over the floor of a depression and forms a playa lake. Evaporation between periods of inflow leaves a thin layer of fine-grained material, some of which is later removed or redistributed by wind action. In some of the depressions in this part of the area the playa deposits are about 2 to 3 feet thick. Their relative impermeability causes ponding and retention of water in the depressions.

Occurrence of ground water.—Playa deposits generally contain water only during and shortly after the wet seasons. Cottonwood drain, which now interconnects the series of depressions along an old channel through Muddy Creek terraces in T. 4 N., Rs. 4 and 5 E., will prevent the accumulation of water in some of these depressions. The playa deposits will then receive little water except by effluent seepage after irrigation is begun on adjacent terraces.

GROUND WATER

DEPTH TO WATER TABLE

The depth to water in a well is a measure of the depth either to the water table in an unconfined aquifer or to the piezometric, or pressure, surface of water in a confined aquifer.

Precipitation that is not evaporated, absorbed by the soil and later transpired by vegetation, or carried away as surface runoff infiltrates to the zone of saturation. In some places, a perched ground-water body may be formed above the main water table; the sediments between the perched water body and the main water table are not saturated. The water table rises when recharge to ground-water storage exceeds discharge and declines when discharge exceeds recharge. In the Riverton area the water table rises in response to recharge from irrigation water and declines during the nonirrigation season. Consequently, unless made at approximately the same time of year, measurements of the depth to water in any well are not indicative of changes in the long-term recharge-discharge ratio.

A map (pl. 2) showing the depth to the water table during August 1950 was prepared for the Midvale and North Pavillion areas of the Riverton project. This map shows that the depth to water in unconfined aquifers ranges from less than 1 foot to more than 30 feet below the land surface. Because the configuration of the water table is similar to, but more regular than, the general surface topography, pronounced variations in the depth to water are caused primarily by irregularities of the land surface. Local perched water bodies and local differences in permeability and percolation rate also affect the shape of the water table. The map shows the effect of irrigation on depth to water. In the newly irrigated areas, such as the Lost Wells area and the North Pavillion area (see fig. 2), after 1 to 2 years of irrigation, the depth to water is still generally greater than 10 feet. However, direct recharge from irrigation canals and laterals already has caused the depth to water near canals to decrease to less than 10 feet. Continued irrigation will cause a further rise of the water table, and in a progressively larger area the depth to water will be less than 10 feet. Various stages in the sequence of events are shown by the depth to water in the remaining areas on the map (pl. 2) where irrigation has been practiced for some time. In a great percentage of these areas the depth to water is less than 10 feet. In some materials the capillary fringe above the water table extends to or nearly to the land surface and drainage problems exist.

If waterlogging is to be prevented in other parts of the area, rigid control of water use and the elimination of great losses of water by influent seepage from canals and laterals will be essential. If corrective measures to limit recharge from irrigation water are applied, it is suggested that periodic maps of the depth to water be made. These would aid in the evaluation of the effectiveness of the corrective measures. The rise of the water table in newly irrigated areas should be observed carefully as irrigation is continued.

DEPTH TO PIEZOMETRIC SURFACE

Under artesian conditions water moves into the interconnected sandstone lenses within the Wind River formation either directly from the zone of saturation or through permeable zones and fractures in the relatively impermeable confining beds. Because the water is confined, its upward pressure against the confining bed is equivalent to the head resulting from the difference between the altitude of that point and the altitude of the water table in the recharge area minus the loss of head due to friction of movement. So long as the rate of recharge and discharge are constant, there is little relief for this pressure except where wells penetrate the aquifer or where leakage occurs. The water level in a well that penetrates the aquifer stands at a height above the top of the confining beds equivalent to the pressure head at that point. The imaginary surface to which water from an artesian aquifer would rise under the full pressure head is called the piezometric surface. In heterogeneous aquifers, such as the Wind River formation, however, the height to which water from a given standstone bed will rise in wells corresponds to the pressure head of the water confined in that sandstone at the point penetrated by the well.

At depth the Wind River formation in the report area comprises at least two distinct zones, both of which contain interconnected water-bearing sandstone lenses. The exact relation of these zones to each other is not known, but apparently they can be identified by the depth to water in wells; that is, the water in the upper sandstones of the Wind River formation rises to one piezometric surface and the water in the deeper sandstones rises to another. These relationships cannot be resolved definitely without much more information about deep wells than is now available.

WATER-LEVEL FLUCTUATIONS

The stage of the water table or piezometric surface is a measure of the amount of water in underground storage; a rise of the water level indicates a gain of water in storage and a decline indicates a loss from storage. In wells tapping unconfined aquifers in this area, the water levels fluctuate mainly in response to recharge from irrigation and to discharge by evapotranspiration and natural drainage; the magnitude of these fluctuations is, of course, greatest in wells nearest sources of recharge or points of natural discharge. In wells tapping confined aquifers, the water level fluctuates in response to the increases or decreases in hydraulic head that result from the withdrawal of water from wells and to differences in the rates of recharge and discharge, and, to a minor degree, in response to changes in barometric pressure. If recharge and discharge are constant and the rate of withdrawal is small, the water level fluctuates very little throughout the year; this is the usual condition in the deeper confined aquifers of this area. If recharge and discharge vary substantially even though the withdrawals are small, the water level fluctuates considerably; this is the usual condition in the shallower confined aquifers recharged by irrigation.

In order to determine the type and magnitude of water-level fluctuations in the aquifers of the report area, 32 wells were selected early in the investigation for monthly measurement of the water level. The number of wells has changed from time to time and as many as 109 wells have been measured. In addition, recording gages have been maintained on six wells (A1–4–29bd2, A1–4–33dd, A2–3–35ca1, A2–5–6ad1, A3–2–20cd1, and A3–2–27ab1) in strategic locations. Most of the observation wells tap water that is under water-table conditions, but several tap confined

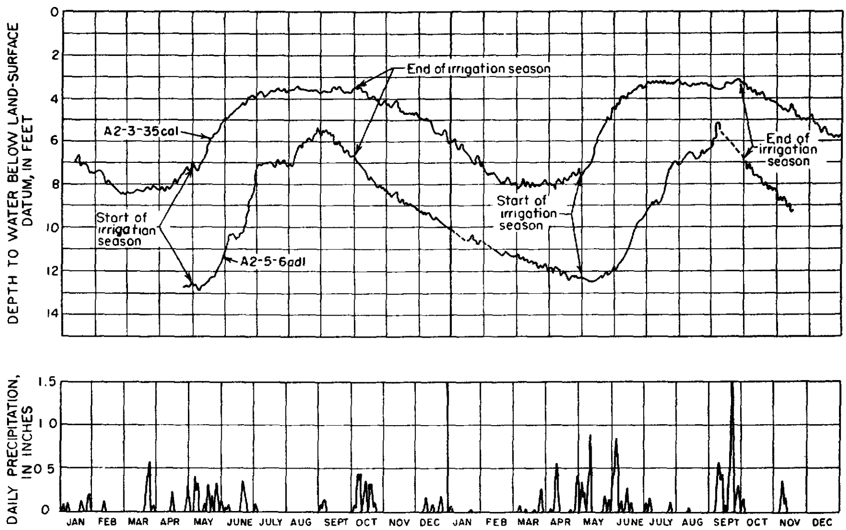

FIGURE 7.—Hydrographs showing fluctuations of the water level in wells A2–3–35ca1 and A2–5–6ad1 and precipitation at Riverton, 1949–50. From recorder charts.

water. Records of the water levels in these wells are given in table 16.

Graphs showing the fluctuations of the water level in wells tapping water under water-table, shallow-artesian, and deep-artesian conditions were prepared from daily noon readings of the water-level recording gages. The fluctuations of the water level in wells A2–3–35ca1 and A2–5–6ad1, both of which are "water-table" wells, show the effect of recharge from irrigation. (See fig. 7.) Well A2–3–35ca1 is near the Pilot canal, and well A2–5–6ad1 is near a lateral fed by the Pilot canal. The somewhat later rise of the water level in well A2–5–6ad1 probably is due to its distance downstream from well A2–3–35ca1. Also, well A2–5–6ad1 is close to a natural drain, which may account for the somewhat greater fluctuation of the water level in this well. The water level in both wells responds to recharge from irrigation; the water level generally rises throughout the irrigation season and falls throughout the nonirrigation season. The short-lived drop of water level, which is shown by the hydrographs to have occurred directly after water was turned into the canals, is thought to be a natural decline of water level before the recharge from irrigation was effective. The water level in well A2–5–6ad1, which is in an area that receives recharge both by seepage from a lateral and by infiltration of applied irrigation water, began to decline about a month before the end of the irrigation season. This decline is explained by the lesser amount of water being carried by the laterals and the cor-

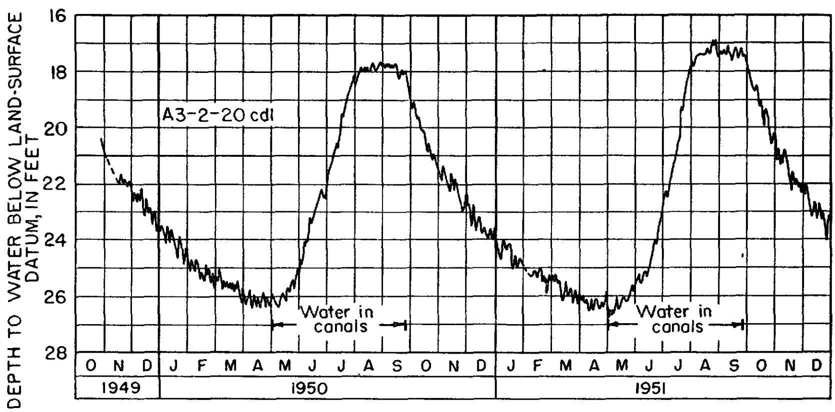

FIGURE 8.—Hydrographs showing water-level fluctuations in well A3–2–20cd1, 1949-51. From recorder charts.

respondingly lesser amount of irrigation water being applied. The water level in well A2–3–35ca1, which is in an area where the recharge is principally from the main canal, did not begin to decline until the canal no longer carried water.

The hydrographs of the water level in these two wells show, in general, the trend of water-table fluctuations throughout the Riverton project area and adjacent irrigated lands.

Because seepage from irrigation recharges the shallow artesian aquifer and because the withdrawal of water from the aquifer is small, the water level in well A3–2–20cd1, which taps this aquifer, responds primarily to the increase or decrease in pressure resulting from irrigation recharge. (See fig. 8.) The prompt rise or fall of the water level when irrigation water is turned into or from the canals indicates that the hydraulic pressure in the aquifer varies directly with the amount of recharge from irrigation. The minor fluctuations in the well are due to changes in barometric pressure.

Wells A1–4–33dd and A1–4–29bd2, which are near Riverton, are deep artesian wells. As recharge to and discharge from the aquifer tapped by these wells is relatively constant and as the withdrawal of water is the principal means by which hydraulic pressure in the aquifer is relieved, the water level in the wells fluctuates in response to the changes in pressure that result from the pumping of wells concentrated in the area. (See fig. 9.) Well A1–4–33dd is within the radius of influence of the Riverton city

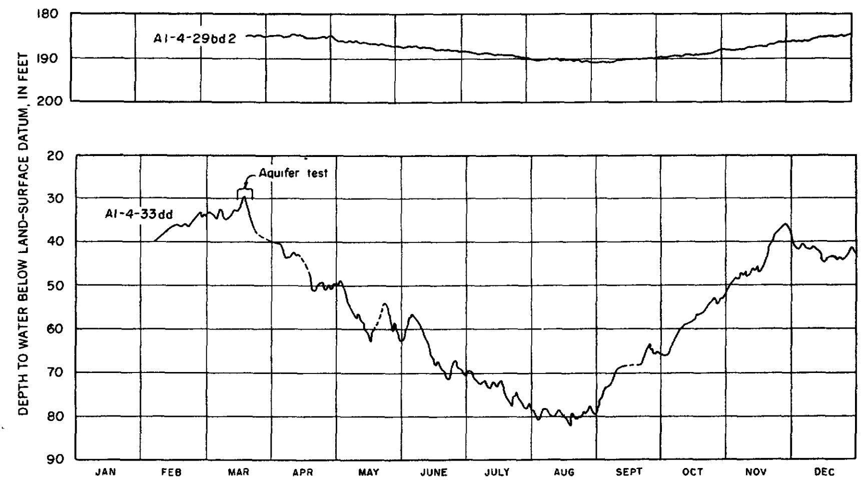

FIGURE 9.—Hydrographs showing fluctuations of the water level in wells A1–4–29bd2 and A1–4–33dd, 1951. From recorder charts.

wells. During August, when pumping is the heaviest, the water level in this well drops to more than 80 feet below the land surface. During the winter months, when demands for water are less, the water level rises to about 30 feet below the land surface. The water level in well A1–4–29bd2, which is farther from the Riverton pumping wells, also is lowest during August, but the difference between the August and winter water levels amounts to only about 6 feet. Both these wells provide an excellent record of the effect of large withdrawals of water from an artesian aquifer that is constantly being recharged.

In order to determine the long-term trend in storage, the measurement of water levels in the observation wells should be continued. By comparing the water levels of successive years with the earliest water-level records, current conditions within the aquifers can be evaluated.

RECHARGE

In the Riverton area recharge to the ground-water reservoir is from precipitation, irrigation, and surface-water infiltration.

PRECIPITATION

In comparison with the other sources of recharge, precipitation is not an important direct source of ground-water recharge in this area. The precipitation generally is rapidly absorbed by the soil or is evaporated directly from the surface. Only a small fraction, if any, of the water in the soil zone filters through the zone of aeration to the zone of saturation. This is indicated by the presence of caliche in the soil zone and by the absence of a shallow zone of saturation in dryland areas before they are irrigated. The caliche, which is a foot or more thick in some places, is an accumulation of mineral matter resulting from evaporation of soil moisture derived from precipitation; if water moved downward from the soil zone in large quantities, the caliche would not have formed. If precipitation were an important source of ground-water recharge, at least a thin zone of saturation would exist in most areas prior to irrigation.

A comparison of the hydrographs of the water level in two shallow wells in irrigated tracts with the daily record of precipitation during the same period (fig. 7) indicates that precipitation usually causes no change in the water level. Fluctuations of the water level in wells at times of heavy precipitation during the nonirrigation season are minor; actually, it is not known whether the fluctuations are attributable to precipitation or to other causes. During the irrigation season, any water-level fluctuations caused by precipitation are obscured by the much greater fluctuations due to recharge from irrigation.

IRRIGATION

Recharge to the ground-water reservoirs in the Riverton area occurs mainly by influent seepage from irrigation canals, laterals, and reservoirs and by infiltration of water applied to cultivated land. Irrigation in the Riverton area is a large-scale and effective water-spreading operation comparable with that in areas where water spreading is practiced as a method of artificial recharge. The area is traversed by an elaborate system of canals and laterals, many of which are situated in relatively permeable surficial deposits. Also, water is stored the entire year in Pilot Butte Reservoir and Ocean Lake. Considerable water seeps from the reservoirs and from the ditches in transit to the farms of the area; personnel of the Bureau of Reclamation report that only about 50 percent of the water diverted for the Riverton project actually reaches cultivated land. The loss of water in this area is of major importance. Not only is less water available for irrigation, but the large amount of water infiltrating the surficial deposits causes waterlogging in many places. Many canals and laterals, especially where incised into very permeable material, have been or are being lined to prevent further loss of water. Because the amount of irrigation water applied often is in excess of crop needs and because the soil is highly permeable in some places, such as on the terraces north of Muddy Creek, much of the irrigation water sinks into the soil and is transmitted downward to the zone of saturation. Preliminary figures of the Surface Water Branch of the Geological Survey indicate that 100,000 to 150,000 acre-feet of irrigation water is lost annually in the Riverton irrigation project by infiltration to the ground-water reservoir, evaporation, and transpiration. No attempt has been made to determine the amount of water contributed to the ground-water reservoir in this area because the amounts discharged by evaporation and transpiration are difficult to establish.

The seasonal influence of irrigation on the amount of water in storage is shown by a study of the hydrographs of the water level in two "water-table" wells situated in cultivated areas and near irrigation canals or laterals. (See fig. 7.) The water level in both wells began to rise steadily about a week after water was turned into the canals and laterals and fell gradually after the flow in the canals ceased. Although the rise of the water level in wells during the irrigation season indicates to some extent the amount of water that is added to ground-water storage as a result of recharge from irrigation, it does not in itself show the total increase because discharge from the ground-water reservoir is progressing at the same time as recharge; the rise of the water level indicates only that the recharge exceeded the discharge.

The importance of irrigation as a source of recharge is emphasized by the rapidity with which a zone of saturation develops and by the rapid rise of the water level in newly irrigated areas. In parts of the North Pavillion area, in Tps. 3 and 4 N., Rs. 1-3 E., recharge from irrigation caused waterlogging in only 1 year.

Water is contributed to the ground-water reservoir by streams crossing areas where the water table is below the level of the stream; such streams are said to be influent. Data pertaining to the loss of streamflow from Muddy Creek have been compiled by the Surface Water Branch of the Geological Survey. During September 1949 the measured loss of water within the Riverton irrigation project was about 113 cfs. During the same month a flash flood increased the normal flow of Muddy Creek by 100 cfs where the creek entered the project area, but no increase in flow was noted at the lower end of the project. These data demonstrate that streamflow in influent stretches contributes considerable water to ground-water storage. The extent of the contribution by streams other than Muddy Creek, however, is unknown.

MOVEMENT

Ground water in a permeable material moves from one place to another if there is a hydraulic gradient (difference in head) between the two places. Ground water generally is in motion; truly stagnant ground water, or at least stagnant fresh water, is rare if it exists at all. Unconfined ground water moves in permeable rock that is underlain by relatively impermeable rock; confined water moves in permeable rock that is both underlain and overlain by relatively impermeable rock. In either situation, ground water moves from a place of recharge to a place of discharge at lower altitude. Although the rate of ground-water movement is affected by the texture and structure of the rocks, the direction of movement always coincides with the path of least resistance to flow. Ground water generally moves so slowly that the internal friction of its particles is relatively low and its flow is "laminar" or "viscous."

According to Darcy's law the rate of movement of ground water is directly proportional to the hydraulic gradient and the permeability, and the quantity of water discharged in a unit of time depends on the rate of movement and the cross-sectional area through which the water is moving.

The configuration of both the water table and the piezometric (pressure) surface can be shown on maps by contour lines. As water moves in the direction of the greatest slope of the water table or piezometric surface, the direction of movement is perpendicular to the contour lines. The maximum difference in hydrostatic pressure is at right angles to the contour lines, and the slope or hydraulic gradient is measured along the line of maximum difference.

UNCONFINED AQUIFERS

In much of the Riverton area the colluvial-alluvial, alluvial, and terrace deposits together constitute the principal shallow aquifer and the water in them generally in unconfined. Because the recharge is considerable during the irrigation season, the water table rises and discharge increases somewhat. The slow decline of the water levels after the irrigation season (fig. 7) indicates that ground-water movement is slow. Nevertheless, because the surficial deposits are recharged directly by irrigation water, the quantity of water passing through them is comparatively large.

The direction of movement of ground water in the surficial deposits is generally the same as the slope of the land surface. For example, in inter-butte areas, ground water moves downgradient through the colluvial-alluvial deposits either toward some ephemeral wash or toward the center of a closed basin. In terrace areas ground water moves in a downvalley direction through the terrace deposits toward the principal surface drainage. In valley alluvium, water moves in a downvalley direction as underflow parallel to streamflow. Although the topography of the land surface generally is a key to ground-water movement in the surficial deposits of the area, the irregularities of the underlying bedrock surface locally modify and complicate the direction of movement.

To illustrate these characteristics of shallow ground-water movement in unconfined aquifers in the Riverton area, a generalized map of the Midvale area of the Riverton irrigation project was prepared from data in the files of the Bureau of Reclamation. (See pl. 3.) This map shows the position of the water-table contours immediately before the 1950 irrigation season (about March 15) and during the latter part of the irrigation season (August 15), and thus approximately represents the low and high water levels during the year. The relative rates of movement are indicated by the spacing between the water-table contours for March and August. If the contours are closely spaced or if the March contour crosses the August contour line (thus showing higher water levels), the movement of ground water evidently is slow. Conversely, if the contours are more widely separated, the movement of ground water evidently is more rapid. The entire Midvale is mantled primarily by colluvial-alluvial deposits that receive direct recharge from irrigation.

CONFINED AQUIFERS

In the Riverton area, ground water in the Wind River formation generally is confined under artesian pressure. The water level in a well that penetrates one of the systems of essentially horizontal lenticular water-bearing sandstones in the Wind River formation coincides with the piezometric surface of that system. At least two major water-bearing zones and two piezometric surfaces are known to be present in the Riverton area, but insufficient data are available for the precise depiction of these surfaces. The response of the water level in observation wells to the pumping of ground water during an aquifer test in the Riverton well field indicates that the sandstone lenses within a certain depth range are interconnected hydraulically and that the formation within this depth range reacts as a hydraulic unit. Although the mode of interconnection of the sandstone lenses is unknown, it is assumed to be largely by fractures in the impermeable materials separating them.

DISCHARGE

In the Riverton area, ground water is discharged by evapotranspiration; into streams, drains, and lakes; and through wells and springs. Some ground water is discharged from the area as underflow in the alluvium of some of the creeks.

EVAPOTRANSPIRATION

The loss of soil moisture and ground water by evaporation is greatest during the summer when the temperature is highest and where the water table or capillary fringe extends to the land surface. Inasmuch as the periods of high temperature coincide with the periods of high water table resulting from the application of large amounts of irrigation water, much water is evaporated and an accumulation of salts is left on or near the land surface.

The loss of soil moisture and ground water by transpiration of plants is also greatest during the growing season owing to higher temperatures and large applications of irrigation water. Quantitatively, however, the transpiration of soil moisture is much more important than the transpiration of ground water, despite the fact that phreatophytes derive most of their water supply from the zone of saturation or capillary fringe.

Although the total discharge of ground water by evaporation and transpiration is quantitatively important, it probably is small compared with other types of ground-water discharge. It is of economic importance, however, because much of the ground water discharged in this manner is wasted or produces plants that have little or no value.

STREAMS AND DRAINS

Most of the ground water discharged from unconfined aquifers and some of the water discharged from confined aquifers leaves the Riverton area in streams and open drains and eventually flows into the Wind River.

Wherever a stream is incised below the water table in surficial deposits, ground water discharges into the stream. For example, the average base flow of Fivemile Creek, which is about 38 cfs in the winter season, represents essentially the total inflow of ground water into the creek and its tributaries. During the irrigation season, when the increased recharge causes a higher water table and a correspondingly steeper hydraulic gradient to the creek, the discharge into the creek is greater. Some shallow confined water in the Wind River formation also is released to streamflow, especially where lower Fivemile Creek is incised into the formation.

Similarly, where the water table is higher than the floor of an open drain, ground water is discharged into the drain. However, the efficiency of a drain as an agent of ground-water discharge depends on the course of the drain with respect to the direction of ground-water flow, the elevation of the water table with respect to the floor of the drain, and the permeability of the material transmitting the water. If a drain is perpendicular to the direction of ground-water movement, it will intercept the maximum amount of ground-water flow; and the greater the depth of a drain below the water table, the larger the amount of ground water discharged into it. However, even though a drain is perpendicular to the direction of ground-water movement and is incised well below the water table, it will not be effective if the water-bearing materials are relatively impermeable.

In many parts of the Riverton irrigation project the permeability of the waterlogged material is low because of a high content of sodium salts or because of fine-grained texture, and, although the hydraulic gradient is steep, the drains are ineffective except for short distances on either side. The low permeability of the waterlogged material is the principal obstacle to drainage of many waterlogged areas within the Riverton project.

LAKES

The total inflow of ground water into topographic depressions has contributed to the formation of lakes in some parts of this area. Discharge occurs directly when the elevation of the water table is greater than the elevation of the lake surface and indirectly when ground water discharges to open drains flowing into the lake. The lakes are formed only where the surficial deposits transmit water into the depressions and tributary open drains faster than it can be evaporated. As the bottom of such a depression generally is bedrock of low permeability, the ground-water discharge, along with some return flow from irrigation, accumulates in the depression and remains throughout the year. Effluent ground water is known to be the primary source of recharge to the lakes because, after irrigation return flow has ceased, a relatively constant water level in the lakes is maintained even though water is discharged from the natural or artificial outlets of the lakes. Ocean Lake, which has existed only since the beginning of irrigation in this area, is a notable result of total ground- and surface-water inflow.

WELLS AND SPRINGS

Most wells in the report area penetrate zones of confined water in the Wind River formation. Although some along the Wind River are flowing wells, elsewhere in the area a pump generally is needed to lift the water to the surface. A few wells tap the terrace deposits or alluvium, but their total yield is small compared to that of wells tapping the Wind River formation. Springs issue from the terrace and alluvial deposits along the Wind River and other drainages, especially where these deposits are irrigated or are adjacent to irrigated land.

The locations of wells and springs in the Riverton area are shown on plate 1, and data pertaining to them are given in table 18.

AQUIFER TEST OF WIND RIVER FORMATION AT RIVERTON

The rapid increase in the population of Riverton during the period 1930-50 greatly increased the demand for water. When additional wells were installed, however, it soon became apparent that the supply of ground water in the vicinity of Riverton was limited. Accordingly, an aquifer test was run to obtain information on the water-bearing properties of the Wind River formation. The well numbers used in describing the aquifer test correspond, as follows, to the coordinate numbers used elsewhere in the report:

Well 1	A1–4–35bb2	Well 7	A1–4–34ba1
2	35bb1	8	34bb2
3	34ad	9	34bb1
4	27dd	10	34ca
5	27dc	11	33dd
6	27cd1		

Construction records and logs of all wells used in the test are given in tables 17 and 18; with the exception of well 11, all are owned by the city of Riverton.

TEST PROCEDURE

A time of year was selected when a minimum number of wells could supply the daily municipal demand. Well 8 (fig. 10) was selected as the well to be pumped during the test because it was centrally located and its rate of pumping could be controlled so as

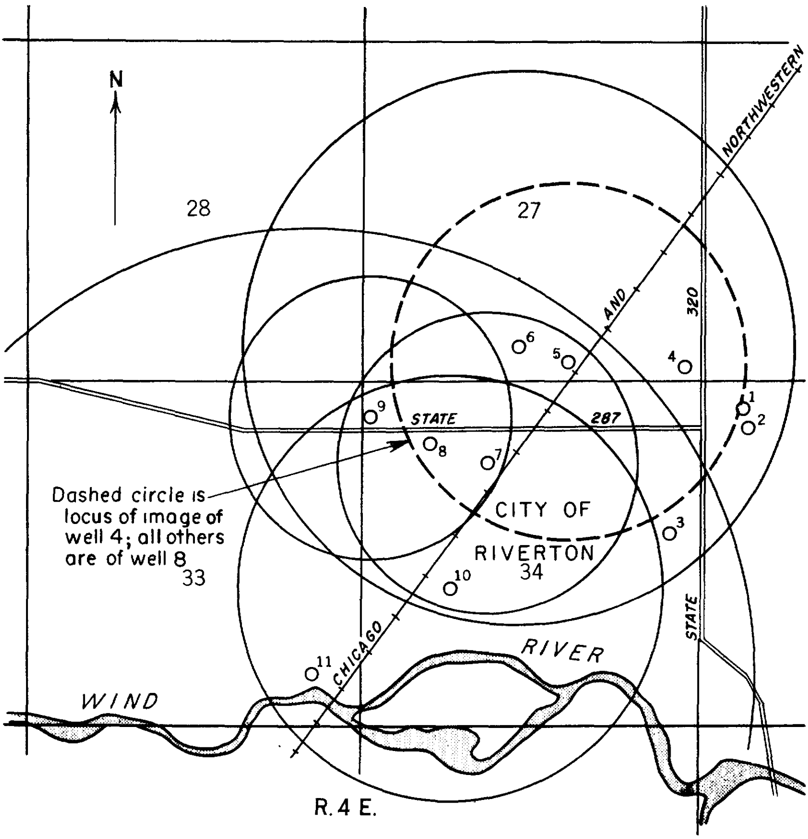

FIGURE 10.—Map showing location of municipal wells used in pumping test and circles whose radii are equal to the computed distance to the image well.

to produce fluctuations in the water level of nearby observation wells. After the daily municipal demand had been estimated, wells 2, 3, and 4 on the east side of the city well field were selected for continuous pumping to meet that demand for the duration of the test. Arrangements were made for the disposal of all excess water so that the discharge for supply purposes could be maintained at a constant rate.

The schedule of pumping in the Riverton well field prior to March 13 was not recorded. During the daytime of March 13 only well 8 was pumping, and that evening well 8 was shut off and the pumping of wells 3 and 4 was begun. Because the demand for water during the test period was expected to exceed the yield of wells 3 and 4, the pumping of well 2 was begun on the morning of March 14. Measurements of the water level in the wells to be used during the test were made at intervals for the remainder of

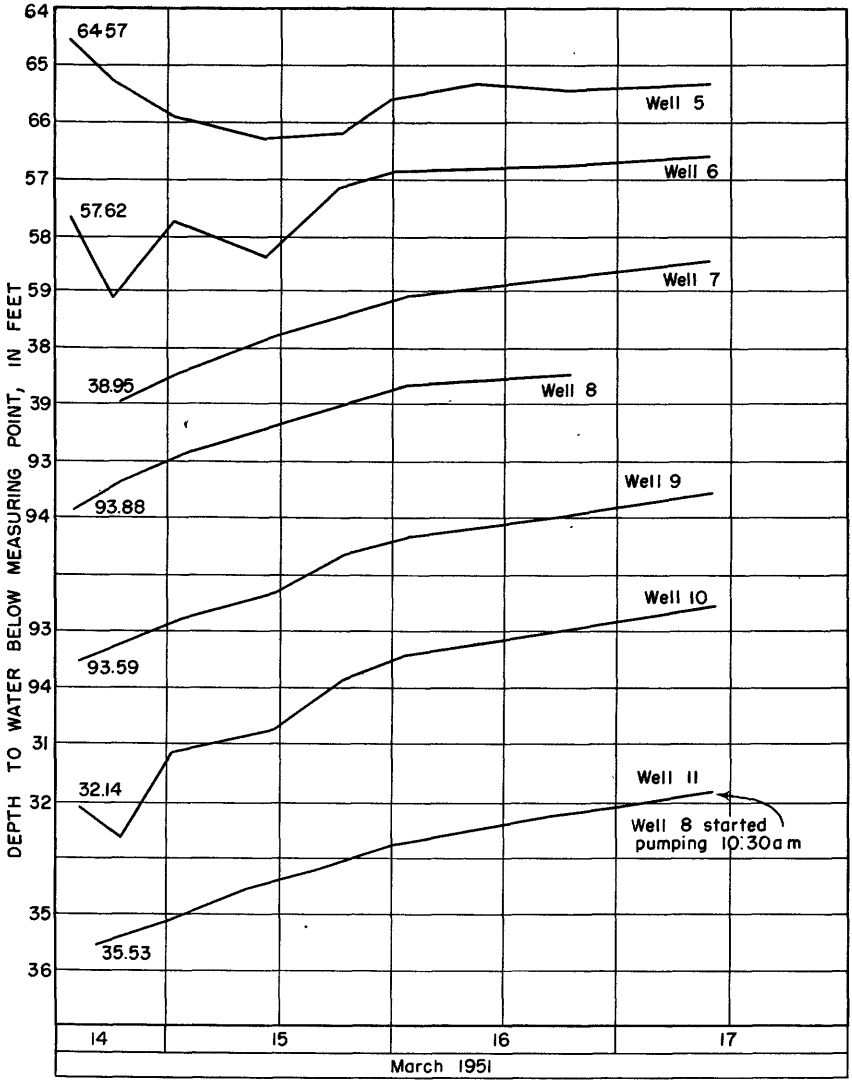

FIGURE 11.—Hydrographs showing the recovery of the water level in wells 5 to 11 prior to beginning of test.

that day and on the following 2 days. By March 16 the water level in all the wells was recovering at a similar rate. (See fig. 11.) One observer was assigned to each observation well.

The starting of the pump on well 8 at 10:30 a. m. on March 17 marked the beginning of the drawdown test. During the test the pumping of well 8 was regulated at an average rate of 200 gpm and measurements of the water level in each observation well were made at frequent intervals. At 1:47 p. m. on March 19, after well 8 had been pumped for about 51 hours, the pumping of well 4, which was yielding at an average rate of 190 gpm, was discontinued, but the pumping of well 8 was continued as before. The stopping of the pumping of well 4 marked the beginning of the recovery test. Water-level measurements were continued for about 48 hours more. The test was terminated at 1:30 p. m. on March 21, at which time the control of the pumping schedule was returned to the waterworks operator. Changes in barometric pressure were recorded during the entire test period.

ANALYSIS OF TEST DATA

ADJUSTMENTS

Before evaluating the results of the test, the measured drawdowns (table 7) were adjusted as necessary to eliminate the effects of extraneous factors that caused water-level changes.

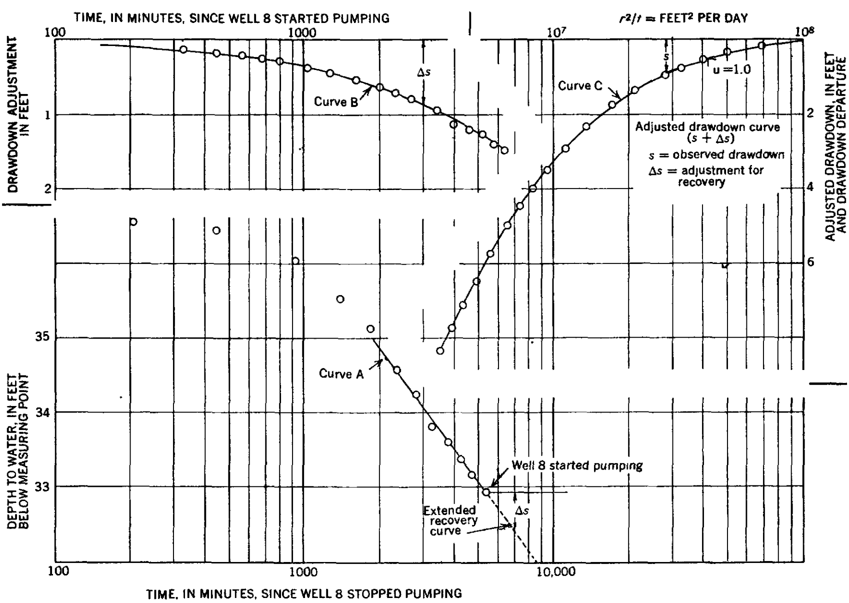

FIGURE 12.—Semilogarithmic plot of drawdown data and recovery adjustment, observation well 11.

To compensate for the slight water-level recovery that was in progress during the test, an adjustment curve similar to curve *B* in figure 12 was prepared for each well. Curve *A* in figure 12 was plotted from observed data and represents the recovery of the water level in well 11 resulting from the stopping of pumping well

8 The adjustment increment Δs (the distance between the water level at the time well 8 was started and the extension of curve A) was replotted as curve B in terms of the time since the pumping of well 8 started. The adjustment increment Δs was added to the observed drawdowns, and the adjusted drawdown $(s + \Delta s)$, plotted as curve C in figure 12, was plotted beside the observed drawdown (s), as shown in figure 13. A comparison of the observed data with the adjusted data showed that only the measurements of the water level in well 11 were appreciably affected; hence, only the data from well 11 were adjusted for the final computations.

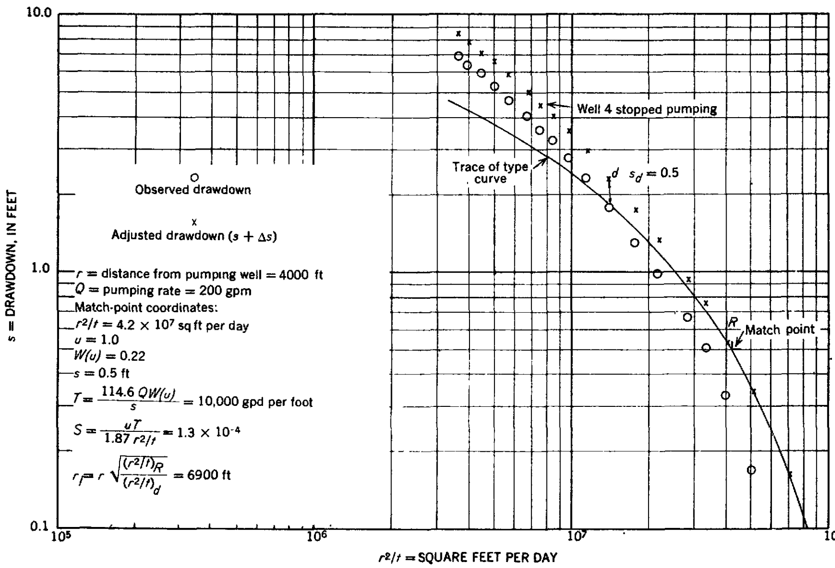

FIGURE 13.—Logarithmic plot of drawdown data, observation well 11.

TABLE 7.—*Measurements of the water level in wells, in feet below measuring point, during aquifer test at Riverton, March 1951*

t: Time since well 8 started pumping, in minutes; *t* equals 3,077 when *t'* equals 0. Pumping of well 8 started at 10:30 a.m., March 17.

t': Time since well 4 stopped pumping, in minutes. Pumping of well 4 stopped at 1:47 p.m., March 19.

Well 4

[Altitude of measuring point, 4,955.23 feet. Distance from well 8 is 2,995 feet.]

Time	Water level	Time	Water level	Time	Water level
March 14		*March 19—Con.*		*March 20—Con.*	
6:00 p.m.	168.05	*t'*		*t'*	
March 15		100	89.97	668	64.91
10:26 a.m.	172.11	110	88.93	728	64.67
March 19		121	87.87	745	63.33
t'		136	86.50	808	62.22
0	--------	150	85.36	868	61.23
3	120	165	84.21	923	60.35
5	110.62	186	82.76	983	59.47
7	110.10	205	81.48	1,063	58.43
13	106.26	225	80.28	1,168	57.22
16	106.12	263	78.14	1,278	55.98
21	103.42	283	77.20	1,283	55.98
26	101.96	328	75.11	1,408	54.76
32	100.46	358	73.98	1,528	53.67
38	99.11	388	72.82	1,648	52.84
45	97.72	418	71.75	1,833	51.64
51	96.62	448	70.15	*March 21*	
61	94.97	488	69.57	2,091	50.25
70	93.64	533	68.22	2,363	48.96
79	92.43	578	67.04	2,603	48.06
82	92.06	*March 20*		2,823	47.23
89	91.22	623	65.97		

Well 5

[Altitude of measuring point, 4,970.40 feet. Distance from well 8 is 2,995 feet; distance from well 4 is 1,490 feet]

Time	Water level	Time	Water level	Time	Water level
March 14		*March 17—Con.*		*March 19—Con.*	
1:45 p.m.	64.57	*t*		*t'*	
6:10 p.m.	65.20	387	65.69	9	68.56
March 15		417	65.73	12	68.56
12:59 a.m.	65.89	448	65.80	23	68.56
10:38 a.m.	66.26	478	65.86	26	68.56
6:27 p.m.	66.19	509	65.89	29	68.55
11:55 p.m.	65.62	549	65.97	32	68.55
March 16		599	66.08	35	68.54
9:32 a.m.	65.34	650	66.16	38	68.53
7:20 p.m.	65.43	700	66.23	41	68.51
March 17		760	66.35	44	68.50
10:19 a.m.	65.32			47	68.48
t		*March 18*		50	68.46
0	65.30	820	66.39	53	68.41
3	65.32	880	66.46	56	68.41
12	65.34	940	66.56	59	68.39
24	65.34	1,000	66.68	62	68.36
30	65.34	1,060	66.74	66	68.32
39	65.34	1,120	66.76	70	68.28
48	65.34	1,180	66.81	77	68.20
63	65.35	1,240	66.86	80	68.17
68	65.37	1,300	66.87	84	68.14
82	65.37	1,360	67.05	88	68.09
102	65.37	1,408	67.08	92	68.03
122	65.38	1,515	67.15	96	67.98
142	65.39	1,645	67.30	100	67.94
162	65.40	1,800	67.47	105	67.88
172	65.42	2,025	67.76	110	67.83
192	65.44	2,145	67.90	115	67.76
212	65.44	*March 19*		120	67.69
232	65.46	2,280	68.05	130	67.56
252	65.48	2,400	68.13	140	67.43
272	65.50	2,580	68.25	150	67.30
292	65.53	2,805	68.39	160	67.17
312	65.55	3,071	68.56	170	67.04
332	65.57	*t'*		180	66.91
352	65.59	0	68.57	193	66.75

TABLE 7.—*Measurements of the water level in wells, in feet below measuring point, during aquifer test at Riverton, March 1951*—Continued

Well 5—Continued

Time	Water level	Time	Water level	Time	Water level
March 19—Con.		*March 20*		*March 20—Con.*	
t'		*t'*		*t'*	
208	66.55	718	61.74	1,538	57.95
248	66.02	818	61.11	1,653	57.60
278	65.61	878	60.76	1,838	57.11
308	65.34	933	60.45		
343	64.91	993	60.12	*March 21*	
403	64.34	1,073	59.79	2,095	56.51
478	63.75	1,173	59.31	2,369	55.90
568	62.86	1,288	58.85	2,613	55.49
658	62.16	1,418	58.37	2,828	55.10

Well 6

[Altitude of measuring point, 4,983.77 feet. Distance from well 8, 2,345 feet; distance from well 4, 2,590 feet]

Time	Water level	Time	Water level	Time	Water level
March 14		*March 17—Con.*		*March 19—Con.*	
1:50 p.m.	57.62	*t*		*t'*	
6:15 p.m.	58.15	444	56.64	88	62.08
March 15		503	56.86	98	62.10
12:53 a.m.	56.76	540	56.97	108	62.12
10:48 a.m.	57.35	590	57.15	118	62.12
6:33 p.m.	56.10	640	57.30	128	62.12
March 16		690	57.45	148	62.15
12:05 a.m.	55.89	750	57.64	168	62.19
9:27 a.m.	55.81	810	57.80	188	62.20
7:05 p.m.	55.72	*March 18*		218	62.22
March 17		870	58.00	238	62.23
10:17 a.m.	55.56	930	58.19	273	62.25
t		990	58.31	298	62.26
0	55.57	1,050	58.47	338	62.28
4	55.58	1,110	58.65	368	62.30
10	55.58	1,170	58.80	398	62.32
18	55.58	1,290	59.10	428	62.35
26	55.58	1,413	59.38	473	62.37
33	55.58	1,510	59.56	518	62.37
42	55.58	1,640	59.81	563	62.39
60	55.58	1,795	60.08	*March 20*	
70	55.59	2,030	60.60	608	62.40
81	55.60	*March 19*		653	62.38
90	55.60	2,150	60.82	698	62.37
100	55.61	2,282	61.02	758	62.37
110	55.63	2,408	61.19	823	62.35
120	55.64	2,585	61.44	883	62.34
130	55.66	2,800	61.73	938	62.34
140	55.68	3,074	62.00	998	62.33
150	55.70	*t'*		1,078	62.36
160	55.72	0	62.00	1,183	62.39
170	55.75	6	62.00	1,298	62.36
180	55.77	12	62.01	1,423	62.33
190	55.80	18	62.01	1,543	62.28
200	55.83	26	62.03	1,658	62.26
210	55.85	30	62.04	1,843	62.27
230	55.90	38	62.05	*March 21*	
252	55.96	48	62.04	2,099	62.24
291	56.08	58	62.05	2,377	62.22
324	56.21	68	62.07	2,618	62.21
382	56.40	78	62.09	2,838	62.16

Well 7

[Altitude of measuring point, 4,968.10 feet. Distance from well 8, 860 feet; distance from well 4, 3,570 feet]

Time	Water level	Time	Water level	Time	Water level
March 14		*March 16*		*March 17—Con.*	
2:00 p.m.	44.48	12:22 a.m.	37.15	*t*	
6:40 p.m.	38.95	8:40 a.m.	36.99	0	36.50
March 15		6:45 p.m.	36.79	2	36.50
12:25 a.m.	38.47			4	36.49
11:25 a.m.	37.80	*March 17*		6	36.49
6:17 p.m.	37.43	10:20 a.m.	36.49	8	36.49

TABLE 7.—*Measurements of the water level in wells, in feet below measuring point, during aquifer test at Riverton, March 1951*—Continued

Time	Water level	Time	Water level	Time	Water level
		Well 7—Continued			
March 17—Con.		*March 17—Con.*		*March 19—Con.*	
t		*t*		*t'*	
10	36.50	280	40.65	0	------
12	36.52	300	40.86	4	50.62
14	36.55	320	41.07	19	50.65
16	36.58	340	41.24	36	50.60
18	36.60	360	41.43	52	50.73
20	36.63	390	41.71	68	50.74
22	36.67	420	41.95	91	50.80
24	36.73	450	42.21	125	50.85
26	36.77	480	42.42	146	50.87
28	36.81	510	42.65	163	50.86
30	36.85	540	42.81	180	50.88
33	36.93	580	43.10	211	50.93
36	37.00	620	43.37	227	50.96
39	37.07	670	43.68	267	50.95
42	37.13	733	44.05	297	51.01
46	37.18	790	44.37	328	51.02
50	37.31	*March 18*		358	51.07
55	37.42	850	44.67	388	51.10
60	37.52	910	44.94	418	51.14
65	37.61	970	45.17	458	51.19
70	37.73	1,034	45.44	508	51.31
75	37.84	1,090	45.68	553	51.39
80	37.95	1,150	45.94	593	51.45
85	38.05	1,210	46.19	*March 20*	
90	38.15	1,270	46.37	653	51.53
100	38.33	1,330	46.63	713	51.62
110	38.51	1,390	46.85	833	51.75
120	38.69	1,452	47.01	953	51.89
130	38.82	1,638	47.52	1,093	52.10
140	38.98	1,765	47.93	1,198	52.23
150	39.12	1,891	48.32	1,338	52.34
160	39.27	2,050	48.81	1,563	52.41
170	39.40	2,170	49.10	1,858	52.71
180	39.54	*March 19*		*March 21*	
190	39.65	2,300	49.34	2,115	52.98
200	39.78	2,415	49.53	2,403	53.26
210	39.90	2,590	49.78	2,853	53.38
240	40.24	2,695	50.20		
260	40.45	3,065	50.59		

Well 8

[Altitude of measuring point, 5,023.47 feet. Distance from well 4, 2,995 feet]

Time	Water level	Time	Water level	Time	Water level
March 14		*March 15*		*March 16*	
2:10 p.m.	93.88	12:45 a.m.	92.98	12:30 a.m.	91.69
6:30 p.m.	93.42	10:55 a.m.	92.43	8:45 a.m.	91.55
		6:27 p.m.	92.02	7:00 p.m.	91.41

Well 9

[Altitude of measuring point, 5,030.15 feet. Distance from well 8, 1,180 feet; distance from well 4, 5,045 feet]

Time	Water level	Time	Water level	Time	Water level
March 14		*March 17—Con.*		*March 17—Con.*	
2:20 p.m.	93.59	*t*		*t*	
6:24 p.m.	93.37	6	90.65	80	91.24
March 15		16	90.68	90	91.37
12:40 a.m.	92.88	22	90.67	100	91.50
11:04 a.m.	92.20	28	90.70	110	91.66
6:22 p.m.	91.76	33	90.70	120	91.75
March 16		36	90.74	140	92.02
12:40 a.m.	91.42	39	90.79	160	92.20
8:55 a.m.	91.22	42	90.75	185	92.41
6:56 p.m.	91.02	46	90.89	200	92.68
March 17		50	90.88	225	92.83
10:20 a.m.	90.68	55	90.96	247	93.13
t		60	91.00	274	93.29
0	90.67	70	91.08	296	93.48

TABLE 7.—*Measurements of the water level in wells, in feet below measuring point, during aquifer test at Riverton, March 1951*—Continued

Well 9—Continued

Time	Water level	Time	Water level	Time	Water level
March 17—Con.		*March 19—Con.*		*March 19—Con.*	
t		*t*		*t'*	
316	93.67	2,810	102.21	513	103.08
330	93.88	3,057	102.45	558	103.14
370	94.22	*t'*		598	103.28
397	94.43	0	-------	*March 20*	
426	94.65	4	102.53	663	103.25
495	95.19	25	102.54	723	103.27
519	95.36	41	102.57	783	103.39
569	95.64	57	102.59	843	103.43
670	96.20	74	102.60	903	103.49
790	96.87	101	102.64	963	103.60
March 18		130	102.68	1,023	103.65
910	97.39	151	102.68	1,098	103.75
1,030	97.87	168	102.73	1,208	103.90
1,150	98.36	190	102.76	1,308	103.96
1,270	98.77	216	102.76	1,428	104.05
1,388	99.18	235	102.81	1,548	104.11
1,505	99.48	274	102.83	1,663	104.17
1,653	99.82	306	102.87	1,848	104.39
1,788	100.20	338	102.90	*March 21*	
2,040	100.90	368	102.93	2,103	104.58
March 19		398	102.95	2,385	104.86
2,292	101.43	428	102.97	2,625	105.06
2,605	101.88	468	103.01	2,843	105.08

Well 10

[Altitude of measuring point, 4,963.24 feet. Distance from well 8, 2,125 feet; distance from well 4, 5,200 feet]

Time	Water level	Time	Water level	Time	Water level
March 14		*March 17—Con.*		*March 19—Con.*	
2:30 p.m.	32.14	*t*		*t'*	
6:47 p.m.	32.66	370	30.17	116	37.45
March 15		400	30.35	140	37.50
12:59 a.m.	31.18	430	30.50	159	37.50
11:31 a.m.	30.80	460	30.65	175	37.54
6:12 p.m.	29.95	490	30.81	199	37.57
March 16		520	30.94	222	37.60
12:15 a.m.	29.54	550	31.08	262	37.65
9:03 a.m.	29.30	590	31.26	292	37.68
6:39 p.m.	29.05	625	31.41	322	37.74
March 17		677	31.64	353	37.77
10:20 a.m.	28.69	743	31.89	383	37.82
t		795	32.10	413	37.85
0	28.68	*March 18*		453	37.91
10	28.68	912	32.50	505	38.00
20	28.65	1,039	32.89	548	38.05
30	28.65	1,155	33.24	588	38.09
39	28.67	1,280	33.62	*March 20*	
50	28.66	1,395	33.93	648	38.18
60	28.67	1,457	34.09	708	38.23
65	28.68	1,635	34.49	768	38.32
75	28.70	1,760	34.79	828	38.39
85	28.72	1,880	35.09	888	38.48
90	28.76	2,055	35.52	948	38.55
100	28.77	2,175	35.80	1,008	38.63
110	28.83	*March 19*		1,083	38.74
120	28.86	2,305	36.05	1,193	38.88
140	28.96	2,420	36.24	1,328	39.04
160	29.03	2,595	36.53	1,448	39.14
180	29.14	2,780	36.84	1,568	39.22
200	29.27	3,075	37.25	1,678	39.30
220	29.37	*t'*		1,868	39.54
247	29.54	0	37.25	*March 21*	
267	29.64	15	37.28	2,119	39.76
287	29.75	31	37.33	2,408	40.03
307	29.86	47	37.36	2,643	40.24
327	29.95	64	37.36	2,863	40.34
347	30.07	86	37.39		

TABLE 7.—*Measurements of the water level in wells, in feet below measuring point, during aquifer test at Riverton, March 1951*—Continued

Well 11

[Altitude of measuring point, 4,972.88 feet. Distance from well 8, 4,000 feet; distance from well 4, 7,600 feet]

Time	Water level	Time	Water level	Time	Water level
March 13		*March 17*		*March 19*	
4:00 p.m.	36.48	8:00 a.m.	32.99	*t*	
8:00 p.m.	36.56	*t*		2,370	35.70
12:00 p.m.	36.45	0	32.92	2,730	36.14
March 14		210	32.88	*t'*	
8:00 a.m.	36.03	330	32.96	0	36.46
4:00 p.m.	35.53	450	33.09	373	36.95
12:00 m.	35.12	570	33.25	*March 20*	
March 15		690	33.43	973	37.56
8:00 a.m.	34.59	810	33.58	1,573	38.18
4:00 p.m.	34.24	*March 18*		*March 21*	
12:00 m.	33.80	1,050	33.91	2,173	38.78
March 16		1,290	34.25	2,773	39.28
8:00 a.m.	33.60	1,650	34.70	3,373	39.79
4:00 p.m.	33.38	2,010	35.22		
12:00 m.	33.18				

A similar adjustment was made to the recovery data—recovery due to the discontinuance of the pumping of well 4. Adjusted water-level data (fig. 14) for only well 5 were used in the final

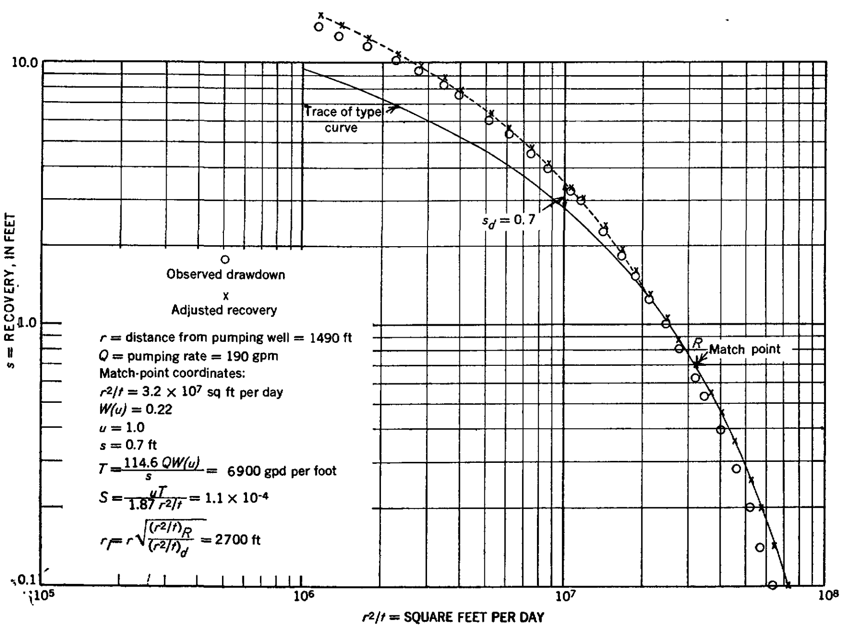

FIGURE 14.—Logarithmic plot of recovery data, observation well 5.

recovery computations because the adjustment increment was larger than the observed recovery in all other wells.

No other adjustments were deemed necessary. The personal and mechanical functions involved in the making of the test were so well controlled that corrections for these were unnecessary. Recorded barometric fluctuations were compared with observed water levels; however, as the barometric effects were small and tended to balance out during the test period, no barometric adjustment was made.

TRANSMISSIBILITY AND STORAGE COEFFICIENTS

The transmissibility and storage coefficients were computed by means of the Theis nonequilibrium method, which was described by Wenzel (1942). The computations and values for coefficients of transmissibility and storage are shown on figures 13 to 19. The drawdown test gave consistent values for transmissibility, 10,000 gpd per ft, and the values for storage coefficient ranged between 0.00012 and 0.00021. Because the thickness of the water-bearing sands in the well field is not uniform, an accurate determination of the permeability is impossible. The average of the reported thicknesses of the water-bearing sands penetrated by eight of the wells is about 55 feet; hence, the indicated permeability is 10,000 ÷ 55, or about 180 gpd per ft^2. The logs of these wells indicate that the water-bearing sands may not be directly interconnected. The lower transmissibility value obtained from the recovery test on well 4 probably indicates that this well does not penetrate all the

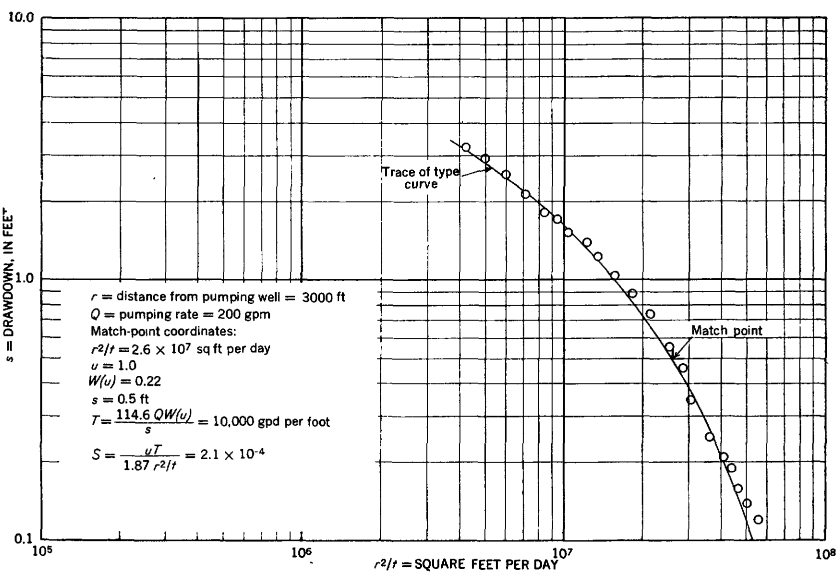

FIGURE 15.—Logarithmic plot of drawdown data, observation well 5.

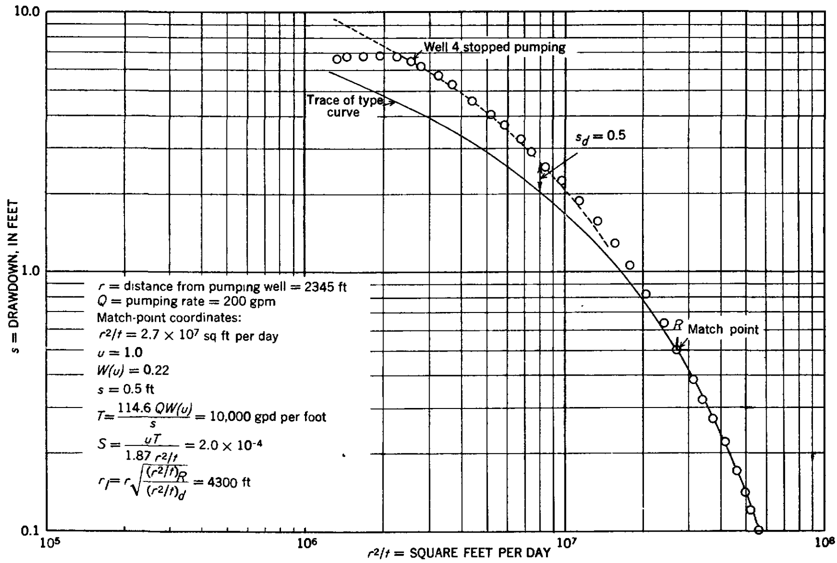

FIGURE 16.—Logarithmic plot of drawdown data, observation well 6.

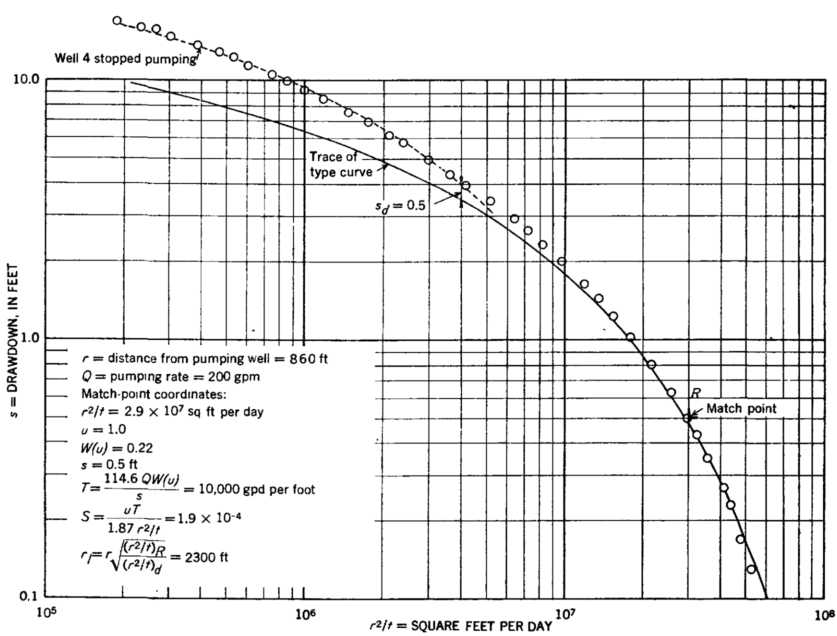

FIGURE 17.—Logarithmic plot of drawdown data, observation well 7.

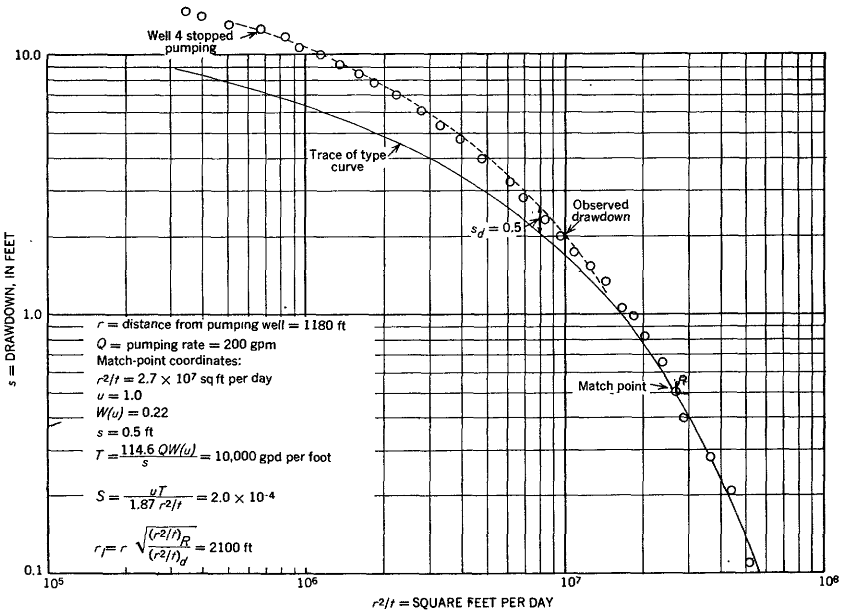

FIGURE 18.—Logarithmic plot of drawdown data, observation well 9.

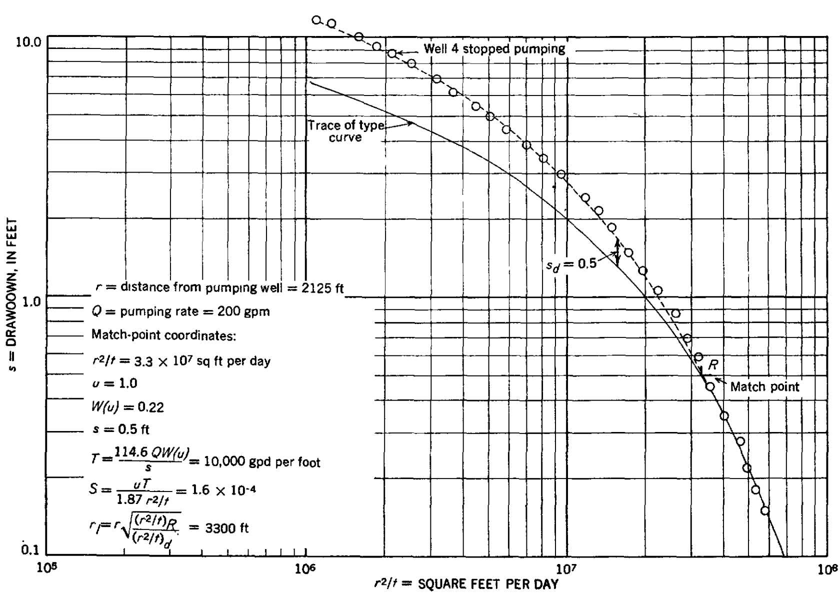

FIGURE 19.—Logarithmic plot of drawdown data, observation well 10.

sands penetrated by well 8. A plot of the recovery data for well 4 did not produce a curve that could be used for computing transmissibility. It did, however, indicate that any portion of the curve that might be selected for computation would produce a transmissibility much smaller than that computed from data for other wells.

HYDRAULIC BOUNDARIES

If all the plotted drawdown data fit the Theis type curve for radial flow, the existing hydraulic conditions are assumed to be those of an infinite aquifer. However, if the later drawdown data plot above the type curve—that is, the observed drawdowns are greater than indicated by the type curve—the existence of one or more impermeable hydraulic boundaries is suggested; or, if they plot below the type curve—that is, the observed drawdowns are less than indicated by the type curve—a source of recharge is suggested. The hypothetical impermeable boundary shown by the plotted curves in figures 13 to 19 was studied by examining the shape of the departure curves. (See fig. 20.) In the image-well

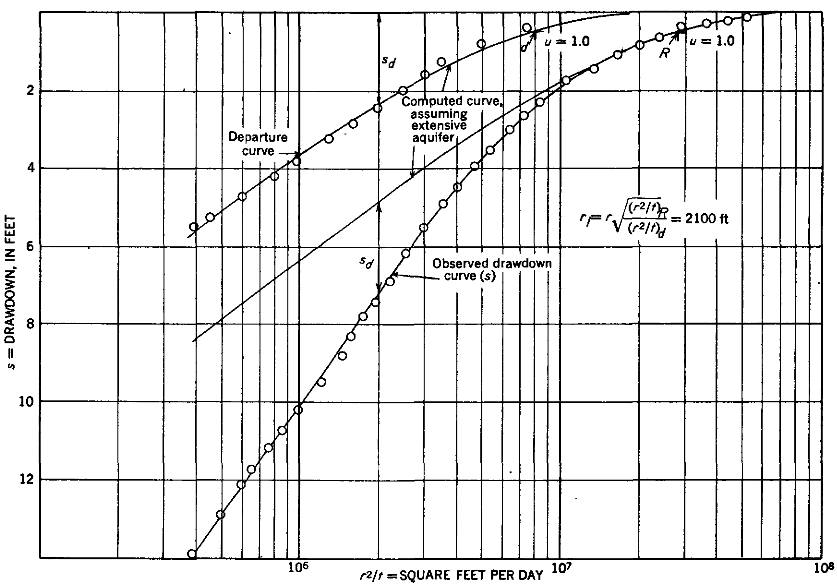

FIGURE 20.—Semilogarithmic plot of drawdown data, observation well 9, showing departure curve caused by a boundary.

method of analysis for a single boundary, described by Ferris (1948), the departure curve is considered to indicate the presence of an image well that started pumping at the same time and at the same rate as the real well. This condition is satisfied if the departure curve—the coordinate used for each departure point assumes its abscissa from the curve below—fits the type curve and if $s_d = s$ at the common match points. Because time (t) for the image well is the same as for the real well, the relationship of the distance of the observation well to the image well (r_I) and of the observation well to the real well (r) may be determined as follows:

When $u_I = u$,

$$\frac{1.87\, r_I^2 S}{T t_I} = \frac{1.87\, r^2 S}{T t}$$

Cancelling the constants leaves

$$\frac{r_I^2}{t_I} = \frac{r^2}{t},$$

and as

$$\frac{t_I}{t} = \frac{(r^2/t)_R}{(r^2/t)_d},$$

then

$$r_I = r \sqrt{\frac{(r^2/t)_R}{(r^2/t)_d}}$$

The computations of the image distances are shown on figures 13, 14, 16, 17, 18, 19, and 20.

A circle whose radius is equal to the computed distance to the image well was circumscribed about each observation well. (See fig. 10.) Theoretically, if all the circles representing the computed distances to a single image well had intersected at a common point —the position of the image well—the hydrologic boundary would be a vertical plane perpendicular to and bisecting the line connecting the image well with the pumped well. As there was no such common point of intersection, either the boundary is not a vertical plane or none exists. Because the water-bearing beds penetrated by all the wells used in the test are known to be hydraulically connected, a vertical boundary could not possibly exist between any two wells in the well field; hence, only those intersections outside the well field could indicate the position of an image well. Therefore, a boundary, if it exists, is a short distance northwest of the well field. No attempt was made to locate a boundary more precisely, because available geologic evidence fails to indicate the existence of a true boundary and some of the test data gave inconsistent results. Although the drawdown data from wells 6, 7, 9, 10, and 11 indicated the presence of a single true boundary, the drawdown data from well 5 indicated no such boundary even though the length of the drawdown test was ample for the same boundary effect to be noticeable at that well. Data from well 5 during the recovery test, however, did indicate a boundary image at a distance of 2,700 feet, and gave a transmissibility value of

6,900 gpd per ft, which is somewhat less than that obtained from wells 6, 7, 9, 10, and 11. The data from well 4 during the recovery test were erratic and, because they did not conform with those from the other wells, could not be analyzed by similar methods. The data from well 4 indicated a transmissibility of less than 3,000 gpd per ft. The water-level data collected at well 6 during the test period showed much less effect from the recovery of well 4 than would be expected in view of the effects at well 5. The water levels in the other observation wells west of well 5 showed no response during the 48-hour recovery period, despite the fact that other evidence indicated the water-bearing beds penetrated by all wells are hydraulically connected. All available evidence being considered, the following conclusions have been reached: No single true plane boundary exists; the boundary effect indicated by the test data was caused by the lenticular nature of the water-bearing deposits; and the hydraulic connection of water-bearing beds in the Riverton well field is imperfect across a north-south line passing between wells 5 and 6.

ESTIMATE OF WELL-FIELD PERFORMANCE

The test results provide a basis for understanding present well problems and for predicting the future performance of the well field. Inspection of the test data indicates a large lowering of the water level in wells close to the pumped well. Obviously, the pumping of two closely spaced wells at the same time results in a considerable loss of efficiency. An example of the interference that may be expected if wells are spaced at various intervals assuming idealized boundary conditions, is shown in figure 21. If the pumping lift of a well cannot be increased, the yield of the well will decrease. To obtain maximum efficiency from the Riverton well field, it would be necessary to decentralize pumping as much as possible and to space new wells as far apart as practical.

In making a prediction of well-field performance, it is necessary to consider the effects of the previously described boundary condition. Although the existence of a true boundary was not established by the results of the aquifer test, the approximate location of the boundary described above was used in the prediction of the general performance of the Riverton well field. To compute the effects of pumping at great distances from the well field, the total discharge from the field is assumed to be from a centrally located point within the well field. The drawdown effects with respect to the distance from the approximate center of the well field, if no source of recharge is intercepted, are shown in figure 22. Because of the uncertainties of the test results, figures 21 and 22

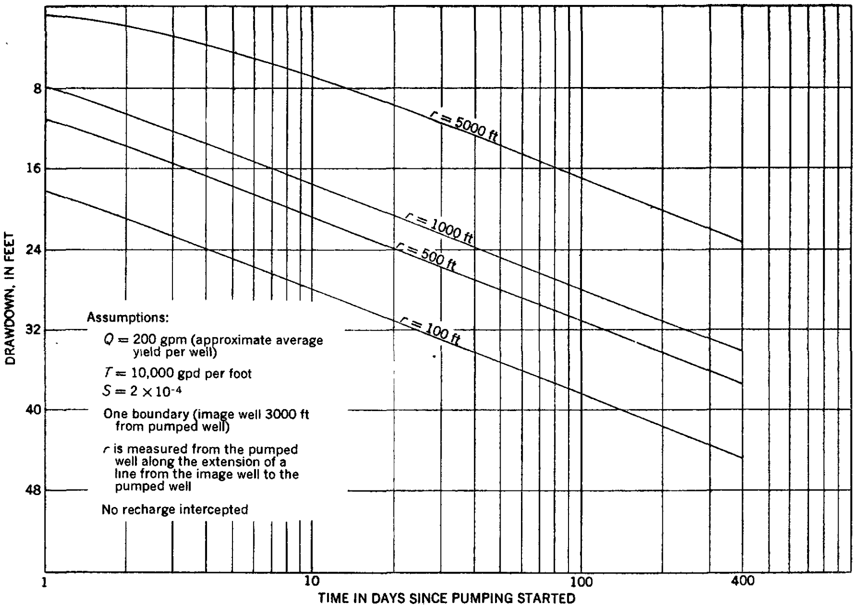

FIGURE 21.—Graph showing drawdown (interference) in well field at distance *r* from a well pumped for *t* days.

should serve only as a rough guide in predicting future well-field performance.

By observing water levels in wells remote from the well field the relation of recharge to discharge can be determined. (See fig. 9.) Depletion of the aquifer, which is indicated by a decline of water level in the distant observation wells, contines until the drawdown cone intercepts enough recharge to equal the discharge. So long as the water level in the distant observation wells remains constant, recharge is in equilibrium with discharge. An increase in the average yearly pumpage will be reflected by a renewed decline of the piezometric surface. If water-level measurements and amounts of pumpage are accurately recorded, the continuous evaluation of the ground-water reservoir and the prediction of the effects of any proposed development will be a relatively simple matter.

RELATION TO PROJECT AREA

Because it is likely that the sandstone beds penetrated by the city wells are similar to those elsewhere in the project area, the permeability of the water-bearing material in the Riverton well field should be of the same order of magnitude as that in other parts of the area. Therefore, in places on the project where a known thickness of sandstone of the Wind River formation is penetrated and artesian conditions prevail, it is possible to make estimates of

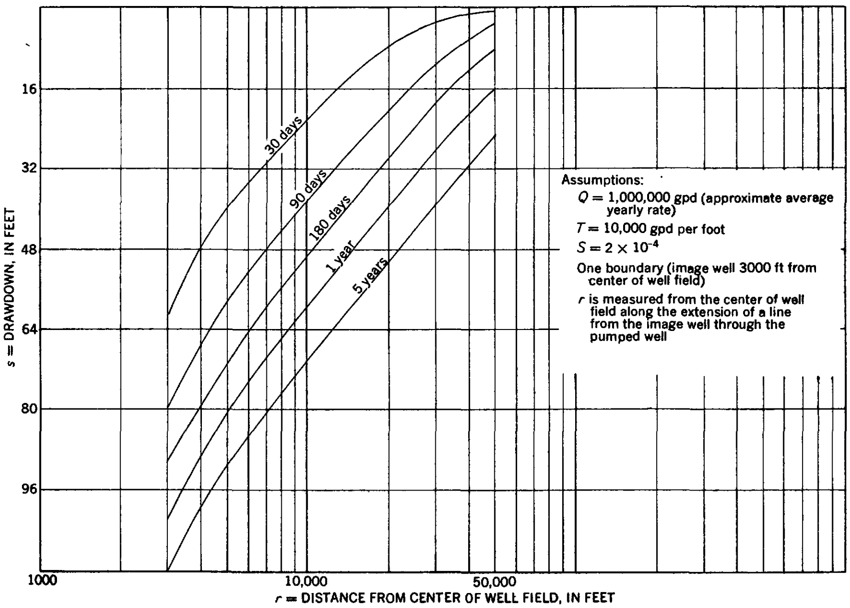

FIGURE 22.—Graph showing decline of piezometric surface at distance r from approximate center of well field after pumping from storage for t days.

transmissibility by multiplying the thickness of sandstone by 180 and of the storage coefficient by multiplying the thickness of sandstone by $\frac{0.0002}{55}$. These values should be considered as only approximate, however, because wide variations in thickness within short distances are characteristic of the Wind River formation. A more reliable estimate can be obtained by making an aquifer test at the site in question, and this procedure is recommended where relatively large supplies of water are required.

CHEMICAL QUALITY OF THE GROUND WATER

By W. H. DURUM

The chemical quality of ground water is related to the lithologic character of the rock materials through which the water moves, to the rate of movement, and to the length of time the water is in contact with such materials. Changes in the chemical composition of the ground water in the Riverton irrigation project result from recharge owing to irrigation, return flow, and influent seepage from canals; geochemical interpretations of such changes are made insofar as possible. For the purpose of discussion, the area from which ground-water samples were obtained for chemical analysis

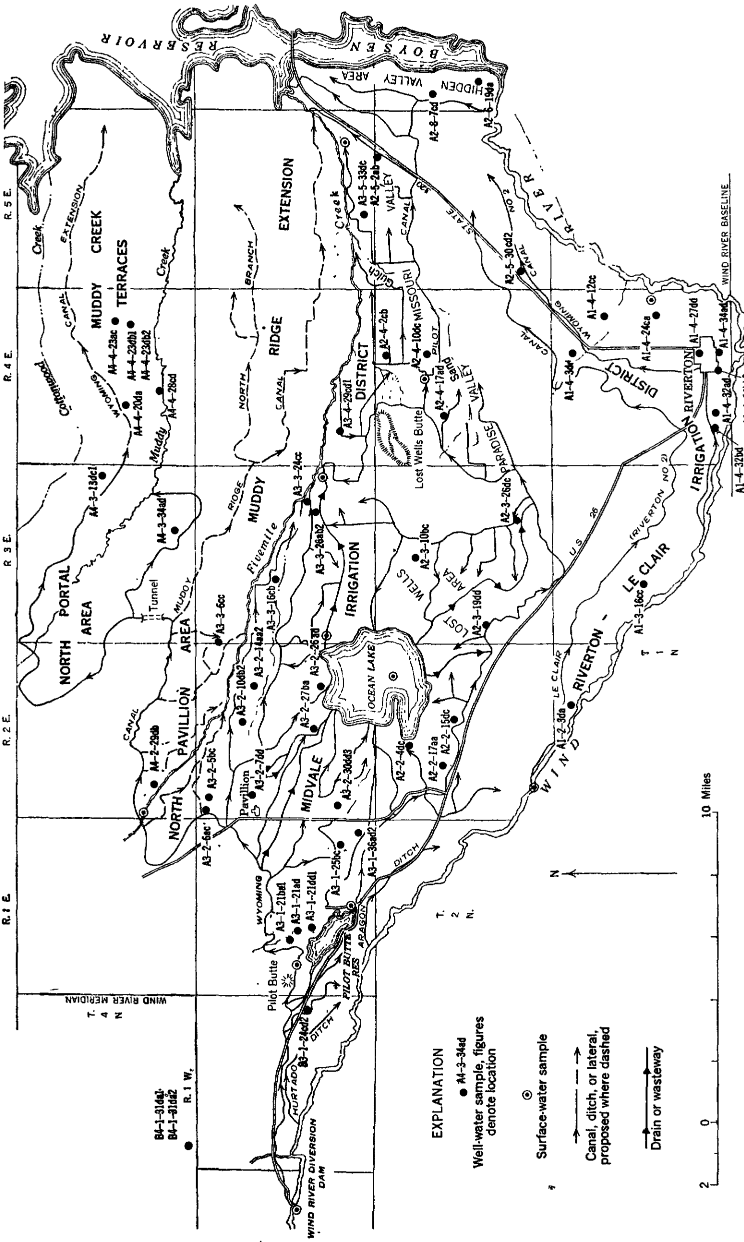

FIGURE 23.—Map of Riverton irrigation project and adjacent land showing locations at which samples were collected for chemical analysis.

is divided into the Riverton-Le Clair and Midvale irrigation districts, the newly irrigated North Portal and North Pavillion areas, and the now dry Muddy Creek terraces. (See fig. 23.) From 1947 to 1951, 81 samples from wells and 17 samples from surface sources were collected for chemical analysis.

QUALITY OF GROUND WATER

Dissolved solids in ground water result from the solvent action of percolating water on minerals in the soil and rocks. The water dissolves soluble salts and organic compounds in the soil and, assisted by the chemical action of other dissolved constituents, particularly carbon dioxide, decomposes rocks and minerals. Cementing materials, such as carbonates and silicates, are particularly susceptible to chemical decompostion. Changes in the chemical composition of the dissolved constituents of the ground water indicate to some extent the types of water-soluble minerals in the strata through which the water percolates. The range in concentration of several constituents in the samples of water from wells in irrigated tracts is given in table 8.

Sulfate is the predominant anion in most samples of deep ground water in the Riverton project area. The exact nature of the chemical alteration from a bicarbonate type of recharge water to a sodium sulfate type of ground water is not known. The results of analyses of some samples indicate that the explanation is simply that of accretion of soluble sulfates, followed by cation exchange. Undoubtedly, the accretion is an important factor in this area, as sulfate-bearing minerals are commonly present in the surficial deposits. Epsomite ($MgSO_4 \cdot 7H_2O$), probably deposited by ground water, is present in terrace deposits north of Muddy Creek, and water from one of the flowing wells near Muddy Creek has a relatively high content of calcium and magnesium sulfate. However, the chemical characteristics of water from some sources, especially water that has a deficiency in bicarbonate ion, indicate a rather complex series of chemical reactions in the formation of the water type.

In areas where the depth to confined water is greater, the phenomenon of cation exchange generally occurs as the water infiltrates the soil and bedrock. When the water is in contact with sodium-bearing materials, the calcium and magnesium ions are replaced by sodium and the water is made correspondingly softer. The degree of the chemical replacement is indicated by analyses of samples from deep wells (A1–4–27dd, 34ad, and 34bb2) that supply the city of Riverton. The percent sodium exceeds 90, and the hardness is as low as 5 ppm. (See table 9.)

RIVERTON-LE CLAIR IRRIGATION DISTRICT

Chemical analyses were made of 17 samples from 11 wells that tap the alluvium in the bottom lands, the deposits that underlie the

TABLE 8.—*Maximum and minimum concentrations of mineral constituents in ground water in several irrigated areas*

[Mineral constituents in parts per million]

Constituent	Riverton-Le Clair irrigation district (17 samples)		Midvale irrigation district (49 samples)		Muddy Creek terraces (5 samples)	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Calcium (Ca)	87	1.6	488	6.0	186	14
Magnesium (Mg)	15	.1	183	.1	69	.7
Sodium (Na)	248	21	966	60	557	175
Potassium (K)	6.4	.2	22	.8		
Bicarbonate (HCO_3)	388	85	625	22	334	34
Sulfate (SO_4)	426	47	2,980	3.2	1,150	122
Chloride (Cl)	39	5.0	258	2.0	260	17
Fluoride (F)	3.6	.3	2.8	.2	4.0	.8
Iron (Fe)	3.0	.02	8.0	.01	1.6	.08
Dissolved solids	830	247	4,520	252	1,960	606
Hardness as $CaCO_3$:						
Total	270	5	1,960	18	748	38
Noncarbonate	107	0	1,740	0	514	0
Percent sodium	98	22	94	24	95	50

low stream terraces, or the deeper sandstones of the Wind River formation within the Riverton-Le Clair district. (See table 9.) In general, the ground water from these sources is of moderately low mineral content; dissolved solids ranged from 247 to 830 ppm in the samples that were analyzed. The total hardness ranged from 5 to 270 ppm, and the noncarbonate (permanent) hardness ranged from 0 to 107. In most samples sodium was the predominant anion, and in several the amounts of iron were significantly large. Water-bearing materials less than 100 feet deep, recharged by the dilute Wind River water, may yield water that is similar in mineral content to, although harder than, water in aquifers several hundred feet deep. For example, water from well A1–2–3da, drilled to a depth of 41 feet, had 256 ppm of dissolved solids and a hardness of 165 ppm. Also, the chemical character of this water closely resembles that of the sample from the Wind River above the Le Clair diversion dam. However, the ground water is somewhat more mineralized, particularly in bicarbonate, than the weighted average of daily samples from the Wind River at Riverton for the 1948 water year. The composition of the water from these sources is shown in table 10.

The chemical character of water from deep wells in the Riverton-Le Clair irrigation district is similar to that of water from deep wells in the Midvale irrigation district. Many of these wells yield moderately mineralized water that is characterized by a high percent sodium and is generally soft.

TABLE 9.—*Mineral constituents, in parts per million, and related physical measurements of ground and surface water*

Location	Depth (feet)	Date of collection	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Specific conductance (micromhos)	pH
Ground water																						
Riverton-Le Clair irrigation district:																						
A1-2-3da	41.0	10-15-48	49	24	0.60	48	11	28	2.0	202	0	47	5.0	0.3	0.8	0.07	256	165	0	27	435	8.0
A1-3-16cc	103.0	10-19-48	50	15	.02	81	8.2	171	4.0	157	0	426	17	.3	1.2	.12	830	236	107	61	1,200	7.5
A1-4-3dd	124.0	10-20-48	52	26	3.0	64	15	98	.8	388	0	84	7.0	.6	19	.20	500	221	0	49	784	7.9
12cc	64.0	10-21-48	51	19	.32	42	14	21	.8	145	4	68	7.0	.4	.5	.30	247	162	37	22	385	8.3
24ca	40	10-21-48	50	12	1.4	5.0	2.2	226	.8	85	5	368	39	2.0	.4	.38	698	22	0	96	1,090	8.3
27dd	600	10-22-48	55	13	.03	6.5	.3	142	.4	191	7	125	9.9	.4	.8	.22	394	17	0	95	664	8.6
32ad	11.6	10-15-48	54	38	.34	87	13	56	6.4	368	0	86	7.0	1.2	.6	.18	494	270	0	30	738	7.5
32bd	367	10-15-48	50	9.5	2.4	8.5	.2	155	2.8	133	0	220	16	3.6	.2	.34	510	22	0	93	768	8.2
34ad (15-min sample)		10-25-51	57	10	.10	1.6	.7	157	.3	198	6	161	14	.4	.3	.18	454	7	0	98	716	8.4
(2-hr 40-min sample)	609	10-25-51	57	----	----	----	----	153	.2	212	0	164	----	----	----	----	----	8	0	98	728	8.1
(33-hr 10-min sample)		10-26-51	56	----	----	----	----	154	.2	194	9	163	----	----	----	----	----	8	0	98	731	8.7
34bb2 (15-min sample)		10-25-51	56	10	.08	1.9	.4	127	.2	194	6	102	11	.5	.4	.18	366	6	0	98	575	8.4
(2-hr 15-min sample)		10-25-51	----	----	----	----	----	123	.2	207	0	95	----	----	----	----	----	5	0	98	562	8.2
(8-hr 15-min sample)	660	10-25-51	----	----	----	----	----	120	.2	193	7	93	----	----	----	----	----	5	0	98	558	8.5
(23-hr 10-min sample)		10-26-51	56	----	----	----	----	124	.9	198	4	95	----	----	----	----	----	5	0	98	558	8.4
(32-hr 2-min sample)		10-26-51	----	12	.06	2.3	1.1	125	.7	191	8	96	10	.6	.5	.24	355	10	0	96	562	8.6
A2-5-30cd2	177	10-21-48	52	10	1.9	10	.1	248	.4	163	0	376	28	1.2	.8	.40	734	25	0	95	1,210	8.0
Midvale irrigation district:																						
A2-2-4dc	40.0	9-17-49	49	10	2.0	370	70	403	6.4	236	0	1,780	20	.2	17	.30	2,790	1,210	1,020	42	3,140	7.3
15dc	22.0	10-18-48	50	14	.08	37	5.9	167	18	386	0	140	23	1.0	.6	.08	618	116	0	72	916	7.9
17aa	500	10-18-48	50	25	2.8	34	1.5	148	1.2	186	0	232	6.5	.5	.0	.12	548	91	0	78	825	7.7
A2-3-10bc	85.0	10-19-48	49	11	.16	23	3.4	250	3.6	152	0	448	7.6	1.4	.0	.25	864	72	0	88	1,240	7.4
19dd	228	9-17-49	50	10	2.0	14	.6	235	4.0	35	0	456	41	1.2	.6	.48	800	38	9	92	1,130	7.3
26dc	80.0	9-17-49	49	10	2.4	62	.5	579	4.8	28	0	1,250	82	1.2	41	.52	2,050	157	134	89	2,770	6.9
A2-4-2cb	50.0	10-20-48	50	16	1.1	13	1.7	343	2.4	561	0	3.2	258	2.8	.4	.66	933	40	0	91	1,610	7.9
10dc	350	9-17-49	52	10	.54	16	.4	260	4.8	34	0	456	92	1.2	.3	.46	874	42	14	92	1,280	6.8
17ad	40.0	10-20-48	49	12	.26	12	1.3	350	21	625	14	224	20	1.0	4.4	.24	984	36	0	92	1,470	8.3
A2-5-2ab	306.0	10-20-48	50	16	.16	14	1.5	261	.8	34	0	444	97	2.8	.2	.43	872	41	13	93	1,360	7.7

A2-6-7cd	128	9-17-49	52	8.8	.96	8.0	10	235	4.8	138	0	400	18	.8	.3	.24	752	61	0	88	1,090	7.2
19da	360	10-20-48	55	13	2.0	26	4.6	284	.8	126	6	440	94	1.6	1.4	.22	953	84	0	88	1,480	8.2
A3-1-21ad	226	10-14-48	52	13	.60	46	2.0	458	4.4	85	0	1,000	12	.7	.3	.08	1,580	123	53	89	2,060	7.5
21ba1	40.0	9-17-49	51	14	1.1	81	24	86	3.2	284	0	196	21	1.2	34	.28	606	301	68	38	867	7.8
21dd1	75.0	10-14-48	50	28	4.0	282	73	414	2.4	414	0	1,380	46	1.4	9.8	.22	2,440	1,000	661	47	3,030	7.2
25bc	66.0	9-17-49	49	14	8.0	230	59	966	6.4	512	0	2,120	163	2.4	92	.33	3,910	817	397	72	4,840	7.8
36ad2	77.0	10-14-48	50	13	2.2	450	167	748	5.6	342	0	2,760	158	.7	.3	.18	4,470	1,810	1,530	47	4,790	7.7
		10-14-48	54	13	.02	72	33	203	2.4	307	0	480	10	1.4	25	.10	994	315	63	58	1,400	7.4
		9-17-49	55	10	.02	58	26	159	3.2	258	10	332	6.8	1.0	24	.31	766	252	17	57	1,060	8.2
		4-26-50	48	12	.08	128	58	233	2.8	296	0	760	14	.9	24	.14	1,380	558	315	47	1,850	7.4
A3-2-7dd	36	8-14-50	55	----	----	108	32	173	----	294	0	480	12	----	24	----	974	401	160	48	1,390	7.5
		12-5-50	49	12	.08	76	30	169	2.4	299	0	393	7.0	1.0	15	.12	876	314	69	54	1,200	7.6
		4-17-51	50	----	----	----	----	215	3.1	----	----	648	----	----	----	----	1,280	----	----	----	----	----
		7-31-51	----	----	----	----	----	133	2.3	----	----	353	----	----	----	----	774	----	----	----	1,130	7.5
		10-26-51	52	----	----	----	----	82	2.4	----	----	137	----	----	----	----	486	----	----	----	753	----
10db2	482	10-18-48	50	14	1.6	6.0	.6	174	5.2	44	0	320	26	1.4	.4	.10	612	18	0	94	913	7.5
		10-14-48	54	11	4.6	97	17	90	3.2	228	0	316	4.7	1.4	2.6	.18	698	312	125	38	960	8.0
		9-17-49	55	9.2	.59	30	7.9	60	4.0	210	0	64	2.0	1.1	1.1	.23	284	108	0	54	443	7.7
		4-26-50	52	10	.30	82	17	94	2.0	204	0	301	7.6	1.4	2.4	.20	635	275	108	42	908	7.9
		8-14-50	53	----	----	40	6.7	71	----	207	0	103	4.0	----	----	----	477	128	0	55	546	8.0
14aa2	40.0	12-5-50	49	11	.06	37	6.7	71	1.2	214	0	94	4.0	----	1.1	.09	376	120	0	56	519	7.7
		4-17-51	51	----	----	----	----	74	1.8	----	----	87	5.0	----	----	----	348	----	----	----	----	----
		7-31-51	----	----	----	----	----	70	1.9	----	----	52	----	----	----	----	281	----	----	----	462	----
		10-26-51	53	----	----	----	----	65	1.6	----	----	35	----	----	----	----	252	----	----	----	414	----
		12-5-51	49	10	.07	42	7.5	72	1.3	214	0	112	3.5	1.4	1.0	.15	370	136	0	53	545	7.8
26ad	321.0	10-18-48	53	13	2.0	46	.1	445	7.6	22	0	988	18	.7	.2	.22	1,530	116	98	89	2,160	7.1
		10-14-48	50	18	2.8	484	183	339	6.0	263	0	2,310	29	.9	13	.14	3,510	1,960	1,740	27	3,790	7.5
		9-17-49	49	11	.24	450	180	309	22	248	0	2,240	26	.6	16	.27	3,380	1,860	1,660	26	3,540	7.4
		4-26-50	47	12	.21	464	174	306	4.0	260	0	2,180	22	.6	22	.17	3,310	1,870	1,660	26	3,760	7.3
		8-14-50	49	----	----	478	164	284	----	258	0	2,150	25	----	----	----	3,230	1,870	1,660	25	3,590	7.3
27ba	57	12-5-50	49	12	.08	488	167	282	5.3	256	0	2,190	24	.7	13	.15	3,310	1,910	1,700	24	3,500	7.1
		4-17-51	47	----	----	----	----	286	5.2	----	----	2,160	----	----	----	----	3,650	----	----	----	----	----
		7-31-51	----	----	----	----	----	276	5.4	----	----	2,180	----	----	----	----	3,570	----	----	----	3,600	----
		10-25-51	49	----	----	----	----	274	5.8	----	----	2,180	----	----	----	----	3,390	----	----	----	3,480	----
30dd3	582	10-18-48	52	15	.03	70	2.6	579	7.2	119	0	1,290	15	.6	.3	.04	2,040	185	87	87	2,720	7.5
A3-3-16cb	360	10-18-48	50	17	.60	12	.1	217	1.2	34	0	394	36	2.0	.0	.27	716	30	2	94	1,100	8.0
24cc	50	10-20-48	48	16	2.1	460	179	714	10	175	0	2,980	69	1.2	.8	.98	4,520	1,880	1,740	45	5,160	7.9
26ab2	244	10-19-48	49	11	.28	27	.1	332	4.0	23	0	664	59	1.0	.3	.12	1,110	68	49	91	1,660	7.1
A3-4-29cd1	76.0	9-17-49	49	9.2	3.0	74	7.9	473	4.8	416	0	848	17	1.1	.7	.28	1,640	217	0	82	2,190	7.8
A3-5-33dc	35	10-16-48	47	19	.06	206	41	735	3.2	330	0	1,760	58	1.1	44	.34	3,030	682	411	70	3,830	7.6
B3-1-24cd2	40	9-17-49	54	32	.01	70	29	124	3.2	405	15	175	16	1.4	15	.31	696	294	0	47	964	8.2

TABLE 9.—*Mineral constituents, in parts per million, and related physical measurements of ground and surface water*—Continued

Location	Depth (feet)	Date of collection	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Specific conductance (micromhos)	pH
North Pavillion area:																						
A3-2-5bc	100	8-14-50	58	10		33	0.5	459	1.3	78	0	990	8.5	0.8	0.8	0.10	1,540	85	21	92	2,180	7.5
6ac (36-min sample)	41	6-18-51	50					253	2.6	134	0	400	290			.12	1,220	391	281	58	1,830	7.8
(23-hr 50-min sample)	41	6-19-51	49					362	3.7	164	0	945	330			.30	2,150	808	674	49	2,810	7.7
A3-3-6cc	270	10-26-51	52	21		.9	.1	97	.2	74	33	42	38	1.6	.4	.21	272	3	0	99	446	9.7
A4-2-29db	260	8-14-50	50	12		31	.1	548	1.8	64	0	1,090	48	1.1	.3	.10	1,770	78	26	94	2,560	8.2
North Portal area:																						
A4-3-13dc1	465	10-26-51	51	10	0.25	5.5	.1	256	.6	32	16	435	49	2.0	.4	.35	802	14	0	97	1,270	9.5
34ad	305	10-26-51	50	12		7.5	.1	264	.2	43	0	500	35	1.8	.4	.24	866	19	0	97	1,320	7.2
Muddy Creek terraces:																						
A4-4-20da	234.5	10-26-51	52	8.0	1.6	31	.9	556	.9	34	0	1,020	160	3.2	.3	.22	1,800	81	53	94	2,740	7.2
23ac	23	6-26-51						175		334	7	122	17		17		606	68	0	85	897	8.4
23db1	621	6-26-51	53	6.8	.08	14	.7	380	.6	78	0	415	260	4.0	.3	.15	1,120	38	0	95	1,870	7.5
23db2	20	10-26-51						240		294	14	273	27		15		796	76	0	87	1,210	8.7
28cd		10-19-48	48	13	.30	186	69	354	6.0	285	0	1,150	34	.8	.0	.14	1,960	748	514	50	2,490	7.5
Other wells:																						
B4-1-31da1	384	11-14-51		7.4	.06	71	4.1	716		138	0	1,520	37	1.2	1.0	.21	2,430	194	81	89	3,380	7.5
31da2	382																					

Surface water

Location	Depth (feet)	Date of collection	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$: Total	Hardness as $CaCO_3$: Noncarbonate	Percent sodium	Specific conductance (micromhos)	pH
Wind River above Wind River diversion dam.		10-14-48	46	15	0.02	44	13	19	1.6	167	0	62	8.0	0.3	1.1	0.18	262	164	27	20	397	7.7
Wind River above Le Clair diversion dam.		10-15-48	52	23	.04	45	14	21	1.2	150	0	77	7.0	.3	.2	.01	264	170	47	21	411	8.0
Wyoming canal at power drop		9-16-49	55	9.6	.01	30	7.6	9.7	3.2	100	0	38	3.6	.1	.7	.18	158	107	25	16	248	7.6
Pilot Butte Reservoir at outlet		9-16-49	58	12	.01	34	7.9	14	4.0	114	0	52	4.0	.2	1.3	.19	188	118	25	20	294	7.1
Pilot canal at bridge near Lost Wells Butte.		9-16-49	58	9.6	.02	29	7.9	19	2.4	104	0	56	4.0	.1	.9	.09	192	105	20	28	288	7.6
Ocean Lake		9-23-47		8.2	.01	143	49	532		152	0	1,390	100	.6	.2	.16	2,290	558	433	67	3,110	8.2

		9-23-47	----	8.2	.01	140	48	521		148	0	1,360	100	.7	.2	------	2,240	547	426	67	3,080	8.2
Upper Ocean drain	------	10-14-48	54	11	.08	101	45	519	3.2	67	0	1,310	93	.7	1.2	.15	2,120	437	382	72	2,910	7.4
		9-16-49	61	4.2	.01	109	41	518	4.8	88	0	1,350	83	.7	1.6	.23	2,160	441	369	72	2,910	7.1
Lower Ocean drain	------	10-14-48	54	17	.16	118	42	513	4.8	108	0	1,310	86	.8	1.4	.18	2,150	467	378	70	2,890	7.8
Fivemile Creek below upper gaging station.	------	10-21-48	50	12	.07	2.5	1.3	150	.8	193	8	157	11	.6	.4	.17	451	12	0	96	724	8.5
Lower Fivemile Creek at bridge	------	10-19-48	46	10	.01	222	53	592	7.2	237	0	1,640	78	.7	13	.28	2,730	772	578	62	3,450	7.7
		9-16-49	58	9.2	.01	139	30	344	2.4	176	0	992	44	.7	10	.40	1,660	471	327	61	2,220	7.5
Drain ditch near Riverton	------	10-21-48	50	33	.02	77	16	171	1.6	343	16	279	16	1.6	7.2	.29	774	258	0	59	1,200	8.5
		9-17-49	51	9.2	.04	172	44	603	4.8	256	0	1,560	66	1.0	18	.47	2,600	610	400	68	3,330	7.8
Spring along Eagle drain near Fivemile Creek.	------																					
		8-18-50	52	------	------	142	32	633		320	0	1,440	64	-----	13	------	2,480	486	224	74	3,250	7.7
Seep from Wyoming canal extension	------	8-14-50	69	19	.02	215	8.0	29		86	0	530	5.0	1.1	.8	.10	927	570	499	10	1,080	7.7

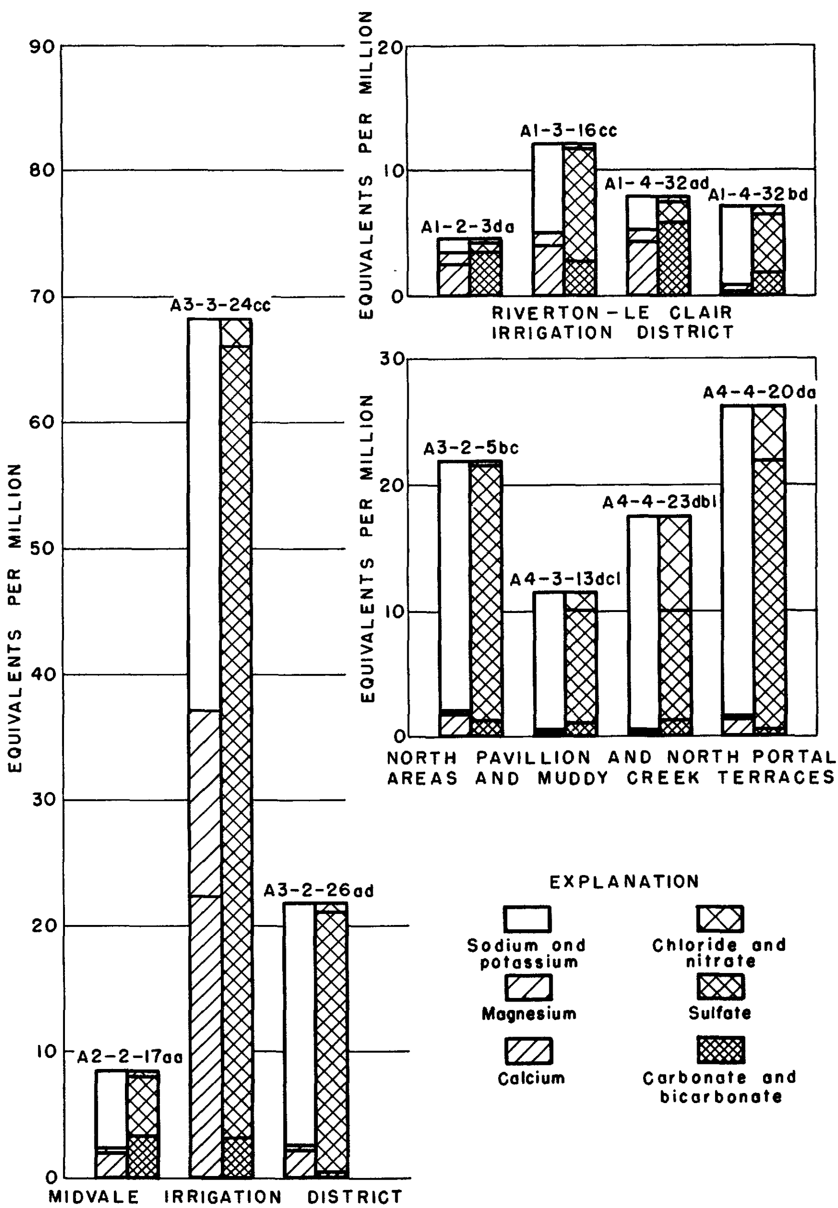

FIGURE 24.—Principal mineral constituents of ground water.

The Burch well (A1–4–27dd), one of several deep wells that supplies the city of Riverton, yields satisfactory water for domestic use. The analysis of this water shows 394 ppm of dissolved solids and a hardness of 17 ppm.

The results of analyses, in equivalents per million, for several representative samples from the Riverton-Le Clair irrigation district are expressed graphically in figure 24. The results of the analysis of resamples from a well are not shown in the illustrations in this report.

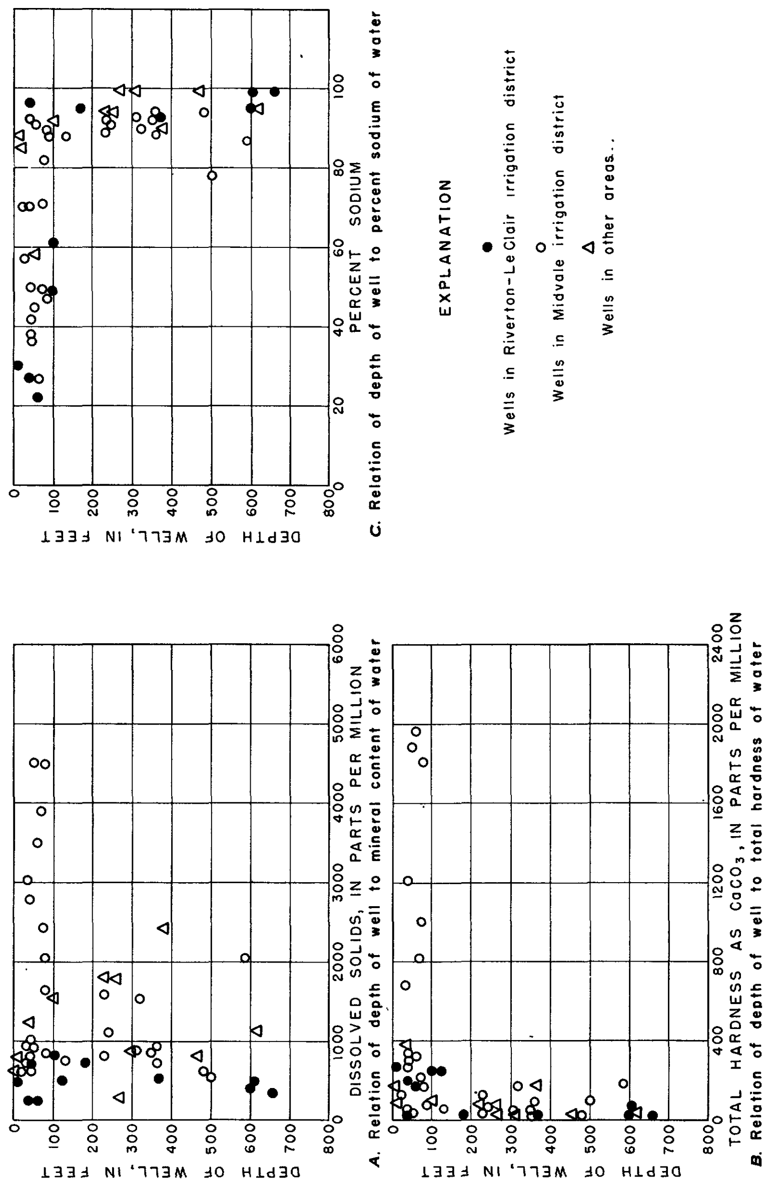

FIGURE 25.—Relation of depth of well to mineral content, total hardness, and percent sodium of water.

TABLE 10.—*Comparison of chemical composition of ground and surface water*

Constituent	Percentage (by weight) of soluble constituents for —	
	Wind River at Riverton, October 1947 to September 1948 (weighted average)	Well A1-2-3da, Oct. 15, 1948
Silica (SiO_2)	8.91	6.51
Iron (Fe)	.02	.16
Calcium (Ca)	12.92	13.02
Magnesium (Mg)	3.08	2.98
Sodium (Na)	5.79	7.59
Potassium (K)	1.38	.54
Bicarbonate (HCO_3)	49.03	54.78
Sulfate (SO_4)	16.49	12.74
Chloride (Cl)	1.65	1.36
Fluoride (F)	.09	.08
Nitrate (NO_3)	.62	.22
Boron (B)	.02	.02
Total	100.00	100.00
Total constituents in solution ppm	224	369
Hardness ppm	101	165

A plot of the data obtained for wells in the Riverton-Le Clair irrigation district shows that the hardness of the water is consistently less than about 200 ppm at depths greater than about 100 feet. Coincident with this relatively low hardness is greater uniformity of high percent sodium with depth. (See fig. 25.)

MIDVALE IRRIGATION DISTRICT

Several fairly well defined relationships are apparent from the results of analyses of 51 samples from wells in the Midvale irrigation district. (See table 9.) In general, wells less than 200 feet deep yield highly mineralized sulfate water, the result of leaching by infiltrating irrigation water. The water is characteristically hard unless the well draws from an aquifer in which the water is diluted by canal seepage of better quality, and the iron concentration in the water in many wells is higher than is desired for most uses.

In the Midvale district the concentration of dissolved solids tends to decrease with depth of well. (See fig. 25.) The plotted points depict a similarity in mineral content for the water in wells that have a depth greater than 300 feet. This similarity indicates that the chemical quality of water below this depth in the Wind River formation probably is unaffected by surface recharge and, in general, may be expected to be more dilute than the water from shallow sources.

The relation of anions to dissolved solids in samples of ground water from the Midvale district, as well as the rest of the report area, is shown in figure 26. The concentrations of dissolved solids

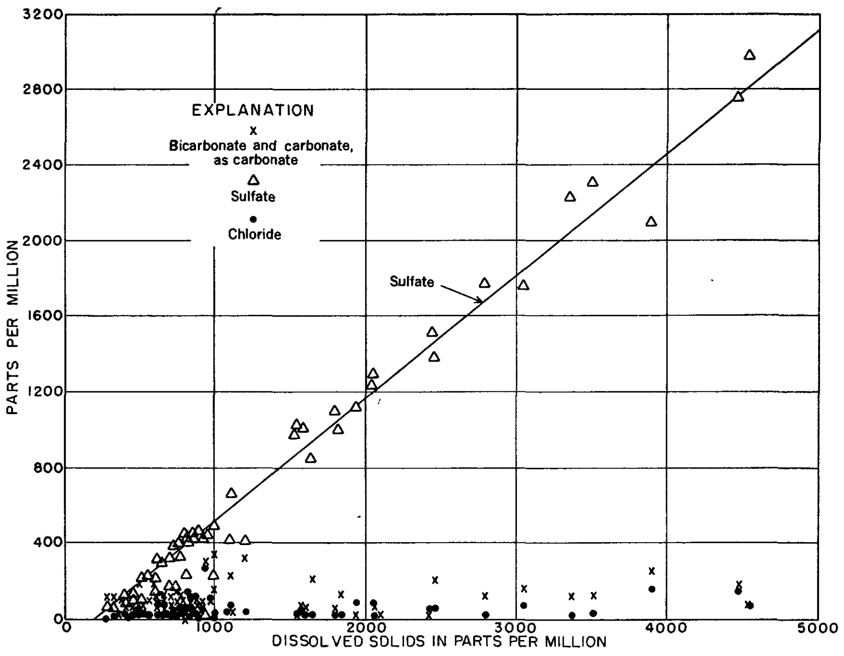

FIGURE 26.—Relation of anions to dissolved solids in ground water.

and sulfates are proportionate to each other, but carbonate and chloride are of minor significance in water in which the content of dissolved solids exceeds 1,000 ppm.

Although the percent sodium in samples of water from depths less than 125 feet ranges widely, the percent sodium generally increases with depth. Coincident with the increase is the reduction in hardness; water from most deep wells is softer than water from shallow wells. (See fig. 25.) The high concentration of alkaline earths in samples that were obtained from shallow wells in the Midvale irrigation district contrasts sharply with the characteristically low hardness of samples that were obtained from wells on the low terraces and bottom lands along the Wind River. This is not surprising because of the more complete leaching of the surficial materials on the older irrigated tracts in the Riverton-Le Clair irrigation district.

The analysis of water from well A2–2–15dc, 22 feet deep, indicates dilution of the shallow ground water by seepage from Pilot canal. The dissolved solids concentration of the water is 618 ppm, the hardness is 116 ppm, and the chemical quality is satisfactory for general domestic use.

Well A3–2–26ad, 321 feet deep, is near the north edge of Ocean Lake. The water from this well contains 1,530 ppm dissolved solids, of which 988 ppm is sulfate, and is more highly mineralized than water from most other wells that are deeper than 300 feet. Although the well reportedly is cased to a depth of 296 feet, there is a possibility that the casing is leaking and that more highly mineralized water from shallow horizons is entering the well.

OTHER TRACTS

In areas other than the Midvale and the Riverton-Le Clair irrigation districts, only a few wells were available for sampling. Five samples were obtained from the North Pavillion area, two samples from the North Portal area, and five samples from the Muddy Creek terraces. (See fig. 23 and table 9.) Most of these samples were obtained after the main Wyoming canal had been extended and therefore represent comparatively new supplies.

In the North Pavillion area a field permeability test was made by pumping temporary well A3–2–6ac, 41 feet deep. As shown in the following abridged analysis (table 11), the total mineralization —particularly the hardness (calcium and magnesium) and sulfate —increased significantly from the sample collected 36 minutes after pumping began to the sample collected 23 hours and 50 minutes after pumping began; sodium increased to a somewhat lesser extent than hardness and sulfate. The data indicate possible induced infiltration of water from an aquifier that contains water having greater concentration of calcium sulfate. The data indicate possible induced infiltration of water from an aquifer that contains water having greater concentration of calcium sulfate.

TABLE 11.—*Results of chemical analysis of two samples of water from well A3–2–6ac*

Constituent	Time from start of pumping	
	36 min	23 hr 50 min
Sodium ppm	253	362
Hardness as $CaCO_3$ ppm	391	808
Sulfate ppm	400	945
Dissolved solids ppm	1,220	2,150
Percent sodium	58	49

The water from well A3–3–6cc, 270 feet deep, had a moderately low mineral content (272 ppm) but was reported unsatisfactory for drinking because of the strong hydrogen sulfide odor and the precipitation of sulfur on standing. Although no gas analyses were made, the problem of hydrogen sulfide in water supplies, particularly in deep wells, was observed for new supplies in other tracts. Some preliminary investigations by the writer have indicated that a commercial unit of exchange resins is a possible means for the removal of hydrogen sulfide from water of otherwise good quality; however, aeration of the water probably will be a satisfactory method if the supply can be protected from freezing. The water from well A3–3–6cc had almost no hardness, presumably as a result of base-exchange reactions.

In the North Portal area, samples from wells A4–3–13dc1, 465 feet deep, and A4–3–34ad, 305 feet deep, were similar in total mineralization and in chemical composition. The hardness in the water was very low; and although the water was somewhat higher in sulfate and fluoride than is desirable, it was of acceptable quality for domestic use. It is of interest to note that the concentration and composition of the water from well A4–3–34ad were similar to those of the water from several wells of comparable depth in the Midvale irrigation district.

The analyses of five samples from shallow and deep wells in the Muddy Creek terraces are indexes of the quantities and composition of mineral substances that can be expected in supplies from this area. Deep wells, such as A4–4–20da and A4–4–23db1, yield water having the softness and the high percent sodium that characterize water from deep wells in other parts of the project area. (See table 9.) The rapidity of the alteration from a calcium bicarbonate irrigation water to a sodium sulfate ground water several times more concentrated is indicated in the results of analyses of samples from observation wells A4–4–23ac and A4–4–23db2. The analyses of water from these wells, which are on the experimental farm, further indicate that a water supply obtained at shallow depth from terrace deposits in a newly irrigated area is likely to be appreciably mineralized during the early life of the well. However, the general degree of mineralization is somewhat less than that of water at shallow depths in the bedrock.

SEASONAL FLUCTUATIONS

It was recognized early in the study that irrigation water probably influenced significantly the quality of ground water in permeable materials adjacent to the canals. So that these seasonal changes could be observed, the water in three shallow wells (A3–2–7dd, A3–2–14aa2, and A3–2–27ba) was sampled periodically; well A3–2–27ba was selected because the immediate area was waterlogged. The analytical results for selected constituents are given in table 12.

TABLE 12.—*Comparison of seasonal fluctuations of chemical constituents in water from selected wells*

Well no.	Date	Ca+Mg	Na+K	HCO_3	SO_4	Dissolved solids	Relation to irrigation season
		Parts per million					
A3-2-7dd	10-14-48	105	205	307	480	994	After
	9-17-49	84	162	258	332	766	At peak.
	4-26-50	186	236	296	760	1,380	Before.
	8-14-50	140	173	294	480	974	At peak.
	12- 5-50	106	171	299	393	876	After.
	4-17-51	--------	218	--------	648	1,280	Before.
	7-31-51	--------	135	--------	353	774	At peak.
	10-26-51	--------	84	--------	137	486	After.
A3-2-14aa2	10-14-48	114	93	228	316	698	After.
	9-17-49	38	64	210	64	284	At peak.
	4-26-50	99	96	204	301	635	Before.
	8-14-50	47	71	207	103	477	At peak.
	12- 5-50	44	72	214	94	376	After.
	4-17-51	--------	76	--------	87	348	Before.
	7-31-51	--------	72	--------	52	281	At peak.
	10-26-51	--------	67	--------	35	252	After.
	12- 5-51	50	73	214	112	370	After.
A3-2—27ba	10-14-48	667	345	263	2,310	3,510	After.
	9-17-49	630	331	248	2,240	3,380	At peak.
	4-26-50	638	310	260	2,180	3,310	Before.
	8-14-50	642	284	258	2,150	3,230	At peak.
	12- 5-50	655	287	256	2,190	3,310	After.
	4-17-51	--------	291	--------	2,160	3,650	Before.
	7-31-51	--------	281	--------	2,180	3,570	At peak.
	10-25-51	--------	280	--------	2,180	3,390	After.

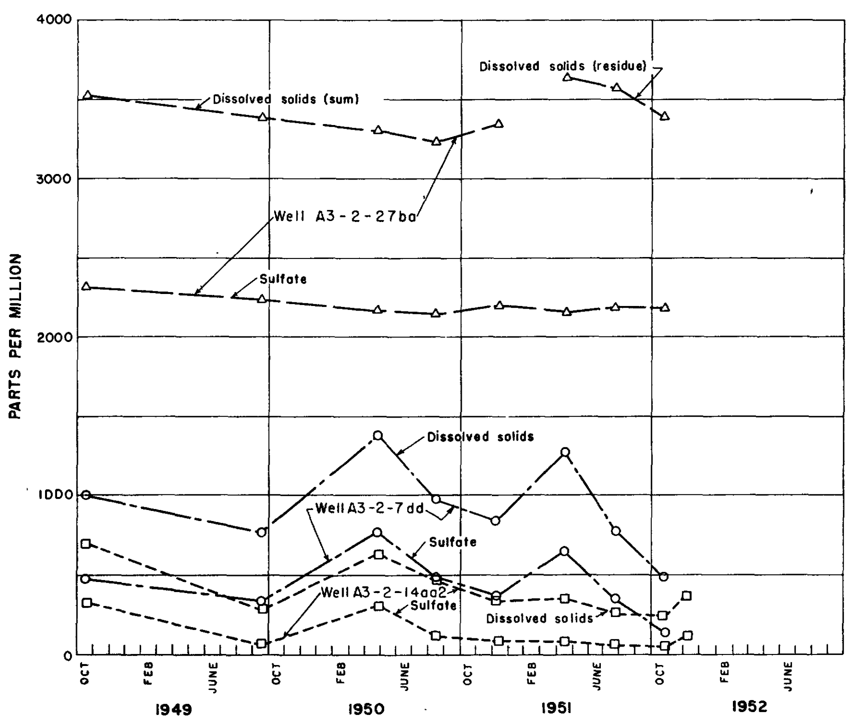

FIGURE 27.—Seasonal fluctuations of dissolved solids and sulfate in water from selected wells.

The more significant changes occurred in the water in wells A3–2–7dd and A3–2–14aa2 as a direct result of dilution by irrigation water from the main Wyoming canal or its laterals. The changes in dissolved solids and sulfate are shown graphically in figure 27. Largely through reduction in the content of calcium and magnesium sulfate, the dissolved solids in water from well A3–2–14aa2, 40 feet deep, decreased from 698 ppm in the post-irrigation season of 1948 to 284 ppm in the peak-irrigation season of 1949, then increased to 635 ppm prior to the 1950 irrigation season. The seasonal fluctuations are less pronounced for the samples collected in 1950 and 1951 and show a slight downward trend in concentration. By comparison, much greater fluctuations occur in the mineral content of samples collected in 1950 and 1951 from well A3–2–7dd, 36 feet deep. The residents of the area detect the increase in hardness of their supplies during the winter season.

Changes in the dissolved solids and sulfate in samples from well A3–2–27ba are not as pronounced. Evidently no dilution effect is apparent during the irrigation season because the ground-water level is already high in this immediate area. (See fig. 27.) It is obvious from these results that a long period of flushing action by surface water will be required to improve permanently the quality of the shallow ground water in waterlogged areas even if water levels are lowered. Periodic sampling and water-level measurements of key wells should be continued as a part of the hydrologic studies in the area.

QUALITY OF WATER IN RELATION TO DRAINAGE

A total of 17 samples was collected from 13 surface-water sources in connection with this study. (See fig. 23 and table 9.)

The total concentration of dissolved solids in the Wind River at the Wind River diversion dam was only 262 ppm and is an index of the high quality of the irrigation supply. Occasional checks of the water have indicated that the total mineralization of the canal water remains essentially unchanged in its course through the area.

The chemical character of the water in Fivemile Creek and drains, however, changes significantly in a downstream direction. (See table 9.) A sample of water from upper Fivemile Creek (SW¼ sec. 24, T. 4 N., R. 1 E.), which was collected at a time when the main Wyoming canal water was closed off, had a relatively low mineral content of 451 ppm of dissolved solids. Return flows from irrigation enter Fivemile Creek downstream from this point and effect an increase in the dissolved-solids content to 2,730 ppm near the confluence with the Wind River. This sixfold increase in dissolved solids is evidence of the large amount of soluble salts being leached out of the upper part of the Wind River formation and the mantling deposits. A sample of water from lower Fivemile Creek, obtained about 1 year later, contained 1,660 ppm of dissolved solids. This difference of more than 1,000 ppm was caused principally by surface-water dilution.

The similarity in the chemical character of the water in Ocean Lake in 1947 and in upper Ocean drain in 1947, 1948, and 1949 is shown by the dissolved-solids concentrations of 2,290, 2,240, 2,120, and 2,160 ppm, respectively. Except for an increase in the percent sodium from 67 to 72 and a decrease in calcium bicarbonate and in pH, the quantities of the various constituents have remained about the same. Apparently the process of leaching of the soil and surficial materials in the area is progressing at a fairly uniform rate.

MINERAL SUBSTANCES IN THE ROCKS AND SOILS

Salt deposits have formed in some parts of the Riverton irrigation project area, especially west of Ocean Lake. These materials probably are dissolved principally from the shale and are precipitated at the ground surface by evaporation of the ground water that moves to the land surface by capillary action. Although the salts are dissolved by light rain, they reappear at the land surface after a few days of dry weather. Samples of salt crusts were obtained from three areas, and the results of analyses, expressed as percentage composition of the salts, are given in table 13.

TABLE 13.—*Percentage composition of soluble salts on the ground surface*

Location of sample	Ca	Mg	Na+K	HCO_3	SO_4	Cl
Low terrace along Aragon ditch	4.0	1.3	25.0	0.8	68.9	0.0
Pilot Butte Reservoir bed (low level)	9.9	2.5	16.8	1.6	63.3	5.9
West of Ocean Lake, along secondary State highway to Pavillion	1.2	.2	30.0	.6	66.8	1.2

As might be expected, the chemical character of the ground water in the area is related to these salt deposits; however, the proportion of the constituents usually differs. Sodium sulfate is the predominant salt. In terms of chemical equivalents, the calcium sulfate content of salt at Pilot Butte Reservoir is approximately 34 percent, which is a proportion similar to that in the ground water in the vicinity.

Several samples of water-bearing material of sandstone or shale origin, representing different ground-water conditions in the area, were obtained by use of a soil auger and were analyzed for the water-soluble constituents. (See table 14.) The two samples from sandstone-derived soils in nonirrigated tracts in the NE¼ SW¼ sec. 16, T. 3 N., R. 2 E., were slightly less mineralized than samples from other sources in the area. The water-soluble substances, composed principally of calcium carbonate, totaled less than 0.10 percent of the dry weight of the soil. On the other hand, the total soluble salt content of a sample of shale-derived soil in an untilled area was 0.14 percent. It also was composed principally of calcium carbonate.

Samples of well-drained soil from irrigated tracts in the NE¼ SE¼ sec. 7, T. 3 N., R. 2 E., contained higher concentrations of soluble salts than samples of untilled soil, but the carbonates of calcium plus magnesium also were prominent in these samples. In both samples from waterlogged areas in Paradise Valley (SE¼ SE¼ sec. 18, T. 2 N., R. 4 E.) and near Pavillion (SE¼SW¼ sec. 2, T. 3 N., R 2 E.), the total salt content exceeded 0.5 percent, and the percentages of sodium plus potassium and of sulfate were more prominent.

Kearney and Scofield (1936) and other investigators have established arbitrary limits for separating saline and nonsaline soils. They consider that plants are affected when the salt content of the soil exceeds 0.1 percent. It is apparent from the results given in table 14 that harmful concentrations of salts are being deposited in soils in poorly drained areas.

Chemical analyses of acid-soluble constituents in both unweathered and weathered shales were made in order to determine further those mineral substances possibly affecting the character of water that percolates from the ground surface. (See table 14.) The shales are composed principally of iron and aluminum silicate and contain appreciable quantities of calcium, magnesium, sodium, and potassium. Considerable effervescence resulted from the addition of the hydrochloric acid; apparently an appreciable quantity of carbonates is present. The sulfate content of both samples is low. These results do not provide the evidence necessary to demonstrate the source of sulfate in the water; moreover, because only a few samples were collected, the results given in table 14 may not necessarily be representative of surface or subsurface conditions.

Typical chemical analyses of soil profiles in the Midvale irrigation district have been extracted from the large volume of data made available by the United States Bureau of Reclamation at Riverton to illustrate the various soil conditions in one segment of the project. The terms used in describing soil conditions and soil classes in table 15 are defined by the United States Regional Salinity Laboratory (1947). Although most of the soils examined were

TABLE 14.—*Water-soluble and acid-soluble constituents of soils and rock materials*

<table>
<tr><th rowspan="2">Location</th><th rowspan="2">Source material</th><th colspan="9">Percent of air-dried sample for—</th></tr>
<tr><th>Iron (Fe_2O_3)</th><th>Aluminum (Al_2O_3)</th><th>Calcium (Ca)</th><th>Magnesium (Mg)</th><th>Sodium and potassium (Na+K)</th><th>Bicarbonate (HCO_3)</th><th>Sulfate (SO_4)</th><th>Chloride (Cl)</th><th>Total</th></tr>
<tr><th colspan="11">Water-soluble constituents in soils</th></tr>
<tr><td>T. 2 N., R. 4 E.: SE¼SE¼ sec. 18</td><td>Poorly drained soil (waterlogged area in Paradise Valley).</td><td></td><td></td><td colspan="2">0.05</td><td>0.13</td><td>0.22</td><td>0.09</td><td>0.08</td><td>0.57</td></tr>
<tr><td>T. 3 N., R. 2 E.: SE¼SW¼ sec. 2</td><td>Poorly drained soil (waterlogged area near Pavillion).</td><td></td><td></td><td colspan="2">.17</td><td>.23</td><td>.29</td><td>.60</td><td>.02</td><td>1.31</td></tr>
<tr><td>NW¼NW¼ sec. 7</td><td>Untilled shale-derived soil</td><td></td><td></td><td colspan="2">.01</td><td>.01</td><td>.12</td><td>.00</td><td>.00</td><td>.14</td></tr>
<tr><td>NE¼SE¼ sec. 7</td><td>Well-drained sandstone-derived soil</td><td></td><td></td><td colspan="2">.07</td><td>.01</td><td>.23</td><td>.01</td><td>.00</td><td>.32</td></tr>
<tr><td>NE¼SE¼ sec. 7</td><td>do</td><td></td><td></td><td colspan="2">.04</td><td>.01</td><td>.13</td><td>.01</td><td>.00</td><td>.19</td></tr>
<tr><td>NE¼SW¼ sec. 16</td><td>Untilled sandstone-derived soil</td><td></td><td></td><td colspan="2">.01</td><td>.01</td><td>.04</td><td>.00</td><td>.00</td><td>.06</td></tr>
<tr><td>NE¼SW¼ sec. 16</td><td>do</td><td></td><td></td><td colspan="2">.02</td><td>.01</td><td>.07</td><td>.00</td><td>.00</td><td>.10</td></tr>
<tr><th colspan="11">Acid-soluble constituents in rock materials</th></tr>
<tr><td>T. 1 N., R. 3 E.: sec. 10</td><td>Unweathered shale [1]</td><td>8.19</td><td>3.98</td><td>0.68</td><td>1.32</td><td>1.69</td><td></td><td>0.12</td><td>0.02</td><td>16.00</td></tr>
<tr><td>T. 1 N., R. 4 E.: sec. 29</td><td>Weathered shale</td><td>10.23</td><td>5.51</td><td>1.20</td><td>1.28</td><td>3.29</td><td></td><td>.13</td><td>.06</td><td>21.70</td></tr>
</table>

[1] Silica (SiO_2), 65 percent.

TABLE 15.—*Soil data (abridged) collected during drainage investigations of the Midvale irrigation district*

[Analyses by U. S. Bureau of Reclamation]

Sample no.	Depth (feet)	pH: Saturated paste	pH: 1:5	pH: 1:60	pH: Maximum	Difference in pH: Paste 1:5	Difference in pH: 1:5–1:60	Difference in pH: Paste 1:60	Difference in pH: Maximum	Permeability (in. per hr) at—: 8th hour	Permeability (in. per hr) at—: 24th hour	Settling volume (ml)	Percent of indicated particle size: Sand	Percent of indicated particle size: Silt	Percent of indicated particle size: Clay	Soluble sodium (me per 100 g)	Exchangeable sodium (me per 100 g)	Exchange capacity (me per 100 g)	Exchangeable sodium (percent)	EC (mmhos per cm)	Calcium: Ppm	Calcium: Me per 100 g	Magnesium: Ppm	Magnesium: Me per 100 g	Sodium: Ppm	Sodium: Me per 100 g	Carbonate: Ppm	Carbonate: Me per 100 g	Bicarbonate: Ppm	Bicarbonate: Me per 100 g	Percent sodium	Percent water at saturation
Normal soil [Location: ½ mile north and 4 miles east from northeast corner of T. 2 N., R. 3 E.]																																
55	0.0–1.5	7.9	9.7	9.7	9.7	1.8	0.0	1.8	1.8	1.64	------	11	38.0	30.5	31.5	0.45	2.44	27.5	8.9	1.1	24	0.07	15	0.07	185	0.45	0	0	195	0.18	77.1	55.3
56	1.5–2.5	7.9	9.8	9.6	9.8	1.9	−.2	1.7	1.9	.32	0.28	25	33.2	32.1	34.7	.41	3.26	33.7	9.7	1.0	24	.07	10	.05	170	.41	0	0	232	.21	78.6	55.6
57	2.5–4.4	8.0	9.7	8.6	9.7	1.7	−1.1	.6	1.7	2.76	------	11	78.0	11.1	10.9	.16	.76	13.0	5.9	.7	40	.07	10	.03	99	.16	0	0	146	.09	60.1	36.4
58	4.4–5.0	8.3	10.0	8.5	10.0	1.7	−1.5	.2	1.7	4.08	------	11	86.1	6.2	7.7	.12	.71	9.4	7.5	.5	36	.06	49	.01	90	.12	0	0	159	.08	64.0	31.0
59	5.0–5.8	8.4	9.6	8.1	9.6	1.2	−1.5	.3	1.2	5.00	------	11	90.8	3.2	6.0	.11	.65	7.4	8.8	.5	8	.01	5	.01	101	.11	0	0	165	.07	85.1	26.0
60	8.0–9.0	8.5	9.6	8.4	9.6	1.1	−1.2	−.1	1.1	5.80	------	13	90.8	4.0	5.2	.08	.43	5.8	7.4	.4	16	.02	5	.01	75	.08	0	0	140	.06	73.2	25.3
61	9.0–12.8	8.1	9.3	8.4	9.3	1.2	−.9	.3	1.2	3.28	------	12	81.2	9.5	9.3	.06	.42	12.7	3.3	.3	8	.01	10	.02	52	.06	0	0	146	.06	65.2	26 6
Nonsaline alkaline soil underlain by saline alkaline soil [Location: ½ mile north and 5 miles east from northeast corner of T. 2 N., R. 3 E.]																																
73	0.0–3.5	7.9	9.3	9.6	9.6	1.4	0.3	1.7	1.7	0.24	0.20	30	36.6	29.4	34.0	0.83	8.37	48.1	17.4	1.7	72	0.25	10	0.06	280	0.83	0	0	189	0.27	73.4	68.3
74	3.5–5.0	7.7	9.0	9.3	9.3	1.3	.3	1.6	1.6	.88	.76	21	75.8	11.7	12.5	1.19	4.73	27.9	17.0	4.2	224	.41	29	.09	750	1.19	0	0	153	.09	70.6	36.4
75	5.0–6.0	7.8	8.9	9.4	9.4	1.1	.5	1.6	1.6	3.00	------	18	83.9	5.2	10.9	1.21	12.27	21.8	56.3	6.5	400	.65	58	.16	850	1.21	0	0	146	.08	59.9	32.6
76	6.0–8.0	8.0	8.7	9.0	9.0	.7	.3	1.0	1.0	4.20	------	19	92.4	----	----	2.69	9.31	21.0	44.3	8.2	416	.76	92	.28	1,700	2.69	0	0	105	.08	72.2	36.4
Saline alkaline soil (0.0–4.5 feet) overlying nonsaline alkaline soil [Location: 4 miles south and ½ mile east from northeast corner of T. 2 N., R. 3 E.]																																
30	0.0–1.0	8.1	8.7	9.6	9.6	0.6	0.9	1.5	1.5	0.04	0.08	18	33.3	38.7	28.0	5.64	6.45	26.8	24.0	12.0	760	2.19	34	0.16	2,250	5.64	0	0	281	0.27	70.6	57.6
31	1.0–3.5	8.4	9.2	10.0	10.0	.8	.8	1.6	1.6	0	0	28	43.3	27.0	29.7	5.96	9.00	28.2	31.9	9.5	448	1.31	34	.16	2,359	5.96	0	0	214	.20	80.2	58.3
32	3.5–4.5	8.1	9.6	9.6	9.6	1.5	0	1.5	1.5	.28	.28	15	74.5	12.2	13.3	1.42	2.75	14.3	19.2	5.0	232	.38	24	.07	1,010	1.42	0	0	177	.09	76.3	32.3
33	4.5–14.5	7.9	9.8	9.8	9.8	1.9	0	1.9	1.9	.32	.24	22	63.0	18.8	18.2	.87	3.30	18.8	17.5	2.6	56	.11	15	.05	520	.87	0	0	201	.13	85.0	38.6
Normal soil underlain by saline soil [Location: ½ mile north and 9 miles east from northeast corner of T. 2 N., R. 3 E.]																																
116	0.0–2.0	8.1	9.5	9.7	9.7	1.4	0.2	1.6	1.6	0.08	0.04	35	30.7	25.8	43.5	0.72	3.98	33.7	11.8	1.1	26	0.10	14	0.08	220	0.72	0	0	268	0.32	79.8	74.8
117	2.0–5.0	7.8	8.5	9.0	9.0	.7	.5	1.2	1.2	.24	.20	25	27.5	22.6	49.9	2.81	2.14	34.8	6.2	4.0	360	1.61	68	.50	725	2.81	0	0	159	.23	57.2	89.2
118	5.0–7.0	7.8	8.7	8.5	8.7	.9	−.2	.7	.9	2.72	------	15	76.3	8.1	15.6	1.52	1.23	13.6	9.0	5.5	432	.84	83	.27	900	1.52	0	0	122	.08	57.9	38.9
119	7.0–	7.9	8.9	9.4	9.4	1.0	.5	1.5	1.5	.32	.28	22	65.0	16.2	18.8	2.93	1.78	14.5	12.3	6.5	472	1.38	107	.51	1,150	2.92	0	0	146	.14	60.8	58.3
120	11.0–12.8	7.9	8.7	9.1	9.1	.8	.4	1.2	1.2	.12	.12	20	58.5	16.2	25.3	3.00	2.39	17.8	13.4	7.0	424	1.15	146	.65	1,275	3.00	0	0	134	.12	62.5	54.2

of the normal arid type, four classes of soils—normal, nonsaline alkaline, saline alkaline, and saline types—are represented in the data collected. All analyses in table 15 were by U. S. Bureau of Reclamation.

In places the soil type differs appreciably within a profile. For example, a normal soil at the surface is immediately underlain in some places by nonsaline alkaline soil; conversely, nonsaline alkaline soil at the surface may be underlain by normal soil. Although either sodium or calcium may be the predominant cation in normal soils, percent sodium that exceeds 60 is common in the four soil types. Differences in the bicarbonate and total cations indicate predominance of strong acid radicals, presumably sulfate.

QUALITY OF WATER IN RELATION TO USE

DOMESTIC USE

The United States Public Health Service (1946) recommends the following maximum concentrations of chemical constituents in water to be used for drinking purposes on common carriers:

Constituent	*Maximum concentration (ppm)*	*Constituent*	*Maximum concentration (ppm)*
Iron and manganese together	0.3	Fluoride	[1]1.5
Magnesium	125	Chloride	250
Sulfate	250	Dissolved solids	[2]500

[1] Mandatory upper limit.
[2] Where water of this quality is not available, 1,000 ppm is permitted.

These standards, together with other sanitary, chemical, and biological requirements, are applicable primarily to interstate commerce but can be used also in evaluating the suitability of a water for private and public supplies. Many supplies in the area are of higher mineral content than desirable; sulfate and iron are the principal constituents that exceed the standards.

Many domestic wells in the Midvale irrigation district and in the newly opened tracts, particularly those drawing water from shallow sources, yield water in which the hardness exceeds 200 ppm. Such supplies, in addition to their scale-forming characteristics, are of economic significance to the consumer because of added soap costs. Fluoride, which reduces tooth decay if present in quantities of about 1.0 ppm but which may promote dental mottling if present in quantities of more than about 1.5 ppm (Dean, 1936), is higher than desirable in some of the supplies from both shallow and deep sources throughout the area. In the Muddy Creek terrace area the leaching effect of irrigation water probably will maintain, temporarily at least, a somewhat high concentration of fluoride in shallow sources of water. Many ground-water supplies in the report area are high in iron. Although several parts per million of iron may be in solution as iron bicarbonate in the ground water, oxidation of the iron to ferric hydroxide and subsequent precipitation occur when the water is exposed to air.

Water containing minerals in excess of the recommended standards often is used for drinking as well as other purposes. Many consumers in the Riverton area have become accustomed to the saline properties of the water and now find less mineralized water somewhat less palatable. However, the water from several of the wells that were sampled, particularly the water having excessive concentrations of dissolved solids, is used only for the watering of stock and fowl.

IRRIGATION USE

A small but definite amount of boron in either the soil or the irrigation water is essential for satisfactory crop growth, but for certain crops a toxic effect results from too great an amount of boron in the irrigation water. Water containing more than 2.0 ppm of boron should not be used for the irrigation of crops sensitive to this element. None of the samples of water that were analyzed had troublesome quantities of boron; the maximum was 0.98 ppm.

Wilcox (1948, p. 27) and others have given criteria for classifying irrigation water and have indicated that if the specific conductance is less than 1,000 micromhos, salt probably will not accumulate in the soil, but if the specific conductance is more than 3,000 micromhos, salt is likely to accumulate. Percent sodium also is an index of the suitability of a water for irrigation because a high proportion of sodium in the water generally adversely affects the physical properties of the soil. For most soils the percent sodium of the irrigation water should be less than 60; although for soils having a good structure and permeability, a percent sodium as high as 75 may not cause adverse effects.

Water in the Riverton irrigation project may be rated for supplementary irrigation use on the basis of a diagram devised by Wilcox (1948, p. 26). (See fig. 28.) This diagram is based on the percent sodium and the specific conductance of the water. (See table 9.) The section of the diagram into which a plotted point falls signifies the quality classification of the water.

The analyses of only three samples, all from wells in tracts that have been irrigated for a number of years, rate excellent or good; most of the supplies rate no better than doubtful. The data considered together with analytical results obtained for soils indicate

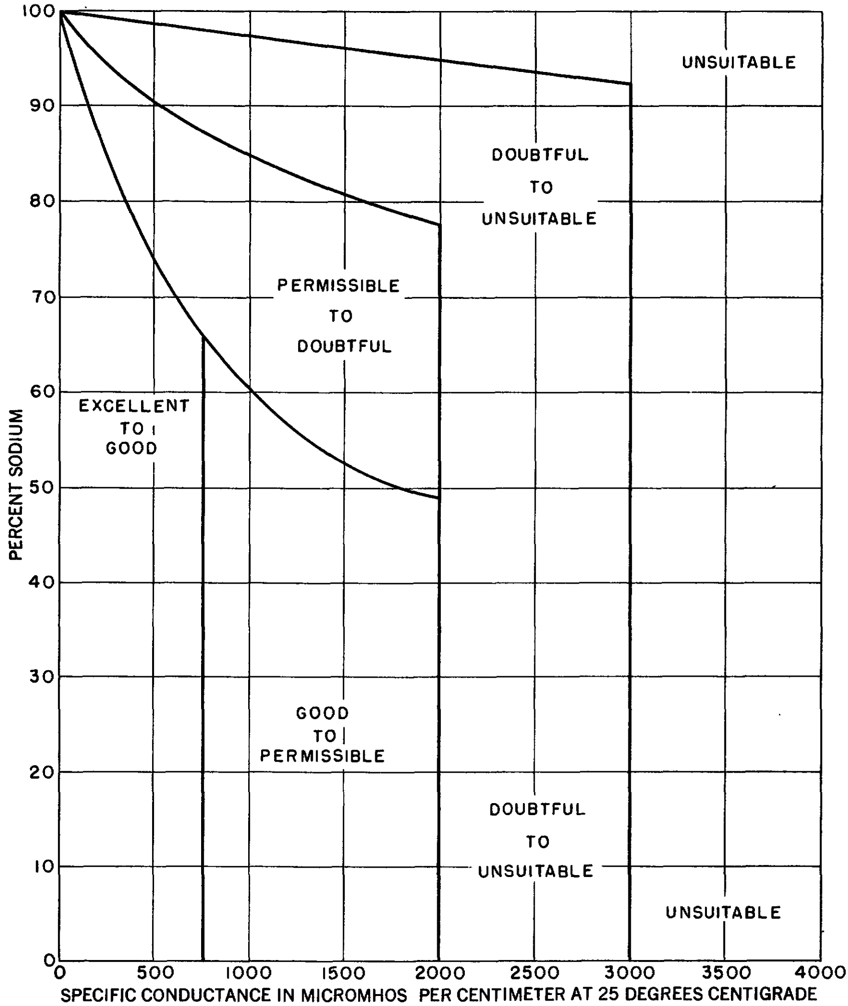

FIGURE 28.—Diagram for use in classifying water for irrigation. After Wilcox.

a generally unsatisfactory supply of ground water for irrigation. Reuse of return irrigation water also should be avoided.

Wilcox points out that the soil, crop, climate, drainage, and management of the soil influence the tolerable quantities of salts in irrigation water; thus, no simple classification is applicable to all conditions.

SUMMARY AND CONCLUSIONS

In the Riverton irrigation project area, ground-water supplies are derived principally from the sandstone beds of the Wind River formation. This source provides the best present and future supply of ground water in the area. Although generally not available in quantities large enough for irrigation, the water yielded by the formation is adequate in quantity and of suitable quality for municipal, domestic, and stock use. Additional sources of satisfactory water from this formation possibly can be obtained at greater depths than now penetrated.

Except where the terrace deposits and the valley alluvium have been recharged for a number of years by seepage from canals and irrigation water or by streamflow, with consequent leaching of salts, most surficial deposits in the report area yield water neither sufficient in quantity nor suitable in quality for domestic or stock use. The continuation and expansion of irrigation will result in the development of ground-water bodies in the terrace deposits along the tributary streams. The quality of the water throughout these aquifers will improve in time if drainage is sufficient to allow the flushing of deleterious salts from them. Wells drilled where the aquifer is recharged by dilute surface water are likely to obtain water of suitable quality. In most places the colluvial-alluvial and alluvial deposits are not potential aquifers because they have low permeability and the water in them is likely to be of poor quality.

Available evidence indicates that, before irrigation, ground water in the surficial materials either was nonexistent or generally was far below the surface and that infiltration from canals and applied irrigation water either has formed a permanent ground-water body or has enlarged one already present. Where the permeability of the surficial materials was great enough to allow the water to move through and be discharged from them, the added recharge caused no great rise of the water table, but where the natural underdrainage was poor, the recharge exceeded the discharge and the water table rose progressively closer to the surface. As shallow ground water generally is highly mineralized, evaporation of the water at or near the surface leaves a concentration of salts that further hinders the drainage of the materials and the use of the land for agriculture. Because most of the surficial materials mantling the report area are poorly drained and because the underlying bedrock is relatively impermeable, serious waterlogging and the accompanying salinization of the soil have occurred or will occur in many places both in the Riverton irrigation project and in adjacent privately irrigated land. Properly designed and strategically located drains would lower the water table in some of the waterlogged areas and, unless the soil has been permanently damaged by the salts, the land again can be cultivated.

However, adequate drainage systems or other measures of improvement can be designed only after the hydrology and geology of the problem areas have been studied in detail. The present general study indicates not only wherein the origin, geologic nature, and physiographic expression of both the surficial materials and the underlying bedrock contribute to these problems but also the factors that should be considered in resolving them.

The area covered by this investigation is subdivisible into several distinct geomorphic units, in each of which the drainage problems are somewhat different.

The lower Wind River terraces, which have been irrigated for several years, are waterlogged in many places along or near the base of slopes between terraces and in some places within the terraces. Waterlogging at the upper margin of a terrace generally is caused by discharge from a higher terrace of ground water or irrigation return flow in quantities too large to be transmitted by the lower terrace. A drain that exposes the full thickness of gravel along the outer terrace edge would intercept the discharge of ground water from that terrace onto the next lower terrace. Terrace T_2, which is waterlogged in the vicinity of Riverton, is likely to become waterlogged in the Hidden Valley area also, because that area is underlain by rather thick and relatively impermeable deposits. As discharge at the terrace edge is retarded and the movement of water within the upper part of the terrace deposits is slow, interception drains penetrating the full thickness of gravel would help alleviate this situation. However, a detailed study should be made to determine the permeability and thickness of the terrace gravel and overlying alluvium and to detect the possible presence of water under hydrostatic pressure in either the terrace deposits or the underlying Wind River formation. If the ground water is confined, the construction of relief wells might be a means of alleviating waterlogging.

The Muddy Creek terraces, which are irrigated to some extent at the present time, possibly will become waterlogged by perched ground water if the sodium-dispersed soil of some of the terraces retards the downward movement of irrigation water into the underlying terrace gravel. After irrigation has been continued for several years, a high water table may cause waterlogging along and near the base of slopes between terraces unless intercepting drains prevent the movement of ground water out of higher terrace deposits into lower terrace deposits. Waterlogging may occur also in the colluvial-alluvial materials, which in places completely mantle the slope between terraces. If these materials retard the flow of ground water from higher to lower terrace deposits, progressive waterlogging will occur near the contact of the colluvial-alluvial material with the higher terrace. Interception drains exposing the full thickness of terrace gravel along the terrace edge would increase the discharge of water from the terrace deposits. At least one line of observation wells along a cross-valley profile should transect each of the eastern, central, and western parts of the terrace system. Measurements of the water level in the wells in irrigated areas will indicate at an early date if the trend is toward high water-table conditions. The possibility of the development of perched bodies of ground water also should be taken into consideration.

The three cross-terrace channels, the eastern one of which contains a series of blowouts now interconnected by Cottonwood drain, will serve as natural ground- and surface-water drains. Measures to prevent gullying may be necessary while the drains adjust to the new conditions of flow.

Problems of erosion along Muddy Creek, similar to those along Fivemile Creek, can be prevented if the discharge of ground water and irrigation return flow from the Muddy Creek terrace system is diverted into drains instead of directly into the creek. If a drain that exposes the entire thickness of gravel along the outer margin of terrace T_3 were constructed parallel to Muddy Creek, it and Cottonwood drain would intercept all the excess surface-water discharge and most of the ground-water discharge resulting from the irrigation of the terraces. Properly designed drop structures would be an essential feature of the new drain. Both drains could discharge into the large closed depression at the lower end of Cottonwood drain and the release of the water from the depression into Muddy Creek could be controlled.

Drainage problems in the terrace systems along Fivemile and Cottonwood Creeks are unlikely because the individual terraces, although similar in many respects to those along Muddy Creek, are small in area and are isolated.

In a large part of the investigated area the Wind River formation is either at the surface or is mantled by only colluvial-alluvial deposits. Wherever the colluvial-alluvial deposits are thin or discontinuous, wherever local irregularities or abrupt changes in the slope of the underlying bedrock surface impede or reduce the lateral movement of water, and wherever the permeability of these deposits and the underlying bedrock is so low that discharge from the deposits is less than recharge to them, drainage problems either have developed already or are likely to develop. After colluvial-alluvial deposits have become waterlogged, it is questionable whether they can be drained effectively. Where waterlogging has not yet occurred, rigid control of water use and reduction of canal losses may forestall waterlogging. In newly irrigated areas, such as the North Portal area, three cross-valley lines of observation wells that penetrate the full thickness of the colluvial-alluvial material should be constructed, and periodic measurements of the water level in the wells should be made in order to foretell any trend toward high water-table conditions. Also, lands proposed for irrigation in the Muddy Ridge extension of the Riverton project should be evaluated according to their drainability. The design and construction of drainage facilities in any area should be preceded by detailed geologic and hydrologic studies.

Waterlogging of the alluvial bottom lands along the Wind River, especially in the eastern part of the area, has been caused primarily by the discharge of ground and surface water from the adjacent terrace. The construction of interception drains at the terrace edge probably would alleviate the condition in areas already waterlogged and prevent the extension of the affected areas. Along the middle and lower parts of Fivemile Creek the irrigation of the valley alluvium or adjacent colluvial-alluvial deposits has caused waterlogging of the alluvium. Because the alluvial deposits are relatively impermeable, these areas possibly could never be well drained. Reduction of the amount of irrigation water applied to the land and reduction of water loss in canals and laterals are probably the most effective means of controlling waterlogging in these areas.

The hydrologic properties of the Wind River formation in the Riverton area were determined by making an aquifer test in the Riverton municipal well field. The transmissibility and storage coefficients of the Wind River formation were computed to be about 10,000 gpd per ft and 2×10^{-4}, respectively. The results of the test, which include a consideration of the effects of boundaries, aid the understanding of present problems in the Riverton well field and make it possible to predict approximately the future performance of the well field, including the expected drawdown interference between wells under different pumping schedules and the distribution of the wells. Records of pumpage and of water-level fluctuations in wells also will be necessary for the most efficient operation of the well field.

Because the geologic and hydrologic conditions in the Wind River formation in the Riverton area are fairly typical of conditions in the Wind River formation throughout the project area, a reasonable estimate of the yield of the formation can be computed for any part of the area for which the thickness of water-bearing sandstone is known.

In some parts of the Riverton irrigation project extensive waterlogging and the resultant deposition of salt on and in the surficial materials are altering the chemical composition and increasing the salinity of the shallow ground waer. The analyses of water from return flow to Ocean drain and Fivemile Creek indicate large amounts of soluble salts in the surficial deposits. The soluble-salt content in the soil in waterlogged areas probably exceeds 0.5 percent in places, and continued saturation of the soil by water containing a high percent sodium is likely to destroy the soil structure. Chemical analyses of soils made by the United States Bureau of Reclamation show that normal arid, saline, saline alkaline, and nonsaline alkaline soils are present in the Midvale irrigation district.

The concentration of dissolved solids in the ground water tends to be variable at shallow depth, but uniformly lower at greater depth. The available analyses indicate that the water from most of the wells that are 300 feet or more deep contains less than 1,000 ppm of dissolved solids. The sulfate content, however, probably exceeds the desired limits unless concentrations of dissolved solids are less than 500 ppm.

In all parts of the area the concentration of dissolved solids in the ground water increases in proportion to the increase in sulfate; the carbonate and chloride concentrations increase very little.

Because of variations in the freshening action of irrigation water from place to place, wells less than 100 feet deep yield water that has a wide range in percent sodium. At depths greater than 100 feet, the percent sodium generally is greater than 80; this fact indicates geochemical alteration and resultant reduction in hardness. The high percent sodium generally will be a limiting factor in the use of ground water and drain water for irrigation.

Sulfate and iron exceed the accepted drinking-water standards in more than half of the ground-water samples collected in the area.

No analyses of the ground water in the area prior to irrigation are available for study. However, the degree of mineralization of the ground water to a depth of 300 feet in the newly irrigated tracts is sufficient evidence of the salinity problems that exist in the area.

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WATER-LEVEL MEASUREMENTS

By measuring at intervals the depth to water in wells, a record of the changes in the amount of ground water in storage can be obtained. Such a record aids in determining the relative effect of the various factors of recharge and discharge to the ground-water reservoir. Measurements were made by the wetted-tape method in 4 wells in 1947, in 83 additional wells in 1948, and in several more wells beginning in 1949 and in 1950. Unless measurements had to be discontinued for some reason, they were made at monthly intervals until late in 1950 or early in 1951. A few wells were measured until the end of 1951. All measurements made by the tape method are given on pages 100 to 124 of table 16.

To obtain a continuous record of water-level fluctuations a water-stage recording gage was installed on 6 of the wells. Daily noon readings were taken from the recorder charts and are given on pages 125 to 130 of table 16.

TABLE 16.—*Water-level measurements, in feet below land-surface datum*

[Measurements made by U.S. Bureau of Reclamation are indicated by an asterisk; all other measurements were made by the U. S. Geological Survey]

Date	Water level	Date	Water level	Date	Water level
		A1–2–2cc			
Mar. 30, 1951	Dry	July 31, 1951	10.41	Oct. 29, 1951	14.07
Apr. 28	Dry	Aug. 28	11.96	Nov. 28	13.45
June 1	Dry	Oct. 1	12.91	Dec. 28	13.50
June 26	13.57				
		A1–2–3da			
Aug. 17, 1948	8.45	Aug. 27, 1949	7.70	May 29, 1950	8.27
Dec. 3	8.55	Sept. 23	7.56	July 11	7.10
Jan. 19, 1949	7.70	Oct. 28	7.98	Aug. 15	7.99
Feb. 10	7.31	Nov. 29	8.25	Aug. 29	8.15
Mar. 9	7.73	Dec. 29	7.91	Sept. 26	7.86
Apr. 5	8.67	Jan. 27, 1950	7.58	Oct. 31	8.43
Apr. 27	8.51	Feb. 28	8.66	Dec. 6	7.72
June 3	8.17	Mar. 27	8.99	Jan. 3, 1951	8.95
July 1	7.75	Apr. 26	9.10	Feb. 2	8.79
Aug. 2	7.46				
		A1–2–4ad			
Aug. 17, 1948	8.72	Aug. 27, 1949	8.04	May 29, 1950	12.71
Dec. 3	12.30	Sept. 23	10.22	July 11	8.66
Jan. 19, 1949	12.53	Oct. 28	11.22	Aug. 15	9.46
Feb. 10	12.61	Nov. 29	11.99	Aug. 29	9.96
Mar. 9	12.77	Dec. 29	12.48	Sept. 26	10.49
Apr. 5	12.60	Jan. 27, 1950	12.78	Oct. 31	11.59
Apr. 27	13.11	Feb. 28	12.95	Dec. 6	12.38
June 3	9.05	Mar. 27	13.30	Jan. 3, 1951	12.74
July 1	10.14	Apr. 26	13.49	Feb. 2	12.82
Aug. 2	6.70				
		A1–2–11aa1			
Aug. 17, 1948	7.57	Sept. 23, 1949	7.02	July 11, 1950	6.87
Dec. 3	8.30	Oct. 28	7.44	Aug. 15	6.70
Jan. 19, 1949	7.98	Nov. 29	7.84	Aug. 29	5.55
Apr. 5	8.70	Dec. 29	8.00	Sept. 26	6.77
Apr. 27	8.32	Jan. 27, 1950	7.55	Oct. 31	7.80
June 3	8.41	Feb. 28	7.71	Dec. 6	7.67
July 1	7.96	Mar. 27	8.08	Jan. 3, 1951	8.03
Aug. 2	7.59	Apr. 26	8.43	Feb. 2	8.21
Aug. 27	6.73	May 29	8.62		
		A1–3–4ab1			
Nov. 17, 1948	37.35	Mar. 9, 1949	37.68	Apr. 27, 1949	37.80
Dec. 1	37.51	Apr. 5	37.76	May 27	37.37
Jan. 12, 1949	37.78				
Feb. 8	37.27				
		A1–3–7ad2			
Aug. 16, 1948	12.05	Aug. 27, 1949	10.39	May 29, 1950	20.34
Dec. 3	16.20	Sept. 23	12.50	July 11	16.53
Jan. 19, 1949	18.13	Oct. 28	14.48	Aug. 15	13.80
Feb. 8	18.94	Nov. 29	15.94	Aug. 29	11.06
Mar. 8	19.83	Dec. 29	17.00	Sept. 26	11.79
Apr. 5	20.17	Jan. 27, 1950	17.89	Oct. 31	14.47
Apr. 27	20.56	Feb. 28	18.84	Dec. 6	16.03
May 27	20.01	Mar. 27	19.48	Jan. 3, 1951	17.13
July 1	16.52	Apr. 26	20.07	Feb. 2	18.12
Aug. 2	12.40				

TABLE 16.—*Water-level measurements, in feet below land surface datum*—Continued

Date	Water level	Date	Water level	Date	Water level
Al-3-7ad3					
Mar. 30, 1951	20.12	July 31, 1951	11.91	Oct. 29, 1951	12.84
Apr. 28	20.84	Aug. 28	9.97	Nov. 28	15.24
June 1	21.02	Oct. 1	11.81	Dec. 28	16.64
June 26	18.10				
Al-3-7dd					
Mar. 30, 1951	14.29	July 31, 1951	8.58	Oct. 29, 1951	11.30
Apr. 28	14.59	Aug. 28	8.34	Nov. 28	12.38
June 1	13.36	Oct. 1	10.02	Dec. 28	13.16
June 26	12.78				
Al-3-16cc					
Aug. 11, 1948	21.42	Aug. 27, 1949	20.18	May 29, 1950	22.30
Dec. 3	19.88	Sept. 23	18.25	July 11	21.78
Jan. 19, 1949	20.93	Oct. 28	18.41	Aug. 15	18.85
Feb. 8	21.30	Nov. 29	19.20	Aug. 29	17.78
Mar. 8	21.66	Dec. 29	19.74	Sept. 26	17.05
Apr. 5	21.89	Jan. 27, 1950	20.10	Oct. 31	18.07
Apr. 27	22.59	Feb. 28	20.57	Dec. 6	18.90
May 27	22.87	Mar. 27	21.08	Jan. 3, 1951	19.51
July 1	22.34	Apr. 26	21.80	Feb. 2	20.38
Aug. 2	21.45				
Al-3-17da					
Apr. 28, 1951	17.11	July 31, 1951	16.42	Oct. 29, 1951	13.94
June 1	17.19	Aug. 28	14.63	Nov. 28	14.65
June 26	17.11	Oct. 1	13.83	Dec. 28	15.13
Al-3-27ad					
Aug. 10, 1948	8.85	Aug. 2, 1949	8.10	May 29, 1950	10.15
Dec. 3	8.87	Sept. 23	8.67	July 11	9.08
Jan. 19, 1949	9.26	Oct. 28	7.15	Aug. 15	1.27
Feb. 8	9.56	Nov. 29	8.05	Aug. 29	3.36
Mar. 8	9.74	Dec. 29	7.92	Sept. 26	7.22
Apr. 5	9.93	Jan. 27, 1950	8.20	Oct. 31	7.73
Apr. 27	10.38	Feb. 28	8.56	Dec. 6	8.11
May 27	9.79	Mar. 27	9.02	Jan. 3, 1951	8.65
July 1	10.80	Apr. 26	9.60	Feb. 2	9.15
Al-3-27bb					
Mar. 30, 1951	6.05	July 31, 1951	4.34	Oct. 29, 1951	4.94
Apr. 28	6.24	Aug. 28	3.65	Nov. 28	5.68
June 1	5.90	Oct. 1	4.75	Dec. 28	6.14
June 26	5.10				
Al-3-35aa					
Aug. 10, 1948	9.73	Sept. 27, 1949	11.42	May 29, 1950	10.60
Dec. 3	9.02	Oct. 10	13.20	July 11	10.80
Apr. 5, 1949	8.92	Nov. 29	14.77	Aug. 15	12.20
Apr. 27	8.83	Dec. 29	13.68	Aug. 29	11.97
May 27	12.33	Feb. 28, 1950	10.85	Sept. 26	12.54
July 1	10.18	Mar. 27	10.40	Oct. 31	11.90
Aug. 2	10.34	Apr. 26	10.81	Jan. 3, 1951	11.62
Aug. 27	[1]6.38				

[1] Well pumped just prior to measurement.

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
		A1-4-1bb			
June 23, 1949	13.87	Dec. 30, 1949	29.02	Apr. 26, 1950	22.29
Aug. 25	10.57	Jan. 30, 1950	22.60	May 29	23.04
Oct. 25	20.78	Mar. 4	22.96	July 6	19.15
Nov. 28	21.62	Mar. 27	24.59		
		A1-4-2dd2			
Jan. 30, 1950	3.90	July 6, 1950	2.35	Oct. 26, 1950	3.33
Mar. 3	4.11	Aug. 3	2.38	Dec. 3	3.44
Mar. 27	4.32	Aug. 26	2.55	Dec. 26	3.92
Apr. 26	4.47	Sept. 27	2.75	Feb. 2, 1951	3.67
May 29	1.61				
		A1-4-3dd			
Oct. 30, 1948	33.90	Aug. 25, 1949	33.00	May 29, 1950	36.92
Dec. 1	37.13	Sept. 23	32.18	July 6	34.04
Mar. 7, 1949	37.22	Oct. 25	34.26	Aug. 3	33.86
Apr. 5	37.45	Nov. 28	34.97	Aug. 26	31.83
Apr. 25	39.64	Mar. 4, 1950	37.03	Sept. 27	34.14
May 27	35.80	Apr. 4	42.38	Oct. 31	34.65
July 1	33.41	Apr. 26	40.97	Dec. 26	35.70
Aug. 1	32.05				
		A1-4-11aa4			
Mar. 30, 1951	11.02	July 30, 1951	6.64	Oct. 26, 1951	7.07
Apr. 28	11.17	Aug. 27	4.64	Nov. 27	8.01
June 4	8.05	Sept. 28	5.82	Dec. 26	8.98
June 26	7.65				
		A1-4-12bb1			
July 15, 1948	6.51	Feb. 8, 1949	10.02	July 1, 1949	7.38
Aug. 8	6.62	Mar. 7	10.43	Aug. 1	6.63
Sept. 23	6.14	Apr. 5	10.69	Aug. 25	5.94
Nov. 10	7.80	Apr. 25	10.60	Sept. 22	6.12
Dec. 1	8.28	May 27	8.34	Oct. 28	7.30
Jan. 11, 1949	9.33				
		A1-4-12cc			
Oct. 21, 1948	16.77	Aug. 1, 1949	15.91	Apr. 26, 1950	20.27
Dec. 1	17.77	Aug. 25	15.06	July 6	17.07
Jan. 11, 1949	18.65	Sept. 22	15.68	Aug. 3	15.73
Feb. 8	19.33	Oct. 28	17.10	Aug. 26	15.03
Mar. 7	19.68	Nov. 28	17.92	Sept. 27	15.72
Apr. 5	20.15	Dec. 30	18.51	Oct. 31	16.97
Apr. 25	20.24	Jan. 30, 1950	21.10	Dec. 6	17.70
May 27	18.43	Mar. 3	19.67	Dec. 26	18.38
July 1	13.57	Mar. 27	19.77	Feb. 2, 1951	18.94
		A1-4-15dd1			
Nov. 17, 1948	5.32	Aug. 25, 1949	5.12	May 29, 1950	5.43
Dec. 1	5.52	Sept. 22	5.14	July 6	4.93
Jan. 11, 1949	5.99	Oct. 24	5.09	Aug. 3	4.50
Feb. 8	6.41	Nov. 28	5.40	Aug. 26	4.97
Mar. 7	6.20	Jan. 3, 1950	5.74	Sept. 27	4.60
Apr. 5	5.97	Jan. 31	6.16	Oct. 31	5.13
Apr. 25	5.93	Mar. 3	6.14	Dec. 6	5.34
May 27	5.22	Mar. 27	6.05	Dec. 26	5.61
July 1	5.39	Apr. 26	6.07	Feb. 2, 1951	6.00
Aug. 1	5.09				

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
A1-4-15dd3					
Mar. 30, 1951	5.63	July 30, 1951	3.72	Oct. 26, 1951	4.91
Apr. 28	5.55	Aug. 27	4.34	Nov. 27	5.21
June 4	5.24	Sept. 28	4.34	Dec. 26	5.56
June 26	4.26				
A1-4-17dd1					
July 7, 1949	6.19	Jan. 31, 1950	11.22	Aug. 3, 1950	5.49
Aug. 1	5.58	Mar. 3	12.88	Aug. 26	4.91
Aug. 25	4.98	Mar. 27	14.34	Sept. 27	6.14
Sept. 22	5.09	Apr. 26	15.45	Oct. 31	8.45
Oct. 28	7.11	May 29	12.40	Dec. 1	9.44
Nov. 28	8.41	July 6	5.86	Dec. 26	10.54
Jan. 3, 1950	9.80				
A1-4-24ca					
July 15, 1948	3.37	July 1, 1949	4.82	Apr. 26, 1950	7.55
Aug. 18	5.11	July 29	5.32	May 29	7.37
Sept. 23	5.90	Aug. 25	5.58	July 6	4.58
Oct. 21	6.65	Sept. 22	5.92	Aug. 3	4.61
Dec. 1	7.08	Oct. 28	6.59	Aug. 26	5.60
Jan. 11, 1949	7.37	Nov. 28	7.02	Sept. 27	6.00
Feb. 8	7.53	Jan. 3, 1950	7.29	Oct. 31	6.73
Mar. 7	7.42	Jan. 30	7.41	Dec. 1	7.13
Apr. 5	7.44	Mar. 3	7.53	Dec. 26	7.34
Apr. 25	7.48	Mar. 27	7.54	Feb. 2, 1951	7.51
May 27	8.04				
A1-4-27ca1					
July 12, 1949	8.90	Sept. 22, 1949	8.63	Nov. 28, 1949	18.14
Aug. 1	6.11	Oct. 28	14.56	Jan. 30, 1950	22.94
Aug. 25	5.60				
A1-4-27cd2					
July 14, 1949	39.12	Aug. 25, 1949	37.05	Oct. 28, 1949	38.35
Aug. 1	37.83	Sept. 22	37.27		
A1-4-28ab					
Mar. 30, 1951	Dry	July 30, 1951	7.23	Oct. 26, 1951	7.72
Apr. 28	Dry	Aug. 27	6.39	Nov. 27	Dry
June 6	Dry	Sept. 28	5.85	Dec. 26	Dry
June 26	Dry				
A1-4-28ba1					
July 8, 1949	13.50	Jan. 31, 1950	16.72	Aug. 3, 1950	14.65
Aug. 1	12.55	Mar. 3	17.87	Aug. 26	10.13
Aug. 25	10.25	Mar. 27	18.71	Sept. 27	11.63
Sept. 22	10.76	Apr. 26	19.70	Oct. 31	13.86
Oct. 28	12.71	May 29	20.03	Dec. 1	15.43
Nov. 28	14.13	July 6	16.20	Dec. 26	15.90
Jan. 3, 1950	14.65				

TABLE 16.—*Water-level measurements, in feet below land-surface datum*
—Continued

Date	Water level	Date	Water level	Date	Water level
A1-4-29bd2 [For measurements by recording gage, see p. 125]					
July 13, 1949	192.67	Jan. 30, 1950	191.05	Aug. 3, 1950	193.22
Aug. 1	193.63	Mar. 1	185.23	Aug. 26	194.10
Aug. 25	187.10	Mar. 27	170.50	Oct. 31	190.90
Sept. 22	194.40	Apr. 26	184.75	Dec. 1	188.59
Oct. 28	203.97	May 29	187.27	Dec. 26	187.68
Nov. 28	191.93	July 6	190.45	Feb. 2, 1951	189.81
Dec. 30	191.65				
A1-4-29cc					
Mar. 30, 1951	4.89	July 31, 1951	2.06	Oct. 29, 1951	4.08
Apr. 28	2.97	Aug. 28	1.43	Nov. 11	4.64
June 1	2.73	Oct. 1	5.35	Dec. 28	5.52
June 26	3.23				
A1-4-32ad					
Aug. 10, 1948	1.98	Aug. 27, 1949	2.00	May 29, 1950	2.80
Dec. 3	3.00	Sept. 23	.94	July 11	2.20
Jan. 19, 1949	5.41	Oct. 28	1.84	Aug. 15	1.88
Feb. 8	6.22	Nov. 29	2.61	Sept. 1	3.30
Mar. 8	5.41	Dec. 29	3.95	Sept. 26	2.30
Apr. 5	4.39	Jan. 27, 1950	4.95	Oct. 31	2.86
Apr. 27	5.02	Feb. 24	5.61	Dec. 1	4.28
May 27	3.07	Mar. 27	5.62	Jan. 3, 1951	5.14
July 1	1.32	Apr. 26	5.30	Feb. 2	6.00
Aug. 2	.90				
A1-4-33dd [No measurements by tape; for measurements by recording gage, see p. 125]					
A1-4-35ac2					
Nov. 17, 1948	6.90	Aug. 25, 1949	8.82	July 6, 1950	8.28
Dec. 1	7.84	Sept. 22	8.55	Aug. 3	8.40
Mar. 7, 1949	8.36	Oct. 28	8.22	Sept. 1	8.16
Apr. 5	8.22	Nov. 28	8.00	Sept. 27	8.50
Apr. 25	8.07	Mar. 3, 1950	8.38	Oct. 31	8.27
May 27	8.41	Mar. 27	8.34	Dec. 6	8.16
July 1	8.60	Apr. 26	8.18	Dec. 26	8.20
July 29	8.77	May 29	8.03		
A2-1-1aa					
*Dec. 12, 1949	4.3	*Aug. 23, 1950	3.4	June 26, 1951	5.84
*Jan. 3, 1950	5.4	*Sept. 26	4.6	July 31	3.38
*Feb. 1	5.9	*Oct. 19	5.2	Aug. 28	3.37
*Mar. 1	6.0	*Nov. 29	5.5	Oct. 1	4.82
*Apr. 18	6.55	*Dec. 20	5.9	Oct. 29	5.48
*May 25	7.15	Mar. 30, 1951	7.20	Nov. 28	5.98
*June 28	4.7	Apr. 28	7.67	Dec. 27	6.57
*July 20	4.7	June 4	8.29		
A2-1-3ac					
Oct. 7, 1948	6.45	Jan. 14, 1949	8.20	Mar. 9, 1949	8.70
Dec. 3	6.60	Feb. 10	8.42		
A2-1-11cb					
Oct. 8, 1948	6.83	Apr. 6, 1948	9.11	Aug. 1, 1949	5.55
Dec. 3	8.37	Apr. 26	9.14	Aug. 27	6.36
Jan. 14, 1949	7.61	June 3	8.65	Sept. 23	8.74
Mar. 9	8.88	July 5	6.10		

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
		A2-2-4dc			
Sept. 20, 1948	6.17	Aug. 27, 1949	8.27	Mar. 27, 1950	7.24
Dec. 3	6.57	Sept. 23	7.90	May 26	7.84
Apr. 6, 1949	6.60	Oct. 31	7.67	May 29	7.94
Apr. 26	6.97	Nov. 29	7.74	July 6	6.27
June 3	8.25	Dec. 29	7.84	Aug. 15	5.58
July 5	7.78	Jan. 27, 1950	7.59	Aug. 29	5.55
Aug. 2	8.61	Feb. 28	7.40		
		A2-2-7ad			
Sept. 21, 1948	11.20	Aug. 2, 1949	13.96	Apr. 26, 1950	23.87
Dec. 3	13.90	Aug. 27	11.31	May 29	21.35
Jan. 14, 1949	17.39	Sept. 23	10.62	July 6	16.97
Feb. 10	18.77	Oct. 31	12.39	Aug. 15	12.52
Mar. 8	20.33	Nov. 29	14.44	Aug. 29	11.55
Apr. 6	22.28	Dec. 29	16.28	Sept. 25	11.20
Apr. 26	23.48	Jan. 27, 1950	17.95	Oct. 30	13.45
June 3	21.00	Feb. 28	19.96	Dec. 6	15.25
July 5	16.97	Mar. 27	21.76	Jan. 3, 1951	16.50
		A2-2-9cc			
*June 9, 1948	3.8	*June 3, 1949	7.0	*June 5, 1950	5.5
*July 7	6.7	*June 17	6.35	*July 3	6.9
*July 21	7.15	*July 1	4.9	*July 28	6.9
*Aug. 4	7.5	*July 18	5.25	*Aug. 31	8.0
*Aug. 18	7.2	*July 28	5.35	*Oct. 28	5.6
*Sept. 1	7.3	*Aug. 8	4.3	*Nov. 27	4.8
*Sept. 15	7.55	*Aug. 23	4.3	*Dec. 28	4.1
*Sept. 29	7.4	*Sept. 5	6.0	Mar. 30, 1951	6.54
*Oct. 13	7.5	*Sept. 22	6.55	Apr. 28	4.27
*Oct. 27	7.8	*Oct. 4	6.75	June 4	3.58
*Nov. 10	7.2	*Oct. 17	7.05	June 26	5.14
*Nov. 24	6.5	*Oct. 31	6.8	July 31	5.42
*Dec. 8	6.8	*Dec. 14	6.8	Aug. 28	6.05
*Jan. 17, 1949	8.0	*Jan. 12, 1950	7.3	Oct. 1	6.82
*Feb. 13	8.6	*Feb. 7	7.8	Oct. 29	6.36
*Mar. 9	8.7	*Mar. 3	8.3	Nov. 28	6.70
*Apr. 8	6.95	*Apr. 21	7.3	Dec. 27	7.45
*May 25	6.8				
		A2-2-10dd			
Sept. 29, 1948	3.88	Aug. 27, 1949	3.05	May 29, 1950	4.48
Dec. 3	4.75	Sept. 23	3.84	July 6	3.89
Jan. 14, 1949	5.77	Oct. 31	4.28	Aug. 15	4.20
Mar. 8	5.59	Nov. 29	4.77	Aug. 29	4.15
Apr. 6	4.44	Dec. 29	5.34	Sept. 25	5.15
Apr. 26	4.26	Jan. 27, 1950	5.75	Oct. 30	5.54
June 3	4.72	Feb. 28	6.02	Dec. 6	5.45
July 5	3.32	Mar. 27	5.49	Jan. 3, 1951	5.47
Aug. 2	3.32	Apr. 26	4.63		
		A2-2-13ad			
July 19, 1948	46.60	Oct. 31, 1949	43.15	Dec. 6, 1950	31.10
Aug. 23	45.96	Nov. 29	41.62	Jan. 3, 1951	30.79
Sept. 23	45.21	Dec. 29	39.42	Mar. 30	31.67
Nov. 10	45.56	Jan. 27, 1950	41.30	Apr. 28	29.77
Dec. 3	45.37	Feb. 28	39.63	June 4	29.70
Jan. 18, 1949	45.96	Mar. 27	36.18	June 26	29.61
Mar. 8	46.00	Apr. 26	34.48	July 30	24.49
May 6	46.02	May 29	34.15	Aug. 27	28.87
May 26	45.75	July 6	33.08	Sept. 28	28.35
June 3	45.54	Aug. 15	31.62	Oct. 26	28.43
July 5	44.82	Aug. 29	31.73	Nov. 27	28.05
Aug. 22	43.80	Sept. 25	31.49	Dec. 26	27.87
Sept. 23	43.10	Oct. 30	31.94		

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

Date	Water level	Date	Water level	Date	Water level
		A2-2-13cc			
July 19, 1948	2.09	Nov. 10, 1948	2.02	Feb. 10, 1949	2.13
Aug. 23	1.24	Dec. 3	2.07	Mar. 8	1.90
Sept. 23	1.39	Jan. 14, 1949	2.44	Apr. 6	1.92
		A2-2-14ad2			
Sept. 29, 1948	4.40	Feb. 10, 1949	4.93	Mar. 8, 1949	4.58
Dec. 3	3.88				
		A2-2-15bb1			
Sept. 27, 1948	17.79	Dec. 3, 1948	23.89	Feb. 10, 1949	30.25
		A2-2-17ad			
Sept. 22, 1948	20.84	Aug. 2, 1949	14.41	Apr. 26, 1950	24.09
Dec. 3	22.35	Aug. 27	14.92	May 29	24.26
Jan. 14, 1949	23.50	Sept. 23	16.45	July 6	21.61
Feb. 10	23.93	Oct. 31	18.87	Aug. 15	15.59
Mar. 8	24.33	Nov. 29	20.18	Aug. 29	16.95
Apr. 6	24.89	Dec. 29	21.08	Sept. 25	18.72
Apr. 26	24.98	Jan. 27, 1950	21.84	Oct. 30	20.35
June 3	25.30	Feb. 28	22.73	Dec. 6	21.40
July 5	16.44	Mar. 27	23.49	Jan. 3, 1951	22.14
		A2-2-17dc			
Sept. 29, 1948	3.97	Aug. 2, 1949	4.13	Apr. 26, 1950	7.94
Dec. 3	3.65	Aug. 27	4.73	May 29	7.98
Jan. 18, 1949	4.11	Sept. 23	6.22	July 11	7.72
Feb. 10	3.98	Oct. 31	7.25	Aug. 15	7.30
Mar. 8	4.06	Nov. 29	7.62	Aug. 29	7.00
Apr. 6	4.08	Dec. 29	7.87	Sept. 25	6.80
Apr. 27	4.28	Jan. 27, 1950	7.60	Oct. 31	7.00
June 3	4.68	Feb. 28	7.65	Dec. 6	7.23
July 5	4.17	Mar. 27	7.52	Jan. 3, 1951	6.70
		A2-2-22aa			
Sept. 27, 1948	7.20	Aug. 2, 1949	5.87	Apr. 26, 1950	48.90
Dec. 3	29.70	Aug. 27	6.03	May 29	11.58
Jan. 14, 1949	47.30	Sept. 23	7.12	July 6	6.77
Feb. 10	47.74	Oct. 31	20.27	Aug. 15	6.08
Mar. 8	48.09	Nov. 29	41.98	Aug. 29	6.14
Apr. 6	48.56	Dec. 29	46.31	Sept. 25	8.11
Apr. 26	49.62	Jan. 27, 1950	47.30	Oct. 30	21.95
June 3	8.90	Feb. 28	47.65	Dec. 6	38.45
July 5	8.40	Mar. 27	48.16	Jan. 3, 1951	46.36
		A2-2-23aa			
*Apr. 28, 1948	Dry	*Mar. 9, 1949	6.3	*July 3, 1950	5.75
*May 12	10.2	*Apr. 13	6.1	*July 28	4.25
*May 26	5.1	*July 18	2.95	*Aug. 31	5.65
*July 7	5.1	*July 28	1.55	*Oct. 27	6.6
*July 21	4.6	*Aug. 8	1.4	*Nov. 28	6.6
*Aug. 4	4.05	*Aug. 23	1.35	*Dec. 28	7.2
*Aug. 18	1.85	*Sept. 5	3.2	Mar. 30, 1951	6.83
*Sept. 1	4.3	*Sept. 22	3.2	Apr. 28	6.90
*Sept. 15	4.25	*Oct. 4	4.5	June 1	6.93
*Sept. 29	4.95	*Oct. 17	5.1	June 26	4.12
*Oct. 13	5.25	*Oct. 31	5.3	July 31	3.64
*Oct. 27	5.5	*Dec. 14	5.9	Aug. 27	3.47
*Nov. 10	5.7	*Jan. 11, 1950	6.9	Sept. 28	4.64
*Nov. 24	5.9	*Feb. 7	6.7	Oct. 26	5.46
*Dec. 8	5.9	*Mar. 6	6.8	Nov. 28	5.55
*Jan. 14, 1949	6.5	*Apr. 21	6.6	Dec. 27	6.16
*Feb. 13	6.5	*June 1	6.5		

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

Date	Water level	Date	Water level	Date	Water level
A2-2-23ad1					
Sept. 27, 1948	4.09	Aug. 2, 1949	4.35	Apr. 26, 1950	14.97
Dec. 3	8.30	Aug. 27	4.83	May 29	11.09
Jan. 14, 1949	10.94	Sept. 23	4.75	July 6	3.38
Feb. 10	12.10	Oct. 31	6.65	Aug. 15	3.84
Mar. 8	12.79	Nov. 29	8.54	Aug. 29	3.05
Apr. 6	14.28	Dec. 29	10.20	Sept. 25	4.20
Apr. 26	14.63	Jan. 27, 1950	11.55	Oct. 30	7.05
June 3	7.42	Feb. 28	13.03	Dec. 6	9.07
July 5	5.10	Mar. 27	14.01	Jan. 3, 1951	10.64
A2-2-23bd					
Sept. 29, 1948	18.82	Nov. 29, 1949	19.37	Jan. 3, 1951	19.96
Dec. 3	19.01	Dec. 29	19.72	Feb. 2	20.05
Jan. 18, 1949	19.87	Jan. 27, 1950	20.02	Mar. 30	21.51
Feb. 10	20.22	Feb. 28	20.59	Apr. 28	22.24
Mar. 8	20.72	Mar. 27	21.12	June 1	21.85
Apr. 6	21.29	Apr. 26	21.86	June 26	21.11
Apr. 26	21.57	May 29	21.64	July 31	19.92
June 3	21.56	July 11	20.28	Aug. 27	19.07
July 6	20.58	Aug. 15	19.34	Oct. 1	18.72
Aug. 2	19.78	Aug. 29	19.03	Oct. 26	18.94
Aug. 27	19.27	Sept. 25	18.72	Nov. 27	19.18
Sept. 23	18.81	Oct. 31	19.06	Dec. 26	19.63
Oct. 31	18.97	Dec. 6	19.55		
A2-3-3bb					
*Aug. 12, 1948	19.3	*Aug. 8, 1949	10.8	*Sept. 28, 1950	13.8
*Sept. 12	18.1	*Aug. 23	10.95	*Oct. 26	15.6
*Oct. 12	15.6	*Sept. 5	11.2	*Nov. 21	16.3
*Oct. 27	16.1	*Sept. 20	11.65	*Dec. 22	17.2
*Nov. 12	16.9	*Oct. 20	12.5	Mar. 30, 1951	12.14
*Dec. 12	17.8	*Nov. 2	13.55	Apr. 28	17.93
*Feb. 13, 1949	20.4	*Dec. 9	15.60	June 1	18.25
*Mar. 9	21.5	*Jan. 1, 1950	17.4	June 25	19.03
*Apr. 12	21.6	*Feb. 6	18.2	July 31	12.71
*May 19	21.1	*Mar. 3	19.1	Aug. 27	11.76
*June 2	16.4	*Apr. 21	19.7	Sept. 28	12.07
*June 16	11.8	*May 1	19.55	Oct. 26	12.67
*June 30	11.3	*May 30	18.3	Nov. 28	14.34
*July 18	11.3	*June 27	14.4	Dec. 26	15.53
*July 25	11.1	*Aug. 30	14.05		
A2-3-10bc					
Oct. 19, 1948	48.38	Feb. 9, 1949	49.28	Apr. 5, 1949	48.67
Dec. 2	49.00	Mar. 8	48.90	Apr. 26	48.61
Jan. 12, 1949	49.37				
A2-3-22bb					
*Aug. 12, 1948	9.8	*Aug. 8, 1949	24.1	*Sept. 3, 1950	18.2
*Sept. 12	17.1	*Aug. 23	23.2	*Oct. 26	18.2
*Oct. 12	17.75	*Sept. 5	23.5	*Nov. 21	18.5
*Oct. 27	18.4	*Sept. 20	22.8	*Dec. 22	18.34
*Nov. 12	19.1	*Oct. 20	21.35	Mar. 30, 1951	8.28
*Dec. 12	19.6	*Nov. 2	20.9	Apr. 28	15.72
*Feb. 13, 1949	20.8	*Dec. 9	20.3	June 1	16.9
*Mar. 9	21.1	*Jan. 10, 1950	24.7	June 25	17.30
*Apr. 12	21.6	*Feb. 6	20.5	July 31	17.58
*May 19	21.7	*Mar. 3	20.2	Aug. 27	17.58
*June 2	21.75	*Apr. 21	19.9	Sept. 28	17.36
*June 16	21.9	*May 1	19.95	Oct. 26	17.47
*June 30	22.2	*June 30	19.85	Nov. 28	17.49
*July 18	23.6	*July 27	18.9	Dec. 26	17.65
*July 25	23.9	*Aug .20	20.0		

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

Date	Water level	Date	Water level	Date	Water level
		A2-3-33cc			
Dec. 1, 1948	10.01	Aug. 26, 1949	6.67	May 29, 1950	11.19
Jan. 12, 1949	12.03	Sept. 23	6.60	July 6	7.10
Feb. 8	13.03	Oct. 28	8.48	Aug. 15	6.27
Mar. 9	14.20	Nov. 28	9.98	Aug. 26	5.25
Apr. 5	15.10	Jan. 30, 1950	12.80	Sept. 27	6.45
Apr. 27	15.65	Mar. 1	13.74	Oct. 26	8.33
May 27	10.48	Mar. 27	14.40	Dec. 1	11.13
July 1	8.44	Apr. 26	8.98	Dec. 26	11.30
Aug. 2	7.15				
		A2-3-34bc			
*May 26, 1948	1.3	*May 19, 1949	1.6	*May 3, 1950	5.0
*June 9	1.9	*June 2	2.55	*June 25	3.8
*July 7	1.4	*June 17	3.4	*July 25	1.45
*July 21	2.75	*July 1	1.85	*Aug. 30	1.20
*Aug. 4	2.25	*July 18	1.4	*Oct. 27	4.45
*Aug. 18	2.5	*July 27	2.55	*Nov. 27	5.2
*Sept. 1	1.2	*Aug. 8	.75	*Dec. 28	5.2
*Sept. 15	3.3	*Aug. 23	1.45	Mar. 30, 1951	5.72
*Sept. 29	4.15	*Sept. 5	1.7	Apr. 28	4.97
*Oct. 13	4.4	*Sept. 20	3.8	June 1	5.39
*Oct. 27	4.4	*Oct. 17	4.5	June 26	1.37
*Nov. 10	4.7	*Nov. 2	4.1	July 31	1.77
*Nov. 24	5.0	*Dec. 14	4.85	Aug. 27	2.35
*Dec. 8	5.35	*Jan. 11, 1950	6.0	Sept. 28	4.57
*Jan. 14, 1949	6.4	*Feb. 3	6.3	Oct. 26	4.73
*Feb. 13	6.9	*Mar. 21	6.5	Nov. 28	5.15
*Mar. 9	7.2	*Apr. 21	5.9	Dec. 28	5.75
*Apr. 13	4.8				
		A2-3-35ca1			
[Measurements by tape: Nov. 17, 1948, 5.13; Dec. 1, 1948, 5.69. For measurements by recording gage, see p. 126]					
		A2-4-1aa			
June 13, 1949	6.17	Jan. 31, 1950	6.90	Aug. 3, 1950	3.25
Aug. 1	2.50	Mar. 1	7.27	Aug. 26	3.25
Aug. 25	2.20	Mar. 27	7.34	Sept. 27	3.46
Sept. 23	1.02	Apr. 26	7.44	Oct. 26	5.01
Oct. 25	4.89	May 29	6.93	Dec. 3	5.57
Nov. 28	5.73	July 6	3.89	Dec. 26	6.33
Dec. 30	6.32				
		A2-4-2cb			
July 14, 1948	5.54	May 27, 1949	10.99	Mar. 27, 1950	10.28
Aug. 23	5.96	July 5	7.25	Apr. 26	10.60
Sept. 23	7.41	Aug. 1	6.31	May 29	10.98
Oct. 20	8.10	Aug. 25	6.80	July 6	7.48
Dec. 2	8.86	Sept. 22	8.00	Aug. 3	5.67
Jan. 11, 1949	9.79	Oct. 28	8.33	Aug. 26	6.65
Feb. 8	10.21	Nov. 28	8.91	Sept. 27	7.57
Mar. 7	11.30	Dec. 30	9.31	Oct. 26	8.13
Apr. 5	10.32	Jan. 31, 1950	9.98	Dec. 1	8.34
Apr. 27	10.60	Mar. 1	10.40	Dec. 26	9.10
		A2-4-2cc			
July 14, 1948	30.55	May 27, 1949	37.90	Mar. 27, 1950	39.35
Aug. 23	31.05	July 5	30.65	Apr. 26	39.74
Sept. 23	30.89	Aug. 1	28.68	May 29	37.66
Nov. 10	34.08	Aug. 25	28.87	July 6	30.30
Dec. 2	35.09	Sept. 22	30.77	Aug. 3	29.35
Jan. 11, 1949	37.20	Oct. 28	33.10	Aug. 26	28.90
Feb. 8	38.21	Nov. 28	34.36	Sept. 27	31.27
Mar. 7	39.08	Dec. 30	34.94	Oct. 26	32.62
Apr. 5	39.72	Jan. 31, 1950	37.46	Dec. 1	36.40
Apr. 27	39.70	Mar. 1	38.82	Dec. 26	35.76

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
		A2-4-4aa			
*Aug. 10, 1949	6.6	*Mar. 2, 1950	13.5	Apr. 28, 1951	15.06
*Aug. 25	5.3	*May 29	14.4	June 1	12.97
*Sept. 8	4.55	*June 28	8.0	June 26	9.94
*Sept. 23	4.6	*July 21	4.05	July 30	5.01
*Oct. 4	5.05	*Aug. 24	4.7	Aug. 27	3.92
*Oct. 17	5.70	*Sept. 26	4.5	Sept. 28	4.17
*Nov. 2	7.10	*Oct. 20	6.6	Oct. 26	6.33
*Dec. 12	9.75	*Nov. 30	9.4	Nov. 28	8.75
*Jan. 4, 1950	11.50	*Dec. 26	11.2	Dec. 26	10.27
*Feb. 2	12.8	Mar. 30, 1951	14.05		
		A2-4-9dd			
June 13, 1949	7.52	Jan. 31, 1950	9.10	Aug. 3, 1950	4.62
Aug. 1	5.31	Mar. 1	9.43	Aug. 26	5.40
Aug. 25	5.26	Mar. 27	9.26	Sept. 27	6.61
Sept. 23	5.87	Apr. 26	9.24	Oct. 26	6.73
Oct. 25	7.57	May 29	7.60	Dec. 3	8.19
Nov. 28	8.14	July 6	4.81	Dec. 27	8.57
Dec. 30	8.74				
		A2-4-11dc			
July 15, 1948	7.19	May 27, 1949	15.58	Apr. 26, 1950	17.75
Aug. 8	5.73	July 5	9.83	May 29	17.71
Sept. 23	4.94	Aug. 1	6.21	July 6	7.85
Nov. 10	6.55	Aug. 25	4.29	Aug. 3	5.73
Dec. 2	7.96	Sept. 22	4.49	Aug .26	4.95
Jan. 11, 1949	11.08	Oct. 28	5.86	Sept. 27	4.36
Feb. 8	12.97	Nov. 28	8.88	Oct. 26	5.67
Mar. 7	14.35	Dec. 30	14.96	Dec. 1	7.23
Apr. 5	16.27	Jan. 31, 1950	14.86	Dec. 26	9.65
Apr. 27	22.74	Mar. 1	17.10		
		A2-4-14ba			
*Aug. 10, 1949	4.9	*Apr. 22, 1950	14.90	Apr. 28, 1951	18.58
*Aug. 25	3.65	*June 28	10.9	June 1	15.65
*Sept. 8	2.9	*July 25	5.8	June 26	11.84
*Sept. 23	3.8	*Aug. 24	4.65	July 30	6.90
*Oct. 17	5.0	*Sept. 26	3.6	Aug. 27	3.09
*Nov. 2	5.9	*Oct. 20	5.3	Sept. 28	3.71
*Dec. 12	8.55	*Nov. 30	7.9	Oct. 26	5.10
*Jan. 6, 1950	10.70	*Dec. 26	10.0	Nov. 28	7.44
*Feb. 2	13.30	Mar. 30, 1951	16.96	Dec. 26	9.80
*Mar. 2	14.90				
		A2-4-17ad			
July 15, 1948	2.21	May 27, 1949	14.72	Mar. 27, 1950	14.10
Aug. 8	10.65	July 1	13.22	Apr. 26	14.34
Sept. 23	10.87	Aug. 1	9.67	May 29	14.33
Oct. 20	11.54	Aug. 26	9.45	July 6	12.10
Dec. 1	12.22	Sept. 23	10.69	Aug. 3	9.42
Jan. 12, 1949	13.14	Oct. 28	11.85	Aug. 26	10.00
Feb. 8	13.65	Nov. 28	11.85	Sept. 27	10.28
Mar. 8	14.03	Dec. 30	12.50	Oct. 26	11.02
Apr. 6	14.44	Jan. 31, 1950	13.28	Dec. 1	11.58
Apr. 27	14.60	Mar. 1	13.94	Dec. 26	12.50
		A2-4-17bc			
June 7, 1949	6.04	Aug. 26, 1949	1.77	Sept. 23, 1949	2.27
Aug. 1	2.05				

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

A2-4-17da

Date	Water level	Date	Water level	Date	Water level
*July 21, 1948	3.15	*June 15, 1949	4.45	*June 29, 1950	3.2
*Aug. 4	3.15	*June 29	3.85	*July 25	3.65
*Aug. 18	3.3	*July 15	3.55	*Aug. 29	4.1
*Sept. 1	3.65	*July 26	3.9	*Sept. 28	4.5
*Sept. 15	4.6	*Aug. 8	4.05	*Oct. 26	4.45
*Sept. 29	4.5	*Aug. 23	3.95	*Dec. 27	4.9
*Oct. 15	4.85	*Sept. 8	4.4	Mar. 30, 1951	3.37
*Oct. 27	4.7	*Sept. 23	4.25	Apr. 28	3.91
*Nov. 10	4.4	*Oct. 17	4.8	June 1	3.40
*Nov. 24	4.6	*Nov. 2	4.65	June 26	2.52
*Dec. 8	5.2	*Dec. 14	4.8	July 30	3.00
*Jan. 14, 1949	Dry	*Jan. 5, 1950	5.5	Aug. 27	1.97
*Feb. 13	5.9	*Feb. 3	5.8	Sept. 28	3.84
*Mar. 9	5.3	*Mar. 2	5.7	Oct. 26	4.05
*Apr. 12	4.1	*Apr. 22	4.0	Nov. 28	4.57
*May 18	3.4	*May 31	4.2	Dec. 26	4.88
*June 1	3.25				

A2-4-18cd2

Date	Water level	Date	Water level	Date	Water level
*June 9, 1948	2.6	*June 1, 1949	3.2	*May 31, 1950	3.2
*July 21	3.5	*June 15	3.9	*June 29	2.25
*Aug. 4	2.85	*June 29	2.75	*July 26	3.05
*Aug. 18	2.9	*July 15	2.1	*Sept. 26	4.2
*Sept. 1	3.45	*July 27	3.6	*Oct. 26	4.0
*Sept. 15	4.15	*Aug. 8	2.8	*Dec. 27	3.9
*Sept. 29	2.7	*Aug. 23	2.35	Mar. 30, 1951	2.64
*Oct. 13	3.7	*Sept. 5	3.4	Apr. 28	2.68
*Oct. 27	3.7	*Sept. 23	3.9	June 1	1.64
*Nov. 10	3.8	*Oct. 17	3.8	June 26	1.65
*Nov. 24	3.8	*Nov. 2	3.7	July 30	3.04
*Dec. 8	4.7	*Dec. 14	3.8	Aug. 27	1.37
*Jan. 14, 1949	3.9	*Jan. 5, 1950	4.6	Sept. 28	3.56
*Feb. 13	4.0	*Feb. 3	4.4	Oct. 26	3.49
*Mar. 9	2.4	*Mar. 2	4.2	Nov. 28	3.55
*Apr. 12	2.3	*Apr. 22	2.7	Dec. 26	3.88
*May 12	3.5				

A2-4-18dc2

Date	Water level	Date	Water level	Date	Water level
June 6, 1949	1.19	Jan. 31, 1950	2.15	Aug. 3, 1950	2.79
Aug. 1	2.88	Mar. 1	1.74	Aug. 26	2.89
Aug. 26	2.74	Mar. 27	.02	Sept. 27	2.01
Sept. 23	2.44	Apr. 26	1.31	Oct. 26	1.83
Oct. 25	1.57	May 29	1.32	Dec. 3	1.15
Nov. 28	1.49	July 6	1.99	Dec. 27	1.70
Dec. 30	2.36				

A2-4-19cd

Date	Water level	Date	Water level	Date	Water level
*July 21, 1948	4.8	*June 15, 1949	Dry	*June 29, 1950	6.2
*Aug. 4	4.5	*June 30	Dry	*July 25	5.9
*Aug. 18	4.9	*July 15	Dry	*Aug. 29	7.95
*Sept. 1	4.95	*July 27	Dry	*Sept. 28	7.2
*Sept. 15	5.0	*Aug. 8	Dry	*Oct. 26	6.8
*Sept. 29	5.2	*Aug. 23	Dry	*Dec. 27	7.5
*Oct. 13	5.35	*Sept. 5	4.9	Mar. 30, 1951	2.25
*Oct. 27	5.5	*Sept. 23	4.9	Apr. 28	2.84
*Nov. 10	5.8	*Oct. 17	5.0	June 1	3.35
*Nov. 24	5.9	*Nov. 2	5.2	June 26	3.51
*Dec. 8	9.2	*Dec. 14	5.5	July 30	3.54
*Jan. 14, 1949	8.9	*Jan. 1, 1950	6.0	Aug. 29	3.65
*Feb. 13	9.0	*Feb. 3	6.0	Sept. 28	3.75
*Mar. 9	5.6	*Mar. 2	6.0	Oct. 26	3.86
*Apr. 12	5.9	*Apr. 22	6.3	Nov. 28	4.28
*May 12	6.2	*May 31	6.4	Dec. 26	4.27
*June 1	Dry				

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
A2-4-22bc2					
June 8, 1949	44.50	Jan. 31, 1950	41.32	Aug. 3, 1950	30.30
Aug. 1	32.39	Mar. 1	42.97	Aug. 26	27.54
Aug. 25	29.59	Mar. 27	43.40	Sept. 27	29.31
Sept. 23	29.63	Apr. 26	44.54	Oct. 26	33.29
Oct. 25	32.87	May 29	45.31	Dec. 3	36.73
Nov. 28	36.38	July 12	35.10	Dec. 27	39.45
Dec. 30	39.21				
A2-4-26dd1					
June 24, 1949	27.65	Sept. 23, 1949	25.72	Nov. 28, 1949	26.63
July 24	26.42	Oct. 25	25.87	Jan. 3, 1950	27.30
Aug. 25	25.53				
A2-4-30bb					
July 14, 1948	8.81	May 27, 1949	12.82	Mar. 27, 1950	12.75
Aug. 23	10.15	July 1	10.98	Apr. 26	12.95
Sept. 23	9.32	Aug. 1	10.08	May 29	12.79
Oct. 20	10.85	Aug. 26	9.14	July 6	9.55
Dec. 2	11.75	Sept. 23	10.70	Aug. 3	8.85
Jan. 12, 1949	12.19	Oct. 28	11.52	Aug. 26	9.65
Feb. 8	11.99	Nov. 28	11.98	Sept. 27	9.82
Mar. 8	12.00	Dec. 30	12.31	Oct. 31	10.83
Apr. 6	12.44	Jan. 31, 1950	12.67	Dec. 1	11.41
Apr. 27	12.77	Mar. 1	12.86	Dec. 26	12.92
A2-4-36db1					
July 7, 1949	3.54	Jan. 30, 1950	10.50	Aug. 26, 1950	3.97
July 24	1.80	Mar. 3	11.19	Sept. 27	4.55
Aug. 25	2.92	Mar. 27	11.58	Oct. 31	5.05
Sept. 23	5.24	Apr. 26	11.95	Dec. 3	8.10
Oct. 25	6.89	May 29	12.10	Dec. 26	8.13
Nov. 28	8.30	July 6	6.14	Feb. 2, 1951	10.33
Dec. 30	9.38	Aug. 3	2.28		
A2-4-36db2					
Mar. 30, 1951	20.20	Aug. 1, 1951	11.30	Oct. 26, 1951	12.50
Apr. 28	20.40	Aug. 27	8.02	Nov. 27	14.55
June 4	19.12	Sept. 28	10.06	Dec. 26	16.34
June 26	13.70				
A2-5-2ab					
Oct. 10, 1947	60.40	May 27, 1949	60.52	Mar. 27, 1950	63.28
July 16, 1948	60.82	July 5	60.71	Apr. 26	62.43
Aug. 18	61.10	Aug. 1	60.71	May 29	60.21
Sept. 23	64.47	Aug. 25	60.60	July 6	63.40
Oct. 20	64.90	Sept. 23	61.03	Aug. 3	59.98
Dec. 2	65.60	Oct. 25	59.87	Sept. 1	62.28
Feb. 8, 1949	63.72	Nov. 28	63.00	Sept. 27	68.30
Mar. 7	60.81	Dec. 30	61.79	Oct. 31	58.63
Apr. 5	62.39	Jan. 31, 1950	62.40	Dec. 1	66.18
Apr. 25	60.88	Mar. 1	59.26		

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
		A2-5-3ab2			
Oct. 20, 1948	47.33	Sept. 23, 1949	49.15	May 29, 1950	47.36
Dec. 2	46.73	Oct. 25	46.57	July 6	46.95
Mar. 7, 1949	49.43	Nov. 28	46.25	Aug. 3	46.62
Apr. 5	47.08	Dec. 30	46.14	Aug. 26	46.59
Apr. 26	47.95	Jan. 31, 1950	46.58	Sept. 27	46.20
May 27	47.54	Mar. 1	48.35	Oct. 31	46.40
July 5	47.57	Mar. 27	46.96	Dec. 1	46.08
Aug. 1	47.49	Apr. 26	46.43	Dec. 26	45.95
Aug. 25	47.29				
		A2-5-4bb1			
July 15, 1948	21.90	May 27, 1949	22.04	Mar. 27, 1950	22.30
Aug. 23	21.07	July 5	22.30	Apr. 26	22.60
Sept. 23	20.64	Aug. 1	22.21	May 29	22.75
Nov. 10	20.64	Aug. 25	21.94	July 6	22.60
Dec. 2	20.82	Sept. 23	21.77	Aug. 3	22.10
Jan. 11, 1949	21.53	Oct. 25	21.56	Aug. 26	21.90
Feb. 8	21.60	Nov. 28	21.60	Sept. 27	21.51
Mar. 7	21.76	Dec. 30	22.99	Oct. 31	21.56
Apr. 5	21.88	Jan. 31, 1950	22.31	Dec. 1	22.64
Apr. 26	22.02	Mar. 1	22.52	Dec. 26	22.12
		A2-5-5aa3			
*Aug. 23, 1949	2.8	*May 29, 1950	4.95	June 1, 1951	5.76
*Sept. 8	3.55	*June 29	4.7	June 26	4.64
*Sept. 23	3.6	*July 24	3.8	July 30	3.77
*Oct. 17	3.6	*Aug. 25	3.3	Aug. 27	2.74
*Nov. 2	3.8	*Sept. 26	3.1	Sept. 28	2.22
*Dec. 14	4.45	*Oct. 23	3.65	Oct. 26	2.84
*Jan. 6, 1950	5.0	*Dec. 26	5.10	Nov. 27	3.28
*Mar. 1	6.0	Mar. 30, 1951	5.48	Dec. 26	4.22
*Apr. 22	5.95	Apr. 28	5.72		
		A2-5-6ad1 [For measurements by recording gage, see p. 127]			
July 15, 1948	9.08	Dec. 2, 1948	9.75	Apr. 5, 1949	12.32
Aug. 23	6.88	Jan. 11, 1949	10.80	Dec. 1, 1950	9.50
Sept. 23	7.18	Feb. 8	11.22	Dec. 26	10.24
Nov. 10	9.12	Mar. 7	11.81		
		A2-5-20ca			
June 23, 1949	54.56	Jan. 30, 1950	48.70	Aug. 26, 1950	48.05
July 24	50.75	Mar. 3	41.92	Sept. 27	43.95
Aug. 25	46.11	Mar. 27	50.09	Oct. 31	44.07
Sept. 23	43.33	Apr. 26	55.49	Dec. 3	44.18
Oct. 25	43.66	May 29	56.20	Dec. 26	45.72
Nov. 28	44.99	July 6	53.48	Feb. 2, 1951	44.63
Dec. 30	46.90	Aug. 3	50.07		
		A2-5-28ca			
Mar. 30, 1951	13.12	July 30, 1951	4.85	Oct. 26, 1951	7.22
Apr. 28	13.98	Aug. 27	2.39	Nov. 27	8.33
June 4	12.02	Sept. 28	4.83	Dec. 26	10.23
June 26	8.68				

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
A2-5-31cc					
Oct. 21, 1948	0.94	July 29, 1949	1.11	Apr. 26, 1950	1.92
Dec. 1	1.86	Aug. 25	.67	May 29	2.01
Jan. 11, 1949	2.65	Sept. 22	.88	July 6	.75
Feb. 8	2.94	Oct. 28	.65	Aug. 3	.52
Mar. 7	2.12	Nov. 28	1.14	Aug. 26	+.01
Apr. 5	1.57	Dec. 30	2.05	Sept. 27	.37
Apr. 25	2.00	Jan. 30, 1950	2.60	Oct. 31	.71
May 27	2.05	Mar. 3	2.42	Dec. 1	.23
July 1	1.51	Mar. 27	1.96	Dec. 26	1.37
A2-6-18da					
Mar. 30, 1951	14.11	July 30, 1951	7.97	Oct. 26, 1951	8.61
Apr. 28	15.74	Aug. 27	6.61	Nov. 27	10.53
June 4	15.24	Sept. 28	7.14	Dec. 26	10.66
June 26	10.37				
A3-1-13cd					
Mar. 30, 1951	1.53	July 31, 1951	1.48	Oct. 29, 1951	1.75
Apr. 28	1.15	Aug. 28	1.53	Nov. 28	2.12
June 1	.90	Oct. 1	3.17	Dec. 27	2.64
June 26	1.20				
A3-1-13dd2					
Sept. 18, 1948	5.80	Aug. 1, 1949	6.58	Apr. 26, 1950	7.92
Dec. 3	6.70	Aug. 26	6.49	May 29	7.90
Jan. 18, 1949	7.55	Sept. 23	6.65	July 6	6.63
Feb. 9	3.00	Oct. 31	6.68	Aug. 15	5.76
Mar. 9	8.13	Nov. 28	6.82	Aug. 28	5.65
Apr. 6	7.93	Dec. 28	7.27	Sept. 25	5.44
Apr. 26	7.91	Jan. 27, 1950	7.53	Oct. 30	5.82
June 2	7.50	Feb. 28	7.70	Dec. 5	6.53
July 5	6.74	Mar. 27	7.80	Jan. 3, 1951	6.50
A3-1-21ba2					
Aug. 25, 1948	22.32	Aug. 26, 1949	20.77	May 29, 1950	32.11
Dec. 3	27.79	Sept. 23	18.30	July 6	20.98
Jan. 14, 1949	30.51	Oct. 31	23.57	Aug. 15	16.74
Feb. 10	31.23	Nov. 28	26.14	Aug. 28	17.55
Mar. 9	32.10	Dec. 28	28.31	Sept. 25	17.70
Apr. 6	32.85	Jan. 27, 1950	29.56	Oct. 30	23.24
Apr. 26	33.04	Feb. 28	30.63	Dec. 5	26.67
June 2	31.86	Mar. 27	31.27	Jan. 3, 1951	23.07
July 5	23.78	Apr. 26	31.59	Feb. 2	29.41
Aug. 1	20.68				
A3-1-21dd1					
July 16, 1948	19.07	Oct. 31, 1949	20.12	Dec. 5, 1950	21.24
Aug. 8	17.52	Nov. 28	21.33	Jan. 3, 1951	21.80
Sept. 23	17.52	Dec. 28	22.61	Feb. 2	22.75
Oct. 14	19.35	Jan. 27, 1950	23.24	Mar. 30	23.60
Nov. 3	22.02	Feb. 28	23.75	Apr. 28	24.00
Jan. 14, 1949	23.79	Mar. 27	24.05	June 1	17.16
Mar. 9	24.57	Apr. 26	24.58	June 26	16.78
Apr. 6	24.80	May 29	24.40	July 31	13.44
Apr. 26	25.07	July 6	19.89	Aug. 28	13.58
June 2	24.79	Aug. 15	17.16	Oct. 1	15.84
July 5	20.50	Aug. 28	17.23	Oct. 29	17.79
Aug. 1	15.87	Sept. 25	16.89	Nov. 28	19.73
Aug. 26	15.53	Oct. 30	19.52	Dec. 27	19.22
Sept. 23	17.71				

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
A3-1-25bc					
Aug. 27, 1948	14.19	Aug. 26, 1949	12.48	May 29, 1950	21.49
Dec. 3	18.14	Sept. 23	12.25	July 6	14.17
Jan. 18, 1949	20.56	Oct. 31	14.72	Aug. 15	10.90
Feb. 10	21.42	Nov. 28	16.13	Aug. 28	11.09
Mar. 9	21.74	Dec. 28	17.79	Sept. 25	12.37
Apr. 6	22.41	Jan. 27, 1950	18.65	Oct. 30	15.48
Apr. 26	22.91	Feb. 28	19.56	Dec. 5	17.93
June 2	22.95	Mar. 27	20.30	Jan. 3, 1951	18.30
July 5	18.82	Apr. 26	21.35	Feb. 2	20.26
Aug. 1	14.83				
A3-1-26bc1					
Aug. 26, 1948	3.53	Aug. 1, 1949	4.10	May 29, 1950	12.82
Dec. 3	8.35	Aug. 26	4.29	July 6	3.15
Jan. 14, 1949	10.13	Sept. 23	5.98	Aug. 15	4.01
Feb. 10	11.68	Oct. 31	4.75	Aug. 28	3.21
Mar. 9	12.69	Nov. 28	5.80	Sept. 25	3.57
Apr. 6	13.41	Jan. 27, 1950	8.94	Oct. 30	5.27
Apr. 26	13.73	Feb. 28	10.39	Dec. 5	7.26
June 2	9.97	Mar. 27	11.37	Jan. 3, 1951	7.92
July 5	5.16	Apr. 26	12.23		
A3-1-26bd2					
Mar. 30, 1951	11.60	July 31, 1951	3.44	Oct. 29, 1951	5.50
Apr. 28	Dry	Aug. 28	2.70	Nov. 28	7.04
June 1	Dry	Oct. 1	4.63	Dec. 27	8.63
June 26	10.20				
A3-1-28cc2					
Aug. 25, 1948	10.98	Mar. 9, 1949	29.71	Aug. 1, 1949	11.51
Dec. 3	25.46	Apr. 6	30.02	Aug. 26	13.99
Jan. 14, 1949	27.95	May 26	30.52	Sept. 23	20.85
Feb. 10	28.89	July 5	10.04	Oct. 31	24.24
A3-1-34aa					
Aug. 26, 1948	10.62	Aug. 26, 1949	9.51	May 29, 1950	14.49
Dec. 3	13.12	Sept. 23	9.90	July 6	10.75
Jan. 14, 1949	14.38	Oct. 31	12.45	Aug. 15	9.13
Mar. 9	14.90	Nov. 28	13.32	Aug. 28	9.47
Apr. 6	14.62	Dec. 28	14.06	Sept. 25	10.88
Apr. 26	14.48	Jan. 27, 1950	14.50	Oct. 30	12.58
June 2	13.79	Feb. 28	14.80	Dec. 5	13.74
July 5	8.51	Mar. 27	14.80	Jan. 3, 1951	14.33
Aug. 1	8.55	Apr. 26	14.91	Feb. 2	14.46
A3-1-36ad2					
Aug. 29, 1948	15.78	Aug. 26, 1949	15.70	May 29, 1950	16.58
Dec. 3	16.17	Sept. 23	15.48	July 6	15.02
Jan. 18, 1949	17.07	Oct. 31	15.97	Aug. 15	14.99
Feb. 10	17.17	Nov. 28	15.90	Aug. 28	15.25
Mar. 8	17.28	Dec. 28	16.56	Sept. 25	14.61
Apr. 5	17.40	Jan. 27, 1950	16.68	Oct. 30	15.04
Apr. 26	17.29	Feb. 28	16.80	Dec. 5	16.00
June 2	16.63	Mar. 27	16.57	Jan. 3, 1951	15.40
July 5	15.89	Apr. 26	16.74	Feb. 2	16.23
Aug. 1	15.83				

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

Date	Water level	Date	Water level	Date	Water level
A3-2-10db1					
Sept. 14, 1948	62.60	Nov. 28, 1949	57.79	Dec. 5, 1950	56.68
Dec. 2	62.19	Dec. 27	59.19	Jan. 3, 1951	56.55
Jan. 12, 1949	62.99	Jan. 27, 1950	59.50	Mar. 30	57.46
Mar. 8	62.93	Feb. 28	59.70	May 28	58.83
Apr. 6	63.23	Mar. 27	59.64	June 1	54.98
Apr. 26	63.37	Apr. 26	60.26	June 25	57.42
June 2	63.19	May 29	60.60	July 31	56.13
July 5	62.40	July 6	59.74	Aug. 28	55.34
Aug. 1	61.55	Aug. 15	58.27	Oct. 1	54.23
Aug. 26	60.35	Aug. 28	57.60	Oct. 26	54.25
Sept. 23	60.04	Sept. 25	56.60	Nov. 28	54.54
Oct. 31	59.30	Oct. 30	56.03	Dec. 27	55.66
A3-2-14aa2					
Sept. 16, 1948	8.32	Aug. 26, 1949	5.90	May 29, 1950	16.32
Dec. 2	12.14	Sept. 23	8.02	July 6	9.65
Jan. 12, 1949	13.85	Oct. 31	10.15	Aug. 15	9.64
Mar. 8	15.35	Nov. 28	11.36	Aug. 28	7.89
Apr. 6	16.34	Dec. 27	12.60	Sept. 27	6.78
Apr. 26	16.93	Jan. 27, 1950	13.90	Oct. 30	8.89
June 2	8.64	Feb. 28	14.37	Dec. 5	10.68
July 5	5.66	Mar. 27	15.06	Jan. 3, 1951	11.33
Aug. 1	5.17	Apr. 26	15.70		
A3-2-15bb					
*Dec. 12, 1949	26.2	*Aug. 21, 1950	26.3	June 25, 1951	13.51
*Jan. 4, 1950	26.1	*Sept. 26	25.5	July 31	24.01
*Feb. 2	26.9	*Oct. 20	24.8	Aug. 28	23.42
*Mar. 1	26.1	*Nov. 30	24.7	Oct. 1	23.17
*Apr. 18	26.2	*Dec. 21	24.7	Oct. 29	22.63
*May 26	26.1	Mar. 30, 1951	15.68	Nov. 28	23.45
*June 28	26.3	Apr. 28	24.13	Dec. 27	18.80
*July 20	26.1	June 1	24.24		
A3-2-15cc1					
Sept. 17, 1948	6.14	Mar. 8, 1949	13.84	Apr. 26, 1949	14.18
Dec. 2	10.11	Apr. 5	13.97	June 2	9.75
Jan. 12, 1949	12.19				
A3-2-16cc1					
Sept. 3, 1948	10.90	Aug. 1, 1949	10.87	Apr. 26, 1950	14.34
Dec. 2	11.89	Aug. 26	11.04	May 29	14.05
Jan. 12, 1949	14.03	Sept. 23	11.74	July 6	11.04
Feb. 9	14.50	Oct. 31	12.69	Aug. 15	10.78
Mar. 8	14.50	Nov. 28	12.96	Aug. 28	9.08
Apr. 5	14.26	Dec. 27	14.15	Sept. 25	11.27
Apr. 26	14.04	Jan. 27, 1950	14.36	Oct. 30	12.08
June 2	13.41	Feb. 28	14.54	Dec. 5	13.03
July 5	11.16	Mar. 27	14.27	Jan. 3, 1951	13.77
A3-2-17db					
July 16, 1948	19.68	July 5, 1949	19.03	Apr. 26, 1950	30.52
Aug. 8	15.35	Aug. 1	15.31	May 29	32.82
Sept. 23	16.92	Aug. 26	14.45	July 6	20.42
Nov. 10	21.76	Sept. 23	15.95	Aug. 15	8.27
Dec. 2	23.46	Oct. 31	19.13	Aug. 28	12.58
Jan. 12, 1949	26.67	Nov. 28	21.56	Sept. 25	13.90
Mar. 8	29.34	Dec. 28	24.21	Oct. 30	17.18
Apr. 5	30.49	Jan. 27, 1950	26.45	Dec. 5	21.16
Apr. 26	31.28	Feb. 28	28.02	Jan. 3, 1951	23.12
June 2	30.40	Mar. 27	29.08		

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
A3-2-18ba					
*Mar. 1, 1950	1.8	*Oct. 12, 1950	0.6	July 31, 1951	1.13
*Apr. 19	1.5	*Nov. 29	1.1	Aug. 28	1.07
*May 25	1.2	*Dec. 20	1.15	Oct. 1	.32
*June 28	.6	Mar. 30, 1951	3.25	Oct. 29	.39
*July 20	.8	Apr. 28	1.40	Nov. 28	.85
*Aug. 21	.6	June 1	1.09	Dec. 27	1.55
*Sept. 22	.0	June 25	.59		
A3-2-20cd1 [For measurements by recording gage, see p.128-129]					
July 16, 1948	19.67	Feb. 19, 1949	25.07	July 5, 1949	21.00
Aug. 8	16.86	Mar. 8	25.46	Aug. 1	17.69
Sept. 23	16.73	Apr. 6	26.00	Aug. 26	16.49
Nov. 10	20.86	Apr. 26	26.22	Sept. 23	17.25
Dec. 3	21.91	June 2	25.41	Oct. 24	20.24
Jan. 12, 1949	24.17				
A3-2-20cd2					
*Nov. 2, 1949	11.5	*July 20, 1950	8.8	June 1, 1951	16.68
*Dec. 12	13.0	*Aug. 21	8.1	June 26	11.68
*Jan. 4, 1950	14.7	*Sept. 26	8.2	July 31	5.34
*Feb. 2	16.5	*Oct. 19	11.1	Aug. 28	6.63
*Mar. 1	17.0	*Nov. 29	13.4	Oct. 1	7.92
*Apr. 18	18.15	*Dec. 20	14.1	Oct. 29	10.70
*May 26	16.0	Mar. 30, 1951	15.15	Nov. 28	12.39
*June 28	11.25	Apr. 28	18.26	Dec. 26	12.70
A3-2-22cb					
July 16, 1948	15.39	July 5, 1949	16.21	Feb. 28, 1950	18.02
Aug. 8	14.99	Aug. 1	14.61	Mar. 27	17.97
Sept. 23	16.09	Aug. 26	15.44	Apr. 26	18.26
Nov. 10	16.98	Sept. 23	15.75	May 29	18.15
Dec. 2	17.27	Oct. 31	16.77	July 6	16.60
Mar. 8, 1949	18.55	Nov. 28	16.93	Aug. 15	15.60
Apr. 6	18.54	Dec. 28	17.48	Aug. 23	15.29
Apr. 26	18.65	Jan. 27, 1950	17.83	Sept. 27	15.02
June 2	17.75				
A3-2-23ba					
Sept. 17, 1948	4.55	Aug. 1, 1949	4.33	Apr. 26, 1950	4.84
Dec. 2	4.52	Aug. 26	4.55	May 29	5.21
Jan. 12, 1949	4.93	Sept. 23	3.93	July 6	5.15
Feb. 9	5.00	Oct. 24	4.10	Aug. 15	3.50
Mar. 8	4.25	Nov. 28	4.44	Aug. 28	3.75
Apr. 6	4.24	Dec. 27	4.98	Sept. 27	4.00
Apr. 26	4.66	Jan. 27, 1950	5.07	Oct. 30	4.39
June 2	5.20	Feb. 28	4.74	Dec. 5	3.84
July 5	4.30	Mar. 27	4.53	Jan. 3, 1951	4.79
A3-2-23bc					
July 15, 1948	16.44	June 2, 1949	26.58	Mar. 27, 1950	22.59
Aug. 8	12.21	July 5	14.18	Apr. 26	25.00
Sept. 23	12.42	Aug. 1	10.44	May 29	26.02
Nov. 10	16.31	Aug. 26	8.91	Aug. 15	23.29
Dec. 2	18.34	Sept. 23	9.95	Aug. 29	21.97
Jan. 12, 1949	21.68	Oct. 24	11.87	Sept. 27	20.91
Feb. 9	23.39	Nov. 28	14.31	Oct. 30	22.48
Mar. 8	21.20	Dec. 27	17.32	Dec. 5	25.16
Apr. 6	25.39	Jan. 27, 1950	20.05	Jan. 3, 1951	27.06
Apr. 26	26.15	Feb. 28	21.89		

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

A3-2-25aa

Date	Water level	Date	Water level	Date	Water level
July 14, 1948	7.21	June 1, 1949	7.59	Mar. 27, 1950	7.79
Aug. 8	7.41	July 5	7.12	Apr. 26	7.59
Sept. 23	7.94	Aug. 1	7.47	May 29	7.11
Nov. 10	8.46	Aug. 26	6.94	July 6	6.26
Dec. 2	8.29	Sept. 23	7.37	Aug. 15	6.59
Jan. 2, 1949	8.90	Oct. 31	7.65	Aug. 29	8.25
Feb. 9	9.15	Nov. 28	7.36	Sept. 27	7.48
Mar. 8	8.74	Dec. 27	7.84	Oct. 30	7.53
Apr. 6	8.75	Jan. 27, 1950	8.20	Dec. 5	8.24
Apr. 26	8.41	Feb. 28	8.15	Jan. 3, 1951	7.50

A3-2-27ab1

[For measurements by recording gage, see p.130]

Date	Water level	Date	Water level	Date	Water level
July 16, 1948	14.66	June 2, 1949	15.23	Feb. 28, 1951	15.15
Aug. 8	14.32	July 5	13.38	Mar. 27	15.08
Sept. 23	13.96	Aug. 1	14.72	Apr. 26	15.61
Nov. 10	15.52	Aug. 26	14.70	May 29	15.71
Dec. 2	14.94	Sept. 23	14.46	July 6	13.85
Jan. 12, 1949	15.37	Oct. 24	14.46	Aug. 15	13.07
Feb. 9	15.97	Nov. 28	14.69	Aug. 28	13.69
Mar. 8	16.53	Dec. 28	15.10	Sept. 25	13.58
Apr. 6	15.15	Jan. 27, 1951	15.18	Oct. 30	14.00
Apr. 26	14.67				

A3-2-27ab2

Date	Water level	Date	Water level	Date	Water level
*Nov. 2, 1949	3.2	*July 20, 1950	3.8	June 1, 1951	6.80
*Dec. 12	4.1	*Aug. 23	2.8	June 25	5.70
*Jan. 4, 1950	5.2	*Sept. 26	2.1	July 31	2.46
*Feb. 2	6.3	*Oct. 20	2.6	Aug. 28	1.90
*Mar. 1	6.7	*Nov. 30	4.1	Oct. 1	1.06
*Apr. 18	6.6	*Dec. 21	4.6	Oct. 29	1.86
*May 26	7.25	Mar. 30, 1951	6.43	Nov. 28	3.03
*June 28	5.1	Apr. 28	6.88	Dec. 26	4.35

A3-2-28dd

Date	Water level	Date	Water level	Date	Water level
Sept. 1, 1948	12.73	June 2, 1949	16.48	Nov. 28, 1949	15.25
Dec. 2	16.58	July 5	14.81	Dec. 28	16.93
Jan. 12, 1949	17.28	Aug. 1	13.59	Jan. 27, 1950	17.94
Mar. 8	17.81	Aug. 26	11.91	Feb. 28	18.50
Apr. 8	18.48	Sept. 23	14.12	Mar. 27	18.75
Apr. 26	18.02	Oct. 31	14.29		

A3-2-29cd

Date	Water level	Date	Water level	Date	Water level
Sept. 2, 1948	3.02	Aug. 1, 1949	3.32	Apr. 26, 1950	8.74
Dec. 3	5.34	Aug. 26	3.41	May 29	10.60
Jan. 12, 1949	7.31	Sept. 23	3.64	July 6	5.09
Feb. 9	8.92	Oct. 31	4.13	Aug. 15	3.70
Mar. 8	8.93	Nov. 28	5.02	Aug. 28	3.07
Apr. 5	5.65	Dec. 28	6.47	Sept. 25	2.53
Apr. 26	9.77	Jan. 27, 1950	8.01	Oct. 30	4.03
June 2	9.88	Feb. 28	8.79	Dec. 5	5.37
July 5	6.62	Mar. 27	9.60	Jan. 3, 1951	6.51

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
		A3-2-30bb2			
*Nov. 2, 1949	9.6	*Aug. 21, 1950	9.35	June 26, 1951	15.05
*Dec. 12	10.2	*Sept. 26	8.15	July 31	11.88
*Jan. 2, 1950	11.2	*Oct. 19	9.1	Aug. 28	9.56
*Feb. 2	12.6	*Nov. 29	10.9	Oct. 1	8.98
*Apr. 18	14.65	*Dec. 20	11.7	Oct. 29	9.35
*May 25	15.7	Mar. 30, 1951	13.83	Nov. 28	10.28
*June 28	14.0	Apr. 28	14.76	Dec. 27	11.14
*July 20	11.45	June 4	15.45		
		A3-2-31cc			
July 19, 1948	4.62	June 2, 1949	4.95	Mar. 27, 1950	4.75
Aug. 23	5.07	July 5	4.82	Apr. 26	4.99
Sept. 23	5.10	Aug. 1	3.78	May 29	5.03
Nov. 10	4.87	Aug. 26	3.85	July 6	4.20
Dec. 3	4.75	Sept. 23	4.77	Aug. 15	4.81
Jan. 18, 1949	5.04	Oct. 31	3.96	Aug. 28	4.92
Feb. 10	5.15	Nov. 28	4.21	Sept. 25	4.95
Mar. 8	5.07	Dec. 28	4.55	Oct. 30	5.05
Apr. 5	4.80	Jan. 27, 1950	4.71	Dec. 5	5.15
Apr. 26	5.20	Feb. 28	4.79	Jan. 3, 1951	5.22
		A3-2-32dd			
*Dec. 12, 1949	4.4	*Aug. 23, 1950	4.1	June 26, 1951	4.95
*Jan. 3, 1950	4.8	*Sept. 26	3.2	July 31	4.32
*Feb. 1	5.5	*Oct. 20	3.7	Aug. 28	3.68
*Mar. 1	5.6	*Nov. 30	4.3	Oct. 1	4.09
*Apr. 19	5.65	*Dec. 21	5.1	Oct. 29	4.16
*May 25	5.1	Mar. 30, 1951	5.45	Nov. 28	4.51
*June 28	5.6	Apr. 28	5.62	Dec. 27	4.97
*July 28	4.8	June 4	4.41		
		A3-2-33cc			
Sept. 1, 1948	8.07	Aug. 1, 1949	8.36	Apr. 26, 1950	9.61
Dec. 3	8.30	Aug. 26	8.13	May 29	8.65
Jan. 12, 1949	8.85	Sept. 23	7.95	July 6	7.87
Feb. 9	9.11	Oct. 31	8.07	Aug. 15	7.50
Mar. 8	9.07	Nov. 28	8.13	Aug. 28	6.85
Apr. 5	8.89	Dec. 28	8.50	Sept. 25	7.28
Apr. 26	9.25	Jan. 27, 1950	8.80	Oct. 30	8.49
June 2	8.98	Feb. 28	8.87	Dec. 5	8.06
July 5	8.48	Mar. 27	8.77	Jan. 3, 1951	8.09
		A3-3-15cc			
May 9, 1949	17.11	Dec. 30, 1949	15.90	Aug. 3, 1950	14.27
Aug. 2	14.47	Jan. 30, 1950	16.25	Aug. 26	13.70
Aug. 26	13.56	Mar. 1	16.84	Sept. 27	14.42
Sept. 23	14.05	Mar. 27	16.64	Oct. 26	14.72
Oct. 28	14.85	May 29	17.38	Dec. 3	19.69
Nov. 28	15.32	July 6	15.34	Dec. 26	15.91
		A3-3-18dd1			
July 16, 1948	7.39	June 1, 1949	11.47	Mar. 27, 1950	13.69
Aug. 23	6.52	July 5	6.37	Apr. 26	14.09
Sept. 23	6.91	Aug. 3	6.14	May 29	11.88
Nov. 10	10.42	Aug. 25	5.30	July 6	8.04
Dec. 2	11.20	Sept. 23	6.57	Aug. 15	7.26
Jan. 12, 1949	12.95	Oct. 31	9.32	Aug. 29	6.68
Feb. 9	13.90	Nov. 28	10.66	Sept. 27	7.49
Mar. 8	14.27	Dec. 27	11.77	Oct. 30	10.13
Apr. 6	14.76	Jan. 27, 1950	12.74	Dec. 5	11.39
Apr. 26	15.00	Feb. 28	13.36	Jan. 3, 1951	11.90

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
A3-3-21ad2					
Dec. 2, 1948	147.21	Dec. 27, 1949	147.24	Dec. 26, 1950	146.06
Feb. 9, 1949	147.25	Jan. 30, 1950	147.04	Feb. 2, 1951	147.13
Mar. 8	147.13	Mar. 1	147.21	Mar. 30	146.88
Apr. 5	147.22	Mar. 30	146.84	Apr. 28	147.10
Apr. 26	147.45	May 5	147.05	June 26	147.13
June 1	147.28	May 29	147.19	July 31	147.23
July 5	147.22	July 6	146.80	Aug. 27	146.98
Aug. 3	147.87	Aug. 3	147.06	Sept. 28	147.11
Aug. 26	147.26	Aug. 26	147.47	Oct. 26	147.27
Sept. 23	147.33	Oct. 26	146.89	Nov. 28	147.32
Oct. 28	147.24	Dec. 1	146.29	Dec. 26	147.56
Nov. 28	147.15				
A3-3-23bb2					
May 10, 1949	21.96	Sept. 23, 1949	19.25	Nov. 28, 1949	20.73
Aug. 2	19.50	Oct. 25	20.11	Dec. 30	21.00
Aug. 26	19.20				
A3-3-24cc					
Oct. 20, 1948	10.45	Aug. 2, 1949	9.62	Apr. 26, 1950	13.61
Dec. 1	11.57	Aug. 25	9.63	May 29	13.69
Jan. 12, 1949	12.75	Sept. 22	10.09	July 6	12.17
Feb. 9	13.22	Oct. 25	10.86	Aug. 15	11.48
Mar. 8	12.78	Nov. 28	11.48	Aug. 26	11.50
Apr. 5	12.23	Dec. 30	12.39	Sept. 27	11.45
Apr. 26	13.23	Jan. 30, 1950	10.27	Oct. 26	13.04
June 1	11.39	Mar. 1	13.50	Dec. 5	12.51
July 5	10.25	Mar. 27	13.31	Dec. 26	13.50
A3-3-25bb					
*Oct. 4, 1949	8.3	*June 28, 1950	11.3	June 1, 1951	12.51
*Oct. 17	9.2	*July 21	11.05	June 25	11.97
*Nov. 2	9.4	*Aug. 24	11.3	July 31	11.63
*Dec. 12	10.1	*Sept. 26	10.7	Aug. 27	11.01
*Jan. 4, 1950	10.8	*Oct. 20	11.7	Sept. 28	10.23
*Feb. 2	11.9	*Nov. 30	12.3	Oct. 26	11.82
*Mar. 1	12.0	*Dec. 20	12.2	Nov. 28	13.64
*Apr. 21	12.1	Mar. 30, 1951	13.12	Dec. 26	12.98
*May 24	12.05	Apr. 28	13.42		
A3-3-26ab1					
May 16, 1949	8.79	Jan. 30, 1950	9.00	Aug. 3, 1950	9.24
Aug. 2	9.02	Mar. 1	9.09	Aug. 26	9.30
Aug. 26	8.85	Mar. 27	9.24	Sept. 27	9.26
Sept. 23	8.85	Apr. 26	9.20	Oct. 31	9.30
Oct. 25	8.88	May 29	9.23	Dec. 3	9.35
Nov. 28	8.97	July 6	9.28	Dec. 26	9.40
Dec. 30	8.91				
A3-3-26bb					
Nov. 30, 1948	23.96	Jan. 12, 1949	24.20	Feb. 9, 1949	24.25
Dec. 2	23.96				

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

Date	Water level	Date	Water level	Date	Water level
		A3-3-30ab1			
July 14, 1948	2.30	June 1, 1949	6.63	Mar. 27, 1950	8.01
Aug. 8	3.41	July 5	4.44	Apr. 26	7.95
Sept. 23	4.37	Aug. 2	4.60	May 29	7.74
Nov. 10	5.46	Aug. 26	4.59	July 6	3.26
Dec. 2	5.77	Sept. 23	5.20	Aug. 15	3.10
Jan. 12, 1949	6.89	Oct. 31	5.31	Aug. 29	3.62
Feb. 9	7.61	Nov. 28	5.94	Sept. 27	3.75
Mar. 8	7.73	Dec. 27	6.80	Oct. 30	5.05
Apr. 6	7.71	Jan. 27, 1950	7.38	Dec. 5	6.13
Apr. 26	7.62	Mar. 1	7.73	Jan. 3, 1951	6.36
		A3-3-30ab2			
*Oct. 17, 1949	5.2	*July 21, 1950	4.05	June 1, 1951	6.35
*Nov. 2	5.5	*Aug. 24	5.3	June 25	3.77
*Dec. 12	6.1	*Sept. 26	4.55	July 31	3.45
*Jan. 4, 1950	7.4	*Oct. 20	5.25	Aug. 28	4.81
*Feb. 2	7.8	*Nov. 30	5.9	Oct. 1	4.15
*Mar. 2	7.9	*Dec. 20	6.7	Oct. 29	4.98
*Apr. 21	7.5	Mar. 30, 1951	7.61	Nov. 28	5.85
*May 29	7.2	Apr. 28	7.72	Dec. 26	6.69
*June 28	4.35				
		A3-3-34bb			
*Aug. 12, 1948	7.4	*Aug. 8, 1949	7.2	*Sept. 28, 1950	7.0
*Sept. 12	7.5	*Aug. 23	6.75	*Oct. 26	6.8
*Oct. 12	7.7	*Sept. 5	6.6	*Nov. 21	6.7
*Oct. 27	7.2	*Sept. 20	6.6	*Dec. 22	7.2
*Nov. 12	7.9	*Oct. 20	6.75	Mar. 30, 1951	6.42
*Dec. 12	7.85	*Nov. 2	7.05	Apr. 28	6.42
*Feb. 13, 1949	7.8	*Dec. 12	7.05	June 1	7.29
*Mar. 9	7.8	*Jan. 10, 1950	7.3	June 25	6.24
*Apr. 12	7.3	*Feb. 6	7.5	July 31	6.06
*May 19	7.5	*Apr. 21	6.8	Aug. 27	4.44
*June 2	7.45	*June 1	6.65	Sept. 28	5.64
*June 16	7.0	*June 30	6.85	Oct. 26	6.08
*June 30	7.45	*July 27	6.6	Nov. 28	6.02
*July 18	7.2	*Aug. 29	3.6	Dec. 26	6.53
*July 25	7.1				
		A3-3-36ad			
May 16, 1949	13.55	Jan. 30, 1950	13.75	Aug. 3, 1950	6.20
Aug. 2	7.89	Mar. 1	14.66	Aug. 26	7.43
Aug. 26	8.25	Mar. 27	15.07	Sept. 27	7.60
Sept. 23	8.60	Apr. 26	14.93	Oct. 26	9.37
Oct. 25	10.26	May 29	13.89	Dec. 3	10.48
Nov. 28	11.45	July 6	10.40	Dec. 27	11.81
Dec. 30	12.64				
		A3-4-29cc			
July 14, 1948	5.90	June 1, 1949	5.90	Mar. 27, 1950	5.84
Aug. 23	5.56	July 5	5.67	Apr. 26	5.32
Sept. 23	5.16	Aug. 2	5.74	May 29	5.70
Oct. 20	5.30	Aug. 26	6.22	July 6	5.44
Dec. 2	5.79	Sept. 23	5.78	Aug. 15	4.79
Jan. 12, 1949	6.75	Oct. 25	5.20	Aug. 26	5.20
Feb. 9	7.26	Nov. 28	5.42	Sept. 27	5.04
Mar. 8	6.56	Dec. 30	6.23	Oct. 26	5.13
Apr. 5	5.91	Jan. 30, 1950	6.51	Dec. 5	4.92
Apr. 26	5.31	Mar. 1	6.40	Dec. 26	5.71

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
A3-4-30bc1					
June 9, 1949	33.06	Jan. 30, 1950	34.37	Aug. 3, 1950	34.84
Aug. 2	34.01	Mar. 1	34.61	Aug. 26	35.00
Aug. 26	34.17	Mar. 27	34.33	Sept. 27	35.05
Sept. 23	34.20	Apr. 26	34.27	Oct. 26	35.77
Oct. 25	34.50	May 29	34.46	Dec. 3	35.79
Nov. 28	34.66	July 6	34.74	Dec. 26	35.69
Dec. 30	34.18				
A3-4-32ba2					
*Sept. 23, 1949	3.55	*May 29, 1950	8.25	Apr. 28, 1951	8.49
*Oct. 4	4.0	*June 28	5.95	June 1	7.26
*Oct. 17	4.5	*July 21	3.7	June 25	5.01
*Nov. 2	4.95	*Aug. 24	2.9	July 31	3.58
*Dec. 12	5.9	*Sept. 26	3.30	Aug. 27	3.47
*Jan. 4, 1950	6.50	*Oct. 20	4.40	Sept. 28	3.91
*Feb. 2	7.30	*Nov. 30	5.95	Oct. 26	4.44
*Mar. 1	7.80	*Dec. 26	6.35	Nov. 28	5.44
*Apr. 21	8.50	Mar. 30, 1951	8.13	Dec. 26	6.24
A3-4-34bc					
July 15, 1948	53.87	July 5, 1949	53.12	May 29, 1950	55.74
Aug. 23	49.27	Aug. 1	51.76	July 6	51.85
Sept. 23	45.52	Aug. 26	48.94	Aug. 15	47.37
Nov. 10	44.53	Sept. 23	46.64	Aug. 26	45.85
Dec. 1	45.17	Oct. 25	46.58	Sept. 27	45.07
Jan. 12, 1949	47.12	Nov. 28	46.35	Oct. 26	45.78
Feb. 8	47.92	Dec. 30	47.98	Dec. 1	47.16
Mar. 7	49.04	Jan. 30, 1950	49.62	Dec. 26	49.27
Apr. 5	50.65	Mar. 1	51.42	Mar. 30, 1951	53.96
Apr. 26	51.86	Mar. 27	52.26	Apr. 28	55.35
June 1	52.71	Apr. 26	53.81		
A3-4-35dc1					
July 15, 1948	37.53	May 27, 1949	38.08	Mar. 27, 1950	39.49
Aug. 23	36.72	July 5	37.72	Apr. 26	39.36
Sept. 23	36.80	Aug. 1	37.08	May 29	39.06
Nov. 10	38.07	Aug. 25	36.57	July 6	37.24
Dec. 2	37.31	Sept. 23	37.32	Aug. 3	36.07
Jan. 11, 1949	38.40	Oct. 25	37.94	Aug. 26	35.65
Feb. 8	38.73	Nov. 28	38.18	Sept. 27	35.94
Mar. 7	39.41	Dec. 30	38.83	Oct. 31	35.99
Apr. 5	39.07	Jan. 31, 1950	39.42	Dec. 1	36.21
Apr. 27	39.03	Mar. 1	39.80	Dec. 26	37.72
A3-4-36dc					
*Aug. 10, 1949	4.7	*Apr. 22, 1950	4.8	Apr. 28, 1951	4.36
*Aug. 25	4.1	*May 29	5.1	June 1	4.00
*Sept. 8	4.5	*June 28	4.5	June 26	4.32
*Sept. 23	4.7	*July 25	4.75	July 30	4.52
*Oct. 17	5.7	*Aug. 24	4.80	Aug. 27	4.52
*Nov. 2	5.45	*Sept. 26	5.1	Sept. 28	4.90
*Dec. 12	5.6	*Oct. 20	5.25	Oct. 26	4.87
*Jan. 6, 1950	6.4	*Nov. 30	5.15	Nov. 27	4.90
*Feb. 2	6.8	*Dec. 26	5.35	Dec. 26	5.57
*Mar. 1	6.5	Mar. 30, 1951	5.26		

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Date	Water level	Date	Water level	Date	Water level
		A3-5-16da			
Oct. 1, 1947	28.11	Sept. 22, 1949	28.46	Oct. 26, 1950	28.56
July 19, 1948	28.30	Oct. 26	28.44	Dec. 1	28.47
Aug. 18	28.30	Nov. 30	28.35	Dec. 26	28.58
Sept. 23	28.20	Dec. 31	28.40	Feb. 2, 1951	28.86
Oct. 19	28.19	Jan. 30, 1950	28.38	Mar. 30	28.65
Dec. 1	28.34	Feb. 24	28.47	Apr. 28	28.64
Jan. 12, 1949	28.37	Mar. 30	28.40	June 26	28.69
Mar. 7	28.22	May 5	28.44	July 30	28.76
Apr. 5	28.34	May 31	28.57	Aug. 27	28.59
Apr. 25	28.33	July 1	28.50	Sept. 28	28.67
May 27	28.32	Aug. 3	28.51	Oct. 26	28.76
July 1	28.43	Sept. 1	28.68	Nov. 27	28.66
July 29	28.40	Sept. 27	28.50	Dec. 26	28.79
Aug. 25	28.43				
		A3-5-33cc1			
July 15, 1948	5.38	May 27, 1949	5.88	Mar. 27, 1950	7.17
Aug. 23	3.91	July 5	5.95	Apr. 26	7.44
Sept. 23	3.19	Aug. 1	5.06	May 29	7.11
Nov. 10	3.71	Aug. 25	4.76	July 6	6.15
Dec. 2	4.22	Sept. 23	4.65	Aug. 3	5.07
Jan. 11, 1949	5.45	Oct. 25	4.66	Aug. 26	4.72
Feb. 8	4.81	Nov. 28	5.17	Sept. 27	4.43
Mar. 7	5.98	Dec. 30	5.97	Oct. 31	4.88
Apr. 5	6.20	Jan. 31, 1950	6.74	Dec. 1	5.15
Apr. 26	6.49	Mar. 1	7.23	Dec. 26	6.16
		A3-5-36cd			
*Oct. 23, 1950	7.1	June 1, 1950	9.52	Sept. 28, 1951	6.79
Dec. 27	11.7	June 26	6.26	Oct. 26	7.26
*Mar. 30, 1951	9.24	July 30	5.09	Nov. 27	7.69
Apr. 28	9.44	Aug. 27	6.59	Dec. 26	8.23
		A3-6-5ad1			
June 17, 1949	7.58	Apr. 26, 1950	7.45	Mar. 30, 1951	6.65
July 29	10.69	May 31	7.32	Apr. 28	6.88
Aug. 26	10.70	July 6	7.38	June 25	6.62
Sept. 22	9.46	Aug. 3	8.03	July 30	7.38
Oct. 26	8.75	Aug. 26	8.38	Aug. 27	7.83
Nov. 30	8.36	Sept. 27	8.31	Sept. 28	7.95
Dec. 30	8.04	Dec. 3	8.63	Oct. 26	7.55
Jan. 30, 1950	7.69	Dec. 26	7.49	Nov. 27	7.25
Mar. 4	8.47	Jan. 31, 1951	6.97	Dec. 26	6.97
		A4-2-11dd			
July 30, 1951	13.26	Sept. 28, 1951	11.45	Nov. 27, 1951	23.09
Aug. 27	11.33	Oct. 26	18.82	Dec. 27	25.31
		A4-2-29dd			
*Feb. 7, 1950	17.5	*Aug. 17, 1950	7.1	Apr. 28, 1951	15.12
*Mar. 6	17.5	*Sept. 19	6.9	June 1	10.75
*Apr. 24	17.7	*Oct. 17	8.5	June 25	8.02
*May 29	18.25	*Nov. 17	9.6	July 30	7.02
*June 14	16.4	*Dec. 19	11.9	Aug. 28	6.96
*July 5	9.1	Mar. 30, 1951	12.94	Oct. 1	6.94
*July 17	8.05				

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

A4-2-35cc

Date	Water level	Date	Water level	Date	Water level
*May 16, 1949	17.0	*July 5, 1950	18.4	June 1, 1951	12.86
*July 20	17.0	*July 18	18.4	June 25	9.71
*Oct. 31	17.45	*Sept. 19	14.4	July 30	7.22
*Jan. 13, 1950	18.1	*Oct. 18	14.3	Aug. 28	6.51
*Feb. 8	18.4	*Nov. 17	13.7	Oct. 1	5.95
*Mar. 6	18.0	*Dec. 19	14.2	Oct. 29	6.44
*Apr. 24	18.2	Mar. 30, 1951	12.00	Nov. 28	6.99
*May 31	Dry	Apr. 28	13.20	Dec. 27	7.57
*June 14	18.4				

A4-3-5dd

Date	Water level	Date	Water level	Date	Water level
Sept. 28, 1951	11.38	Nov. 27, 1951	15.39	Dec. 27, 1951	16.96
Oct. 26	13.76				

A4-3-11ab

Date	Water level	Date	Water level	Date	Water level
Sept. 30, 1947	71.30	Nov. 2, 1949	71.62	Nov. 30, 1950	72.81
Aug. 18, 1948	71.22	Nov. 30	71.66	Dec. 26	73.04
Sept. 23	71.21	Dec. 27	71.84	Feb. 2, 1951	73.14
Oct. 19	70.76	Jan. 30, 1950	71.94	Mar. 30	73.04
Dec. 1	70.82	Mar. 4	72.09	Apr. 28	73.04
Mar. 7, 1949	71.32	Mar. 30	72.30	June 26	73.23
Apr. 5	71.23	May 5	72.54	July 30	70.71
Apr. 27	71.20	May 31	72.72	Aug. 27	65.03
May 27	71.30	July 1	72.80	Sept. 28	59.43
July 1	71.17	Aug. 3	72.91	Oct. 26	59.68
July 29	70.47	Sept. 1	73.14	Nov. 27	61.68
Aug. 25	70.83	Sept. 27	72.97	Dec. 27	63.38
Sept. 22	70.78	Oct. 26	71.98		

A4-3-18cb

Date	Water level	Date	Water level	Date	Water level
July 30, 1951	7.82	Sept. 28, 1951	5.88	Nov. 27, 1951	22.16
Aug. 27	4.47	Oct. 26	18.84	Dec. 27	22.12

A4-3-31db

Date	Water level	Date	Water level	Date	Water level
*May 31, 1950	26.6	*Sept. 17, 1950	15.5	Oct. 1, 1951	4.34
*June 14	31.1	*Oct. 18	15.3	Oct. 29	4.71
*July 6	29.85	*Nov. 20	13.7	Nov. 28	5.16
*July 18	21.7	*Dec. 20	12.7	Dec. 27	5.73
*Aug. 16	14.3	Aug. 28, 1951	3.80		

A4-5-18dc

Date	Water level	Date	Water level	Date	Water level
Oct. 1, 1947	75.07	Sept. 23, 1949	75.18	Oct. 26, 1950	77.13
July 19, 1948	71.30	Nov. 1	75.86	Nov. 30	77.32
Aug. 18	70.66	Nov. 30	75.84	Dec. 26	77.48
Sept. 23	71.17	Jan. 4, 1950	76.72	Feb. 2, 1951	77.19
Oct. 19	71.06	Jan. 30	75.74	Mar. 30	77.76
Dec. 1	69.68	Feb. 24	75.44	Apr. 28	77.78
Jan. 12, 1949	70.07	Mar. 30	75.59	June 26	77.90
Mar. 7	70.88	May 5	75.90	July 30	78.14
Apr. 5	71.15	May 31	75.99	Aug. 27	78.19
Apr. 27	71.25	July 1	76.49	Sept. 28	78.28
May 27	71.43	Aug. 3	76.50	Oct. 26	78.30
July 1	73.40	Sept. 1	76.70	Nov. 27	78.45
July 29	73.79	Sept. 26	76.70	Dec. 27	78.48
Aug. 25	75.11				

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

B3-1-15dc

Date	Water level	Date	Water level	Date	Water level
Oct. 7, 1948	11.05	Nov. 28, 1949	12.05	Dec. 6, 1950	11.98
Dec. 3	11.58	Dec. 28	13.13	Jan. 3, 1951	12.74
Jan. 14, 1949	13.32	Jan. 30, 1950	13.79	Feb. 2	13.33
Feb. 10	13.07	Feb. 28	14.14	Apr. 28	13.89
Mar. 9	13.15	Mar. 27	14.32	June 1	13.74
Apr. 6	13.60	Apr. 26	14.62	June 26	7.70
Apr. 26	13.91	May 29	13.60	July 31	5.76
June 2	14.34	July 6	8.42	Aug. 29	7.98
July 5	9.41	Aug. 15	7.17	Oct. 1	8.11
Aug. 1	8.98	Aug. 28	8.45	Oct. 29	10.35
Aug. 26	7.71	Sept. 25	6.22	Nov. 28	11.65
Sept. 23	7.60	Oct. 30	9.98	Dec. 27	12.56
Oct. 31	10.72				

B3-1-21bd2

Date	Water level	Date	Water level	Date	Water level
Oct. 7, 1948	4.46	July 5, 1949	4.50	Nov. 28, 1949	4.83
Dec. 3	4.96	Aug. 1	5.00	Dec. 28	5.10
Apr. 6, 1949	4.39	Aug. 26	5.27	Jan. 27, 1950	5.12
Apr. 26	4.58	Sept. 23	3.96	Feb. 28	5.13
June 2	4.51	Oct. 31	4.44	Mar. 27	4.91

B3-1-24cd3

Date	Water level	Date	Water level	Date	Water level
Aug. 24, 1948	2.23	Aug. 26, 1949	1.69	Apr. 26, 1950	Dry
Dec. 3	6.98	Sept. 23	3.34	May 29	Dry
Mar. 9, 1949	Dry	Oct. 31	5.16	July 6	3.50
Apr. 6	Dry	Nov. 28	6.33	Aug. 28	1.67
Apr. 26	Dry	Jan. 27, 1950	Dry	Sept. 25	1.72
June 2	Dry	Feb. 28	Dry	Oct. 30	4.17
July 5	2.25	Mar. 27	Dry	Dec. 6	5.40
Aug. 1	.00				

B3-1-24da

Date	Water level	Date	Water level	Date	Water level
Mar. 30, 1951	Dry	July 30, 1951	2.51	Nov. 28, 1951	6.02
Apr. 28	Dry	Aug. 28	3.38	Dec. 26	Dry
June 25	6.52	Oct. 29	5.70		

B3-2-24bb2

Date	Water level	Date	Water level	Date	Water level
Oct. 6, 1948	5.04	July 5, 1949	4.63	Feb. 28, 1950	4.30
Dec. 3	5.56	Aug. 1	6.40	Mar. 27	4.70
Jan. 14, 1949	2.48	Aug. 26	4.71	Apr. 26	5.80
Feb. 10	2.36	Sept. 23	3.56	May 29	5.17
Mar. 9	2.01	Oct. 31	4.88	July 6	3.65
Apr. 9	3.75	Nov. 28	5.29	Aug. 15	3.92
Apr. 26	4.31	Dec. 28	4.99	Aug. 29	4.00
June 2	4.51	Jan. 27, 1950	4.29	Sept. 25	3.90

D1-4-2bb3

Date	Water level	Date	Water level	Date	Water level
July 14, 1949	14.06	Jan. 31, 1950	14.94	Aug. 3, 1950	15.08
July 29	14.78	Mar. 3	16.50	Sept. 27	15.65
Aug. 25	14.90	Mar. 30	18.21	Oct. 30	16.67
Sept. 22	14.00	May 5	17.61	Dec. 1	17.07
Oct. 28	16.22	May 29	15.60	Dec. 26	17.70
Nov. 28	17.15	July 6	13.80	Feb. 2, 1951	15.91
Dec. 30	14.61				

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

Al-4-29bd2
[Daily noon water level]

Day	1951									
	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	--------	185.00	185.64	187.37	188.83	190.07	191.29	190.08	188.82	186.54
2	--------	185.01	185.88	187.50	188.85	190.11	--------	189.96	188.60	186.36
3	--------	184.94	186.03	187.52	188.99	190.12		189.96	188.55	186.46
4	--------	184.87	186.06	187.53	188.94	190.09	191.41	190.00	188.42	186.33
5	--------	184.92	186.09	187.49	189.05	190.20	191.41	190.08	188.54	186.11
6	--------	184.99	186.20	187.56	189.13	190.29	191.40	190.09	188.52	186.20
7	--------	184.99	186.14	187.58	189.13	190.28	191.38	190.01	188.39	186.40
8	--------	185.04	186.16	187.72	189.21	190.30	191.30	190.01	188.22	186.41
9	--------	184.94	186.31	187.82	189.22	190.38		190.07	188.19	186.38
10	--------	185.16	186.32	187.82	189.29	190.45	--------	189.98	188.16	186.28
11	--------	185.14	186.27	187.78	189.38	190.48	191.05	189.82	187.90	186.11
12	--------	--------	186.19	187.76	189.49	190.53	--------	189.72	187.70	185.98
13	--------	--------	186.33	187.84	189.51	190.57	--------	189.74	187.74	185.85
14	--------	--------	186.45	187.96	189.54	190.70	--------	189.73	187.67	185.99
15	--------	--------	186.61	187.91	189.58	190.73	--------	189.54	187.75	185.90
16	--------	--------	186.67	187.95	189.63	190.68	--------	189.63	187.88	185.76
17	--------	185.07	186.65	187.99	189.70	190.73	--------	189.58	187.73	185.72
18	--------	185.14	--------	188.07	189.68	190.79	190.84	189.71	187.57	185.50
19	--------	185.20	--------	188.09	189.61	190.82	--------	189.52	187.44	185.34
20	--------	--------	--------	--------	189.57	190.96	--------	189.33	187.24	185.46
21	185.05	185.42	--------	188.18	189.63	190.97	--------	189.35	--------	185.50
22	184.91	185.50	187.10	188.24	189.73	190.93	--------	--------	--------	185.39
23	185.10	--------	187.06	188.31	189.79	190.99	--------	189.22	--------	185.50
24	185.09	--------	187.09	188.31	189.76	190.98	--------	189.20	--------	185.39
25	185.01	185.45	187.13	188.44	--------	191.11	190.50	189.19	--------	185.44
26	184.87	185.39	187.20	188.45	--------	191.04	190.55	189.25	--------	185.50
27	184.84	185.51	187.20	188.60	--------	190.99	190.67	189.17	186.97	185.39
28	185.01	185.45	187.22	189.69	--------	191.08	190.40	189.05	186.81	185.18
29	184.93	185.32	187.29	188.80	--------	191.17	190.27	188.85	186.79	185.04
30	184.84	185.35	--------	188.83	--------	191.25	190.22	188.86	186.65	184.95
31	184.91	--------	187.34	--------	190.06	191.31	--------	188.79	--------	185.05

Al-4-33dd
[Daily noon water level]

Day	1951										
	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	-------	34.20	-------	49.78	62.86	69.60	79.72	77.47	65.89	50.36	39.39
2	-------	33.00	-------	49.08	61.01	69.72	80.63	76.07	66.05	49.95	41.21
3	-------	32.99	-------	49.54	59.38	70.80	81.00	74.50	65.95	49.50	41.54
4	-------	34.56	40.35	51.32	57.78	71.60	80.55	73.29	65.67	48.56	41.35
5	-------	33.56	42.40	53.40	56.83	71.79	78.99	73.00	64.35	49.25	40.82
6	39.50	32.66	43.80	55.49	57.06	72.58	78.50	73.59	63.54	47.77	41.49
7	39.00	34.16	43.71	55.91	57.40	73.38	78.81	72.82	62.07	47.27	41.85
8	38.84	34.92	43.79	56.86	58.74	72.02	79.29	71.37	60.79	47.80	41.83
9	38.32	35.01	43.14	57.50	60.93	72.30	79.77	69.65	59.92	47.10	41.86
10	37.70	34.62	43.09	56.34	60.75	73.70	80.02	69.25	59.10	47.90	41.49
11	37.04	34.16	42.64	57.02	61.81	73.60	79.72	69.38	59.07	46.28	42.50
12	36.42	32.82	43.03	58.72	63.76	72.47	79.50	68.94	58.97	46.17	42.39
13	36.23	32.95	-------	59.64	65.04	72.54	78.84	-------	58.79	46.26	43.08
14	36.56	32.49	-------	61.12	66.17	73.10	79.58	-------	58.32	46.45	43.96
15	35.64	31.18	-------	62.58	67.31	71.62	80.22	-------	57.54	45.49	44.62
16	36.25	30.18	-------	61.70	68.08	72.71	80.51	-------	56.78	46.77	44.17
17	35.94	29.59	46.10	60.10	67.54	74.20	81.23	-------	56.68	45.86	43.76
18	36.10	31.24	48.75	59.60	68.32	75.50	82.01	-------	56.92	43.74	42.99
19	36.90	33.10	51.46	-------	69.77	76.50	79.87	68.43	56.70	41.61	43.74
20	35.95	34.69	-------	-------	-------	77.17	80.42	68.70	56.12	-------	43.39
21	36.30	35.95	-------	-------	71.30	77.62	80.90	67.59	55.87	39.25	43.25
22	36.12	-------	49.85	54.43	71.57	75.60	80.35	66.71	54.81	38.15	43.75
23	34.93	36.85	49.25	54.64	69.94	74.70	80.43	65.83	54.08	37.34	44.48
24	34.87	-------	-------	56.40	67.46	75.44	79.80	64.56	53.33	37.27	43.74
25	34.26	-------	50.78	58.15	67.34	76.25	79.90	64.61	52.88	36.64	43.30
26	32.95	-------	50.02	60.26	68.30	77.27	78.75	65.00	54.23	36.54	42.53
27	33.92	-------	50.52	58.82	69.02	77.80	77.90	65.88	53.94	36.71	42.16
28	33.86	-------	50.51	59.89	69.86	78.20	78.76	65.63	53.09	36.09	41.90
29	-------	-------	50.13	61.15	70.04	77.30	78.64	65.82	52.21	38.58	42.60
30	-------	-------	49.68	-------	70.82	78.30	79.43	66.18	51.45	39.08	42.65
31	-------	-------	-------	64.38	-------	78.87	78.69	-------	51.40	-------	42.33

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

A2-3-35ca1
[Daily noon water level]

Day	1949 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	------	------	8.36	8.24	7.08	4.84	3.90	3.70	3.69	[3]3.51	4.25	5.02
2	------	7.44	8.40	8.14	7.13	4.87	3.87	3.66	3.64	3.54	4.34	4.97
3	------	7.41	8.40	8.19	[2]7.12	4.93	3.79	3.64	3.64	3.56	4.34	5.01
4	------	7.43	8.39	8.29	7.17	4.91	3.75	3.60	3.64	3.58	4.36	5.12
5	------	7.39	8.37	8.25	7.35	4.81	3.74	3.60	3.61	3.49	4.41	5.01
6	------	7.48	8.48	8.19	7.47	4.78	3.77	3.60	3.61	3.52	4.39	4.98
7	------	7.43	8.37	8.16	7.24	4.68	3.82	3.57	3.62	3.55	4.30	5.07
8	------	7.65	8.28	8.02	7.06	4.60	3.88	3.55	3.62	3.70	4.15	5.08
9	------	[1]7.81	8.35	8.16	6.99	4.64	3.92	3.56	3.57	3.76	4.14	4.97
10	------	[1]7.93	------	8.26	6.88	4.61	3.87	3.54	3.51	3.66	4.16	4.83
11	------	[1]7.76	------	8.16	6.83	4.51	3.82	3.59	3.49	3.78	4.37	5.02
12	6.97	[1]7.82	------	7.93	6.70	4.45	3.79	3.60	3.56	3.85	4.60	5.24
13	6.85	[1]8.04	------	7.84	6.55	4.41	3.76	3.61	3.63	3.95	4.62	5.39
14	6.72	[1]8.00	------	7.94	6.45	4.42	3.74	3.60	3.63	4.02	4.60	5.53
15	6.65	[1]7.95	------	8.00	6.26	4.35	3.74	3.60	3.60	3.98	4.56	5.46
16	7.10	8.07	8.30	7.86	6.07	4.22	3.62	3.62	3.54	3.92	4.69	5.23
17	7.00	8.14	8.30	7.84	5.90	4.19	3.62	3.62	3.58	3.90	4.72	------
18	7.00	8.13	8.36	7.73	5.99	4.30	3.67	3.61	3.69	3.87	4.70	------
19	6.99	8.12	8.32	7.61	5.92	4.22	3.65	3.62	3.75	4.06	4.61	------
20	7.00	8.23	8.10	7.52	5.78	4.17	3.61	3.66	3.71	4.06	4.70	------
21	7.00	8.31	8.20	7.50	5.73	4.15	3.67	3.65	3.75	4.10	4.78	5.66
22	7.02	8.38	8.19	7.51	5.65	4.06	3.67	3.63	3.78	4.18	4.74	5.75
23	7.14	8.31	8.02	7.51	5.57	4.01	3.64	3.59	3.77	4.26	4.67	5.76
24	7.38	8.38	8.11	7.37	5.54	3.93	3.64	3.64	3.69	4.24	4.70	5.58
25	7.44	8.38	8.17	7.27	5.45	3.87	3.62	3.66	3.62	4.20	4.80	5.79
26	7.41	8.42	8.20	7.34	5.34	3.86	3.60	3.68	3.69	4.15	4.73	5.83
27	[1]7.33	8.47	8.15	7.41	5.21	3.90	3.59	3.71	3.72	4.14	4.71	5.89
28	7.48	8.42	8.19	7.30	5.07	3.89	3.65	3.71	3.70	4.17	4.73	------
29	7.48	------	8.31	7.05	4.97	3.82	3.69	3.69	3.59	4.14	4.95	6.12
30	7.41	------	8.26	7.02	4.95	3.86	3.69	3.73	3.54	4.30	4.94	6.00
31	7.42	------	8.30	------	4.91	------	3.70	3.72	------	4.30	------	6.12

A2-3-35ca1—Continued

Day	1950 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1951 Jan.
1	6.08	7.30	8.16	8.03	7.49	4.37	3.41	3.31	3.47	3.37	4.32	4.71	5.76
2	5.96	7.45	8.04	7.87	7.26	4.34	3.37	3.31	3.52	3.49	4.39	4.87	5.85
3	6.04	7.50	7.94	7.87	7.23	4.41	3.37	3.28	3.53	3.58	4.48	4.97	5.73
4	6.07	7.51	7.98	8.13	7.26	4.29	3.35	3.27	3.51	3.53	4.43	4.93	5.93
5	6.25	7.42	8.00	8.22	7.24	4.17	3.34	------	3.49	------	------	5.30	6.11
6	6.39	7.43	7.71	8.01	7.21	4.04	3.33	------	3.50	------	------	5.24	6.35
7	6.51	7.42	7.97	7.90	7.18	3.94	3.29	------	3.52	------	4.40	5.00	[1]6.42
8	6.30	7.60	8.03	7.77	7.03	3.97	3.25	3.37	3.57	------	4.47	5.16	6.20
9	6.13	7.58	7.93	7.70	6.95	4.05	3.26	3.36	3.52	------	4.69	5.42	6.09
10	6.43	7.54	7.93	7.85	6.88	4.05	3.27	3.36	3.52	------	4.64	5.45	6.21
11	6.41	7.42	7.96	8.00	6.72	3.92	3.28	3.36	3.46	3.79	4.55	5.35	6.09
12	6.46	7.63	8.03	8.00	6.43	3.83	3.34	3.35	3.36	3.82	4.32	5.30	6.19
13	6.43	7.80	8.09	7.85	6.19	3.82	3.34	3.35	3.34	3.82	4.37	5.30	6.39
14	6.38	7.82	8.00	7.72	5.97	3.77	3.27	3.33	3.28	3.82	4.41	5.36	------
15	6.58	7.87	7.95	7.77	5.77	3.77	3.23	3.33	3.24	3.73	4.60	5.45	------
16	6.76	7.81	8.06	7.81	5.68	3.78	3.22	3.35	3.23	3.83	4.79	5.59	6.21
17	6.72	7.80	8.00	7.71	5.57	3.69	3.27	3.39	3.22	3.82	4.73	5.62	6.23
18	6.79	7.93	7.90	7.80	5.33	3.67	3.27	3.38	3.23	3.88	------	5.63	6.25
19	6.93	7.92	8.00	7.89	5.34	3.67	3.28	3.40	3.25	4.01	------	5.58	6.39
20	7.02	7.78	8.00	7.79	5.29	3.63	3.30	3.39	3.25	3.96	------	5.62	------
21	7.02	7.78	8.10	7.62	5.18	3.57	3.34	3.36	3.27	3.93	4.88	5.70	------
22	6.96	7.78	8.06	7.49	5.04	3.47	3.32	3.33	[3]3.25	3.99	4.87	5.68	------
23	6.79	7.71	7.96	7.41	4.91	3.43	3.31	3.29	3.16	3.99	4.95	5.71	6.77
24	6.63	7.76	7.95	7.58	4.90	3.42	3.30	3.32	3.15	4.08	5.00	5.75	6.88
25	6.77	7.91	7.79	7.61	4.97	3.49	3.29	3.36	3.14	4.06	5.00	5.61	6.85
26	7.15	8.04	7.68	7.49	4.89	3.57	3.25	3.42	3.13	4.01	5.02	5.74	------
27	7.21	7.89	7.77	7.51	4.71	3.55	3.21	3.43	3.18	4.01	4.97	5.71	------
28	6.93	8.01	7.98	[2]7.37	4.52	3.55	3.19	3.41	3.25	4.14	5.04	5.71	------
29	7.10	------	8.23	7.60	4.56	3.52	3.17	3.39	3.26	4.19	4.95	5.80	------
30	7.17	------	8.25	7.65	4.50	3.46	3.17	3.40	3.30	4.19	4.83	5.77	------
31	7.22	------	8.11	------	4.51	------	3.23	3.41	------	4.18	------	5.57	------

[1] Reading may be in error.
[2] Opening of irrigation season—water released into canals.
[3] Close of irrigation season—no further release of water into canals.

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

A2-5-6ad1

[Daily noon water level]

Day	1949 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	------	------	------	------	[1]12.72	10.82	7.17	7.12	5.55	[2]6.76	8.38	9.26
2	------	------	------	------	12.72	10.72	------	7.08	5.52	6.83	8.44	9.20
3	------	------	------	------	12.77	10.59	------	7.14	5.60	6.97	8.43	9.38
4	------	------	------	------	12.79	10.42	------	6.91	5.55	6.98	8.51	9.36
5	------	------	------	------	12.93	10.36	------	6.45	5.56	6.94	8.54	9.18
6	------	------	------	------	12.88	10.38	7.04	6.38	5.58	7.11	8.49	9.35
7	------	------	------	------	12.77	10.33	7.03	6.28	5.61	7.17	8.45	9.39
8	------	------	------	------	12.76	10.41	7.02	6.29	5.70	7.40	8.36	9.37
9	------	------	------	------	12.75	10.47	------	6.12	5.67	7.21	8.46	9.26
10	------	------	------	------	12.72	10.46	------	6.15	5.72	7.33	8.50	9.32
11	------	------	------	------	12.71	10.41	------	6.22	5.71	7.47	8.83	9.57
12	------	------	------	------	12.60	10.54	------	6.08	6.11	7.51	8.83	------
13	------	------	------	------	12.58	10.45	7.01	6.00	6.03	7.67	8.76	------
14	------	------	------	------	12.51	10.47	7.02	------	6.04	7.66	8.77	9.65
15	------	------	------	------	12.44	10.34	7.02	------	6.12	7.59	8.82	9.56
16	------	------	------	------	12.36	10.22	------	------	6.06	7.62	8.93	9.47
17	------	------	------	------	12.35	10.19	------	------	6.35	7.64	8.90	9.62
18	------	------	------	------	12.45	10.08	7.12	5.82	6.45	7.79	8.86	9.71
19	------	------	------	------	12.35	9.67	7.00	5.88	6.40	7.88	8.82	9.66
20	------	------	------	------	12.24	9.50	6.96	5.94	6.39	7.83	9.01	9.76
21	------	------	------	12.59	12.27	9.15	7.06	5.91	6.49	7.96	8.97	9.85
22	------	------	------	12.69	12.14	9.00	6.94	5.76	6.49	8.01	8.97	9.79
23	------	------	------	12.63	12.06	8.81	6.96	5.37	6.44	8.07	8.90	9.85
24	------	------	------	12.62	11.90	8.58	6.97	5.39	6.41	7.99	9.03	9.69
25	------	------	------	12.67	11.66	8.54	7.03	5.39	6.44	8.04	9.00	9.92
26	------	------	------	12.73	11.64	8.47	7.04	5.40	6.63	8.05	9.01	9.94
27	------	------	------	12.70	11.45	8.14	7.07	5.51	6.61	8.13	8.99	9.97
28	------	------	------	12.64	11.31	7.85	7.18	5.54	6.61	8.14	9.16	10.03
29	------	------	------	12.53	11.19	7.60	7.08	5.65	6.55	8.21	9.30	------
30	------	------	------	12.39	11.14	7.51	7.07	5.66	6.64	8.35	9.14	------
31	------	------	------	------	10.96	------	7.10	5.69	------	8.29	------	------

A2-5-6ad1—Continued

Day	1950 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	------	------	11.46	11.84	------	11.76	9.25	7.07	6.26	6.94	8.55	------
2	------	------	11.29	11.86	12.29	11.90	9.23	7.02	6.10	7.11	8.75	------
3	------	------	11.40	12.02	12.35	11.75	9.10	6.71	5.80	7.25	8.64	------
4	------	------	11.44	12.10	12.39	11.67	9.00	6.66	------	7.04	8.60	------
5	------	------	11.41	12.00	12.40	11.58	8.97	6.55	5.04	7.04	8.58	------
6	------	------	11.26	11.89	12.47	11.47	8.87	6.62	5.21	7.24	8.74	------
7	------	------	11.56	11.94	12.46	11.43	8.79	6.60	5.41	7.45	8.72	------
8	------	10.96	11.46	11.93	12.47	11.45	8.79	6.53	------	7.35	8.92	------
9	------	10.93	11.49	11.96	12.50	11.41	8.78	------	------	7.37	9.05	------
10	------	10.94	11.49	12.18	12.56	11.26	8.73	------	------	7.51	------	------
11	------	10.93	11.58	12.18	12.56	11.11	8.74	------	------	7.61	------	------
12	------	11.12	11.61	12.14	12.49	11.06	8.82	------	5.69	7.61	------	------
13	------	11.08	11.54	12.08	12.42	10.98	8.62	------	------	7.66	------	------
14	------	11.11	11.55	12.08	12.38	10.83	8.47	------	------	7.63	8.86	------
15	------	11.13	11.61	12.18	12.34	10.77	8.37	6.78	------	7.68	9.19	------
16	------	11.10	11.67	12.18	12.38	10.57	8.30	6.76	------	7.78	9.06	------
17	------	11.14	11.60	------	12.28	10.32	8.10	6.77	------	7.82	------	------
18	10.50	11.19	11.74	12.37	12.20	10.22	7.68	6.62	------	7.93	------	------
19	10.35	11.15	11.70	12.32	12.20	10.05	7.23	6.67	6.26	7.96	------	------
20	10.60	11.10	11.80	12.21	12.21	10.00	7.21	6.52	6.33	7.91	------	------
21	10.53	11.19	11.76	12.23	12.13	9.80	7.16	6.48	6.26	7.95	------	------
22	10.52	11.18	11.67	------	12.07	9.67	7.14	6.57	(2)	8.08	------	------
23	10.34	11.22	11.80	------	12.03	9.60	7.12	6.60	------	8.05	------	------
24	10.52	11.26	11.74	------	12.11	------	7.04	6.57	------	8.17	------	------
25	10.65	11.33	11.64	12.17	12.16	------	7.00	6.44	------	8.13	------	------
26	10.79	11.34	11.77	12.33	12.03	------	6.94	6.47	------	8.22	------	------
27	10.65	11.22	11.72	------	11.93	9.57	6.95	6.33	------	8.18	------	------
28	10.62	11.42	11.95	(1)	11.93	9.49	6.99	6.38	6.71	8.34	------	------
29	------	------	12.02	------	11.94	9.42	7.03	6.30	6.78	8.38	------	------
30	------	------	11.88	------	11.95	9.36	7.04	6.25	6.88	8.37	------	------
31	------	------	11.93	------	11.92	------	7.17	6.24	------	8.46	------	------

[1] Opening of irrigation season—water released into canals.
[2] Close of irrigation season—no further release of water into canals.

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

Day	1949 Oct.	1949 Nov.	1949 Dec.	1950 Jan.	1950 Feb.	1950 Mar.	1950 Apr.	1950 May	1950 June	1950 July	1950 Aug.	1950 Sept.	1950 Oct.	1950 Nov.	1950 Dec.
A3-2-20cd1 [Daily noon water level]															
1	--------	20.82	22.48	23.51	24.86	25.74	25.84	26.00	24.72	21.70	18.43	17.82	18.68	21.49	22.27
2	--------	20.98	22.34	23.42	24.98	25.35	25.72	25.98	24.99	21.66	18.27	17.80	19.10	21.81	22.72
3	--------	20.97	22.62	23.57	25.05	25.42	26.02	26.07	25.01	21.55	18.14	17.73	19.33	21.83	22.67
4	--------	--------	22.71	23.65	24.91	25.51	26.35	26.18	24.69	21.41	18.12	17.64	19.05	21.65	22.65
5	--------	--------	22.34	23.89	24.90	25.34	26.22	26.22	24.45	21.31	17.93	17.68	18.98	21.37	23.40
6	--------	--------	22.72	24.12	24.81	25.10	25.91	26.34	24.08	21.17	17.90	17.66	19.09	21.61	23.09
7	--------	--------	22.62	24.04	24.98	25.70	25.98	26.35	23.90	20.94	17.91	17.76	19.62	21.60	22.73
8	--------	--------	22.58	23.71	25.11	25.53	25.78	26.31	24.08	20.82	17.95	17.77	19.68	21.88	23.21
9	--------	--------	22.26	23.56	24.98	25.50	25.76	26.39	24.08	20.74	17.95	17.60	19.52	21.32	23.64
10	--------	--------	22.17	24.08	24.93	25.50	26.27	26.49	23.92	20.55	18.00	17.81	19.77	--------	23.44
11	--------	--------	22.69	23.82	24.77	25.63	26.35	26.45	23.55	20.49	17.99	17.74	20.00	--------	23.32
12	--------	--------	22.86	23.95	25.26	25.73	26.27	26.26	23.43	20.63	17.95	17.67	20.05	--------	23.21
13	--------	--------	23.19	23.99	25.27	25.62	26.08	26.14	23.43	20.30	17.94	17.86	20.10	--------	23.18
14	--------	--------	23.20	23.65	25.28	25.58	25.99	26.08	23.23	19.97	17.88	17.72	20.05	21.59	23.34
15	--------	--------	22.98	24.22	25.33	25.63	26.21	25.94	23.33	19.81	17.94	17.71	20.00	22.21	23.47
16	--------	--------	22.58	24.27	25.23	25.76	26.24	26.07	23.27	19.75	18.00	17.84	20.30	22.24	23.71
17	--------	21.95	22.75	24.34	25.32	25.57	25.99	25.86	22.96	19.67	18.03	17.81	20.28	22.14	23.68
18	--------	21.85	22.98	24.34	25.40	25.76	26.39	25.70	23.00	19.57	17.90	17.96	20.50	21.75	23.69
19	--------	21.66	22.85	24.54	25.24	25.69	26.39	25.79	22.89	19.44	17.97	17.98	20.74	22.01	23.56
20	--------	22.01	23.12	24.67	24.97	25.87	26.12	25.84	22.78	19.46	17.84	18.09	20.55	22.45	23.74
21	--------	22.00	23.29	24.52	25.27	25.88	26.02	25.70	22.47	19.33	17.74	18.19	20.59	22.50	23.87
22	--------	21.94	23.24	24.41	25.17	25.66	25.83	25.54	22.19	19.08	17.68	[2]17.93	20.80	22.44	23.75
23	--------	21.77	23.35	23.96	25.15	25.88	25.81	25.41	22.10	18.99	17.62	17.95	20.72	22.75	23.84
24	--------	21.95	22.92	24.06	25.24	25.67	26.31	25.56	22.11	18.89	17.83	17.96	20.92	22.75	23.81
25	--------	21.96	23.40	24.33	25.49	25.40	26.07	25.70	22.41	18.77	17.87	17.87	20.83	22.79	23.57
26	--------	21.89	23.44	24.83	25.53	25.55	26.14	25.44	22.45	18.63	17.93	17.85	20.84	22.82	23.85
27	--------	21.84	23.53	24.60	25.20	25.66	26.00	25.16	22.26	18.45	17.75	18.24	20.75	22.73	23.69
28	20.38	22.06	23.75	24.34	25.58	26.06	[1]26.06	25.00	22.30	18.35	17.75	18.30	21.10	22.89	23.71
29	20.50	22.43	23.66	24.59	--------	26.35	26.38	25.09	22.10	18.21	17.63	18.35	21.18	22.65	23.92
30	20.87	22.22	23.58	24.63	--------	26.05	26.31	25.11	21.91	18.19	17.63	18.49	21.17	22.41	23.68
31	20.76	--------	23.69	24.71	--------	26.03	--------	25.07	--------	18.40	17.67	--------	21.20	--------	23.57

[1] Opening of irrigation season—water released into canals.
[2] Close of irrigation season—no further release of water into canals.

TABLE 16.—*Water-level measurements, in feet below land-surface datum*—Continued

Day	1951											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
A3-2-20cd1—Continued												
1	------	------	25.45	26.16	26.20	25.72	22.58	17.78	17.35	------	21.05	22.11
2	23.85	------	25.31	26.16	26.56	25.81	22.45	17.82	17.35	17.41	20.76	21.92
3	23.72	------	25.48	26.04	26.74	25.66	22.51	17.77	17.35	17.55	20.83	22.32
4	23.96	------	25.34	25.91	26.67	25.52	22.26	17.59	17.33	17.88	20.74	22.25
5	24.28	------	25.20	26.04	26.58	25.35	22.40	17.65	17.31	18.19	21.18	22.00
6	24.58	25.10	25.55	26.19	26.69	25.38	22.42	17.59	17.33	18.34	21.28	22.40
7	24.62	25.12	25.69	26.15	26.44	25.30	22.23	17.44	17.34	18.45	21.19	22.99
8	24.19	25.22	25.85	26.24	26.38	25.45	22.18	17.40	17.18	18.56	21.07	23.10
9	24.19	------	25.53	26.03	26.59	25.61	21.95	------	17.34	18.65	21.19	23.13
10	24.29	25.20	25.97	26.50	26.48	25.48	21.80	------	17.10	18.69	21.29	22.05
11	23.96	25.03	26.32	26.37	26.23	25.30	21.62	------	17.01	18.55	20.86	------
12	24.26	25.12	26.10	26.37	25.98	25.13	21.45	------	17.30	18.62	20.71	22.79
13	24.48	------	25.79	26.06	26.16	25.16	21.05	------	17.42	19.01	21.21	22.65
14	24.37	25.53	25.79	26.25	26.28	25.28	20.73	17.42	17.41	19.20	21.29	23.07
15	24.45	25.25	25.60	26.37	26.45	25.02	20.44	17.41	17.58	19.00	21.75	23.06
16	24.19	25.13	25.44	------	26.46	24.83	20.14	17.27	17.38	19.40	22.23	22.92
17	24.14	25.12	25.82	------	26.16	24.64	19.94	17.27	17.36	19.51	22.13	22.92
18	24.16	25.02	------	26.09	26.07	24.57	19.77	17.27	17.24	19.91	21.93	22.68
19	24.34	25.43	------	26.14	26.11	24.45	19.48	17.18	17.22	19.60	21.79	22.72
20	24.98	25.46	------	26.31	26.04	------	19.27	17.33	17.39	19.35	21.56	23.00
21	24.72	25.28	25.81	26.40	26.16	24.15	19.27	17.15	17.53	19.67	21.63	23.25
22	24.57	25.50	25.64	------	26.05	24.11	19.34	16.99	------	19.88	21.82	23.15
23	24.80	25.33	26.10	------	25.82	24.01	19.20	17.03	------	20.04	22.01	23.52
24	24.94	25.87	26.09	------	25.80	23.67	18.87	17.00	------	19.91	21.82	23.40
25	24.78	25.25	25.95	26.38	25.77	23.59	18.77	17.11	17.20	20.18	22.25	23.74
26	24.49	25.35	25.70	26.19	25.83	23.35	18.81	17.12	17.42	20.56	22.31	23.94
27	24.75	25.31	25.72	26.36	25.75	23.26	18.71	16.92	------	20.56	22.27	23.67
28	------	25.45	26.15	26.14	25.62	23.11	18.43	17.03	------	20.48	22.14	23.26
29	------	------	25.98	25.82	25.77	23.04	18.19	17.27	------	20.20	22.29	23.18
30	------	------	25.84	25.85	------	22.86	18.10	17.35	------	20.66	22.24	23.13
31	------	------	26.03	------	25.65	------	17.87	17.44	------	20.75	------	23.54

TABLE 16.—*Water-level measurements, in feet below land-surface datum* —Continued

A3-2-27ab1
[Daily noon water level]

Day	1950 Nov.	1950 Dec.	1951 Jan.	1951 Feb.	1951 Mar.
1	------	14.46	------	15.46	15.43
2	------	14.71	15.02	15.42	15.38
3	------	14.67	15.05	15.44	15.43
4	------	14.71	15.10	------	15.40
5	------	14.88	15.18	------	15.34
6	------	14.75	15.24	15.53	15.44
7	------	14.70	15.23	15.52	15.46
8	------	14.86	15.13	15.52	15.52
9	------	14.95	15.22	15.51	15.40
10	------	14.86	15.21	15.49	15.55
11	------	14.34	15.15	15.40	15.65
12	------	14.84	15.27	15.43	15.59
13	------	14.82	15.32	15.55	------
14	------	14.87	15.28	15.53	------
15	------	14.91	15.24	15.43	------
16	------	14.97	15.24	15.38	------
17	------	14.94	15.20	15.36	------
18	14.39	14.94	15.20	15.35	------
19	14.50	14.92	15.22	15.44	------
20	14.56	14.99	15.37	15.43	------
21	14.57	15.00	15.32	15.39	------
22	14.54	14.98	15.25	15.44	------
23	14.64	15.00	15.35	15.41	------
24	14.64	14.98	15.38	15.38	------
25	14.66	14.90	15.35	15.37	------
26	14.65	14.98	15.27	15.38	------
27	14.65	14.92	------	15.37	------
28	14.70	14.95	------	15.42	------
29	14.64	15.02	------	------	------
30	14.49	14.93	------	------	------
31	------	14.95	15.42	------	------

LOGS OF WELLS

Logs of wells obtained from the Farmers Home Administration and from local well drillers as well as those of the United States Geological Survey are presented in table 17. Because it was impossible to verify the logs by examination of the drilling samples, the logs are presented without significant changes in the drillers' terminology. The logs are believed to be fairly accurate, although materials at depth designated "sand" probably are consolidated and should be called sandstone; it is thought that "hard rock" also is sandstone.

TABLE 17.—*Logs of wells*

[Land-surface altitudes are in feet above mean sea level]

Al-2-1bc

[Rex Snyder. Land-surface altitude, 5,199.4 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy, hard	5	5
Sandstone, soft	40	45
Shale, sandy, gray (water)	40	85
Rock, hard	1	86
Sandstone, gray (water)	39	125
Shale, sandy, gray	10	135
Sandstone, hard, gray	35	170
Shale, hard, sandy, gray	30	200
Sandstone (water)	35	235
Shale, hard, sandy, gray	38	273
Shale, soft, sandy, gray	24	297
Rock, hard	1	296
Sandstone (water)	20	318

Al-2-2cc

[U.S. Geological Survey. Land-surface altitude, 5,167.2 ft]

	Thickness (feet)	Depth (feet)
Sand and silt	11.5	11.5
Gravel	3.2	14.7

Al-2-3aa1

[John Hubenka. Land-surface altitude, 5,219.95 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	40	40
Gravel	19	59
Sandstone, yellow	11	70
Shale, gray	30	100
Sandstone, gray	25	125
Shale, gray	15	140
Sandstone, gray	30	170
Sand (water)	10	180
Shale, gray	3	183

Al-2-3ba

[Vern N. Thomas. Land-surface altitude, 5,207.07 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy clay	10	10
Clay, yellow	10	20
Gravel	27	47
Shale, blue	8	55
Shale, sandy, gray	20	75
Shale, blue	10	85
Shale, gray	15	100
Sandstone, gray	25	125
Sand, gray (water)	20	145

Al-2-11ab

[H. Busch. Land-surface altitude, 5,155.2 ft]

	Thickness (feet)	Depth (feet)
Soil, clay	3	3
Sand	2	5
Gravel and rock	16	21
Shale, sandy, yellow	13	34
Sandstone, gray	20	54
Shale, sandy, gray	38	92
Sandstone, gray (water)	8	100

Al-3-4aa

[Walter E. McGrath. Land-surface altitude, 5,365 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	5	5
Shale, sticky, pink	19	24
Shell, hard, limestone (water)	2	26
Shale, blue, gray, brown	34	60
Shale, hard, sandy, gray	25	85
Sandstone, soft	17	102
Shell, hard, flint	1	103
Sandstone, soft	17	120
Sandstone, hard (water)	25	145
Shale, hard, gray	7	152
Shale, sandy, soft	18	170
Shale, sandy, hard	39	209
Shale, sandy, gray	41	250
Sandstone	22	272

Al-3-7ad3

[U.S. Geological Survey. Land-surface altitude, 5,160.8 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	31.5	31.5

Al-3-7dd

[U.S. Geological Survey. Land-surface altitude, 5,133.1 ft]

	Thickness (feet)	Depth (feet)
Sand and silt	7.5	7.5
Clay	.5	8.0
Clay, sandy	8.0	16
Gravel	7.0	23

TABLE 17.—*Logs of wells*—Continued

Al-3-13dd2
[O. G. Griffey. Land-surface altitude, 5,456.07 ft]

	Thickness (feet)	Depth (feet)
Soil	4	4
Gravel	14	18
Shale, green	5	23
Shale, gray	34	57
Shale, red (water)	123	180
Shale, blue	100	280
Sandstone (dry)	22	302
Shale, blue	2	304

Al-3-16dbl
[Marvin Williams. Land-surface altitude, 5,173.8 ft]

	Thickness (feet)	Depth (feet)
Sandstone	20	20
Shale, blue	80	100
Shale, brown	40	140
Sandstone, hard, gray and white	45	185

Al-3-16dd3
[Dean Spencer. Land-surface altitude, 5,162.7 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	12	12
Shale, sandy, gray	21	33
Rock, hard, gray	2	35
Shale, sandy, gray	40	75
Sandstone, gray	5	80
Shale and coal	3	83
Shale, blue	29	112
Shale, sandy, gray	24	136
Sandstone, gray	24	160
Shale, sandy, gray	26	186
Shale, sticky, gray	34	220
Shale, sandy, gray	50	270
Shale, brown and blue	15	285
Shale, sandy, blue	15	300
Shale, sandy, gray	12	312
Shale, sticky, gray	15	327
Shale, sandy, blue	18	345
Shale, sticky, gray	15	360
Sandstone, gray	17	377
Sand (water)	33	410

Al-3-17ad
[Alex Heil. Land-surface altitude, 5,130.4 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	40	40
Gravel	16	56
Shale, sandy, gray	14	70
Sand (water)	30	100
Shale, sandy, gray	20	120
Shale, sticky, blue	27	147
Shale, sticky, gray	46	193
Sandstone, red and black	32	225
Shale, blue	10	235
Shale, sandy, gray	11	246
Sandstone, coarse (water)	34	280
Shale, sandy, gray	5	285

Al-3-17da
[U.S. Geological Survey. Land-surface altitude, 5,116.8 ft]

	Thickness (feet)	Depth (feet)
Sand and silt	14	14
Clay	2	16
Sand and silt	16.5	32.5
Gravel	1.3	33.8
Sandstone	------	------

Al-3-21da
[Mrs. Gould Quiver. Land-surface altitude, 5,096.65 ft]

	Thickness (feet)	Depth (feet)
Soil, yellow clay	18	18
Muck(?), yellow	12	30
Gravel	20	50
Shale, yellow	10	60
Shale, blue	30	90
Sand, gray (water)	10	100

Al-3-22bb
[Dean Spencer. Land-surface altitude, 5,153.77 ft]

	Thickness (feet)	Depth (feet)
[?]	115	115
Shale, sandy, gray	75	190
Shale, green	4	194
Shale, sticky, gray	76	270
Shale, blue and green	24	294
Shale, sandy, gray	66	360
Sandstone	10	370
Shale, sandy, gray	10	380
Sandstone	25	405
Shale, sticky, gray	5	410
Shale, sticky, blue	16	426
Shale, brown	6	432
Sand (water)	43	475

Al-3-22cc
[Lewis Weber. Land-surface altitude, 5,088.21 ft]

	Thickness (feet)	Depth (feet)
Soil, clay, sandy	16	16
Muck	10	26
Gravel	11	37
Sandstone, yellow	25	62
Shale, sandy, gray	10	72
Sandstone	11	83

Al-3-25db
[W. A. Jarvis]

	Thickness (feet)	Depth (feet)
Soil, sandy, and boulders	10	10
Sandstone and shale	40	50
Sandstone	30	80
Shale, brown, and coal	10	90

Al-3-26ca
[Claude Fike. Land-surface altitude, 5,083.19 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	45	45
Gravel (water)	15	60
Shale, sandy, gray	40	100
Sandstone, gray	35	135
Shale, sandy, blue	5	140
Shale, sandy, gray	60	200
Shale, sandy, blue	12	212
Shale, sandy, gray	8	220
Shale, gray	19	239
Rock, hard, gray, and sandy shale	41	280
Sand (water)	30	310
Sandstone, gray	35	345
Sand (water)	20	365
Shale, sandy, blue	10	375
Sand (water)	25	400
Shale, sandy, gray	27	427
Shale, red, brown	3	430

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
Al-3-27bb [U.S. Geological Survey. Land-surface altitude, 5,078.1 ft]		
Silt, sandy	14	14
Clay, green	5	19
Clay	6	25
Al-4-1da [Al Hursch. Land-surface altitude, 4,890.07 ft]		
Soil, sandy	1	1
Shale, sandy, gray	19	20
Sandstone, yellow	32	52
Shale, sandy, gray (water at 63 feet)	18	70
Sandstone, yellow	20	90
Shale, sandy, gray; contains hard layer.	60	150
Shale, hard, gray	33	183
Shale, sandy, gray (water at 200 feet)	42	225
Shale, hard, gray	48	273
Sandstone, gray	27	300
Shale, gray	27	327
Shale, brown	5	332
Shale, gray	15	347
Shale, sandy, gray	23	370
Shale, gray	20	390
Sandstone	67	457
Shale, gray	13	470
Sand (water)	10	480
Shale, sandy, blue	17	497
Shale, sandy, light-brown	3	500
Al-4-11aa3 [Fred Goens. Land-surface altitude, 4,936 ft]		
Soil, sandy	23	23
Gravel	14	37
Sandstone	18	55
Shale, blue	3	58
Sandstone	7	65
Shale, blue and brown	19	84
Al-4-15dd3 [U.S. Geological Survey. Land-surface altitude, 4,957.9 ft]		
Sand and silt	18	18
Gravel	8.3	26.3
Al-4-18cb [City of Riverton. Land-surface altitude, 5,452.3 ft]		
Soil and gravel	15	15
Shale, sandy, gray	9	24
Sandstone, yellow	8	32
Shale, sandy, gray	7	41
Shale, purple and brown	2	43
Shale, gray	5	48
Shale, brown	8	56
Shale, sandy, gray	18	74
Shale, brown	12	86
Shale, sandy, gray	22	108
A1-4-18cb—Continued		
Sandstone, yellow	9	117
Shale, sandy, gray	12	129
Shale, brown and blue (water)	35	146
Shale, sandy, blue	14	178
Shale, sandy, gray	20	198
Shale, sticky, light-blue	51	249
Shale, sandy, gray	6	255
Shale, sticky, light-blue	12	267
Shale, gray	6	273
Shale, light-blue	6	279
Shale, sandy, gray	35	314
Shale, light-blue	33	347
Shale, gray	7	354
Sandstone, gray	18	372
Shale, light-blue	23	395
Shale, sandy, gray	13	408
Shale, brown, blue, and gray	4	412
Shale, light-blue	8	420
Shale, sandy, gray	58	478
Shale, gray	5	483
Sandstone, gray (water)	32	515
Shale, light-blue	14	529
Shale, gray	19	548
Shale, soft, blue	6	554
Shale, gray	7	561
Sandstone, gray	5	566
Shale, gray	10	576
Sandstone, gray (water)	24	600
A1-4-22aa [Jake Fabrizius. Land-surface altitude, 4,955.78 ft]		
Soil, sandy	24	24
Gravel	14	38
Sandstone and shale, gray	22	60
Sand (water)	70	130
Shale, brown	30	160
[?]	9	169
A1-4-23cd [Pure Gas Service Co. Land-surface altitude, 4,938.4 ft]		
Soil, sandy	4	4
Gravel	14	18
Sandrock, yellow	42	60
Shale, sandy, gray	20	80
Shale, brown	23	103
Sandstone, gray	32	135
Sand (water)	12	147
Shale, blue	3	150
A1-4-26bc [John Real. Land-surface altitude, 4,953.74 ft]		
Soil	6	6
Gravel	10	16
Sandstone, yellow	12	28
Shale, gray	189	217
Sand	25	242

TABLE 17.—*Logs of wells*—Continued

A1-4-27aa3
[Robert Spencer. Land-surface altitude, 4,952 ft]

	Thickness (feet)	Depth (feet)
Soil (water)	10	10
Gravel and sand (water)	8	18
Sandstone, yellow	22	40
Sand and coal	10	50
Shale, sandy, gray	38	88
Rock, hard, gray	2	90
Shale, hard, gray	75	165
Shale, brown and blue	6	171
Shale, sandy, brown	24	195
Sand (water)	25	220
Shale, brown	25	245
Shale, sandy, gray	10	255
Sand	40	295
Shale, brown and blue	5	300

A1-4-27aa4
[Earl Sullivan. Land-surface altitude, 4,951.40 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Boulders (water)	12	15
Shale, gray	22	37
Sandstone, yellow (water)	4	41
Shale, sandy, gray	12	53
Sandstone, gray	12	65
Shale, sandy, gray	15	80
Sandstone, gray	15	95
Shale, sandy, gray	13	108
Shale, bluish-brown, mixed with coal	10	118
Shale, gray	2	120
Shale, brown, containing some oil	8	128
Shale, gray	7	135
Shale, dark-brown	2	137
Shale, sandy, gray	3	140
Sand (water)	35	175
Shale, brown	25	200
Sand (water)	85	285

A1-4-27ab
[Carlos Apodaca. Land-surface altitude, 4,961.4 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	3	3
Sand, fine	9	12
Gravel	10	22
Sandstone, yellow	38	60
Shale, hard, gray	10	70
Sandstone, gray	28	98
Shale, hard, gray	62	160
Shale, blue and brown	10	170
Shale, brown	15	185
Sand, coarse, white	34	219

A1-4-27ad1
[Earl Sullivan. Land-surface altitude, 4,954.94 ft]

	Thickness (feet)	Depth (feet)
Soil	7	7
Gravel	13	20
Sandstone, yellow	25	45
Shale, sandy, gray	95	140
Shale, blue and brown	10	150
Sandstone	10	160
Sand	------	------

A1-4-27bb2
[E. E. Davis. Land-surface altitude, 5,022.29 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Gravel (water)	13	15
Sandstone, yellow	15	30
Shale, hard, gray	95	125
Sandstone, gray and red	9	134
Shale, blue and gray	11	145
Sand (water)	20	165
Shale, gray	16	181
Sandstone, hard	5	186
[?]	4	190

A1-4-27bc
[Elmer Peterson. Land-surface altitude, 5,015.18 ft]

	Thickness (feet)	Depth (feet)
Gravel	26	26
Shale, gray	54	80
Shale, sandy, gray	40	120
Sandstone	28	148
Sand (water)	32	180

A1-4-27ca4
[Eldin Robertson. Land-surface altitude, 5,009.9 ft]

	Thickness (feet)	Depth (feet)
Gravel	14	14
Sandstone, yellow (water)	21	35
Shale, hard, sandy, gray	23	58
Shale, soft, sandy, gray	15	73
Crevice	2	75
Shale, soft, sandy, gray	30	105
Shale, hard, gray	10	115
Sandstone, gray	35	150
Sand (water)	12	162
Sandstone, gray	4	166

A1-4-27cb2
[Lon Wagoner. Land-surface altitude, 5,015.71 ft]

	Thickness (feet)	Depth (feet)
Gravel (water)	18	18
Sandstone, yellow	14	32
Sandstone, gray	18	50
Shale, blue	10	60
Shale, gray	12	72
Sandstone, gray	5	77
Shale, hard, gray	38	115
Sandstone, gray	20	135
Shale, gray	15	150
Sand (water)	35	185

A1-4-27cd1
[City of Riverton. Land-surface altitude, 4,983.37 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy, and gravel	10	10
Shale, gray and blue	50	60
Sandstone, hard	5	65
Sandstone; contains a crevice	8	73
Shale, sandy	12	85
Sand (water)	45	130
Rock, hard	1	131
Shale, hard, gray	5	136
Shell, hard	3	139
Shale, hard, gray	5	144
Shale, soft, green	1	145

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A1-4-27cd1—Continued		
Shale, soft, gray	7	152
Shale, hard, gray	18	170
Shale, very sandy, gray	9	179
Shell, hard	1	180
Shale, gray	10	190
Shale, sandy, gray	30	220
Shale, gray	20	240
Shale, brown	1	241
Shale, gray	2	243
Shale, sandy, gray	12	255
Sand (water)	10	265
Shale, sandy, brown	19	284
Shale, brownish-blue	23	307
Shale, sandy, gray	13	320
Sand (water)	30	350
Shale, gray and green	5	355
Shale, sandy, gray	13	368
Sand (water)	12	380
Shale, gray	3	383
Shale, brown	2	385
Shale, sandy, gray	5	390
Shale, brown and blue	28	418
Sand and hard shells (water)	10	428
Sandstone, hard	34	462
Sand (water)	21	483
Shell, hard	4	487
Sand (water)	9	496
Shell, hard	5	501
Shale, sandy, gray	5	506
Shale, brown and blue	29	535
Shale, light-brown	19	554
Shale, brown and blue	36	590
Sand (water)	25	615
Shell, hard	7	622
Sand (water)	23	645
A1-4-27dc [City of Riverton. Land-surface altitude, 4,969.90 ft]		
Gravel	20	20
Sandstone (water)	55	75
Sand (water)	23	98
Shale, sandy, gray	67	165
Sandstone, gray	27	192
Shale, gray	18	210
Shale, sandy, gray	25	235
Sand (water)	15	250
Shale, dark-gray	4	254
Shale, brown and blue	14	268
Shale, gray	4	272
Shale, brown	21	293
Shale, sandy, gray	10	303
Sand (water)	34	337
Shale, hard, blue	18	355
Shale, brown and blue	48	403
Shale, hard, gray	12	415
Shale, brown	10	425
Sandstone, gray	5	430
Sand (water)	20	450
Shale, hard, gray	8	458
Shale, brown and blue	22	480
Shale, gray	5	485
Sand, coarse	3	488
Shale, brown	5	493
Rock, hard	5	498
Shale, brown and blue	12	510
Sand (water)	22	532
Shale, sandy, gray	3	535
Sand and hard shells (water)	36	571
Shale, hard, gray	4	575
Rock, hard	3	578
Shale, brown	7	585

	Thickness (feet)	Depth (feet)
A1-4-27dd [City of Riverton. Land-surface altitude, 4,954.93 ft]		
Soil	3	3
Gravel	13	16
Sandstone, yellow	34	50
Shale, sandy, gray	32	82
Shale, soft, gray	25	107
Shale, soft, gray	29	136
Shale, gray	25	161
Shale, sandy, gray	14	175
Shale, brown and gray	6	181
Shale, coarse, sandy, gray	11	192
Shale, brownish-blue	24	216
Shale, sandy, gray	56	272
Shale, hard, gray	9	281
Shale, brown	31	312
Shale, sandy, gray	8	320
Shale, brown and blue	33	353
Sand (water)	9	362
Rock, hard	3	365
Shale, sandy, blue	10	375
Shale, sandy, gray	8	383
Sand (water)	11	394
Shale, hard, gray	6	400
Shale, brown	2	402
Shale, hard, gray	8	410
Sand (water)	10	420
Shale, gray	5	425
Shale, brown	30	455
Shale, hard, blue	5	460
Sand (water)	55	515
Shale, brown	15	530
Shale, sandy, light-brown	12	542
Shale, brown and blue	31	573
Shale, blue	7	580
Sand (water)	18	598
Shale, sandy, gray	2	600
A1-4-28aa4 [Eugene Gassel. Land-surface altitude, 5,053 ft]		
Sand and gravel	12	12
Sandstone, yellow	23	35
Sandstone, gray	15	50
Shale, gray	4	54
Sandstone, gray	7	61
Sandstone, yellow	3	64
Sandstone, gray	16	80
Rock, hard	7	87
Sandstone, gray	4	91
Shale, blue	11	102
Shale, sticky, gray	10	112
Rock, hard	3	115
Shale, hard, gray	24	139
Shale, blue	7	146
Shale, sandy	32	178
Shale, blue	1	179
Shale, gray	6	185
Sandstone, red and blue	15	200
Sand, coarse (water)	17	217
A1-4-28ab [U.S. Geological Survey. Land-surface altitude, 5,058.2 ft]		
Sand and silt	2	2
Gravel	7.2	9.2

TABLE 17.—*Logs of wells*—Continued

A1-4-28ad
[C. Witt Anderson. Land-surface altitude, 5,025.39 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	2	2
Gravel	11	13
Shale, gray	12	25
Sandstone, yellow	6	31
Rock, hard	1	32
Sandstone, yellow	13	45
Shale, sandy, gray	15	60
Shale, blue	12	72
Shale, gray	18	90
Shale, hard, sandy, gray	50	140
Sandstone, gray	20	160
Shale, hard, gray	15	175
Sand (water)	23	198
Shale, gray	2	200

A1-4-29bd2
[City of Riverton. Land-surface altitude, 5,182.80 ft]

	Thickness (feet)	Depth (feet)
Soil	10	10
Sand	20	30
Shale	20	50
Shale, sandy	30	80
Sand	20	100
Shale, sandy	20	120
Sand	10	130
Shale, sandy	30	160
Shale	30	190
Shale	10	200
Shale, sandy	10	210
Shale	10	220
Shale, sandy	60	280
Shale	60	340
Shale and shells	30	370
Shale	10	380
Sand shell	10	390
Sand	10	400
Shale	30	430
Sand shell, hard	2	432
Sand	17	449
Shale	36	485
Sand	4	489
Sand shell, hard	1	490
Sand and shells	13	503
Shale and sand	3	506
Sand	69	575
Shale, brown	3	578

A1-4-29cc
[U.S. Geological Survey. Land-surface altitude, 5,039.4 ft]

	Thickness (feet)	Depth (feet)
Sand and silt	8	8
Clay	2	10
Sandstone	2.7	12.7

A1-4-30ca
[Charles Ridgeway. Land-surface altitude, 5,095.40 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	4	4
Gravel (water)	12	16
Sandstone, yellow	25	41
Shale, sandy, gray	42	83
Coal	3	86
Shale, sandy, gray	64	150
Shale, gray	20	170
Sandstone, gray	19	189
Shale, gray	21	210
Shale, sandy, gray	9	219
Shale, sandy, blue	27	246
Shale, sandy, gray	29	275
Sandstone	43	318
Shale, sandy, gray	18	336
Sandstone	56	392
Sand (water)	9	401
Shale, sandy, blue	11	412
Sand (water)	15	427
Shale, sandy, blue	11	438
Shale, blue, brown	6	444
Shale, brown	1	445
Shale, sandy, gray	10	455
Sand (water)	14	469
Sand, coarse	13	482
Shale, brown	30	512
Sand (water)	23	535
Shale, sandy, blue	3	538

A1-4-31bc
[I. D. Woodward. Land-surface altitude, 5,035.47 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy, and gravel	30	30
Clay, yellow	10	40
Sandstone, yellow	10	50
Sandstone, very hard, gray	9	59
Sandstone, soft, gray (poor water)	14	73
Shale, sandy, gray	32	105
Sandstone, gray	25	130
Shale, sandy, gray	40	170
Sandstone, gray	20	190
Shale, sandy, gray	45	235
Sandstone, gray	33	268
Sand (poor water)	10	278
Shale, sandy, gray	37	315
Shale, brown, gray and blue	7	322
Sand (soft water)	36	358
Shale, blue	2	360

A1-4-32dc
[George Rein. Land-surface altitude, 4,990.68 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Gravel	15	18
Sandstone, yellow	12	30
Shale, sandy, gray	22	52
Shale, gray	23	75
Shale, sandy, gray	100	175
Sandstone, red, gray	47	222
Sandstone, hard	2	224
Shale, sandy, gray	13	237
Sandstone, hard	1	238
Shale, sandy, gray	62	300
Shale, sandy, brown	10	310
Sand, white (water)	20	330

TABLE 17.—*Logs of wells*—Continued

A1-4-33ba3
[William Mund. Land-surface altitude, 5,067.87 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	4	4
Gravel	20	24
Shale, yellowish-gray	6	30
Sandstone, yellow	9	39
Coal shale	3	42
Shale, sandy, blue	11	53
Sandstone, gray	8	61
Shale, sandy, gray	69	130
Sandstone, gray	20	150
Shale, gray	12	162
Shale, sandy, gray	3	165
Shale, gray	15	180
Shale, sandy, gray	20	200
Shale, gray	25	225
Shale, sandy, gray	20	245
Sand (water)	33	278
Shale, gray	2	280

A1-4-34ad
[City of Riverton. Land-surface altitude, 4,934.24 ft]

	Thickness (feet)	Depth (feet)
Soil	8	8
Gravel	12	20
Sandstone, yellow	18	38
Shale, sandy, gray	88	126
Shale, soft, gray	31	157
Shale, hard, sandy, gray	4	161
Shale, brown and blue	19	180
Shale, hard, sandy, gray	6	186
Sand (water)	16	202
Shale, brown	25	227
Shale, coarse, sandy, gray	13	240
Shale, brownish-blue	35	275
Shale, hard, sandy, blue	15	290
Shale, hard, sandy, gray	20	310
Shale, brown and blue	25	335
Shale, sandy, gray	11	346
Shale, brown	17	363
Sand (water)	6	369
Shale, sandy, gray	11	380
Shale, brown	12	392
Shale, hard, gray	16	408
Shale, brown and blue	28	436
Shale, hard, blue	4	440
Shale, brown and blue	31	471
Sand (water)	29	500
Shale, hard, gray	36	536
Shale, sandy, light-brown	19	555
Shale, hard, sandy, gray	14	569
Shale, brown	11	580
Shale, sandy, blue	10	590
Sand (water)	15	605
Shale, hard, sandy, gray	4	609

A1-4-34ba1
[City of Riverton. Land-surface altitude, 4,969.00 ft]

	Thickness (feet)	Depth (feet)
Wash, gravelly	23	23
Shale, sandy (trace of water)	17	40
Shale, gray	60	100
Shale, sandy	10	110
Shale, blue	25	135
Shale, gray	50	185
Sand	55	240
Shale, red	30	270
Sand	5	275

A1-4-34ba1—Continued

	Thickness (feet)	Depth (feet)
Shale, red	60	335
Shale, light-blue	33	368
Sand and hard shells	62	430
Shale, brown	7	437
Hard shell	6	443
Shells	7	450
Sand (water)	25	475
Shale, light-colored	12	487
Sand (water)	20	507
Shale, brick-red	3	510
Shale, variegated	25	535

A1-4-34bb1
[City of Riverton. Land-surface altitude, 5,030.15 ft]

	Thickness (feet)	Depth (feet)
Soil, heavy	4	4
Gravel and sand	14	18
Sandstone, yellow	9	27
Shale, gray	9	36
Sandstone, yellow	24	60
Shale, hard, sandy, gray	110	170
Shale, soft, sandy, gray	10	180
Sandstone, red, black, and white	43	223
Shale, hard, sandy, gray	17	240
Shale, gray and green	15	255
Shale, hard, gray	15	270
Sandstone, gray and red	13	283
Shale, blue and gray	3	286
Shale, hard, gray	14	300
Sandstone	5	305
Shale, sandy, gray	10	315
Sandstone, gray	6	321
Shale, dark	14	335
Sandstone, coarse-grained	15	350
Sand, coarse (water)	35	385
Shale, brown and blue	25	410
Sandstone, very hard	31	441
Shale, gray	4	445
Sand, coarse (water)	21	466
Shale, light-gray	19	485
Sand (water)	35	520
Shale, blue and gray	8	528
Shale, blue and brown	3	531
[?]	79	610
Shells, hard, and sandstone	52	662

A1-4-34bb2
[City of Riverton. Land-surface altitude, 5,022.87 ft]

	Thickness (feet)	Depth (feet)
Gravel	12	12
Shale, gray	8	20
Sandstone, yellow	30	50
Shale, green and gray	20	70
Shale, gray	72	142
Rock, hard	1	143
Shale, hard, sandy, gray	16	159
Sandstone, soft, gray	19	178
Shale, gray	22	200
Shale, green	2	202
Shale, hard, gray	63	265
Shell, hard	1	266
Shale, soft, gray	6	272
Shale, sandy, gray	13	285
Shale, gray	22	307
Shale, brown	8	315

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A1-4-34bb2—Continued		
Sandstone, gray	5	320
Shale, blue and brown	25	345
Shale, sandy, gray	15	360
Shale, brown and blue	50	410
Shale, sandy, gray	50	460
Sand (water)	20	480
Shale, hard, gray	15	495
Shale, brown and blue	20	515
Shale, sandy, gray	45	560
Shale, brown and blue	40	600
Sand (water)	7	607
Shale, brown	11	618
Sand (water)	27	645
Shale, brown and blue	15	660

A1-4-34ca
[City of Riverton. Land-surface altitude, 4,963.24 ft]

	Thickness (feet)	Depth (feet)
Gravel	12	12
Shale, hard, sandy, gray	78	90
Shale, soft, sandy	15	105
Sand, very coarse	28	133
Shale, hard, gray	7	140
Sandstone, soft, gray	5	145
Shale, soft, gray	9	154
Shale, hard, sandy, gray	21	175
Sandstone, black and white	29	204
Shell, hard	1	205
Sandstone, soft, gray	8	213
Shell, hard	1	214
Coal and gray shale	6	220
Shale, sandy, gray	10	230
Shale, blue and brown	24	254
Shale, brown	8	262
Shale, blue	7	269
Shell, hard	1	270
Sand (water)	30	300
Shale, brown	15	315
Shale, blue	20	335
Sand (water)	25	360
Shale, sandy, blue	5	365
Sand, white	20	385
Rock, hard	5	390
Sand, coarse	32	422
Shell, hard	2	424
Sandstone, coarse	13	437
Shell, hard	9	446
Shale, hard, gray	10	456
Sandstone, soft	9	465
Shell, hard	1	466
Sand (water)	5	471
Shale, sandy, gray	9	480
Sand and hard shells	15	495
Shale, brown	11	506
Shale, variegated	19	525

A1-4-34dd
[City of Riverton. Land-surface altitude, 4,930.6 ft]

	Thickness (feet)	Depth (feet)
Gravel	12	12
Sandstone, yellow	8	20
Shale, sandy, blue	18	38
Sandstone, gray	12	50
Sand (water)	27	77
Shale, blue	2	79

A1-4-35ab2
[Jim Petsch. Land-surface altitude, 4,935.5 ft]

	Thickness (feet)	Depth (feet)
Gravel	13	13
Sandstone, yellow	5	18
Shale, green	12	30
Shale, brown	7	37
Sand (water)	8	45
Shale, brown and blue	22	67
Sandstone, gray	10	77
Shale, brown	3	80
Shale, blue	5	85
Shale, brown	49	134
Sandstone, gray	13	147
Water sand (water)	11	158

A1-4-35cb1
[Ed Cunningham. Land-surface altitude, 4,928.59 ft]

	Thickness (feet)	Depth (feet)
Soil	7	7
Gravel	11	18
Sandstone, yellow (water)	8	26
Shale, sandy, gray	14	40
Shale, sandy, blue	25	65
Shale, hard, sandy, gray	3	68
Sand (water)	12	80

A1-4-35cc1
[Tom Knight. Land-surface altitude, 4,925.51 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	2	2
Gravel	12	14
Sand, soft, coarse, yellow	6	20
Sandstone, yellow	12	32
Shale, soft, sandy, gray	16	48
Shale, hard, sandy, gray (water at 65 feet)	35	83
Shale, soft, sandy, blue (water)	17	100

A1-4-35cc2
[I. J. King. Land-surface altitude, 4,927.2 ft]

	Thickness (feet)	Depth (feet)
Gravel (water)	15	15
Sandstone, yellow	19	34
Shale, sandy, gray	77	111
Shale, blue	11	122
Shale, sandy, gray	23	145
Shale, blue and brown, and sand stone layers	20	165
Sandstone	8	173
Sand (water)	17	190

TABLE 17.—*Logs of wells*—Continued

A1-4-35cd
[Art Beer. Land-surface altitude, 4,924.40 ft]

	Thickness (feet)	Depth (feet)
Soil	4	4
Gravel (water)	21	25
Sandstone, yellow	40	65
Shale, gray	61	126
Sand (water)	30	156

A2-1-1aa
[U.S. Bureau of Reclamation. Land-surface altitude, 5,214.2 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	31	31
Shale, sandy	5	36

A2-1-2bb2
[Morton School. Land-surface altitude, 5,401.2ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	3	3
Sandstone, yellow	47	50
Sandstone, gray	30	80
Shale, blue, hard	8	88
Sandstone, gray	8	96
Sandstone (hard water)	6	102
Shale, blue	6	108
Shale, gray	26	134
Sandstone, gray	19	153
Rock, hard	2	155
Sandstone, hard	8	163
Shale, sandy, gray	8	171
Sandstone, red and white	12	183
Shale, sandy, gray	15	198
Shale, blue	17	215
Sandstone	25	240
Shale, blue	5	245
Sandstone	23	268
Shale, blue	2	270
Shale, gray	6	276
Sandstone	32	308
Sandstone, coarse-grained	4	312
Shale, blue	21	333
Sandstone	15	348
Shale	2	350
Sandstone (water)	20	370

A2-1-11ab1
[Earl Gardner. Land-surface altitude, 5,398.66 ft]

	Thickness (feet)	Depth (feet)
Gravel	8	8
Shale, gray	60	68
Shale, blue	130	198
Sandstone, yellow	125	323
Sand (water)	29	352

A2-2-4bc2
[Sherman Johnson. Land-surface altitude, 5,292 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Sandstone, yellow	2	5
Shale, yellow	11	16
Sandstone, yellow	4	20
Shale, yellow	20	40
Shale, blue	20	60
Sandstone, gray	20	80
Shale, sandy, gray	40	120
Shale, gray	52	172
Shale, sandy, gray	26	198
Rock, hard	5	203
Shale, hard, gray	27	230
Shale, sandy, gray	30	260
Shale, hard, gray	16	276
Shale, sandy, gray	28	304
Shale, hard, gray	21	325
Shale, sandy, gray	25	350
Shale, hard, gray	10	360
Shale, blue	10	370
Shale, hard, gray	18	388
Sand, gray (water)	8	396

A2-2-4cb
[Sherman Johnson. Land-surface altitude, 5,296.4 ft]

	Thickness (feet)	Depth (feet)
Soil, yellow clay	2	2
Shale, blue	40	42
Sandstone, yellow	28	70
Shale, green	38	108
Sand (water)	12	120

A2-2-6dd2
[Kenneth Fleenar. Land-surface altitude, 5,421 ft]

	Thickness (feet)	Depth (feet)
Shale, sandy, gray	60	60
Shale, soft, gray and blue	30	90
Sandstone, gray	17	107
Shale, blue	6	113
Sandstone, gray and red, and shells of hard stone	47	160
Shale, gray	7	167
Sandstone, gray and red	128	295
Shale, hard, sandy, gray	30	325
Shale, green	15	340
Shale, sandy, gray	30	370
Sandstone, gray, red, black	57	427
Sandstone (water)	6	433
Sandstone, gray	9	442
Shale, blue	18	460
Sandstone, gray	13	473
Sandstone (water)	11	484
Shale, sandy, blue	1	485
Shale, brown	3	488
Shale, sandy, blue	17	505

A2-2-8ca
[Vernon Day. Land-surface altitude, 5,375 ft]

	Thickness (feet)	Depth (feet)
Soil	40	40
Shale, blue	40	80
Shale, sandy, gray (poor water at 100 feet)	80	160
Shale, gray	140	300
Shale, green	10	310
Shale, gray	60	370
Shale, sandy	40	410
Sand (water)	34	444
Shale, blue	1	445

TABLE 17.—*Logs of wells*—Continued

A2-2-9bc
[Ernest Stuhr. Land-surface altitude, 5,297 ft]

	Thickness (feet)	Depth (feet)
Soil, yellow, and sandy clay	3	3
Shale, yellow	20	23
Sandstone, yellow	15	38
Shale, yellow	10	48
Shale, gray	10	58
Shale, sandy, gray	14	72
Sandstone, gray	10	82
Shale, sandy, gray	28	110
Shale, gray	5	115
Shale, sandy, gray	5	120
Sandstone, gray (water)	7	127
Shale, gray	131	258
Shale, sandy	12	270
Shale, gray	30	300
Shale, sandy	56	356
Shale, blue	30	386
Sandstone, gray (water)	9	395

A2-2-9cb2
[William Brush. Land-surface altitude, 5,307 ft]

	Thickness (feet)	Depth (feet)
Soil	4	4
Shale, blue	26	30
Sand, brown	30	60
Shale, sandy, gray	40	100
Sand, gray (water at 110 feet)	30	130
Shale, gray	110	240
Shale, blue	20	260
Shale, sandy, gray	110	370
Sand (water)	28	398

A2-2-9cb3
[William Brush. Land-surface altitude, 5,307 ft]

	Thickness (feet)	Depth (feet)
Clay, yellow	14	14
Sand, yellow, and shale	16	30
Sandstone, yellow	30	60
Sandstone, gray	28	88
Rock, hard	2	90
Sandstone, gray	15	105
Sandstone, gray (water)	25	130

A2-2-9cc
[U.S. Bureau of Reclamation. Land-surface altitude, 5,303.2 ft]

	Thickness (feet)	Depth (feet)
Loam	5	5
Sand, loamy	5	10
Sandstone	------	------

A2-2-13bc2
[Hugh Foster. Land-surface altitude, 5,263 ft]

	Thickness (feet)	Depth (feet)
Quicksand, yellow	32	32
Sandstone, yellow	23	56
Shale, blue	73	129
Sand (water)	8	137

A2-2-13dc
[Howard N. Gould. Land-surface altitude, 5,294 ft]

	Thickness (feet)	Depth (feet)
Soil	4	4
Muck(?), sandy	35	39
Shale, yellow	21	60
Shale, gray	60	120
Shale, blue	40	160
Shale, brown	5	165
Shale, sandy, hard, gray	20	185
Sand, gray (water)	23	208

A2-2-15ad
[Ivan Riese. Land-surface altitude, 5,295 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Quicksand, yellow	37	40
Shale, blue	8	120
Shale, hard, gray	3	123
Shale, gray	55	178
Shale, green	6	184
Shale, hard, gray	4	188
Sand (water)	45	233

A2-2-15ca2
[George Groathouse. Land-surface altitude, 5,353 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	4	4
Clay, yellow	16	20
Shale, blue	30	50
Shale, sandy, blue (water)	10	60
Shale, blue	35	95
Sandstone (water)	5	100

A2-2-16bc1
[J. B. Andrews. Land-surface altitude, 5,363 ft]

	Thickness (feet)	Depth (feet)
Soil	6	6
Sand, yellow	38	44
Shale, blue	69	113
Shale, gray	90	203
Limestone (?), hard	6	209
Shale, gray	116	325
Sand (water)	115	440

A2-2-17aa
[John A. Corkill. Land-surface altitude, 5,325 ft

	Thickness (feet)	Depth (feet)
Clay, sandy, yellow	6	6
Sandstone, yellow	14	20
Shale, light-colored	18	38
Rock, hard	6	44
Shale, blue	6	50
Rock, hard	2	52
Shale, sandy, blue	138	190
Shale, blue	290	480
Shale, brown	6	486
Sand (water)	14	500

TABLE 17.—*Logs of wells*—Continued

A2-2-17bc
[Fred Ellerbruch. Land-surface altitude, 5,395.69 ft]

	Thickness (feet)	Depth (feet)
Soil	5	5
Shale, gray (water at 27 feet)	22	27
Shale, blue	33	60
Shale, gray (water at 140 feet)	100	160
Shale, green	10	170
Shale, gray	140	310
Shale, green	15	325
Shale, sandy, hard, gray	35	360
Sand (water)	27	387
Shale, gray	1	388

A2-2-17cc
[Floyd Real. Land-surface altitude, 5,362.53 ft]

	Thickness (feet)	Depth (feet)
Soil, yellow, clay	6	6
Rock, hard	3	9
Shale, yellow	10	19
Rock, hard	4	23
Shale, yellow	22	45
Sandstone, yellow	35	80
Shale, gray	30	110
Shale, blue	10	120
Shale, gray	60	180
Shale, sandy, gray	10	190
Shale, gray	60	250
Shale, sandy, gray	50	300
Shale, brown	11	311
Sand, gray (water)	15	326

A2-2-17da1
[R. E. Novatny. Land-surface altitude, 5,376.05 ft]

	Thickness (feet)	Depth (feet)
Clay, sandy	25	25
Shale, blue	20	45
Sand (water)	5	50

A2-2-18ab
[J. H. Russell. Land-surface altitude, 5,417 ft]

	Thickness (feet)	Depth (feet)
Soil	8	8
Sandstone, gray	10	10
Shale, blue	2	20
Sandstone, coarse-grained	5	25

A2-2-18ad2
[R. W. Philburn. Land-surface altitude, 5,410.05 ft]

	Thickness (feet)	Depth (feet)
Soil	5	5
Sand, brown	40	45
Sand (bad water)	10	55
Shale, blue	55	110
Sand, gray	50	160
Shale, gray (bad water)	125	285
Shale, green	10	295
Shale, gray	75	370
Sand, gray (good water)	26	396

A2-2-18da
[Leo Taylor. Land-surface altitude, 5,378.21 ft]

	Thickness (feet)	Depth (feet)
Soil	5	5
Sand, brown	25	30
Shale, gray (water at 60 feet)	195	225
Shale, sandy, gray	135	360
Sandstone, hard	10	370
Sand (water)	56	426

A2-2-24ab
[Bertha Gould. Land-surface altitude, 5,299 ft]

	Thickness (feet)	Depth (feet)
Soil	21	21
Sand, yellow	52	73
Shale, sandy, gray	14	87
Shale, blue	44	131
Shale, brown	6	137
Shale, green	13	150
Shale, blue	12	162
Sand (water)	25	187

A2-2-24ba
[H. C. Meyer. Land-surface altitude, 5,294 ft]

	Thickness (feet)	Depth (feet)
Soil	14	14
Sand, yellow	26	40
Shale, sandy, gray	25	65
Shale, blue	37	102
Shale, hard	3	105
Sand (water)	22	127
Shale, blue and green	28	155
Sand (water)	30	185

A2-2-24dd
[John Weber. Land-surface altitude, 5,385 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Sand	4	6
Shale, red	10	16
Shale, yellow	14	30
Sandstone, yellow	8	38
Rock, hard	6	44
Shale, hard, gray	71	115
Shale, blue	50	165
Shale	20	185
Shale, blue	65	250
Sand	15	265
Coal	2	267
Shale, sandy	38	305
Sand (water)	25	330

A2-2-29bb
[R. H. Miller. Land-surface altitude, 5,393 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	5	5
Sandstone, fine-grained, buff	70	75
Shale, sandy, bluish-gray (water)	8	83
Sand, clayey, gray	5	88
Clay, sandy, gray	7	95
Sand, gray	15	110
Shale, clayey, bluish-gray	55	165
Sand, bluish-gray	5	170
Shale, clayey, bluish-gray	35	205
Shale, red	5	210
Shale, sandy, gray	95	305
Sand, clayey (water)	8	313
Shale, blue	6	319
Sand, gray (water)	13	332
Shale, blue	18	350
Sand, gray (water)	25	375

TABLE 17.—*Logs of wells*—Continued

A2-3-3aa2
[W. C. Womack. Land-surface altitude, 5,285 ft]

	Thickness (feet)	Depth (feet)
Soil, yellow clay	6	6
Shale and clay, yellow	25	31
Shale, brown	12	43
Sandstone, blue-gray	18	61

A2-3-3bb
U.S. Bureau of Reclamation. Land-surface altitude, 5,285 ft]

	Thickness (feet)	Depth (feet)
[?]	3.5	3.5
Sandstone	.5	4
Sandstone, hard, red	3.5	7.5
[?]	4.5	12
Sandstone, brown	8	20
Sandstone, gray	9	29

A2-3-5da
[Robert Heumeyer. Land-surface altitude, 5,270 ft]

	Thickness (feet)	Depth (feet)
Topsoil	3	3
Shale, yellow	20	23
Shale, gray	58	81
Sand, gray (water)	5	86
Shale, blue	64	150
Shale, gray	46	196
Sand, gray (water)	4	200

A2-3-8bc
[Stanley Huffman. Land-surface altitude, 5,290 ft]

	Thickness (feet)	Depth (feet)
Topsoil, sandy	2	2
Sandstone, yellow	1	3
Shale, gray	5	8
Sandstone, yellow	52	60
Shale, gray	15	75
Sandstone (water)	5	80
Shale, sandy, gray	25	105
Sandstone, red and gray	20	125
Sand (water)	20	145
Shale, gray	5	150

A2-3-9da
[L. G. Edge. Land-surface altitude, 5,338 ft]

	Thickness (feet)	Depth (feet)
Soil	20	20
Shale, blue	20	40
Shale, blue and brown	20	60
Shale, blue	50	110
Shale, sandy	10	120
Shale, blue	40	160
Shale, gray	15	175
Shale, sandy	49	224
Shale, gray	26	250

A2-3-10bc
[Jack Cole. Land-surface altitude, 5,331 ft]

	Thickness (feet)	Depth (feet)
Topsoil, sandy clay	3	3
Sandstone, yellow	4	7
Shale, brown	10	17
Shale, gray	27	44
Sandstone, yellow	10	54
Shale, blue	6	60
Sand, gray (water)	5	65
Shale, sandy	18	83
Shale, brown	2	85

A2-3-19ba
[H. J. Peterson. Land-surface altitude, 5,325 ft]

	Thickness (feet)	Depth (feet)
Soil	7	7
Shale, gray	3	10
Clay, yellow	8	18
Sand, yellow	14	32
Shale, blue	40	72
Sand, gray	21	93
Shale, blue	98	191
Sand (hard water)	21	212
Shale, blue	28	240
Shale, green	6	246
Shale, brown	7	253
Lime shell (?)	2	255
Sand (hard water)	31	286
Lime shell (?)	2	288
Sand (good water)	31	319

A2-3-19dd
[John Weber. Land-surface altitude, 5,359 ft]

	Thickness (feet)	Depth (feet)
Topsoil, yellow clay	9	9
Sandstone, yellow (water)	20	29
Shale, gray	20	49
Shale, blue	15	64
Shale, hard, blue	46	110
Shale, blue	30	140
Shale, sandy, blue	25	165
Sand, dry	15	180
Shale, sandy	22	202
Sand (water)	26	228

A2-3-20cd
[Dale M. Ibach. Land-surface altitude, 5,340 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy, light	1	1
Clay, sandy, gray	5	6
Shale, blue	87	93
Shale, sandy, gray	17	110
Shale, sandy, blue	68	178
Sand (water)	42	220

A2-3-21cd
[A. J. Gardner. Land-surface altitude, 5,310 ft]

	Thickness (feet)	Depth (feet)
Topsoil, sandy	4	4
Sandstone, yellow	13	17
Shale, sandy, gray	46	63
Sandstone, red and gray	12	75
Shale, gray	5	80
Sand (water)	25	105

A2-3-21dd
[Walter H. White. Land-surface altitude, 5,307 ft]

	Thickness (feet)	Depth (feet)
Soil and sand	3	3
Shale, sandy, gray	5	8
Sandstone, gray	8	16
Shale, gray, brown, purple	16	32
Shale, sandy, gray	24	56
Shale, brown, blue	11	67
Shale, sandy, gray	10	77

TABLE 17.—*Logs of wells*—Continued

A2-3-22bb
[U.S. Bureau of Reclamation. Land-surface altitude, 5,320 ft]

	Thickness (feet)	Depth (feet)
[?]	1	1
Shale, blue, soft	4	5
Shale, hard, red and blue	7	12
Shale, red	7	19
Shale, blue	8	27
Shale, red and blue	3	30

A2-3-26dc
[Leonard Withington. Land-surface altitude, 5,369 ft]

	Thickness (feet)	Depth (feet)
Clay, yellow	3	3
Shale, purple and brown	19	22
Shale, blue	13	35
Shale, brown (water)	20	55
Shale, brown	25	80

A2-3-28da2
[Harold Holmes. Land-surface altitude, 5,365 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	6	6
Sandstone, yellow	29	35
Shale, sandy, gray	20	55
Sandstone, gray	15	70
Shale, soft, gray	20	90
Shale, hard, gray	5	95
Sand (water)	15	110
Sandstone, soft, gray	30	140
Shale, sandy, gray	6	146
Sandstone, gray	9	155
Shale, blue and gray	3	158
Shale, hard, gray	4	162
Rock, hard, gray	1	163
Sandstone, fine-grained, gray	12	175
Shale, gray, sandy	13	188
Sandstone, gray	7	195
Shale, blue and gray	5	200
Shale, stickey, gray	8	208
Sandstone, gray	7	215
Shale, hard, gray	25	240
Shale, blue and green	5	245
Sandstone, gray and black	5	250
Sandstone, red and white	30	280
Sand, soft (water)	10	290
Sandstone, gray	10	300
Shale, hard, gray	7	307
Sandstone, gray	5	312
Shale, hard, dark	2	314
Sandstone, gray	6	320
Shale, light-gray	10	330
Shale, coal	4	334
Shale, green	7	341
Shale, sandy, gray	14	355
Sandstone, gray	38	393
Shale, sticky, gray	12	405
Sand (water)	30	435

A2-3-29bb
[Andrew Ibach. Land-surface altitude, 5,361 ft]

	Thickness (feet)	Depth (feet)
Topsoil	3	3
Clay and gravel	9	12
Shale, blue	80	92
Shale, gray	23	115
Shale, blue	59	174
Sand	83	257

A2-3-29bc
[George Hinkle. Land-surface altitude, 5,369 ft]

	Thickness (feet)	Depth (feet)
[?]	190	190
Shale, sandy, gray	45	235
Sandstone	30	265
Shale, sandy, brown	10	275
Coal	4	279
Shale, blue	11	290
Shale, sandy, hard, gray	10	300
Shale, sandy, soft, gray	10	310
Limestone(?), white	2	312
Shale, sandy, soft, gray	23	335
Sandstone, hard, gray	5	340
Shale, sandy, soft, gray	35	375
Shale, hard, gray	10	385
Shale, soft, gray	43	428
Shale, gray	22	450
Shale, brown	6	456
Sand (water)	9	465
Shale, blue	4	469

A2-3-29cb2
[J. J. Portlock. Land-surface altitude, 5,363 ft]

	Thickness (feet)	Depth (feet)
Soil	6	6
Sandstone, yellow	14	20
Shale, green	20	40
Sandstone, yellow (water)	20	60
Shale, gray	5	65

A2-3-32ad
[A. M. Peterson. Land-surface altitude, 5,349 ft]

	Thickness (feet)	Depth (feet)
Clay, sandy, yellow	4	4
Sandstone, soft, yellow	7	11
Shale, yellow	2	13
Shale, sandy, yellow	10	23
Sandstone, yellow	22	45
Shale, yellow and brown	7	52
Sand (water)	24	76

A2-3-33bb1
[Henry Johnson. Land-surface altitude, 5,345 ft]

	Thickness (feet)	Depth (feet)
Topsoil	10	10
Sandstone	4	14
Shale, brown	36	50
Sand, coarse, yellow	22	72
Sandstone, yellow	16	88
Sandstone, gray	4	92
Sand, blue (water)	13	105
Shale, blue	136	241
Shale, sandy	29	270
Shale, brown	3	273
Shale, blue	12	285
Shale, brown	2	287
Shale, light-colored	28	315
Shale, brown	5	320
Shale, blue	50	370
Rock, hard	2	372
Shale, blue	128	500

TABLE 17.—*Logs of wells*—Continued

A2–3–33da
[Joe Detimore. Land-surface altitude, 5,349 ft]

	Thickness (feet)	Depth (feet)
[?]	132	132
Shale, blue	69	201
Sand (water)	33	234

A2–3–34bc
[U.S. Bureau of Reclamation. Land-surface altitude 5,348 ft]

	Thickness (feet)	Depth (feet)
Soil, loamy sand	1	1
Sand, loamy	2	3
Clay, heavy, red	.5	3.5
Sandstone, soft	5.5	9
Shale, red and blue	1	10

A2–3–34cc2
[Henry Bath. Land-surface altitude, 5,359 ft]

	Thickness (feet)	Depth (feet)
Topsoil	3	3
Soil, sandy	17	20
Shale, gray	28	48
Sand, white (water)	4	52
Shale, gray	98	150
Shale, blue	30	180
Shale, gray	40	220
Shale, blue	15	235
Shale, gray	7	242
Rock, hard	8	250
Sandstone, brown	20	270
Sandstone, gray	15	285
Rock, brown	10	295
Shale, gray	35	330
Coal	3	333
Shale, blue	27	360
Shale, gray	20	380
Shale, blue	22	402

A2–3–34cc3
[Henry Bath. Land-surface altitude, 5,358 ft]

	Thickness (feet)	Depth (feet)
Topsoil	2	2
Sand, brown	6	8
Mud, sandy, red	20	28
Shale, gray	32	60
Shale, blue	40	100
Coal	5	105
Sand (water)	23	128
Rock, brown	10	138
Shale, blue	27	165
Rock, gray	6	171
Shale, blue	24	195
Sandstone	15	210
Sand (water)	12	222
Shale, gray	2	224

A2–3–34cd
[Paul and Andy Peterson. Land-surface altitude 5,359 ft]

	Thickness (feet)	Depth (feet)
Topsoil	4	4
Shale	6	10
Mud, red	18	28
Shale, blue	60	88
Shale, gray	17	105
Sand (water)	25	130
Shale, blue	65	195
Sand (water)	23	218

A2–4–1cb
[Gerhard Medow. Land-surface altitude, 5,019 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy, soft	20	20
Sandstone, hard, gray and yellow	25	45
Shale, hard, gray	15	60
Sandstone, hard, gray	3	63
Sandstone, soft	2	65
Shale, and rock, hard, gray	10	75
Sand, white (water)	10	85
Rock, hard	15	100
Shale, blue and gray	12	112
Rock, hard	2	114
Sandstone, soft	4	118
Rock, hard	2	120
Sandstone, red and black	10	130
Sand (water)	12	142
Sandstone, soft	23	165

A2–4–1dc
[V. B. Plummer. Land-surface altitude, 5,023 ft]

	Thickness (feet)	Depth (feet)
Topsoil	6	6
Sand, brown	10	16
Shale, blue-gray	24	40
Lime shell, hard	4	44
Shale, sandy, hard gray	24	68
Sand (water)	16	84
Shale, blue	------	------

A2–4–2ad
[H. M. Currah. Land-surface altitude, 5,011 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	5	5
Sandstone, yellow	31	36
Sand (water)	1	37
Sandstone, gray	13	50
Shale, sandy	8	58
Shale, sandy, gray	29	87
Sandstone, gray	8	95
Sandstone, coarse, gray	7	102
Sandstone, fine-grained, gray	3	105
Shale, sandy, gray	18	123
Sandstone, gray	3	126
Shale, green	16	142
Sandstone, gray	34	176
Shale, blue	19	195
Shale, brown	5	200
Sand, coarse, dry	15	215
Shale, blue	5	220
Shale, sandy, gray	40	260
Sandstone, soft	20	280
Shale, blue	25	305
Sandstone, gray	15	320
Sand, coarse (water)	15	335
Shale, fine, green	15	350
Sandstone, gray	15	365
Shale, green and brown	15	380
Shale, blue	22	402
Sand, fine (water)	11	413
Shale, blue	7	420

A2–4–2dc
[Floyd W. Uglow. Land-surface altitude, 5,075 ft]

	Thickness (feet)	Depth (feet)
Topsoil	4	4
Sandstone, yellow	35	39
Shale, hard, dark	34	73
Sandstone, light	3	76
Shale, light	59	135
Sand, gray (water)	23	158

TABLE 17.—*Logs of wells*—Continued

A2-4-3bb
[Ray Hursh. Land-surface altitude, 5,135 ft]

	Thickness (feet)	Depth (feet)
Sandstone	3	3
Shale, sandy, gray	17	20
Sandstone, yellow	32	52
Shale, sandy, gray (water)	18	70
Sandstone, yellow	20	90
Shale, sandy, gray (hard shells)	60	150
Shale, hard, gray	33	183
Shale, hard, gray	42	225
Shale, hard, gray	50	275
Sandstone, gray	25	300
Shale, gray	27	327
Shale, brown	5	332
Shale, gray	15	347
Shale, sandy, gray	23	370
Shale, gray	20	390
Sandstone	67	457
Shale, gray	13	470
Sand (hard water)	10	480
Shale, sandy, blue	17	497
Shale, brown and blue	43	540
Sandstone	5	545
Sand (water)	15	560

A2-4-3cc
[Larry Barrett. Land-surface altitude, 5,179 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	7	7
Sandstone, yellow	13	20
Shale, blue and yellow	5	25
Shale, brown, and coal	6	31
Shale, green	6	37
Sandstone, yellow	54	91
Sandstone, gray	7	98
Shale, sandy, gray	97	195
Sandstone, red and gray	21	216
Sand, coarse, gray	14	230
Shale, sandy, gray	17	247
Shale, brown	3	250
Shale, sandy, gray	10	260
Sand (water)	27	287
Shale, sandy	21	308
Rock, hard	6	314
Sandstone, red and black	96	410
Shale, sandy, gray	4	414
Sandstone, red and blue	16	430
Shale, sandy, gray	30	460
Shale, brown, blue, and green	40	500
Shale, sandy, brown	10	510
Sand, white (water)	20	530

A2-4-4aa
[U.S. Bureau of Reclamation. Land-surface altitude, 5,113.5 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	8	8
Sandstone, soft, brown	6	14
Shale, brown	6	20
Sandstone, soft	4	24

A2-4-4dd
[I. W. Douglas. Land-surface altitude, 5,185 ft]

	Thickness (feet)	Depth (feet)
Topsoil	9	9
Sand, yellow	31	40
Shale, blue	23	63
Coal	3	66
Shale, brown	5	71
Shale, blue	18	89
Shale, hard, gray	61	150
Shale, blue	16	166
Shale, hard, gray	74	240
Sand	8	248
Shale, gray	12	260
Sand (water)	34	294

A2-4-9aa1
[Milo Runyan. Land-surface altitude, 5,183 ft]

	Thickness (feet)	Depth (feet)
Topsoil	3	3
Sandstone, yellow	3	6
Shale, yellow	24	30
Shale, blue	22	52
Shale, brown, and coal	4	56
Shale, blue	10	66
Shale, hard, gray	186	252
Sand (dry)	26	278
Shale, blue	52	330
Shale, brown	6	336
Shale, blue	4	340
Sand (dry)	38	378
Shale, blue	100	478

A2-4-9aa2
[Milo Runyan. Land-surface altitude, 5,183 ft]

	Thickness (feet)	Depth (feet)
Topsoil	4	4
Sandstone, hard	20	24
Shale, hard, yellow	6	30
Shale, hard, gray	15	45
Shale, brown, and coal	5	50
Shale, blue, soft	6	56
Rock, hard	6	62
Shale, hard, gray	18	80
Sandstone (water)	72	152
Shale, hard, gray	40	192
Shale, light-colored	12	204
Shale, hard, gray	48	252
Shale, sandy	18	270
Shale, blue	28	298

A2-4-9aa3
[T. W. Walthers. Land-surface altitude, 5,190 ft]

	Thickness (feet)	Depth (feet)
Topsoil	4	4
Sandstone, yellow	26	30
Shale, blue (water)	15	45
Shale, brown and blue	20	65
Shale, brown, and coal	5	70
Shale, dark	20	90
Shale, blue	55	145
Shale, sandy	15	160
Shale, hard, gray	85	245
Shale, sandy, soft	12	257
Shale, sandy, hard, gray	5	262
Sand, blue (water)	37	299

TABLE 17.—*Logs of wells*—Continued

A2-4-9cc
[J. R. Longfellow. Land-surface altitude, 5,279 ft]

	Thickness (feet)	Depth (feet)
Shale, sandy	10	10
Sandstone, yellow	25	35
Rock, hard, gray	2	37
Shale, sandy, gray	8	45
Shale, sandy, brown	5	50
Rock, hard, gray	1	51
Shale, sandy, brown	25	76
Shale, sandy, gray	44	120
Sandstone, gray	26	146
Shale, sandy, soft, gray	6	152
Coal	5	157
Shale, green	3	160
Rock, coarse-grained, gray	20	180
Sandstone, fine-grained, gray	40	220
Sandstone, coarse-grained, gray (water)	35	255
Shale, sandy, hard, gray	43	298
Rock, hard, gray	2	300
Sandstone, gray	18	318
Shale, sandy, hard, gray	22	340
Sandstone, gray	14	354
Shale, sandy, hard, gray	26	380
Sandstone, fine-grained, gray	35	415
Sandstone, coarse-grained, gray	32	447
Sand (water)	18	465

A2-4-10bb
[Fred Devish. Land-surface altitude, 5,179 ft]

	Thickness (feet)	Depth (feet)
Topsoil, sandy	3	3
Gravel, hard	4	7
Sandstone, yellow	20	27
Shale, brown and blue	17	44
Coal	3	47
Shale, sandy, gray	46	93
Rock, hard	3	96
Shale, sandy, gray	24	120
Sandstone, gray	15	135
Shale, sandy, gray	37	172
Rock, hard, brown	23	197
Shale, gray, blue	52	242
Rock, hard, gray	5	255
Shale, sandy	5	257
Sandstone (dry)	21	278
Shale, gray	4	282
Sand (water)	16	298
Shale, gray	2	300

A2-4-10bd
[Roy Haggerty. Land-surface altitude, 5,185 ft]

	Thickness (feet)	Depth (feet)
Soil	8	8
Sandstone, yellow	32	40
Shale, blue	10	50
Shale, brown	9	59
Muck (water)	11	70
Sandstone, yellow	12	82
Shale, blue	94	176
Shale, light-colored	54	230
Sand, gray	56	286
Sand (water)	40	326

A2-4-10dc
[Leonard Templin. Land-surface altitude, 5,171 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	5	5
Sandstone, yellow	30	35
Shale, blue	20	55
Shale, carboniferous	5	60
Shale, blue	15	75
Sandstone, yellow	16	91
Sandstone, gray	5	96
Shale, gray	7	103
Sandstone, soft, gray	7	110
Shale, hard, gray	8	118
Sandstone, soft, gray	12	130
Shale, sandy, hard, gray	65	195
Sandstone, hard, gray	40	235
Shale, sandy, gray	23	258
Sandstone (dry)	17	275
Shale, sandy, hard, gray	12	287
Sandstone, gray	43	330
Sand, gray (water)	20	350

A2-4-11da
[Arthur McCoy. Land-surface altitude, 5,073 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	8	8
Sandstone, yellow	12	20
Rock, hard	7	27
Sandstone, hard, gray	52	79
Shale, sandy, hard, gray	42	121
Sandstone, red and gray	8	129
Shale, gray	6	135
Shale, sandy, gray	25	160
Sand (dry)	25	185
Sandstone	5	190
Sand (water)	15	205
Shale, sandy, gray	13	218

A2-4-12bc
[Oliver Lund. Land-surface altitude, 5,060 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	5	5
Sandstone, yellow (water at 25 feet)	51	56
Shale, sandy, hard, gray	44	100
Shale, sandy, soft, gray	16	116
Shale, gray	10	126
Shale, sandy, gray	12	138
Sandstone, red	28	166
Shale, sandy, gray	6	172
Sand, coarse (water)	18	190

A2-4-12cb
[E. T. Steenbock. Land-surface altitude, 5,073 ft]

	Thickness (feet)	Depth (feet)
Topsoil, sandy	7	7
Sandstone, yellow (water)	21	28
Sandstone, yellow	28	56
Shale, sandy, gray	65	121
Shale, gray	14	135
Sandstone, red	25	160
Sand (water)	28	188

TABLE 17.—*Logs of wells*—Continued

A2-4-13bb1
[John P. Sanders. Land-surface altitude, 5,121 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	6	6
Sandstone, yellow	54	60
Sandstone, gray (water at 75 feet)	60	120
Sandstone, soft, gray	24	144
Sandstone, hard, gray	3	147
Shale, sandy, soft, gray	8	155
Shale, hard, gray	16	171
Sand, coarse (dry)	11	182
Shale, brown, gray and blue	8	190
Shale, sandy, gray	25	215
Sand, coarse (dry)	15	230
Shale, sandy, hard, gray	25	255
Sandstone, red, gray, and black	25	280
Shale, gray	10	290
Sandstone, red, gray, and black	35	325
Shale, gray	10	335
Sandstone, hard, gray	20	355
Sand, coarse (dry)	15	370
Shale, gray	25	395
Shale, gray, brown, and blue	15	410
Shale, brown	20	430
Sandstone, gray	30	460
Shale, blue and brown	5	465
[?], red	35	500

A2-4-13bb2
[J. P. Sanders. Land-surface altitude, 5,101 ft]

	Thickness (feet)	Depth (feet)
Sandstone, yellow	50	50
Shale, sandy, hard, gray	15	65
Sandstone, hard, gray	20	85
Sand (bad water)	45	130
Shale, fissile, gray	5	135
Sandstone, hard	5	140
Shale, sandy, gray	25	165
Shale, soft, gray	17	182
Sandstone, hard, gray	8	190
Sandstone, gray	22	212
Sand (water)	14	226
Sandstone, gray	4	230

A2-4-14ba
[U.S. Bureau of Reclamation. Land-surface altitude 5,118.5 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	2	2
Soil, loam	15	17
Sandstone	16	33

A2-4-14bb
[Oswald Anderson. Land-surface altitude, 5,175 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	5	5
Sandstone, yellow	36	41
Shale, coal	5	46
Shale, sandy, gray	9	55
Sandstone, yellow	5	60
Rock, hard	1	61
Sandstone, soft, yellow	5	66
Rock, hard	1	67
Sandstone, yellow	28	95

A2-4-14bb—Continued

	Thickness (feet)	Depth (feet)
Rock, hard	1	96
Sandstone, yellow	34	130
Shale, soft, gray	17	147
Rock, hard	1	148
Shale, soft, gray	5	153
Rock, hard	2	155
Sandstone, soft, gray	64	219
Rock, hard	1	220
Sandstone, soft, gray	27	247
Shale, sandy, gray	28	275
Sandstone, red, and gray	23	298
Sandstone, coarse-grained	22	320
Shale, gray	3	323
Sand, coarse (water)	10	333
Shale, sandy, gray	2	335

A2-4-15ab
[Charles Wheeler. Land-surface altitude, 5,176 ft]

	Thickness (feet)	Depth (feet)
Loam, sandy	6	6
Sandstone, yellow (water at 35 feet)	40	46
Shale and coal	5	51
Shale, soft, blue	5	56
Shale, sandy	7	63
Sandstone, gray	12	75
Shale, sandy, gray	15	90
Sandstone, gray	43	133
Sand (water)	4	137
Sandstone, gray	13	150
Shale, sandy, gray	25	175

A2-4-15ac
[Floyd Verley. Land-surface altitude, 5,195 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	7	7
Clay, yellow	13	20
Shale and coal	10	30
Clay, yellow	10	40
Sandstone	70	110
Sandstone, hard (water)	15	125
Sandstone, hard, gray	35	160
Sandstone, soft, gray	30	190
Sandstone, coarse-grained, gray	53	243
Sand (water)	17	260
Sandstone, soft, gray	45	305
Sand, coarse (water)	25	330

A2-4-15bb
[Victor C. Hughes. Land-surface altitude, 5,230 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	2	2
Sandstone, yellow	33	35
Shale, sandy, gray	55	90
Sandstone, gray	25	115
Shale, coal	10	125
Sandstone, gray	30	155
Shale, gray	25	180
Shale, sandy, gray	120	300
Sandstone, gray	25	325
Sandstone, coarse-grained	15	340
Shale, hard, gray	5	345
Sandstone	30	375
Sand, coarse (water)	20	395

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A2-4-16ab [John L. Sinner. Land-surface altitude, 5,233 ft]		
Topsoil	9	9
Clay, yellow	7	16
Sandstone, yellow (water)	30	46
Shale, blue	40	86
Shale, gray	44	130
Shale, brown	4	134
Shale, blue	23	157
Lime shell	1	158
Sand (water)	17	175
Shale, blue	45	220
Shale, hard, gray	55	275
Shale, blue	29	304
Sandstone (water)	76	380
Lime shell, hard	6	386
Sand (water)	17	403
A2-4-16bb [W. C. York. Land-surface altitude. 5,279 ft]		
[?]	50	50
Sandstone, hard, gray	22	72
Shale and sandstone	28	100
Sandstone	30	130
Shale, sandy	25	155
Shale, blue	8	163
Coal	4	167
Shale, blue and green	13	180
Sandstone, hard	5	185
Shale, gray	18	203
Shale, sandy	5	208
Sandstone	28	236
Shale, gray	4	240
Sandstone, gray	20	260
Shale, black	3	263
Sand, gray (water)	9	272
Shale, gray	38	310
Sandstone, brown	10	320
Shale, gray	45	365
Shale, blue	7	372
Shale, gray	28	400
Sandstone, brown	48	448
Rock, hard	9	457
Sandstone, coarse-grained, hard	8	465
Sand, fine (water)	8	473
A2-4-17aa [E. C. Brines. Land-surface altitude, 5,296 ft]		
Loam, sandy	8	8
Shale, pink	12	20
Rock, hard, gray	4	24
Shale, sandy, gray	14	38
Sandstone, gray	7	45
Sandstone, yellow (water)	3	48
Sandstone, gray	9	54
Shale, blue	20	63
Shale, sandy, gray	17	83
Sandstone, gray	6	100
Shale, sandy, gray	40	140
Sandstone, gray	18	158
Shale, light-brown	6	164
Shale, sandy, gray	11	175
Shale, black, and coal	7	182
Shale, green	10	192
Shale, sandy, blue	16	208
Sandstone, gray	52	260
Rock, hard, black	3	263
Sand, coarse (water)	18	281
Shale, gray	3	284
A2-4-17ba [Oscar Evans. Land-surface altitude, 5,353 ft]		
Topsoil, sandy	3	3
Quicksand	9	12
Clay, blue	28	40
Shale, hard, gray	70	110
Sandstone, hard	15	125
Shale, sandy, hard, gray	70	195
Sandstone, hard	25	220
Sand (water)	15	235
Shale, sandy, hard, gray	15	250
Sand (water)	19	269
Shale, blue	3	272
A2-4-17da [U.S. Bureau of Reclamation. Land-surface altitude, 5,262 ft]		
Soil, sandy loam	6	6
Sand, fine	4.5	10.5
Sand, loamy	1	11.5
A2-4-17dd1 [H. E. Clapp. Land-surface altitude, 5,243 ft]		
Topsoil	4	4
Quicksand	27	31
Sandstone, yellow	24	55
Shale, brown	12	65
Shale, sandy, gray	18	87
Sandstone, gray	28	113
Coal	5	118
Shale, soft, blue	8	126
Shale, hard, blue	9	135
Shale, sandy, gray	35	170
Sandstone, gray	25	195
Sand, gray (water)	20	215
Sandstone, gray	10	225
A2-4-18cd2 [U.S. Bureau of Reclamation. Land-surface altitude, 5,301 ft]		
Soil, sandy loam	4	4
Sand	5	9
Sand, coarse, and gravel	1	10
A2-4-18dc1 [C. C. Williams. Land-surface altitude, 5,301 ft]		
Soil and gravel	28	28
Shale	56	84
Sand	14	98
A2-4-19cd [U.S. Bureau of Reclamation. Land-surface altitude, 5,291.5 ft]		
Soil, sandy clay-loam	3	3
Soil, clay-loam	3	6
Soil, sandy loam	3	9

TABLE 17.—*Logs of wells*—Continued

A2-4-19dd
[G. Eiseman. Land-surface altitude, 5,294 ft]

	Thickness (feet)	Depth (feet)
Quicksand	35	35
Sandstone, yellow	21	56
Shale, sandy, gray	12	68
Shale, blue	17	85
Shale, sandy, gray	40	125
Shale, blue	15	140
Shale, sandy, gray	10	150
Sandstone, gray	25	175
Shale, sandy, gray	20	195
Coal	5	200
Shale, sandy, gray	20	220
Sandstone, gray	40	260
Sandstone, white (water)	40	300
Shale, sandy	11	311
Sandstone	21	332
Sand (water)	23	355

A2-4-21ac
[K. R. Loghry. Land-surface altitude, 5,215 ft]

	Thickness (feet)	Depth (feet)
Soil	6	6
Sandstone, yellow	71	77

A2-4-21ad
[James Knight. Land-surface altitude, 5,229 ft]

	Thickness (feet)	Depth (feet)
Loam, sandy	2	2
Sandstone, yellow	26	28
Shale, gray (water)	3	31
Sandstone, yellow	25	56
Rock, hard, gray	2	58
Shale, sandy, gray	22	80
Coal	6	86
Shale, gray	4	90
Sandstone, gray	10	100
Shale, green	10	110
Shale, gray	8	118
Sandstone, coarse-grained, gray	36	154
Sand (water)	21	175
Shale, hard, gray	78	253

A2-4-21ca2
[J. D. Verley]

	Thickness (feet)	Depth (feet)
Soil, sandy	10	10
Shale, sandy, gray	20	30
Sandstone, gray, hard	5	35
Sandstone, yellow (water)	35	70
Shale, sandy, gray	20	90
Shale, green and brown	18	108
Shale, soft, gray	10	118
Shale, brown, and coal	5	123
Shale, green	5	128
Shale, sandy, gray	59	187
Rock, hard, gray	3	190
Sandstone, gray (water)	25	215
Shale, sandy, gray	25	240
Sandstone, gray	12	252
Shale, sandy, gray	48	300
Shale, sandy, gray	25	325
Shale, sandy, blue	15	340
Shale, sandy, gray	20	360
Sandstone, hard, gray	2	362
Shale, sandy, gray	18	380
Shale, blue	10	390
Shale, hard, gray	22	412
Sandstone, coarse-grained, gray	11	423
Shale, sandy, gray	67	490
Shale, gray	28	518
Shale, brown	1	519

A2-4-21ca2—Continued

	Thickness (feet)	Depth (feet)
Shale, sandy, gray	16	535
Shale, brown	5	540
Shale, sandy, gray	10	550

A2-4-21ca3
[J. D. Verley. Land-surface altitude, 5,249 ft]

	Thickness (feet)	Depth (feet)
Shale, friable, gray	3	3
Sandstone, soft	2	5
Shale, blue	5	10
Sandstone, gray	5	15
Shale, green	12	27
Rock, hard	3	30
Sandstone, hard, yellow	15	45
Shale, sandy, gray	15	60
Sandstone, yellow	10	70
Sand (water)	20	90

A2-4-30ca2
[J. S. Draper. Land-surface altitude, 5,354 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	12	12
Shale, gray	18	30
Shale, light-brown	6	36
Shale, sandy, dark-gray	24	60
Sandstone, gray (water)	20	80
Shale, sandy gray	22	102
Shale, gray	6	108
Shale, green	6	114
Shale, gray	76	190
Shale, gray	20	210
Shale, sandy, gray	16	226
Shale, soft, blue	15	241
Sandstone, red	13	254
Shale, sandy, gray	54	308
Sandstone, gray	17	325
Shale, blue	16	341
Coal	5	346
Shale, green	8	354
Shale, sandy, gray	41	395
Sand (water)	35	430

A2-4-36db2
[U.S. Geological Survey. Land-surface altitude, 4,959.8 ft]

	Thickness (feet)	Depth (feet)
Soil and clay	25	25
Shale	------	------

A2-5-2ab
[Joe R. Foster. Land-surface altitude, 4,875 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	10	10
Sandstone (water)	15	25
Shale, hard, blue	20	45
Shale, hard, blue, sandy, gray	23	68
Sandstone, hard, glassy	2	70
Shale, soft, gray	13	83
Shale, hard, sandy, gray	8	91
Shale, gray	44	133
Sandstone, soft	10	145
Shale, gray	15	160
Shale, sandy, gray	18	178
Sandstone, gray	22	200
Shale, gray	16	216
Shale	29	245
Shale, blue	10	255
Shale, brown	20	275
Sand (water)	25	300
Shale, sandy, blue	6	306

TABLE 17.—*Logs of wells*—Continued

A2-5-3ab1
[Ernest Pintgetzer. Land-surface altitude, 4,871 ft]

	Thickness (feet)	Depth (feet)
Loam, sandy	7	7
Shale, blue	21	28
Rock, hard, gray	2	30
Shale, sandy, gray (bad water at 75 feet)	100	130
Sand (water)	10	140
Shale, gray	3	143
Sandstone, hard	27	170
Shale, gray	10	180
Sand (water)	5	185
Shale, brown	13	198

A2-5-3ab2
[Ernest Pintgetzer. Land-surface altitude, 4,873 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	1	1
Gravel	4	5
Soil, sandy (water)	7	12
Shale, sandy, gray, with hard shells	53	65
Shale, gray	15	80
Shale, sandy, gray	40	120
Shale, gray, with hard shells	45	165
Shale, sandy, gray	31	196
Shale, brown, and blue	38	234
Sand (water)	35	269

A2-5-3bb
[C. H. Hayen. Land-surface altitude, 4,879 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	7	7
Sandstone, yellow	8	15
Shale, sandy, gray	24	39
Rock, hard	3	42
Shale, sandy, gray	23	65
Sandstone, hard, gray	7	72
Shale, soft, sandy, gray	13	85
Sand, fine (water under artesian head)	15	100
Shale, sandy	14	114
Sandstone, gray	18	132
Shale, sandy, gray	38	170
Sandstone, gray	5	175
Shale, gray	20	195
Shale, red, blue, yellow, and brown	15	210
Shale, blue	8	218
Sand (water)	30	248

A2-5-4aa
[E. S. Peltzer. Land-surface altitude, 4,888 ft]

	Thickness (feet)	Depth (feet)
Soil	12	12
Gravel	15	27
Sandstone, yellow (water)	33	60
Shale, sandy, gray	48	108
Shale, sandy, blue	27	135
Shale, sandy, gray	33	168
Shale, sandy, blue	22	190
Shale, sandy, gray	30	220
Sand (water)	40	260
Shale, gray	2	262

A2-5-4bb2
[C. B. Brown. Land-surface altitude, 4,916 ft]

	Thickness (feet)	Depth (feet)
Soil and yellow clay	10	10
Sand, yellow	10	20
Shale, yellow	10	30
Rock, hard	5	35
Sandstone, yellow	45	80
Sandstone, gray	10	90
Rock, hard	5	95
Shale, sandy, gray	30	125
Shale, hard, gray	20	145
Rock, hard	10	155
Shale, gray	50	205
Sand, gray (water)	10	215

A2-5-5aa2
[R. C. Neal. Land-surface altitude, 4,929 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	13	13
Sandstone, hard, gray (water at 27 feet)	27	40
Shale, hard, gray	40	80
Shale, soft, gray	10	90
Shale, hard, gray	18	108
Sandstone, soft, gray	8	116
Shale, soft, gray	7	123
Sand, black and gray (water)	19	142
Sandstone, hard, gray	38	180
Shale, gray	5	185
Sandstone, soft, gray	10	195
Shale, hard, sandy, gray	36	231
Shale, brown	19	250
Shale, blue	2	252
Shale, brown	3	255
Sandstone, hard, gray	5	260
Sand (water)	15	275
Shale, blue	2	277

A2-5-5aa3
[U.S. Bureau of Reclamation. Land-surface altitude 4,916 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	10	10
Sandstone, soft	2	12
Sandstone, hard	2	14
Shale	2	16
Siltstone	14	30
Shale	4	34

A2-5-5dd
[Harry Waugh. Land-surface altitude, 4,989 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Sandstone, yellow	20	23
Shale, yellow	20	43
Shale, gray	39	82
Sand, gray (water)	10	92

A2-5-6bd
[Leo Cunningham. Land-surface altitude, 5,001 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	7	7
Sandstone, yellow	28	35
Shale, gray	50	85
Sandstone, hard, gray	5	90
Shale, blue and green	20	110
Sandstone, gray and red	15	125
Sand (water)	15	140

TABLE 17.—*Logs of wells*—Continued

A2-5-7bb

[C. M. Corr. Land-surface altitude, 5,012 ft]

	Thickness (feet)	Depth (feet)
Soil	4	4
Quicksand	12	16
Shale, yellow	24	40
Shale, blue	58	98
Shale, sandy (water)	7	105

A2-5-7bd

[John Kobayashi. Land-surface altitude, 5,024 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	6	6
Sandstone, gray	19	25
Crevice (water)	1	26
Sandstone, light-gray	24	50
Shale, green and gray	25	75
Sandstone, hard, gray	1	76
Sandstone, red and white	26	102
Shale, soft, gray	19	121
Shale, hard, gray	3	124
Sandstone, red and white	31	155
Sand, coarse (water)	10	165
Shale, blue	8	173
Sandstone, gray	8	181
Shale, blue	2	183
Shale, gray	5	188
Sandstone, red and white	------	------

A2-5-8bb

[Roy J. Eells. Land-surface altitude, 5,007 ft]

	Thickness (feet)	Depth (feet)
Shale, sandy	2	2
Shale, sandy, gray	7	9
Shale, soft, gray	11	20
Sandstone, yellow	16	36
Shale, sandy, gray	59	95
Sand (water)	15	110

A2-5-10ac

[Y. W. Causey. Land-surface altitude, 4,999 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	3	3
Sandstone, yellow	27	30
Shale, gray	5	35
Shale, blue	7	42
Shale, gray	15	57
Sandstone, yellow	13	70
Sandstone, gray	3	73
Sandstone, yellow	6	79
Rock, hard	5	84
Shale, blue	1	85
Rock, hard	2	87
Sandstone, hard, gray	23	110
Shale, hard, gray	22	132
Sandstone, red and gray	13	145
Shale, blue	5	150
Shale, hard, gray	8	158
Sandstone, gray	10	168
Shale, gray	2	170
Sandstone, gray	7	177
Shale, blue, gray	5	182
Sandstone, gray	11	193
Shale, blue	2	195
Shale, sticky, gray	19	214
Shale, blue	3	217
Sandstone, gray	8	225
Shale, blue	3	228
Sandstone, gray	22	250
Shale, blue	4	254

A2-5-10ac—Continued

	Thickness (feet)	Depth (feet)
Rock, hard	2	256
Shale, sandy, blue	12	268
Shale, blue and brown	68	336
Shale, blue	7	343
Sandstone, gray	3	346
Sand (water)	11	357
Shale, blue	3	360

A2-5-10bb

[Irl Pintgetzer. Land-surface altitude, 4,999 ft]

	Thickness (feet)	Depth (feet)
Soil and gravel	7	7
Sandstone	17	24
Shale, blue	22	46
Sandstone	50	96
Shale, sandy, blue	13	109
Shale, hard, sandy, gray	6	115
Sandstone, dark-brown	10	125
Shale, sandy	51	176
Shale, sandy, light-blue	29	205
Shale, sandy, gray	35	240
Shale, sticky, gray	20	260
Shale, blue and brown	18	278
Shale, blue	2	280
Sand, coarse (water)	12	292
Shale, blue and brown	2	294

A2-5-11bb1

[Lincoln Todd. Land-surface altitude, 4,964 ft]

	Thickness (feet)	Depth (feet)
Soil	8	8
Sandstone	42	50
Shale, sandy, blue	43	93
Shale, sandy, gray	52	145
Shale, sandy, blue	7	152
Shale, sandy, gray	24	176
Shale, sandy, blue	4	180
Shale, sandy, gray	10	190
Shale, blue and brown	5	195
Shale, sticky, brown	16	211
Shale, sandy, sticky, gray	5	216
Shale, sticky, brown	14	230
Shale, sticky, gray	25	255
Shale, brown	3	258
Shale, sticky, blue	3	261
Shale, sticky, brown	14	275
Shale, sticky, blue	5	280
Shale, brown	20	300
Sandstone, brown	23	323
Sandstone, gray	8	331
Sandstone (water)	14	345
Shale, sandy, blue	2	347

A2-5-12bb

[Geo. English. Land-surface altitude, 4,983 ft]

	Thickness (feet)	Depth (feet)
[?]	10	10
Sand, gray-brown	20	30
Sand, brown, and sandy shale	10	40
Shale, bluish-green	10	50
Shale, sandy, blue	40	90
Shale, brownish-red	10	100
Shale, bluish-green	30	130
Shale, sandy, reddish-brown	10	140
Shale, dark-gray	10	150
Shale, gray	40	190
Shale, brown	10	200
Shale, brown and gray, bentonite	80	280
Sand	20	300

TABLE 17.—*Logs of wells*—Continued

A2-5-20dc1
[Paul Madlock. Land-surface altitude, 4,986.17 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	6	6
Sandstone	9	15
Shale, hard, gray	15	30
Sandstone, yellow (water at 30 feet)	10	40
Shale, hard, gray	25	65
Sandstone, gray	10	75

A2-5-27ca
[N. R. Shelly. Land-surface altitude, 4,829.97 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	25	25
Gravel	12	37
Shale, brown	26	63
Sand (water)	117	180

A2-5-28ca
[U.S. Geological Survey. Land-surface altitude, 4,861.1 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	17.7	17.7

A2-5-28cb2
[Harry Littlefield. Land-surface altitude, 4,882.78 ft]

	Thickness (feet)	Depth (feet)
Soil	8	8
[?], gray	54	62
Shale,gray	78	140
Sand (water)	30	170

A2-5-29dd
[Harry Littlefield. Land-surface altitude, 4,871.50 ft]

	Thickness (feet)	Depth (feet)
Soil	5	5
Gravel	5	10
Sandstone, yellow (water)	38	48

A2-5-30ad
[Leo Kehm. Land-surface altitude, 5,005.64 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	4	4
Sandstone, yellow	16	20
Shale, gray	7	27
Sandstone, yellow	21	48
Shale, gray	30	78
Sandstone, gray	12	90
Shale, gray	15	105
Sandstone, gray	17	122
Sand (water)	8	130
Sandstone, gray	19	149
Sand (water)	21	170

A2-5-30cd2
[Lowell Lund. Land-surface altitude, 4,962.55 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	4	4
Gravel	15	19
Sandstone, yellow	22	41
Shale, sandy, gray	34	75
Sandstone, yellow (water)	12	87
Shale, brown and blue	53	140
Shale, sandy, light-brown	25	165
Sand (water)	12	177

A2-6-6da
[L. O. Allread. Land-surface altitude, 4,829 ft]

	Thickness (feet)	Depth (feet)
Gravel	35	35
Sandstone, yellow	28	63
Shale, sandy, gray	21	84
Sandstone, yellow	30	114
Shale, sandy, gray	16	130
Shale, brown	2	132
Shale, sandy, gray	11	143
Shale, brown and blue	15	158
Sandstone	16	174
Sand (water)	14	138
Shale, brown	2	190

A2-6-6dd
[A. R. Morse. Land-surface altitude, 4,839 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	10	10
Gravel	20	30
Sandstone, yellow	13	43
Shale, hard, gray	12	55
Sandstone, yellow	30	85
Shale, sandy, gray	21	106
Shale, brown	32	138
Shale, blue	6	144
Sandstone, gray (water)	20	164
Shale, brown	26	190
Shale, sandy	14	204
Shale, brown	33	237
Shale, blue	8	245
Shale, sandy, light-gray	10	255
Sandstone, hard	1	256
Sand (water)	18	274
Shale, gray	8	282
Sand (sulfur water)	8	290
Shale, gray	4	294
Sand (sulfur water)	26	320
Shale, blue	4	324
Sand (sulfur water)	56	380
Sand, coarse	22	402
Shale, blue	3	405
Shale, brown	47	452
Sand (water)	10	462
Rock, hard	4	466
Shale, blue	4	470
Shale, gray	10	480
Shale, blue and brown	31	511
Sandstone	1	512
Shale, blue, brown	11	523
Sand	25	548
Shale, gray	7	555
Sand (water)	12	567
Shale, sandy, gray	3	570

TABLE 17.—*Logs of wells*—Continued

A2-6-7cd
[Sam Schrinar. Land-surface altitude, 4,864 ft]

	Thickness (feet)	Depth (feet)
Sand with lenses of gravel	32	32
Shale, sandy, brown	35	67
Shale, blue and brown	28	95
Sandstone, gray	13	108
Sand	17	125
Shale, blue	3	182

A2-6-7db
[Howard Edwards. Land-surface altitude, 4,809 ft]

	Thickness (feet)	Depth (feet)
Sand and gravel	12	12
Shale, soft, sandy, gray	18	30
Crevice	5	35
Shale, sticky, gray	10	45
Shale, soft, brown	12	57
Sandstone, light-gray	7	64
Sand, white (water)	6	70

A2-6-18ad
[M. Marlowe. Land-surface altitude, 4,808 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	20	20
Sand and boulders (water)	14	34
Sandstone, yellow	9	43
Shale, blue	11	54
Sandstone, gray	4	58
Rock, hard	1	59
Shale and coal (sulfur water)	66	125
Shale, blue and brown	25	150
Shale, brown	26	176
Sandstone, gray	17	193
Shale, sandy, gray	17	210
Sand (sulfur water and gas)	25	235
Shale, sandy, gray	25	260
Shale, brown and blue	20	280
Shale, sandy, gray	13	293
Sand (sulfur water)	27	320
Shale, sandy, gray	35	355
Shale, brown	6	361
Shale, sandy, gray	24	385
Sand (water)	20	405

A2-6-18ba
[B. G. Gillette. Land-surface altitude, 4,854 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	4	4
Sand and boulders	21	25
Shale, brown	25	50
Shale, hard, sandy, gray	10	60
Sandstone, hard, gray	22	82
Sand (water)	21	103
Shale, gray	2	105

A2-6-18ca
[Mel Devish. Land-surface altitude, 4,843 ft]

	Thickness (feet)	Depth (feet)
Soil	15	15
Gravel, coarse	45	60
Shale, blue	15	75
Sand, gray (water)	28	103

A2-6-18cd
[E. H. Marlatt. Land-surface altitude, 4,835 ft]

	Thickness (feet)	Depth (feet)
Soil	7	7
Gravel and cobbles	83	90
Shale	3	93
Sand	18	111

A2-6-18da
[U.S. Geological Survey. Land-surface altitude, 4,814.6 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	5.5	5.5
Sand and gravel	16.3	21.8

A2-6-19ba
[Ira D. Ablard. Land-surface altitude, 4,828 ft]

	Thickness (feet)	Depth (feet)
Sand and gravel	40	40
Sandstone, yellow	23	63
Shale, sandy, gray	24	87
Rock, hard	2	89
Sand and coal shale (sulfur water)	16	105
Shale, brown	1	106
Shale, blue	6	112
Shale, gray	12	124
Rock, hard	2	126
Sand (sulfur water and gas)	14	140

A2-6-19bd
[T. H. Coleman. Land-surface altitude, 4,834 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	15	15
Gravel	30	45
Shale, sandy, brown	15	60
Shale, brown	30	90
Shale, sandy, gray	10	100
Sand (sulfur water)	35	135
Shale, brown and blue	80	215
Shale, sandy, blue	5	220
Sand (sulfur water)	15	235
Shale, brown and blue	22	257
Sand (water)	20	277

A2-6-19cb
[E. M. Dixson. Land-surface altitude, 4,833 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	6	6
Gravel	32	38
Shale, sandy, gray	18	56
Sand (sulfur water)	14	70
Shale, sandy, gray	18	88
Shale, blue and brown	49	137
Shale, sandy, light-brown	15	152
Shale, brown	36	188
Shale, sandy, light-brown	37	225
Shale, sandy, gray	39	264
Rock, hard	1	265
Sand (water)	17	282

TABLE 17.—*Logs of wells*—Continued

A2-6-19da
[G. Davison. Land-surface altitude, 4,801 ft]

	Thickness (feet)	Depth (feet)
Gravel	20	20
Sandstone, yellow	31	51
[?] (sulfur water)	1	52
Sandstone, gray	26	78
Shale, blue and brown	7	85
Sandstone, gray	25	110
Sand (sulfur water)	20	130
Rock, hard	1	131
Sand (sulfur water)	10	141
Rock, hard	1	142
Sand (sulfur water and gas)	12	154
Shale, gray	10	164
Sandstone, gray	6	170
Sand and coal shale (gas)	29	199
Shale, yellow	6	205
Sand (sulfur water and gas)	33	238
Shale, brown and blue	62	300
Sand, fine (water)	6	306
Shale, gray	9	315
Sandstone, gray	35	340
[?] (water)	13	353
Rock, hard	2	355
Sand, white (gas)	5	360

A3-1-12dd1
[Andrew Harrington. Land-surface altitude, 5,483 ft]

	Thickness (feet)	Depth (feet)
Soil	6	6
Gravel	3	9
Quicksand	3	12
Sandstone, yellow	18	30
Shale, yellow	15	45
Sandstone, yellow	35	80
Shale, blue	10	90
Sand (water)	5	95
Shale, sandy	5	100

A3-1-13cd
[U.S. Geological Survey. Land-surface altitude, 5,452 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	12	12
Shale, reworked	5	17
Shale, green	3.5	20.5

A3-1-13dd1
[Ray Walker. Land-surface altitude, 5,415 ft]

	Thickness (feet)	Depth (feet)
Soil	6	6
Quicksand	10	16
Sandstone, yellow	56	72
Sand (water)	13	85

A3-1-14aa
[Arthur Olson. Land-surface altitude, 5,529 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy clay	3	3
Quic sand	31	34
Sandstone (water)	3	37

A3-1-16cd2
[Fred Ahrens. Land-surface altitude, 5,537 ft]

	Thickness (feet)	Depth (feet)
Soil, clay, yellow	3	3
Gravel	3	6
Shale, yellow	10	16
Sandstone. yellow	69	85
Shale, blue	20	105
Sandstone, blue	15	120
Shale, gray	10	130
Shale, sandy, gray	30	160
Sand, gray (water)	11	171

A3-1-19cd
[Everett J. Hutchinson. Land-surface altitude, 5,520 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Gravel	6	9
Sand, yellow	31	40
Shale, brown	4	44
Sand, yellow	35	79
Shale, sandy, gray	26	105
Limeshell	5	110
Shale, sandy, gray	45	155
Limeshell	3	158
Shale, sandy, gray	73	231
Sand, gray	54	285
Shale, gray	170	455

A3-1-21ad
[Herb Lemming. Land-surface altitude, 5,524 ft]

	Thickness (feet)	Depth (feet)
Soil	12	12
Clay, yellow	18	30
Sandstone, brown	46	76
Shale, gray	8	84
Shale, blue	19	103
Sandstone, gray	46	149
Shale, gray	3	152
Sandstone, gray	20	172
Shale, gray	11	183
Sandstone, gray	42	225
Shale, gray	1	226

A3-1-21ba2
[Kenneth Westlake. Land-surface altitude, 5,542 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	3	3
Sandstone, yellow	47	50
Shale, sandy, gray	5	55
Sand (water)	25	80
Shale, sandy, gray	65	145
Sandstone, gray, red, and black	13	158
Shale, sandy, gray	58	216
Sand (water)	17	233
Shale, sandy, gray	27	260
Sandstone, hard, gray and red	21	281
Shale, sandy, gray	24	305
Sandstone, soft, gray and red	30	335
Limestone (?), hard	2	337
Sandstone, gray	30	367
Shale, sandy, blue	33	400
Sand (water)	8	408
Shale, sandy, blue	17	425
Shale, brown	5	430
Sand (water)	20	450
Shale, sandy, blue	15	465
Shale, brown	35	500

TABLE 17.—*Logs of wells*—Continued

A3-1-21dd2
[F. C. Aydelotte. Land-surface altitude, 5,457 ft]

	Thickness (feet)	Depth (feet)
Soil, clay, yellow	3	3
Shale, yellow	45	48
Sandstone, yellow	27	75
Shale, gray	75	150
Shale, sandy, gray	40	190
Sandstone, gray	40	230
Shale, sandy, gray	80	310
Sand, gray	13	323

A3-1-22bb
[F. M. Duvall. Land-surface altitude, 5,539 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Rock, hard, gray	10	12
Shale, yellow	10	22
Shale, light-colored	43	65
Sandstone, yellow	20	85
Shale, blue	8	93
Shale, brown	3	96
Sandstone (water)	10	106
Shale, sandy, gray	39	145
Shale, sandy, blue	15	160
Sand, gray (water)	20	180
Shale, blue	30	210

A3-1-22da
[Henry E. Parker. Land-surface altitude, 5,487 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Sandstone, yellow	18	20
Shale, yellow	10	30
Sandstone, yellow	15	45
Rock, hard	2	47
Shale, gray	4	51
Sandstone, yellow	24	75
Sand (water)	13	88
Shale, brown	4	92
Shale, blue	30	122
Sand, gray (water)	11	133

A3-1-24db
[Vern Dickman. Land-surface altitude, 5,484 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy clay	6	6
Shale, soft, light-colored	24	30
Shale, hard	15	45
Sandstone, yellow (water)	15	60

A3-1-25bd
[C. S. Stephens. Land-surface altitude, 5,446 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	3	3
Sandstone, gray	10	13
Shale, yellow	32	45
Sandstone, yellow	15	60
Rock, hard	4	64
Shale, hard, gray	26	90
Shale, sandy, gray	25	115
Sand (water)	20	135
Shale, sandy, brown and gray	10	145
Shale, blue	25	170
Shale, sandy, gray	58	228
Sand, gray (water)	24	252

A3-1-25da
[Alva Gray. Land-surface altitude, 5,383 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy clay	6	6
Muck(?), yellow	9	15
Sandstone, yellow	65	80
Shale, blue	70	150
Shale, gray	30	180
Sandstone, gray	15	195
Shale, gray	20	215
Shale, sandy, gray	127	342
Sandstone, gray (water)	8	350

A3-1-26bd1
[Ross Bisbee]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	1	1
Sandstone, yellow	69	70

A3-1-26bd2
[U.S. Geological Survey. Land-surface altitude, 5,449 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy, clay	7	7
Sandstone	5.5	12.5

A3-1-28cc1
[Leo R. Schenck. Land-surface altitude, 5,508.27 ft]

	Thickness (feet)	Depth (feet)
Gravel	14	14
Shale, gray	14	28
Shale, variegated	150	178
Sand, fine	1	179
Sand, coarse	8	187

A3-1-36ba
[Amos Wisdom. Land-surface altitude, 5,389 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy, clay, yellow	2	2
Rock, hard	4	6
Shale, yellow	4	10
Rock, hard	4	14
Shale, yellow	16	30
Sandstone, yellow	30	60
Shale, blue	46	106
Rock, hard	6	112
Shale, gray	38	150
Sand, gray (water)	8	158

A3-1-36cb
[Art Fisher. Land-surface altitude, 5,411 ft]

	Thickness (feet)	Depth (feet)
Soil	7	7
Sandstone, yellow	28	35
Shale, blue	10	45
Sandstone, yellow (water)	35	80
Shale, blue	20	100
Shale, gray	15	115
Shale, sandy, gray	17	132
Shale, gray	9	141
Shale, sandy, gray	48	189
Sandstone, gray	15	204
Shale, gray	11	215
Sandstone, gray	20	235
Shale, sandy, gray	10	245
Sandstone, coarse, gray	35	280
Shale, sandy, gray	90	370
Sandstone, coarse, gray	38	408
Shale, gray	22	430
Sandstone, gray	15	445
Sand (water)	15	460

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A3-1-36dd1 [Marion Schmuck. Land-surface altitude, 5,366 ft]		
Soil	3	3
Sand (water)	16	19
Sandstone, brown	13	32
Clay, yellow	6	38
Shale, sandy, gray	3	41
Shale, sandy, blue	7	48
Sandstone, brown	6	54
Shale, blue	22	76
Shale, brittle, blue	8	84
Sand, green	2	86
Shale, green	15	101
Sandstone, green	11	112
Shale, green	6	118
Sandstone, green	17	135
Shale, brown	5	140
Sandstone, green	37	177
Shale, brittle, blue	7	184
Shale, sandy, green	12	196
Sandstone, green	35	231
Shale, green	29	260
Sandstone, green	43	303
Shale, green	31	334
Hard shell	1	335
Sandstone, green	13	348
Shale, sandy, green	24	372
Sandstone, green	24	396
Hard shell	1	397
Sand, fine, green (water)	6	403
Sand, coarse, green (water)	6	409
A3-1-36dd2 [Marion Schmuck. Land-surface altitude, 5,366 ft]		
Soil	3	3
Sand	6	9
Sandstone, red	21	30
Mud, brown	10	40
Shale, blue and green	45	85
Rock, hard, brown	10	95
Shale, sandy, gray	8	103
Rock, hard	40	143
Shale	7	150
Sandstone, gray	30	180
Shale, sticky, light	5	185
Shale, brown	4	189
Rock, hard, brown	108	297
Shale, gray	5	302
Rock, hard, gray	8	310
Shale, brown	4	314
Sandstone, hard	34	348
Shale, blue	3	351
Rock, light-gray	16	367
Shale, light	4	371
Rock, hard	3	374
Sandstone, brown (water)	6	380
Shale, sandy, light	31	411
Sand (water)	25	436
Shale, light	4	440
A3-2-2cd [Ruben Yaunkin. Land-surface altitude, 5,338 ft]		
Soil, yellow clay	4	4
Gravel	6	10
Sandstone, yellow	24	34
Shale, yellow	4	38
Sandstone, yellow	27	65
A3-2-2cd—Continued		
Shale, gray	43	108
Shale, blue	36	144
Shale, brown and blue	6	150
Shale, light and chalky	2	152
Shale, gray	28	180
Shale, gray, sandy	14	194
Sandstone, gray (water)	11	205
A3-2-5bc [Ted E. Aston. Land-surface altitude, 5,451 ft]		
Soil, sandy clay	6	6
Sand, soft, yellow	10	16
Sandstone, yellow	22	38
Shale, blue	32	70
Sandstone, gray (water)	30	100
A3-2-6ba [Tom E. Bullington. Land-surface altitude, 5,549 ft]		
Soil, sandy, yellow clay	10	10
Sandstone, yellow	55	65
Sandstone, gray (water)	5	70
Shale, gray	34	104
A3-2-6cb [Ted H. Gies. Land-surface altitude, 5,537 ft]		
Soil, yellow clay	2	2
Sandstone, yellow	18	20
Shale, light-gray	52	72
Shale, gray, sandy	40	112
Sandstone	18	130
A3-2-6db [L. Montgomery. Land-surface altitude, 5,539 ft]		
Soil, sandy, yellow clay	4	4
Sandstone, yellow	26	30
Shale, yellow	4	34
Shale, gray	48	82
Shale, sandy, gray	38	120
Shale, gray	12	132
Sandstone, gray (water)	17	149
A3-2-7bc [Morris and Knudson. Land-surface altitude, 5,525 ft]		
Soil, sandy clay	4	4
Rock, hard	4	8
Sandstone, yellow	2	10
Shale, gray	48	58
Sandstone, yellow	16	74
Sandstone, yellow (water)	26	100

TABLE 17.—*Logs of wells*—Continued

A3-2-7cc1
[U.S. Bureau of Reclamation. Land-surface altitude, 5,479 ft]

	Thickness (feet)	Depth (feet)
Loam, sandy	13	13
Sandstone, soft	82	95
Shale, blue	188	283
Shale, red	12	295
Shale, gray	19	314
Shale, light-colored	9	323
Shale, gray	8	331
Sand, coarse, white	9	340
Sand, fine	40	380

A3-2-7cc2
[U.S.Bureau of Reclamation. Land-surface altitude, 5,479 ft]

	Thickness (feet)	Depth (feet)
Sand, soft, brown	10	10
Sandstone, hard, brown	36	46
Sandstone, hard, brown	36	82
Sandstone, hard, gray	20	102
Sandstone and medium-blue shale	19	121
Sandstone, hard, gray	8	129
Shale, hard, sandy, blue	20	149
Shale, sandy, blue	31	180
Sand and medium-blue sandy shale	43	223
Sandstone with medium-gray shale	35	258
Shale, medium-gray	20	278
Shale, medium-gray	15	293
Shale, brown	2	295
Shale, hard, sandy, gray	10	305
Shale, hard, gray	23	328
Sand, soft, light-colored	6	334
Sandstone, medium light-colored	34	368
Sand, soft, light-colored	30	398

A3-2-7dd
[Mike Sauter. Land-surface altitude, 5,425 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Sandstone, yellow	12	14
Shale, blue	2	16
Sandstone, yellow	20	36

A3-2-10cd3
[J. F. Wempen. Land-surface altitude, 5,365 ft]

	Thickness (feet)	Depth (feet)
Soil	1	1
Rock, hard	2	3
Clay, sandy	10	13
Sandstone, yellow	67	80
Shale, gray	25	105
Shale, sandy, gray	25	130
Shale, gray	30	160
Shale, brown and gray	15	175
Shale, blue	35	210
Shale, brown and gray	10	220
Shale, sandy, gray	40	260
Shale, gray (water)	8	268

A3-2-10db2
[A. B. Miller. Land-surface altitude, 5,440 ft]

	Thickness (feet)	Depth (feet)
Soapstone	10	10
Shale, blue	12	22
Sandstone, yellow	8	30
Shale, sandstone	20	50
Shale, light-colored	15	65
Sandstone, brown (water)	50	115
Shale, blue	4	119
Rock, hard, gray	21	140
Shale, light-colored	3	143
Sandstone, brown	37	180
Shale, blue	4	184
Rock, hard, gray	10	194
Shale, gray	6	200
Sandstone, light-colored	15	215
Shale, green and gray	25	240
Shale, blue	6	246
Rock, brown	4	250
Shale, gray	15	265
Sandstone, brown	10	275
Shale, sandy, light-colored	58	333
Rock, hard, brown	3	336
Shale, gray	20	356
Sandstone, white	4	360
Rock, hard, brown	8	368
Shale, sandy, gray	48	416
Sandstone, gray	4	420
Shale, light-colored	6	426
Rock, brown	5	431
Shale, brown	3	434
Shale, sandy, gray	28	462
Shale, brown	4	466
Sand (water)	16	482

A3-2-11ba
[P. H. Seyler. Land-surface altitude, 5,355 ft]

	Thickness (feet)	Depth (feet)
Soil, yellow clay	3	3
Sandstone, yellow	14	17
Clay, yellow	18	35
Sandstone, yellow (water)	32	67

A3-2-12bb
[Robert L. Crawford. Land-surface altitude, 5,349 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Sandstone	38	40
Shale, brown	18	58
Shale, blue	10	68
Sandstone	30	98
Shale, blue	25	123
Shale, brown	5	128
Shale, blue	5	133
Shale, brown	12	145
Shale, blue	28	173
Sandstone	67	240
Shale, blue	40	280

A3-2-12bd2
[Elton Williams. Land-surface altitude, 5,322 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Clay	29	32
Clay, soft, yellow	30	62
Sandstone, yellow (hard water)	10	72
Shale, gray	52	124
Sandstone, gray (water)	8	132

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A3-2-12dc [Charles Wilson. Land-surface altitude, 5,311 ft]		
Soil	4	4
Shale, brown	66	70
Gravel (water)	2	72
Sand, brown	38	110
Shale, blue	50	160
Shale, gray	10	170
Sand, gray (water)	25	195
Shale, blue	45	240
Shale, gray	175	415
Sand, gray (water)	34	449
A3-2-14cc2 [A. E. Kintzler. Land-surface altitude, 5,301 ft]		
Soil, sandy clay	4	4
Shale, yellow	14	18
Sandstone, yellow	62	80
Shale, gray	25	105
Sand, gray (water)	25	130
Shale, sandy, gray	10	140
Shale, gray	10	150
Shale, sandy, gray	45	195
Shale, blue	20	215
Shale, gray	47	262
Shale, sandy, gray	20	282
Sand, gray (water)	20	302
A3-2-15dc [J. R. Newberry. Land-surface altitude, 5,339 ft]		
Soil, yellow clay	3	3
Sand, yellow	4	7
Shale, yellow	23	30
Sandstone, yellow	10	40
Shale, gray	20	60
Sandstone, yellow	10	70
Shale, gray	30	100
Shale, sandy, gray	30	130
Shale, gray	20	150
Shale, sandy, gray	35	185
Shale, brown	10	195
Shale, sandy, gray	7	202
Sand, gray (water)	16	218
Shale, sandy	22	240
Shale, blue	20	260
Shale, hard, gray	63	323
Sand (water)	15	338
A3-2-17cb [Frank Goertzen. Land-surface altitude, 5,423 ft]		
Clay, yellow	10	10
Shale, yellow	14	24
Sandstone, yellow	16	40
Shale, gray	10	50
Rock, hard	4	54
Shale, sandy, gray	16	70
Shale, gray	35	105
Shale, sandy	5	110
Sand (water)	16	126
Shale, gray	24	150
Rock, hard	2	152
Shale, gray	8	160
Rock, hard	2	162
Shale, gray	8	170
Shale, sandy, gray	10	180
Shale, gray	35	215
Shale, sandy, gray	5	220
Shale, blue	40	260
Shale, brown and gray	5	265
Shale, hard, gray	35	300
Shale, sandy, gray	24	324
Sand (water)	11	335
A3-2-18ac [Lynn Moore. Land-surface altitude, 5,449 ft]		
Soil	1	1
Rock, hard	2	3
Shale, blue	10	13
Shale, yellow	10	23
Sandstone	40	63
Shale, yellow	20	83
Sand (water)	17	100
A3-2-18ba [U.S. Bureau of Reclamation. Land-surface altitude, 5,443.5 ft]		
Loam, sandy	8	8
Clay	------	------
A3-2-18bd [John Heath. Land-surface altitude, 5,451 ft]		
Sand, clay, yellow	2	2
Shale, yellow	23	25
Sandstone, yellow	42	67
Shale, yellow	5	72
Sandstone, yellow	8	80
Shale, yellow	6	86
Shale, sandy, gray	6	92
Sand (water)	13	105
A3-2-18da [Leroy Justice. Land-surface altitude, 5,435 ft]		
Soil, yellow, sandy clay	4	4
Sandstone, yellow	2	6
Shale, yellow	19	25
Sandstone, yellow	95	120
Shale, gray	50	170
Sandstone, gray (water)	10	180
A3-2-19bb [Edward Shipper. Land-surface altitude, 5,413 ft]		
Soil, yellow clay, sandy	6	6
Shale, yellow	34	40
Sandstone, yellow	15	55
Sandstone, gray (water)	10	65
Shale, sandy, gray	10	75
Shale, blue	11	86
Sand, gray (water)	14	100
A3-2-20aa [Pete Yaeger. Land-surface altitude, 5,334 ft]		
Soil and sand (water)	18	18
Sandstone	22	40

TABLE 17.—*Logs of wells*—Continued

A3-2-20ac
[John W. Fink. Land-surface altitude, 5,334 ft]

	Thickness (feet)	Dept (feet)
Shale, blue	24	24
Sandstone	16	40
Shale, white	5	45
Sandstone (water)	13	58
Shale, gray	16	74
Sand, white (water)	24	98
Shale, gray	7	105
Shale, blue	12	117
Sand, coarse (dry)	13	130
Sand, coarse (water)	7	137

A3-2-20ca
[L. E. Gordon. Land-surface altitude, 5,346 ft]

	Thickness (feet)	Dept (feet)
Soil, sandy, yellow clay	4	4
Sandstone, yellow	10	14
Shale, yellow	10	24
Sandstone, yellow	56	80
Shale, gray	20	100
Shale, blue	15	115
Rock, hard, gray	60	175
Shale, sandy, gray	25	200
Sand	8	208
Shale, hard, gray	10	218
Sandstone, gray (water)	12	230

A3-2-20cd2
[U.S. Bureau of Reclamation. Land-surface altitude, 5,447.2 ft]

	Thickness (feet)	Dept (feet)
Soil, sandy loam	2.5	2.5
Sandstone, brown	16.5	19.0
Rock, hard	2	21
Shale, brown	7	28
Rock, hard	1.5	29.5
Shale	3.5	33

A3-2-21aa
[O. C. Maxon. Land-surface altitude, 5,347 ft]

	Thickness (feet)	Dept (feet)
Sandstone, soft, brown	8	8
Sandstone, hard	16	24
Shale, sandy, light-gray	22	46
Shale, white	9	55
Sandstone, brown	24	79
Sandstone, hard	3	82
Sandstone, brown	8	90
Sandstone, fine-grained, gray	15	105
Shale, blue	8	113
Shale, sandy, blue	12	125
Shale, sandy, blue	15	140
Shale, blue	10	150
Shale, gray-blue	10	160
Sandstone, gray (water)	16	176
Sandstone, coarse-grained, gray (water)	14	190

A3-2-21ac
[O. C. Maxon. Land-surface altitude, 5,359 ft]

	Thickness (feet)	Dept (feet)
Soil, yellow clay	1	1
Sandstone, yellow	44	45
Shale, gray	150	195
Shale, brown	5	200
Shale, gray	95	295
Sand, gray (water)	15	310

A3-2-22cd
[W. F. Boyd. Land-surface altitude, 5,393 ft]

	Thickness (feet)	Depth (feet)
Sandstone	14	14
Sandstone, brown	26	40
Sandstone, brown	35	75
Sandstone, gray (water)	8	83
Shale, gray	7	90
Shale, sandy, gray	14	104
Sandstone, black and white	9	113
Shale, gray	4	117
Clay, brown	18	135
Shale, green	50	185
Shale, brown	10	195
Shale, sandy, gray	35	230
Sandstone, soft, gray	80	310
Shale, hard, sandy, gray	35	345
Slate(?) (water)	13	385

A3-2-22dc
[Samuel L. Moore. Land-surface altitude, 5,275 ft]

	Thickness (feet)	Depth (feet)
Shale, blue	2	2
Sand	6	8
Sandstone, yellow	60	68

A3-2-23db
[Arthur Jacox. Land-surface altitude, 5,252 ft]

	Thickness (feet)	Depth (feet)
Old well, no log available	74	74
Sandstone, yellow	6	80
Shale, sandy, gray	45	125
Sand, gray (water)	35	160
Shale, gray	35	195
Sand, gray (water)	35	230
Shale, blue	10	240
Shale, gray	20	260
Shale, brown	5	265
Shale, sandy, gray	20	285
Sand, gray (water)	15	300

A3-2-26ad
[S. K. Abernathy. Land-surface altitude, 5,264 ft]

	Thickness (feet)	Depth (feet)
Sand (water)	14	14
Sandstone	9	23
Shale, gray	7	30
Sandstone, black and white	5	35
Shale, blue and gray	50	85
Sandstone, blue and white	5	90
Shale, gray	10	100
Sandstone, blue and white	25	125
Shale green	45	170
Sandstone, blue and white	30	200
Shale, gray	2	202
Shale, blue	23	225
Sand, gray	6	231
Shale, brown	4	235
Shale, green	6	241
Shale, gray	17	258
Shale, green	6	264
Shale, gray	32	296
Sand, soft (water)	25	321

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A3-2-27aa [Earl Stultz. Land-surface altitude, 5,280 ft]		
Soil, sandy loam	10	10
Sandstone, yellow (hard water)	20	30
Shale, blue	50	80
Sandstone, gray (water)	15	95
A3-2-27ab2 [U.S. Bureau of Reclamation. Land-surface altitude, 5,259 ft]		
Soil, sandy loam	12	12
Sandstone, soft	8	20
Sandstone, hard	4	24
Sandstone	9	33
A3-2-28bb [H. J. Schneider. Land-surface altitude, 5,311 ft]		
Sand	3	3
Shale, blue	7	10
Sandstone, yellow	40	50
A3-2-28cb [Bert Green. Land-surface altitude, 5,334 ft]		
Soil, sandy	7	7
Sandstone, yellow (water)	48	55
Shale, blue	3	58
Sandstone, gray	7	65
Shale, sandy, gray	8	73
Rock, hard, gray	4	77
Sandstone, gray	28	105
Sand (water)	20	125
A3-2-29bb Clarence C. Clark. Land-surface altitude, 5,391 ft]		
Soil, sandy clay, yellow	12	12
Gravel	2	14
Shale, sandy, yellow	31	45
Sandstone, yellow (water)	10	55
Shale, yellow	10	65
Rock, hard	5	70
Shale, hard, gray	15	85
Shale, gray	29	114
Shale, sandy, gray	21	135
Shale, hard, gray	5	140
Shale, blue	8	148
Shale, brown	4	152
Shale, blue	33	185
Shale, hard, gray	15	200
Shale, gray	10	210
Shale, hard, gray	5	215
Shale, sandy	20	235
Sand (water)	12	247

	Thickness (feet)	Depth (feet)
A3-2-29cb [George E. Case. Land-surface altitude, 5,372 ft]		
Soil	8	8
Clay, yellow	13	21
Sandstone, brown	23	44
Sandstone, brown	10	54
Shale, green	6	60
Shale, gray	18	78
Shale, sandy, gray	5	83
Sandstone, gray	49	132
Shale, gray (water)	1	133
A3-2-30aa1 [Henry Lissman. Land-surface altitude, 5,400 ft]		
Soil	21	21
Clay, sandy	22	43
Sand, yellow	33	76
Shale, blue	39	115
Sand (water)	45	160
Shale, green	6	166
Shale, blue	24	190
Shale, brown	4	194
Shale, blue	56	250
Shale, gray	18	268
Sand (water)	74	342
Shale, blue	44	386
Sand (water)	36	422
A3-2-30bb2 [U.S. Bureau of Reclamation. Land-surface altitude, 5,413.8 ft]		
Soil, sandy loam	21	21
Sandstone	13	34
A3-2-30dd1 [Clair Day. Well 1. Land-surface altitude, 5,379 ft]		
Soil	1	4
Sandstone, brown	13	11
Shale, gray	15	29
Shale, brown	2	31
Shale, gray	2	33
Sandstone, brown	19	52
Sandstone, brown	4	56
Shale, sandy, gray	13	69
Shale, gray	32	101
Sandstone, gray	22	123
Shale, gray	8	131
Sandstone, blue	14	145
Shale, blue	1	146

TABLE 17.—*Logs of wells*—Continued

A3-2-30dd2
[Clair Day. Well 2. Land-surface altitude, 5,379 ft]

	Thickness (feet)	Depth (feet)
Soil	4	4
Sandstone (water)	46	50
Shale, hard, gray	40	90
Shale, brown and blue	5	95
Shale, hard, blue	13	108
Shale, sandy, hard	36	144
Shale, blue	20	164
Shale, hard, gray	20	184
Rock, hard	2	186
Shale, sandy	106	292
Shale, gray	50	342
Rock, hard	4	346
Shale, hard, gray	97	443
Rock, hard	3	446
Shale, hard, gray	14	460
Shale, sandy, gray	10	470
Rock, hard	2	472
Shale, hard, gray	10	482
Rock, hard	2	484
Shale, gray	16	500

A3-2-30dd3
[Clair Day. Well 3. Land-surface altitude, 5,379 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	20	20
Sandstone (water at 45 feet)	25	45
Rock, hard	2	47
Shale, hard, gray	53	100
Shale, sandy	27	127
Shale, hard, blue	13	140
Sand (water)	2	142
Shale, blue	14	156
Shale, light-colored	29	185
Shale, hard, gray	15	200
Shale, sandy, gray	15	215
Sand, gray (water)	15	230
Shale, sandy, gray	12	242
Shale, gray	138	380
Rock, hard	6	386
Shale, gray	84	470
Rock, hard	3	473
Shale, gray	77	550
Shale, brown and gray	2	552
Shale, dark-gray	30	582

A3-2-31ad
[Carl G. Welty. Land-surface altitude, 5,335 ft]

	Thickness (feet)	Depth (feet)
Soil	9	9
Clay, yellow	11	20
Shale, gray	24	44
Shale, sandy, brown	16	60
Shale, sandy, gray	12	72
Rock, hard	5	77
Sand, hard (water)	20	97
Shale, sandy, gray	23	120
Rock, hard	3	123
Shale, gray	27	150
Shale, green	4	154
Shale, gray	23	177
Rock, hard	4	181
Shale, gray	47	228
Sand, gray	6	234
Shale, gray	83	317
Sand, gray	28	345
Shale, gray	22	367
Rock, hard	3	370
Sand, gray	24	394
Shale, sandy, hard	57	451
Sand (water)	17	468

A3-2-31bb
[C. F. Schmuck. Land-surface altitude, 5,353 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Sandstone, brown (water)	28	31
Clay, sandy, yellow	3	34
Shale, gray	5	39
Sandstone, light-green	23	62
Shale, gray	22	84
Shale, gray	7	91
Gravel, medium	2	93
Shale, sandy, gray	5	98
Sandstone, gray	14	112

A3-2-31ca
[R. B. Gallegos. Land-surface altitude, 5,355 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	3	3
Sandstone, yellow	7	10
Shale, gray	7	17
Sandstone, yellow (water)	38	55
Shale, gray	9	64
Sandstone, gray	14	78
Sandstone, gray (water)	8	86
Shale, blue	14	100
Sandstone, hard, gray	72	172
Shale, hard, gray	38	210
Sandstone, gray	20	230
Sandstone, coarse	15	245
Shale, sandy, hard, gray	25	270
Sandstone, hard, gray	64	334
Shale, sandy, hard, gray	52	386
Sandstone, gray	34	420
Sandstone (water)	15	435
Shale, gray	2	437
Sand (water)	8	445

A3-2-32aa
[H. A. Stearns. Land-surface altitude, 5,359 ft]

	Thickness (feet)	Depth (feet)
Soil, yellow clay	6	6
Shale, yellow	44	50
Sandstone, yellow	15	65
Shale, green	5	70
Shale, gray	20	90
Shale, sandy, gray	45	135
Shale, blue	30	165
Shale, brown	5	170
Shale, gray	24	194
Shale, sandy, gray	43	237
Sand, gray (water)	8	245

A3-2-32dd
[U.S. Bureau of Reclamation. Land-surface altitude, 5,284.2 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	10	10
Sandstone and lenses of shale	27	37

A3-2-33aa
[A. Rohn. Land-surface altitude, 5,289 ft]

	Thickness (feet)	Depth (feet)
Sandstone	32	32
Shale	18	50
Sandstone	20	70
Shale	18	88
Sandstone	14	102

TABLE 17.—*Logs of wells*—Continued

A3-3-6ba
[Lawrence Williams. Land-surface altitude, 5,340 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	2	2
Shale, sandy, blue	48	50
Shale, sandy, gray	16	66
Shale, sandy, blue	24	90
Shale, sandy, gray	38	128
Shale, sandy, blue	27	155
Sand (sulfur water)	17	172
Shale, sandy, blue	20	192
Shale, sandy, gray	24	216
Shale, sandy, blue	12	228
Shale, blue and brown	7	235
Shale, sandy, gray	17	252
Shale, blue	5	257
Shale, sandy, gray	23	280
Sandstone, gray	50	320
Water sand (water)	27	347
Shale, sandy, gray	3	350

A3-3-6cc
[Kenneth Heald. Land-surface altitude, 5,346 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Shale, blue	8	10
Sandstone	120	130
Shale, brown	50	180
Shale, blue	60	240
Sandstone	30	270

A3-3-6dc
[Lloyd G. Foster. Land-surface altitude, 5,308 ft]

	Thickness (feet)	Depth (feet)
Soil	4	4
Sandstone, yellow	48	52
Shale, yellow	4	56
Sandstone, yellow	14	70
Shale, blue	13	83
Shale, sandy, gray	19	102
Shale, blue	6	108
Shale, green	8	116
Sandstone, gray	20	136
Shale, green	19	153
Shale, blue and brown	29	182
Shale, blue	5	187
Shale, sandy, blue	7	194
Sand	10	204

A3-3-7bb
[Blake P. Helberg. Land-surface altitude, 5,336 ft]

	Thickness (feet)	Depth (feet)
Sand and gravel	15	15
Shale, yellow	3	18
Sand and gravel	5	23
Shale, yellow	5	28
Shale, gray and yellow	22	50
Shale, gray	28	78
Sandstone, hard, gray	2	80
Shale and sand, yellow	18	98
Sand, gray	13	111

A3-3-7bb—Continued

	Thickness (feet)	Depth (feet)
Shale, brown, blue, gray	4	115
Shale and sand, gray	5	120
Sand, hard, gray	2	122
Sandstone, gray, and gray shale	6	128
Sandstone, hard, gray	4	132
Sandstone, gray, and gray shale	16	148
Sandstone, hard, gray	2	150
Sandstone and gray broken shale	14	164
Shale, blue	6	170
Shale, sandy, gray	10	180
Sandstone, gray	20	200
Shale, green	12	212
Shale, brown	8	220
Shale, brown, green and gray	27	247
Sandstone and sandy shale	15	262
Shale, hard, gray	12	274
Shale, hard	1	275
Shale, brown	5	280
Sandstone, gray	13	293
Sandstone, hard	1	294
Sandstone, gray	10	304
Shale	6	310

A3-3-7ca
[Raymond Bond. Land-surface altitude, 5,293 ft]

	Thickness (feet)	Depth (feet)
Clay, sandy (topsoil)	20	20
Sandstone, yellow	18	38
Gravel	4	42
Shale, blue	2	44
Sandstone, yellow	46	90
Shale, coal, brown	4	94
Shale, blue	6	100
Shale, sandy, blue	55	155
Rock, hard	4	159
Shale, blue	29	188
Shale, sandy	12	200
Shale, blue	20	220
Shale, sandy, blue	5	225
Shale, brown	5	230
Shale, blue	5	235
Shale, brown and blue	10	245
Shale, blue	30	275
Rock, hard	4	279
Sand (water)	31	310

A3-3-13ad
[U.S. Bureau of Reclamation. Land-surface altitude, 5,309 ft]

	Thickness (feet)	Depth (feet)
Shale	5	5
Shale, gray	5	10
Shale, gray and red	5	15
Shale, hard, gray	5	20
Shale, hard, gray, with stringers of soft red shale	5	25
Shale, red	10	35
Shale, red to gray	5	40
Shale, gray	5	45
Siltstone	15	60
Shale, gray	5	65
Sand, shaly	10	75
Shale, sandy	10	85
Sand, shaly	5	90
Sandstone, fine, silty	14	104
Sandstone, coarse	7	111

TABLE 17.—*Logs of wells*—Continued

A3-3-13ad—Continued

	Thickness (feet)	Depth (feet)
Shale	3	114
Shale, sandy	6	120
Shale, variegated	5	125
Shale	25	150
Shale, with hard stringers	15	165
Shale	15	180
Shale, with hard stringers	10	190
Shale	10	200
Shale, sandy	20	220
Sand, shaly	5	225
Shale, sandy	15	240
Shale, soft	5	245
Shale, soft and hard	5	250
Shale, hard, with stringers of soft shale	5	255
Shale, soft	5	260
Shale, soft, with stringers of hard shale	15	275
Shale, sandy	10	285
Sand, shaly	15	300
Sandstone, medium-grained, hard	11	311
Sandstone, fine-grained, soft	9	320
Sandstone, fine-grained, soft, to medium-grained, hard	5	325
Sandstone, coarse-grained, soft	5	330
Sandstone, coarse- to medium- and fine-grained, soft	5	335
Sandstone,fine-grained	15	350
Sandstone	20	370
Sandstone	15	385
Sandstone, fine, moderately soft	25	410
Sandstone, fine, and shale	8	418
Shale, moderately hard	2	420
Shale, with hard stringers	7	427

A3-3-16cb
[Richard Pattison. Land-surface altitude, 5,236 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy (some water)	45	45
Shale, sandy, gray (bad water)	75	120
Shale, gray	20	140
Sandstone, red and gray	90	230
Shale, sandy, gray	23	253
Sandstone, red and gray	22	275
Shale, blue and brown	20	295
Shale, sandy, gray	20	315
Sandstone, red and gray	25	340
Sand (good water)	20	360

A3-3-17aa
[Richard Pattison. Land-surface altitude, 5,248 ft]

	Thickness (feet)	Depth (feet)
Soil	15	15
Soil, sandy (water)	41	56
Sandstone, yellow	34	90
Sandstone, black and white (bad water)	114	204
Shale, soft, gray	3	207
Sand, soft, black and white	16	223
Shale, sandy, gray	17	240
Shale, green	5	245
Sand, green and white	20	265
Shale, blue. gray, green and brown	15	280
Sandstone, soft	55	335
Shale, soft, brown, and coal	5	340
Sandstone	5	345
Shale, gray	9	354
Sandstone, black and red	31	385
Shale, hard, gray	27	412
Sandstone, red and black	23	435
Shale, sandy, hard, gray	------	------

A3-3-17ad
[Richard Pattison. Land-surface altitude, 5,254 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	3	3
Sandstone, yellow	47	50
Shale, gray	20	70
Sandstone, gray	15	85
Shale, gray	35	120
Sandstone, gray and black	103	223
Shale, gray	14	237
Sandstone, gray	33	270
Sand (bad water)	20	290
Shale, brown and blue	10	300
Sandstone, white	10	310
Shale, blue and gray	10	320
Sandstone, red and black	30	350
Sand, black, red and white (water)	20	370

A3-3-18ad
[Smith Pattison. Land-surface altitude, 5,281ft]

	Thickness (feet)	Depth (feet)
Sandstone, hard, white	2	2
Sandstone, soft, yellow	48	50
Shale, sandy, hard, gray	50	100
Sand (bad water)	17	117
Sandstone, hard, gray	2	119
Sandstone, soft, gray	48	167
Shale, blue	35	202
Shale, sandy, gray	43	245
Sandstone, soft, brown and gray	15	260
Sand, coarse (bad water)	20	280
Sandstone, gray	5	285
Shale, blue	10	295
Sandstone, soft, gray	13	308
Shale, brown	6	314
Shale, sandy, gray	5	319
Shale, blue	6	325
Sandstone, red and gray	15	340
Shale, sandy, hard, gray	40	380
Sandstone, hard, gray	10	390
Sandstone, soft, gray	30	420
Shale, sandy, hard, gray	30	450
Shell rock, hard	2	452
Sandstone, soft, gray	8	460
Sand (bad water)	15	475
Shale, hard, gray	45	520
Sandstone, hard, gray	7	527
Sand (water)	48	575

A3-3-18dd2
[C. Miranda. Land-surface altitude, 5,283 ft]

	Thickness (feet)	Depth (feet)
Sandy clay (topsoil)	1	1
Sandstone, yellow	29	30
Rock, hard	5	35
Shale, gray	5	40
Shale, brown	20	60
Shale, gray	15	75
Sand, gray (water)	10	85

TABLE 17.—*Logs of wells*—Continued

A3-3-21ad2
[Harvey W. Roland. Land-surface altitude, 5,273 ft]

	Thickness (feet)	Depth (feet)
Sandstone, yellow	35	35
Shale, sandy, gray	35	70
Sandstone, gray (water)	18	88
Shale, gray	3	91
Sandstone, gray	19	110
Shale, gray	8	118
Sandstone, gray	7	125
Rock, hard, gray	2	127
Shale, gray	18	145
Sandstone, gray	24	169
Shale, gray	9	178
Sandstone, gray	25	203
Shale, gray	4	207
Sandstone, gray	20	227
Shale, hard, gray	9	236
Shale, sandy, gray	6	242
Sandstone, gray	29	271
Shale, brown	7	278
Sandstone, gray	4	282
Shale, soft, gray	3	285
Sandstone, brown	5	290
Sand (water)	10	300
Sandstone, gray	18	318
Shale, brown	3	321
Shale, mixed colors	9	330
Sandstone	5	335
Sand (water)	15	350
Shale, sandy, blue	22	372
Shale, green	4	376
Rock, hard, gray	2	378
Shale, gray	3	381
Sandstone, hard, gray	11	392
Shale, gray	8	400
Sand (water)	25	425

A3-3-22ab
[Bryan Annon. Land-surface altitude, 5,198 ft]

	Thickness (feet)	Depth (feet)
[?]	82	82
Sandstone, gray	8	90
Shale, gray	27	117
Shale, sandy, gray	3	120
Sandstone, gray (water)	28	148
Shale, gray	3	151
Sandstone, gray	63	214
Shale, brown	4	218
Shale, gray	46	264
Shale, brown	5	269
Shale, gray	35	304
Sandstone, gray	14	318
Shale, gray	13	331
Sandstone, gray (water)	28	359
Shale, sandy, gray	2	361
Sandstone, gray (water)	32	393
Shale, gray	46	439
Shale, sandy, gray	6	445
Sandstone, gray	15	460

A3-3-22cc
[Midvale Store (Stubbs and Lund). Land-surface altitude, 5,268 ft]

	Thickness (feet)	Depth (feet)
Soil	9	9
Shale, variegated	16	25
Sandstone, soft, yellow	15	40

A3-3-22cc—Continued

	Thickness (feet)	Depth (feet)
Shale, variegated	80	120
Sand, gray	3	123
Shale, variegated	57	180
Sandstone, gray	15	195

A3-3-22cd
[Henry Jaeger. Land-surface altitude, 5,263 ft]

	Thickness (feet)	Depth (feet)
Topsoil, sandy, yellow clay	2	2
Sandstone, yellow	73	75
Shale, gray	55	130
Shale, sandy, gray	45	175
Sand, gray (water)	8	183

A3-3-22dc
[Otis Williams. Land-surface altitude, 5,236 ft]

	Thickness (feet)	Depth (feet)
Topsoil	3	3
Sandstone, fine- to coarse-grained, brown (water)	29	32
Shale, sandy, gray to brown	10	42
Sandstone, gray	5	47
Shale, blue	81	128
Sand, fine, blue to gray (water)	21	149

A3-3-23bb1
[William Eaton. Land-surface altitude, 5,183 ft]

	Thickness (feet)	Depth (feet)
Soil, light-brown	40	40
Gravel and sand (water)	35	75
Shale, gray	3	78
Sandstone, gray	30	108
Shale, sandy, gray	70	178
Shale, gray	5	183
Sandstone, gray	19	202
Shale, blue	4	206
Sand and gray shale	10	216
Shale, blue	6	222
Shale, sandy, hard, gray	13	235
Shale, sandy, hard, gray	14	249
Shale, sandy, gray	11	260
Shale, soft, gray	9	269
Shale, sandy, gray	31	300
Sandstone, gray	12	312
Shale, sandy, gray	16	328
Sandstone, gray	12	340
Sandstone, gray	8	348
Shale, sandy, gray	30	378
Rock, hard, gray	2	380
Sandstone, gray	26	406
Sand, coarse (some water)	6	412
Shale, sandy, gray	6	418
Sandstone, gray	27	445
Shale, sandy, gray	17	462
Shale, variegated	6	468
Shale, sandy, gray	14	482
Sandstone	18	500

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A3-3-23cc [Otis Williams. Land-surface altitude, 5,187 ft]		
Topsoil	3	3
Sandstone, yellow	9	12
Rock, hard	2	14
Shale, sandy, gray	16	30
Rock, hard	2	32
Shale, light	28	60
Sandstone, gray	15	75
Shale, blue	26	101
Sand (water)	23	124
A3-3-23dc [Emil Leonhardt. Land-surface altitude, 5,159 ft]		
Topsoil, yellow clay	20	20
Quicksand	10	30
Sandstone, yellow	15	45
Shale, hard, gray	20	65
Shale, blue	65	130
Shale, sandy, gray	26	156
Shale, brown	20	176
Shale, soft, green	29	205
Shale, light-colored	25	230
Shale, blue	10	240
Sand (water)	11	251
A3-3-24cc [R. W. White. Land-surface altitude, 5,150 ft]		
Soil	29	29
Shale	8	37
Sandstone	13	50
A3-3-25ba [Arno F. Huenefeldt. Land-surface altitude, 5,142 ft]		
Soil and quicksand	75	75
Sandstone	37	112
Shale, gray	83	195
Sand (water)	15	210
Shale, gray	5	215
A3-3-25bb [U.S. Bureau of Reclamation. Land-surface altitude, 5,149.3 ft]		
Soil, sandy loam	30	30
Shale	3	33
A3-3-26ab1 [Carl Leonhardt. Land-surface altitude, 5,154 ft]		
Soil	18	18
Sand, brown (water)	21	39
Sandstone, brown	18	57
Sandstone, gray	9	66
Shale, blue	5	71
Sandstone, gray (water)	14	85
Shale, gray	37	122
Sandstone, gray	23	145
A3-3-26ab2 [Carl Leonhardt. Land-surface altitude, 5,154 ft]		
Topsoil	6	6
Quicksand, yellow	34	40
Sandstone, yellow	20	60
Shale, blue	10	70
Shale, sandy, gray	78	148
Shale, brown	8	156
Shale, blue	19	175
Shale, blue and brown	9	184
Shale, light-colored	20	204
Shale, blue	24	228
Sand (water)	16	244
A3-3-27ab2 [Herbert T. Burton. Land-surface altitude, 5,201 ft		
Topsoil, yellow, sandy clay	4	4
Rock	6	10
Shale	10	20
Rock, sandy	15	35
Shale	35	70
Shale, sandy, and sandstone	30	100
Shale	80	180
Sand (water)	12	192
A3-3-27bb [Jerry Lathrop. Land-surface altitude, 5,259 ft]		
Topsoil, yellow, sandy clay	4	4
Sand, yellow	4	8
Shale, yellow	17	25
Sandstone, yellow	50	75
Sandstone, gray	5	80
Shale, gray	60	140
Shale, sandy, gray	35	175
Sand, gray (water)	15	190
A3-3-27bc2 [Robert Taylor. Land-surface altitude, 5,249 ft]		
Soil, sandy	2	2
Shale, gray	3	5
Shale, sandy, gray	45	50
Sandstone, yellow (bad water)	5	55
Shale, sandy, gray	20	75
Sand (water)	10	85
Shale, sandy, blue	8	93
Shale, sandy, gray	32	125
Sandstone, red and white	10	135
Shale, sandy, hard, gray	20	155
Sandstone, gray	10	165
Shale, sandy, gray	5	170
Sand (water)	22	192
Shale, gray	1	193
A3-3-29ac [I. D. White. Land-surface altitude, 5,281 ft]		
Soil, sandy	8	8
Quicksand	12	20
Sandstone, gray	27	47
Shale, light-red	11	58
Sandstone, gray (water)	11	69
Shale, gray	13	82
Shale, sandy, hard, gray	13	95
Sand (water)	27	122

TABLE 17.—*Logs of wells*—Continued

A3-3-30ab2
[U.S. Bureau of Reclamation. Land-surface altitude, 5,273.5 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	8	8
Sandstone, hard	2	10
Sandstone, soft	20	30
Silt, hard	6	36

A3-3-30ad
[J. I. Stubbs. Land-surface altitude, 5,273 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Quicksand	19	22
Shale, blue	24	46
Shale, brown	4	50
Shale, blue	55	105
Sand, coarse, white	13	118
Shale, blue	67	185
Sand (water)	18	203

A3-3-34ad
[John Hagel. Land-surface altitude, 5,258 ft]

	Thickness (feet)	Depth (feet)
Soil, hard, sandy	12	12
Soil, sandy (water)	33	45
Shale, gray	5	50
Sandstone, gray	12	62
Vein of water	1	63
Sandstone, gray	7	70
Shale, blue	4	74

A3-3-34bb
[U.S. Bureau of Reclamation. Land-surface altitude, 5,229.6 ft]

	Thickness (feet)	Depth (feet)
[?]	4	4
Sandstone, soft, brown	2	6
Shale, blue	8	14
Shale, red and blue	4	18
Shale, gray	4	22
Shale, red and gray	7	29

A3-3-36bd
[Boyd Mason. Land-surface altitude, 5,231 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	6	6
Shale, sandy, hard, gray	69	75
Sandstone, hard, blue and gray	13	88
Sandstone, hard, white	3	91
Sandstone, soft, gray and blue	19	110
Sand, fine (water)	33	143
Sandstone, gray	13	156

A3-4-29dd
[David Dewey. Land-surface altitude, 5,115 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	10	10
Sand, yellow	35	45
Shale, blue	59	104
Sand, gray (hard water)	18	122
Sand, white	14	136
Shale, soft, blue	114	250

A3-4-31aa
[Harvey Stone. Land-surface altitude, 5,154 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	10	10
Shale, sandy, gray	7	17
Sandstone, gray (water)	8	25
Shale, gray	7	32
Sandstone, gray and black	13	45
Shale, sandy, gray	16	61
Sandstone, soft, gray	19	80
Rock, hard, white	2	82
Sandstone, soft	26	108
Shale, gray, green, and blue	7	115
Shale, green and brown	5	120
Shale, gray	5	125
Shale, brown and green	15	140
Shale, gray	8	148
Sandstone, red and gray	127	275
Sandstone, hard, gray	32	307
Sandstone, hard	10	317
Shale, brown and green	6	323
Shale, hard, sandy, gray	7	330
Sandstone, red, black, and gray	10	340
Shale, gray	5	345
Sandstone, hard	7	352
Shale, sandy, gray	48	400
Sandstone, soft, white	25	425
Shale, sandy, gray	15	440
Sandstone, soft, black and red	70	510
Rock, hard, white	1	511
Sandstone (water and sulfur)	19	530
Sandstone, hard (water)	4	534
Sandstone, coarse (water)	8	542
Shale, gray	8	550

A3-4-31ba
[Enid Wagner. Land-surface altitude, 5,176 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam (water in lower part)	25	25
Sandstone, yellow	15	40
Shale, green	6	46
Shale, sandy, gray	47	93
Shale, gray	11	104
Sandstone, gray with black specks	15	119
Shale, light-green	11	130
Shale, brown (water)	15	145
Sandstone, gray	18	163
Shale, sandy, gray	21	184
Rock, light-blue	1	185
Sandstone, gray	33	218
Shale, sandy, gray	32	250

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A3-4-32ba1 [Howard Dewey. Land-surface altitude, 5,139 ft]		
Soil, sandy	10	10
Sand (water)	15	25
Shale, gray	10	35
Sandstone, yellow (water)	22	57
Sandstone, gray	9	66
Shale, sandy, gray	16	82
Shale, brown	3	85
Shale, sandy, gray	30	115
Sandstone, gray and black	24	139
Hard shells	3	142
Sandstone, soft, gray	8	150
Hard shell	1	151
Shale, hard, gray	19	170
Sandstone, black, red, and white	50	220
Sandstone, gray	85	305
Shale, gray	4	309
Sandstone, gray	16	325
Sand and hard shells	15	340
Sandstone	10	350
Shale, gray	10	360
A3-4-32ba2 [U.S. Bureau of Reclamation. Land-surface altitude, 5,135 ft]		
Soil, sandy loam	23	23
Shale	10	33
A3-4-33dd [Earl Dietrich. Land-surface altitude, 5,115 ft]		
Soil, sandy, yellow	6	6
Muck, sandy, yellow	10	16
Clay, yellow	19	35
Sand, hard, yellow	25	60
Sandstone, yellow	65	125
Sandstone, gray	10	135
Shale, hard, gray	20	155
Shale, hard, sandy, gray	137	292
Sandstone, gray (water)	8	300
Shale, hard, gray	175	475
Shale, brown	40	515
A3-4-34bd [W. E. Partridge. Land-surface altitude, 5,047 ft]		
Soil, sandy	12	12
Quicksand	4	16
Shale, yellow	7	23
Sandstone, yellow	85	108
Shale, sandy, gray	42	150
Sandstone, gray	50	200
Shale, sandy, gray	50	250
Sandstone, red and gray	33	283
Shale, sandy, gray	11	294
Sandstone, red and gray	9	303
Shale, blue	10	313
Shale, brown	2	315
Sandstone, gray	70	385
Shale, gray	4	389
Rock, hard	1	390
Shale, gray	10	400
Sand (water)	40	440

	Thickness (feet)	D ept (feet)
A3-4-34cc [Clair Wheeler. Land-surface altitude, 5,094 ft]		
Soil, sandy	35	35
Sandstone, yellow (bad water)	65	100
Shale, hard, gray and blue	30	130
Sandstone, gray, and hard shells	50	180
Shale, gray	50	230
Sandstone, gray	33	263
Shale, gray	18	281
Shale, blue	5	286
Shale, brown	5	291
Sandstone, red and black	9	300
Shale, gray	5	305
Sandstone, red and black	12	317
Shale, gray	15	332
Sandstone, soft, gray	68	400
Sand (soft water)	33	433
Shale, blue	2	435
A3-4-34db [Larry Barrett. Land-surface altitude, 5,048 ft]		
Soil, sandy	4	4
Sandstone, hard, gray	11	15
Sandstone, yellow	30	45
Sandstone, gray	13	58
Sand, yellow (water)	22	80
Sandstone, gray	75	155
Shale, gray	25	180
Sandstone, gray	7	187
Shale, gray	6	193
Sandstone, gray	5	198
Sandstone, coarse-grained, black and white	2	200
Shale, hard, sandy, gray	15	215
Sandstone, hard, gray	20	235
Shale, blue	15	250
Sandstone, black, gray, and red	50	300
Shale, hard, gray	5	305
Sandstone, gray and red	45	350
Shale, blue	5	355
Sandstone	29	384
Limestone(?), hard	2	386
Sand (water)	19	405
A3-4-34dd2 [Geo. Brown. Land-surface altitude, 5,052 ft]		
Soil, yellow, sandy clay	4	4
Muck, yellow	14	18
Sandstone, yellow	52	70
Shale, gray	80	150
Shale, blue	135	285
Sand, gray (water)	15	300
A3-4-35dc2 [John Brockman. Land-surface altitude, 5,011 ft]		
Soil, sandy	15	15
Quicksand	17	32
Sandstone, yellow	21	53
Shale, hard, gray	35	88
Sandstone, hard, gray	32	120
Sandstone, soft	27	147
Shale, soft, gray	2	149
Sandstone, soft, gray	36	185
Shale, hard, gray	8	193
Sandstone, gray	15	208
Sand (water)	22	230
Shale, sandy, gray	70	300

TABLE 17.—*Logs of wells*—Continued

A3-4-36cd
[Joseph A. Downey. Land-surface altitude, 4,974 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	4	4
Shale, gray, sandy	6	10
Sandstone, gray	35	45
Sand (water)	10	55
Sandstone, gray	21	76
Shale, sandy, gray	22	98
Sandstone, gray	18	116
Shale, sandy, gray	26	142
Sand (water)	8	150
Shale, sandy, gray	10	160

A3-4-36dc
[U.S. Bureau of Reclamation. Land-surface altitude, 4,971.4 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	5	5
Sand, loamy	10	15
Sandstone, soft	3	18
Shale	15.5	33.5

A3-5-31cb1
[Fred Colman. Land-surface altitude, 4,976 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	6	6
Sandstone, yellow	29	35
Shale, sandy, gray	35	70
Sandstone, gray and red	17	87
Shale, hard, sandy, gray	43	130
Sandstone, gray and red	12	142
Shale, gray	8	150
Sandstone, gray and red	44	194
Sand (water)	17	211

A3-5-31cc
[W. S. Parkhurst. Land-surface altitude, 4,990 ft]

	Thickness (feet)	Depth (feet)
Loam, sandy	4	4
Sandstone, yellow	18	22
Shale, sandy, gray	28	50
Sandstone, hard	10	60
Shale, gray	3	63
Sandstone, soft, gray	37	100
Sandstone, hard, gray	25	125
Sandstone, medium-gray	20	145
Sandstone, coarse-grained	40	185
Shale, hard, sandy, gray	9	194
Sandstone, coarse-grained	9	203
Rock, hard, white	2	205
Rock, coarse-grained, white	10	215
Shale, blue	5	220

A3-5-31da
[Arthur Hensleigh. Land-surface altitude, 4,953 ft]

	Thickness (feet)	Depth (feet)
Sandstone	25	25
Shale, blue	49	74
Sand, gray (water)	10	84
Shale, sandy, dark-colored	11	95
Shale, blue	40	135
Sand (water)	25	160

A3-5-32da2
[Lillian B. Downey. Land-surface altitude, 4,905 ft]

	Thickness (feet)	Depth (feet)
Soil	5	5
Sandstone, soft	11	16
Shale, gray	14	30
Shale, sandy, gray	20	50
Shale, bluish-brown and gray	10	60
Shale, sandy, gray	42	102
Sandstone, gray	6	108
Sand, coarse	12	120
Rock, hard	1	121
Sand, coarse	9	130
Shale, sandy, gray	11	141
Shale, soft, gray	15	156
Sandstone, red and gray	29	185
Shale, sandy, gray	45	230
Sand, white (water)	20	250
Shale, sandy, gray	5	255

A3-5-34bc2
[J. K. Waugh. Land-surface altitude, 4,872 ft]

	Thickness (feet)	Depth (feet)
Soil and yellow clay	14	14
Muck, yellow	21	35
Shale, blue	25	60
Shale, gray	20	80
Sandstone, gray	15	95
Shale, gray	65	160
Shale, sandy, gray	25	185
Shale, gray	95	280
Shale, brown	8	288
Shale, gray	12	300
Sand, grayish-white	10	310

A3-5-34dc
[C. E. Lossner. Land-surface altitude, 4,866 ft]

	Thickness (feet)	Depth (feet)
Soil	15	15
Shale, hard, gray	70	85
Shale, sandy, gray	35	120
Shale, gray	40	160
Shale, sandy, gray	25	185
Shale, blue	15	200
Shale, brown	39	239
Sand (water)	36	275

A3-5-35cc
[Harry Waugh. Land-surface altitude, 4,863 ft]

	Thickness (feet)	Depth (feet)
Soil	4	4
Shale, gray	111	115
Shale, sandy, gray	35	150
Sand, gray (water)	10	160

A3-5-35dd
[H. H. Harry. Land-surface altitude, 4,878 ft]

	Thickness (feet)	Depth (feet)
Loam, sandy	14	14
Sandstone, gray	14	28
Shale, gray and blue	234	262
Sandstone, gray	20	282
Shale, gray	18	300
Sand, silver-colored	36	366

TABLE 17.—*Logs of wells*—Continued

A3-5-36ab
[Harry Waugh. Land-surface altitude, 4,854 ft]

	Thickness (feet)	Depth (feet)
Soil, clayey, and cobbles	1	1
Shale, gray	10	11
Shale, sandy, yellow	10	21
Rock, hard	10	31
Shale, gray	33	64
Sandstone, yellow (water)	10	74
Rock, hard	20	94
Shale, blue	104	198
Sand, gray (water)	10	208

A3-5-36cb
[D. D. Weideman. Land-surface altitude, 4,861 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	12	12
Sandstone, yellow (water)	13	25
Sandstone, gray	15	40
Rock crevice	3	43
Sandstone, gray	37	80
Shale, sandy, gray	25	105
Sandstone, gray	2	107
Shale, gray	43	150
Sandstone, soft, gray and red	25	175
Shale, gray	8	183
Shale, hard, sandy, gray	7	190
Sandstone, hard, gray	10	200
Shale, gray, sandy	23	223
Shale, brown	10	233
Sandstone, gray	19	252
Sand (water)	18	270

A3-6-9bb2
[John Herbst. Land-surface altitude, 4,686 ft]

	Thickness (feet)	Depth (feet)
Sandstone	85	85
Shale, hard, sandy, gray	22	107
Shale, soft, blue and gray (water at 160 feet)	105	212
Shale, blue, and brown coal	3	215
Shale, blue, with brown streaks	40	255
Shale, chocolate-brown	15	270
Sandstone, gray	12	282
Shale, brown and blue	33	315
Sand (water under artesian head)	15	330
Shale, brown	30	360
Sandstone, soft	10	370
Sand (water)	10	380
Shale, brown	52	432
Sand (water under artesian head)	68	500

A3-6-30bc
[V. A. Friend. Land-surface altitude, 4,803 ft]

	Thickness (feet)	Depth (feet)
Loam, sandy	12	12
Sandstone, yellow	20	32
Shale, gray	28	60
Sandstone, gray	20	80
Shale, gray	20	100
[?]	224	324

A3-6-31dd
[Hersey Roberts. Land-surface altitude, 4,829 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	70	70
Gravel	6	76
Sandstone	6	82
Shale, sandy	24	106
Sandstone	17	123
Shale, sandy	23	146
Shale, sandy, blue	21	167
Sand (water)	20	187
Shale, blue	2	189

A3-6-32bb
[Carl Ferguson. Land-surface altitude, 4,785 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy, and gravel	45	45
Shale, gray	45	90
Sandstone, gray	30	120
Shale, brown	8	128
Shale, gray	35	163
Shale, brown	7	170
Shale, sandy	22	192
Sandstone (water)	13	205

A3-6-32cd
[Talbert. Land-surface altitude, 4,768 ft]

	Thickness (feet)	Depth (feet)
Soil and gravel	4	4
Gravel	13	17
Sandstone, yellow	34	51
Shale, sandy, gray	22	73
Shale, sandy, blue	11	84
Shale, sandy, brown	10	94
Shale, sandy, blue	6	100
Shale, brown and blue	50	150
Shale, sandy, gray	5	155
Shale, sandy, blue	5	160
Sandstone, gray	5	165
Sandstone (water)	10	175
Sandstone	9	184
Shale and sandstone, blue	10	194

A4-1-25dd
[Herman Funk. Land-surface altitude, 5,518 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy, yellow clay	6	6
Clay, yellow	4	10
Shale, brown	25	35
Shale, gray	9	44
Shale, yellow	4	48
Sandstone, yellow	24	72
Shale, gray	116	188
Shale, sandy	20	208
Shale, gray	16	224
Sandstone, gray (water)	16	240

TABLE 17.—*Logs of wells*—Continued

A4-2-14aa
[Grant Butler. Land-surface altitude, 5,385 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Sandstone	40	42
Shale, brown	30	72
Sandstone, gray	50	122
Shale, brown	63	185
Sand (water)	7	192
Shale, brown	20	212
Sand (water)	6	218
Shale, blue	42	260
Shale, brown	60	320
Shale, blue	32	352
Sand (water)	7	359
Shale, brown	28	387

A4-2-27cc
[Virgil Major. Land-surface altitude, 5,454 ft]

	Thickness (feet)	Depth (feet)
Soil	6	6
Sandstone	10	16
Shale	5	21
Shale, blue	11	32
Shale, gray	11	43
Sandstone	7	50
Shale, blue	22	72
Shale, gray	33	105
Sandstone (water)	13	118
Shale, gray	17	135
Shale, sticky, gray	25	160
Shale, sandy, gray	68	228
Sandstone (water)	9	237
Shale, gray	9	246
Shale, brown	6	251
Shale, sandy, brown	21	272
Shale, blue and brown	48	320
Shale, gray	18	338
Sandstone, gray	37	375
Sandstone (water)	25	400
Shale, sandy	6	406

A4-2-28dc
[Harvey Waugh. Land-surface altitude, 5,455 ft]

	Thickness (feet)	Depth (feet)
Soil	18	18
Gravel	5	23
Shale, brown	17	40
Shale, gray	40	80
Shale, sandy	10	90
Sand (water)	10	100

A4-2-29ab
[Eugene Talman. Land-surface altitude, 5,509 ft]

	Thickness (feet)	Depth (feet)
Shale, sandy	17	17
Shale, sandy, gray	21	38
Sandstone, hard	9	47
Shale, gray	49	96
Shale, green-gray	29	125
Shale and sandstone	8	133
Sandstone, gray	35	168
Shale, gray	3	171

A4-2-29ba
[Gene Beck. Land-surface altitude, 5,505 ft]

	Thickness (feet)	Depth (feet)
Sand	7	7
Sandstone, soft	11	18
Sandstone, hard	5	23
Sandstone and shale	11	34
Sandstone, hard	3	37
Sandstone	11	48
Sandstone, broken	6	54
Sandstone, hard	7	61
Shale, gray	29	90
Shale, sandy, gray	12	102
Shale, gray and pink	18	120
Sand (water)	27	147
Shale, green	3	150

A4-2-29cc
[Clarence Blair. Land-surface altitude, 5,464 ft]

	Thickness (feet)	Depth (feet)
Soil	15	15
Shale, light	5	20
Shale, green	7	27
Shale, gray	68	95
Shale, red	20	115
Sandstone	11	126
Shale, green	4	130
Sandstone (water)	19	149
Shale, gray	2	151
Sandstone	29	180
Shale, green	33	213
Sandstone (water)	27	240
Shale, green	30	270
Sandstone (water)	30	300
Sandstone, gray	22	322
Shale, green	6	328
Sand (water)	35	363
Shale, gray	3	366
Sandstone	26	392
Rock	1	393
Sandstone	5	398
Rock	1	399
Sandstone	24	423
Shale, gray	5	428
Sandstone	4	432
Shale, hard, red	3	435
Shale, red	45	480

A4-2-29db
[Gordon Harris. Land-surface altitude, 5,477 ft]

	Thickness (feet)	Depth (feet)
Shale, brown and gray	95	95
Shale, blue-gray	42	137
Shale, sandy, gray	3	140
Shale, gray-green	12	152
Shale, sandy, gray	2	154
Shale, gray	4	158
Shale, sandy	4	162
Shale, gray	10	172
Shale, sandy, hard	3	175
Shale, gray	5	180
Shale, sandy, hard	18	198
Shale, gray	4	202
Shale, sandy, hard	6	208
Shale, gray	10	218
Shale, sandy, hard	9	227
Shale, gray	8	235
Shale, sandy	12	247
Coal	1	248
Sand, soft	10	258
Shale	2	260

TABLE 17.—*Logs of wells*—Continued

A4-2-31dc
[Melvin Johnson. Land-surface altitude, 5,503 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Sandstone	23	26
Shale, yellow	4	30
Shale, yellow-gray	5	35
Shale, brown	15	50
Shale, gray	50	100
Shale, sandy	25	125
Sandstone (water)	11	136

A4-2-32dd
[J. H. Gitlins. Land-surface altitude, 5,436 ft]

	Thickness (feet)	Depth (feet)
Soil	4	4
Shale, soft	36	40
Shale, soft (water)	5	45
Shale, soft	15	60
Sandstone	7	67
Shale, blue	3	70
Sandstone	12	82
Sand (water)	8	90
Shale, blue	22	112
Shale, blue (water)	3	115
Shale, blue	15	130
Sand (water)	31	161
Shale, blue-gray	3	164

A4-2-34dd
[S. T. Prociw. Land-surface altitude, 5,400 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Gravel and sand	15	17
Shale	25	42
Shale, sandy (water)	38	80

A4-2-35bc2
[Walter A. Boehm. Land-surface altitude, 5,432 ft]

	Thickness (feet)	Depth (feet)
Soil	6	6
Shale, sandy, yellow	12	18
Sandstone, yellow	11	29
Shale, gray	11	40
Rock, hard	4	44
Shale, gray	16	60
Shale, sandy	3	63
Shale, gray	97	160
Shale, sandy, gray	30	190
Shale, gray	18	208
Shale, sandy	12	220
Shale, sandy	8	228
Shale, sandy, gray	8	236
Shale, sandy, dark	14	250
Shale, gray	6	256
Shale, sandy, gray	6	262
Shale, gray	23	285
Shale, sandy, gray	15	300
Sandstone, gray	10	310

A4-2-35cb
[Charles G. Taylor. Land-surface altitude, 5,423 ft]

	Thickness (feet)	Depth (feet)
Soil	8	8
Sand and gravel	10	18
Shale, yellow	7	25
Shale, gray	25	50
Shale, sandy, gray	30	80
Shale, gray	80	160
Shale, sandy, gray	40	200
Shale, sandy, dark	30	230
Shale, gray	40	270
Shale, brown	10	280
Shale, blue	5	285
Shale, brown	33	318
Shale, light-gray	47	365
Sandstone, gray	11	376

A4-2-36bc
[J. W. Breider. Land-surface altitude, 5,400 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	2	2
Shale, sandy, gray	16	18
Shale, sandy, soft, pink	6	24
Shale, sandy, soft, gray	11	35
Shale, sandy, soft, blue	53	88
Shale, sandy, hard, gray	19	107
Shale, sandy, blue	15	122
Shale, sandy, gray	12	134
Shale, sandy, blue	5	139
Shale, sandy, light-brown	7	146
Sandstone, soft, gray	40	186
Shale, sandy, hard, blue	7	193
Shale, sandy, gray	8	201
Sandstone, soft, gray	9	210
Sand	31	241
Shale, sandy, blue	11	252
Shale, sandy, gray	30	282
Sand	21	303
Shale, blue	12	315
Shale, sandy, hard, gray	5	320
Rock, limestone	1	321
Shale, sandy, gray	16	337
Sandstone, soft, gray	26	363
Shale, sandy, hard, gray	8	371
Sandstone	22	393
Shale, sandy, soft, gray	2	395

A4-2-36da1
[B. L. McLaurin. Land-surface altitude, 5,381 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Sandstone	51	53
Gravel	4	57
Shale, blue	18	75
Shale, gray	30	105
Shale, blue	35	140
Rock, hard	10	150
Sandstone	25	175
Shale, blue	25	200
Sandstone	22	222
Sand (water)	5	227
Shale	5	235
Sandstone	10	245
Sand (water)	5	250
Rock, hard	15	265
Sand (water)	10	275
Shale, blue	10	285
Shale, blue	41	326
Shale, gray	204	530

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A4-2-36da2 [Martin Hansen. Land-surface altitude, 5,379 ft]		
Soil	9	9
Gravel	5	16
Shale	14	30
Gravel	4	34
Shale	34	68
Shale and sand	18	86
Shale, hard, green	29	115
Sandstone, hard	32	147
Shale, hard, green	17	164
Sandstone	32	196
Shale	5	201
Sandstone	24	225
Sandstone, broken	5	230
Sandstone	8	238
Shale	2	240
Sandstone	2	242
Shale	7	249
Sandstone	7	256
Shale	4	260
Sandstone	4	264
Shale	4	268
Sandstone and shale	16	284
Sandstone	6	290
Sandstone and shale	11	301
Sandstone	66	367
Shale	5	372
A4-3-11db [Robert Madsen. Land-surface altitude, 5,155.2 ft]		
Sand and gravel	10	10
Shale, sandy, gray	30	40
Sandstone	20	60
Shale, sandy, gray	27	87
Sandstone, gray	3	90
Shale, gray	21	111
Hardshell	2	113
Sandstone, soft, gray	17	130
Shale, hard, gray	2	132
Sand (water)	8	140
Sandstone, hard	22	162
Sandstone, soft	16	178
Shale, coal	2	180
Shale, blue	9	189
Shale, brown	8	197
Shale, sticky, light-gray	18	215
Sandstone, gray (water)	75	290
Sandstone (water)	34	324
Limestone, hard	3	327
Shale, very sandy (water)	18	345
Shale, sandy, gray	2	347
A4-3-13dc1 [C. G. Butler. Land-surface altitude, 5,152.7 ft]		
Soil and gravel	10	10
Shale, dark-brown	17	27
Shale, sandy, gray	8	35
Shale, light-brown	10	45
Shale, sandy, gray	8	53
Sandstone, gray	6	59
Shale, dark-brown	5	64
Shale, light-gray	11	75
Shale, hard, dark	20	95
Sandstone	25	120
Shale, hard, gray	6	126
Sandstone, soft, red and white (water)	59	185
Shale, sandy, gray	25	210
Sandstone, black and white	45	255
Shale, sandy, and coal	5	260
A4-3-13-dc1—Continued		
Shale, sandy, gray	10	270
Sandstone, gray	40	310
Shale	8	318
Sandstone	9	327
Shale	18	345
Shale, chalky, white	13	358
Sandstone	7	365
Shale, flaky, dark	13	378
Shale, sandy, gray	12	390
Sandstone, gray	25	415
Shale, gray	2	417
Sandstone	8	425
Sandstone (water)	11	436
Sandstone, gray	9	445
Shale, gray	15	460
Shale	5	465
A4-3-13dc2 [Dale Smith. Land-surface altitude, 5,124.5 ft]		
Soil, sandy, and gravel	10	10
Sandstone	38	48
Shale, brown	2	50
Shale, sandy, hard, gray	10	60
Sandstone, hard	35	95
Sandstone, soft (water)	15	110
Sandstone, hard	6	116
Sandstone, soft (water)	9	125
Sandstone	4	129
Sandstone, soft	1	130
Sandstone, hard	7	137
A4-3-15aa [Ben Wilkinson. Land-surface altitude, 5,239 ft]		
Soil, sandy	4	4
Shale, sandy	53	57
Shale, blue	3	60
Shale, sandy, gray	99	159
Sandstone, gray	9	168
Shale, sandy, gray	11	179
Shale, sticky, blue	13	192
Shale, sandy, gray	27	219
Shale, blue, brown, red	21	240
Shale, gray	7	247
Shale, sandy, gray	57	304
Sandstone	12	316
Sand (water)	11	327
Shale, blue	3	330
A4-3-21bd [Ray Guthridge. Land-surface altitude, 5,222 ft]		
Soil, sandy	5	5
Sandstone, yellow	9	14
Shale, sandy, gray	10	24
Sandstone, yellow	38	62
Shale, sandy, gray	68	130
Sandstone, gray	12	142
Shale, sandy, gray	23	165
Sandstone, gray	20	185
Sand (water)	20	205
Shale, sandy, gray	25	230
Shale, gray	13	240
Shale, sandy, gray	42	283
Sand, red (water)	15	300
Shale, sandy, gray	10	315
Sand (water)	15	325
Shale, sandy, gray	60	335
Shale, sandy, blue	9	348
Shale, sandy, gray	42	387
Shale, blue and brown	27	419
Shale, sandy, gray	49	466

TABLE 17.—*Logs of wells*—Continued

A4-3-31ad
[Ralph Stear. Land-surface altitude, 5,410ft]

	Thickness (feet)	Depth (feet)
Soil, yellow clay	6	6
Shale, gray and yellow	34	40
Shale, sandy, light-gray	6	46
Sandstone, gray	9	55
Shale, green	5	60

A4-3-31cd
[A. J. Jarnagin. Land-surface altitude, 5,343 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Shale, blue	95	98
Sandstone	12	110
Shale, blue	55	165
Sandstone	20	185
Shale, blue	15	200

A4-3-32bb
[U.S. Bureau of Reclamation. Land-surface altitude, 5,424 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy loam	20	20
Sandstone, gray	20	40
Sandstone, blue (water)	10	50
Sandstone, gray	15	65
Shale, blue	15	80
Shale, sandy, gray	95	175
Shale, sandy, gray	95	270
Shale, gray	8	278
Sandstone	7	285
Shale, gray	73	358
Sandstone	7	365
Shale, gray	144	509

A4-3-34ad
[Delbert Edwards. Land-surface altitude, 4,994 ft]

	Thickness (feet)	Depth (feet)
Soil, sandy	17	17
Sandstone, yellow	18	35
Shale, sandy, gray	68	103
Sandstone, gray (water)	7	110
Shale, sandy, gray	27	137
Sandstone, gray	3	140
Shale, sandy, blue	17	157
Shale, sandy, gray (water)	18	175
Sandstone, gray	18	193
Shale, sandy, blue	39	232
Shale, sandy, gray	34	266
Sandstone, gray	12	278
Sand (water)	24	302
Shale, sandy, gray	3	305

A4-3-35bb
[Arnold L. Wurston. Land-surface atitude, 4,988 ft]

	Thickness (feet)	Depth (feet)
Soil	18	18
Shale, sandy, gray	44	62
Sandstone, yellow	15	77
Shale, sandy, gray	71	148

A4-3-35bb—Continued

	Thickness (feet)	Depth (feet)
Shale, sandy, blue	8	156
Sandstone, gray	10	166
Sand (sulfur water)	16	182
Shale, sandy, blue	28	210
Shale, blue and brown	9	219
Shale, sandy, gray	8	227
Shale, sandy, blue	20	247
Shale, sandy, gray	23	270
Sandstone, gray	23	293
Shale, sandy, gray	27	320
Sandstone, gray	29	349
Shale, sandy, hard, gray	56	405
Sandstone, gray	35	440
Shale, sandy, hard, gray	25	465
Sandstone, gray	9	474
Shale, sandy, hard	3	477
Sandstone, gray	8	485
Shale, blue and brown	6	491
Shale, sandy, hard, gray	11	502
Sandstone, gray	50	552
Shale, sandy, gray	48	600

A4-3-35da
[C. W. Ferguson. Land-surface altitude, 5,007 ft]

	Thickness (feet)	Depth (feet)
Sand and gravel	8	8
Shale, sandy, gray	36	44
Shale, sandy, blue	36	80
Shale, sandy, gray	20	100
Shale, sandy, blue	18	118
Shale, sandy, gray	11	129
Shale, sandy, blue	11	140
Shale, sandy, gray	30	170
Sandstone, gray and red	8	178
Sand (sulfur water)	25	203
Shale, sandy, gray	9	212
Shale, sandy, blue	4	216
Shale, brown and blue	22	238
Shale, sandy, blue	15	253
Shale, sandy, gray	23	276
Sand (water)	24	300
Shale, sandy, blue	5	305

A4-4-20da
[U.S. Bureau of Reclamation. Land-surface altitude, 5,100 ft]

	Thickness (feet)	Depth (feet)
Soil	5	5
Sand	5	10
Shale, blue	60	70
Shale, brown	70	140
Shale, sandy, gray	30	170
Sandstone (water)	40	210
Shale	24.6	234.6

A4-4-23ac
[U.S. Bureau of Reclamation. Land-surface altitude, 5,513.5]

	Thickness (feet)	Depth (feet)
Loam, sandy	3.3	3.3
Gravel and sandy loam	4.7	8
Loam, gravelly	3	11
Loam, sandy, and pea-sized gravel	8	19
Shale, gray	4	23

TABLE 17.—*Logs of wells*—Continued

	Thickness (feet)	Depth (feet)
A4-4-23db1 [U.S. Bureau of Reclamation. Land-surface altitude, 5,009 ft]		
Soil	10	10
Shale, gray	35	45
Shale, sandy, green	35	80
Shale, gray	75	155
Shale, brown	30	185
Shale, gray	35	220
Shale, brown	60	280
Shale, gray	15	295
Shale, brown	10	305
Shale, gray	65	370
Shale, sandy, gray	41	411
Sand (water)	9	420
Shale, gray	8	428
Shale, gray	152	580
Sandstone, gray	10	590
Shale, gray	10	600
Shale, brown and gray	21	621
A4-4-23db2 [U.S. Bureau of Reclamation. Land-surface altitude 5,512.5 ft]		
Soil, sandy	4	4
Gravel and sandy loam	4	8
Cobble rock	7	15
Shale	15	20
B3-1-19ba2 [Robert N. Harris. Land-surface altitude, 5,550.5 ft]		
Soil	5	5
Gravel	33	38
Sandstone	7	45
Shale, sandy	61	106
Sandstone, red and gray	24	130
Shale, sandy, gray	37	167
Sandstone (water)	17	184
Shale	10	194
B3-1-21bd1 [W. E. Smith. Land-surface altitude, 5,503.46 ft]		
Soil	4	4
Gravel	6	10
Quicksand	4	14
D1-4-2ba [Kiva Sproule. Land-surface altitude, 4,918.82 ft]		
Soil	1	1
Gravel	12	13
Shale, gray	27	40
Sandstone	22	62
Shale, gray	26	88
Sandstone	27	115
Sand (water)	25	140
Shale, brown	3	143

INVENTORY OF WELLS AND SPRINGS

The location of all known water wells in the area covered by this report is shown on plate 1. Pertinent available information on all wells shown on the map is given in table 18. Most drilled wells in the area penetrate sandstone beds of the Wind River formation. As it was impossible to obtain a measurement of the depth of every well or of the depth to water in all of the wells, the information given for some of the wells in the table is based on the memory of the owner or driller of the well.

TABLE 18—*Records of wells and springs*

Well number: See explanation of well-numbering system in text.

Type of well: DD, dug and drilled; Dn, driven; Dr, drilled; Du, dug; J, jetted; Sp, spring.

Depth of well: Measured depths are given in feet and tenths below land surface; reported depths are given in feet.

Type of casing: C, concrete (brick, tile, or pipe); G, galvanized iron; M, masonry; N, none; Od, oil drum; P, iron or steel pipe; Pl, plastic pipe; R, rock lined; T, clay tile; W, wood.

Method of lift: C, horizontal centrifugal; Cy, cylinder; F, natural flow (gallons per minute given in parenthesis); J, jet; N, none; P, pitcher pump; S, submersible turbine; T, turbine.

Type of power: E, electric; G, gasoline; H, hand operated; W, wind.

Use of water: BO, observation of water level by U. S. Bureau of Reclamation; D, domestic; I, irrigation; In, industrial; N, not used; O, observation of water level by U. S. Geol. Survey; PS, public supply; RR, railroad; S, stock.

Measuring-point description: Bc, bottom of cover; Bpl, base of platform; Ep, edge of plank under pump; Hc, hole in casing; Hpc, hole in pump column; L, land surface; Op, outlet pipe; Pb, bottom of pump base; Tc, top of cover; Tca, top of casing; Tg, top of galvanized iron; Tmc, top of milk can over casing; Tod, top of oil drum casing; Tpl, top of platform; Tt, top of clay tile; Tw, top of wood casing.

Altitude: Altitudes determined by instrumental leveling are given in feet, tenths, and hundredths; altitudes interpolated from topographic maps having a contour interval of 2 feet are given in feet. Altitude of land surface at well is given for wells having no other measuring point.

Depth to water: Measured depths to water level are given in feet, tenths, and hundredths; reported depths are given in feet. Casing diameter is shown in parenthesis for respective measurements made in inner and outer casing of same well.

Remarks: A, abandoned; Ari, automatic water-level recorder installed; B, buried; BC, chemical analysis of water made by U. S. Bureau of Reclamation; C, caved; Dh, dry hole; Ff, flowed when first drilled; GC, chemical analysis of water made by U. S. Geol. Survey; L, log of well in table 17; Mbc, water-level measurement made between inner and outer casings; Oc, originally a cistern; Ot, unsuccessful oil test; P, plugged (depth, in feet, given in parenthesis); Rw, relief well; SC chemical analysis of water by State of Wyoming; Sah, seven drainage wells drilled in SE¼ sec. 33, T. 3 N., R. 5 E. now abandoned and buried; Wcs, water level in dug well above submerged 12-inch casing.

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point			Depth to water level below measuring point (feet)	Date of measurement	Remarks
									Description	Distance above or below (−) land surface (feet)	Altitude (feet)			
A1-2-1bc	Rex Snyder	1948	Dr	318	4	P	J, E	D	L		5,199.4	82		L
1bd	Oscar Norby		Dr	51.0	7	P	Cy, G	D, S	Pb	0.3	5,189.78	7.75	8-17-48	
1cd	Lars Risvold	1938	Dr	107			Cy, E	D, S	L		5,152.59	15.18		
1da	Peter Busch	1936	Dr	84.0	8	P	Cy, E, H	D, S	Tca	.0	5,195.07	56.30	8-16-48	
2ad	William Reuber, Jr.		Dr	98.5	6	P	Cy, H	N	Tca	.4	5,196.76	30.67	8-17-48	
2bc	William Gilliland	1948	Dr	46.0	8	P	Cy, H	S	Tca	.5	5,204.57	38.37	8-17-48	
2cc	U.S. Geological Survey	1951	J	14.7	¾	P	N	O	Tca	4.0	5,171.2	17.57	6-26-51	L
3aa1	John Hubenka	1942	Dr	183	6	P	J, E	D	Tca	1.0	5,220.95	37.28	1-19-49	SC, L
3aa2	do	1942	Dr	50	6	P	Cy, E	S	L		5,219.04	42		SC
3ba	Vern N. Thomas	1943	Dr	145	7	P	Cy, E	D, S	L		5,207.07	20		L

3bc	William Gilliland		Dr	40		P	Cy, H	D, S	L		5,199.03	32		
3da	E. M. Gorum		Dr	41.0	8	P	C, E	D, S, O	Tca	.0	5,175.18	8.45	8-17-48	GC
4aa	Jimmy Dale		Dr	42.5	6	P	Cy, H	D	Pb	.8	5,201.35	18.39	8-17-48	
4ad	John Hubenka		Du	18.5	36	G	Cy, H	S, O	Tg	.9	5,193.06	9.62	8-17-48	
11aa1	J. D. Deardoff		Du	9.5	18	G	N	O	Tg	.3	5,155.23	7.87	8-17-48	
11aa2	do	1934	Dr	50	8	P	Cy, E	D, S	L		5,153.07	8		
11ab	H. Busch		Dr	100	6	P	J, E	D, S			5,155.2			L
12dd	G. W. Davis	1937	Dr	60	6	P	Cy, E	D	L		5,124.21	6-8		
A1-3-4aa	W. E. McGrath	1941	Dr	272	6	P	Cy, E	D, S	L		5,365	160		SC, L
4ab1	Elmer Brooks	1937	Dr	160	6	P	N	O	Tca	1.5	5,254	38.85	11-17-48	
4ab2	do	1941	Dr	200	6	P	Cy, E	D, S			5,351.8			
5cc	Ivan Lang	1943	Dr	160	6	P	J, E	D, S						
6cd	C. E. Cooper	1948	Dr	150	8	P	J, E	D, S	L		5,171.52	64		
7ab	Pete Stome		Dr	240	6	P	J, E	D, S			5,169.55			
7ad1	H. M. Johnson	1936	Dr	150		P	Cy, E	D, S			5,153.58			
7ad2	do		Dr	77.0	7	P	N	O	Tca	.5	5,154.85	12.55	8-16-48	
7ad3	U.S. Geological Survey	1951	J	28.8	¾	P	N	O	Tca	2.7	5,163.5	22.82	3-30-51	L
7bb	William Reuber, Jr.	1943	Dr	260	6	P	Cy, E	D, S	L		5,162.31	60		
7cc	G. W. Davis		Dr	60	6	G	Cy, H	N	L			.80	8-16-48	
7da	E. W. Beckman		Dr	197.0	5	P	J, E	D, S	Tca	−5.3	5,135.10	66.70	8-16-48	
7dd	U.S. Geological Survey	1951	J	23.0	¾	P	N	O	Tca	5.7	5,138.8	19.99	3-30-51	L
8bb	Peter Busch		Dr	69.0	5	P	Cy, H	N	L		5,173.23	27.61	8-16-48	
8bc	Adam Addison	1934	Dr	145	4	P	J, E	D, S	Tca	.2	5,155.04	45.97	8-16-48	
8cc	E. W. Beckman	1938	Dr	140.0	4	P	J, E	D, S	L		5,123.18	12		
8db	Harvey Eaton	1940	Dr	150	6	P	Cy, E	D, S	L		5,160.03	80		
13dd1	O. G. Griffey	1939	Du	29.5	6	W	N	N	Tw	.0	5,455.79	73.22	7-11-49	
13dd2	do	1946	Dr	730	8	P	Cy, G, H	S	L		5,456.07	80		L
16bb	Henry Heil		Dr	380	6, 4	P	J, E	D, S	L		5,154.99	85+	8-16-48	
16cc	Vern Adams		Dr	103.0	6	P	J, E	D, S, O	Tca	1.5	5,126.14	22.92	8-11-48	GC
16cd	Ralph Adams	1945	Dr	365		P	J, E	D, S			5,129.43			
16db1	Marvin Williams	1933	Dr	109.0	10	P	Cy, E	D, S	Tca	1.0	5,174.78	51.54	8-11-48	L
16db2	do	1943	Dr	161.0	7	P	J, E	D, S	Pb	−5.8	5,150.79	48.03	8-11-48	
16dc	do		Dr	63.0	7	P	Cy, H	N	Tca	.9	5,145.17	28.13	8-11-48	
16dd1	Dean Spencer	1922	Dr	160.0	6	P	N	N	Tca	.4	5,162.32	52.41	8-11-48	
16dd2	do		Dr	154	6	P	Cy, E	D, S	L		5,164.40	80		
16dd3	do	1949	Dr	410	5	P	Cy, E	D	L		5,162.7	75		L
17aa	Henry Heil		Dr	37.5	4	P	Cy, H	N			5,150.03			
17ad	Alex Heil	1950	Dr	285.0	4½	P	Cy, E	D, S	L		5,130.4	50		L
17ba	Frank Slater	1943	Dr	350	8, 4	P	Cy, E	D, S			5,118.11			
17da	U.S. Geological Survey	1951	J	31.2	¾	P	N	O	Tca	5.3	5,122.1	19.81	4-28-51	L
21ab	Pete Heil	1938	Dr	145	6	P	Cy, E	D, S	Pb	.6	5,133.05	21.37	8-11-48	
21da	Mrs. Gould Quiver	1948	Dr	100	6	P	Cy, H	D, S	L		5,096.65	25		L
22ba	Dean Spencer	1941	Dr	100	6	P	Cy, E	D, S	L			80		
22bb	do	1949	Dr	475	5	P	Cy, E	D, S	L		5,153.77	70		L
22cc	Lewis Weber	1941	Dr	83		P	Cy, H	D, S			5,088.21			SC, L

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (—) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A1-3-25db	W. A. Jarvis	1944	Dr	90	9	P	Cy, H	N						L
26ca	Claude Fike	1946	Dr	430	8, 6	P		D, S			5,083.19			L
26cc	Roy Hendrickson		Dr		10, 6	P	Cy, E	D	Tca	0.1	5,037.51	12.93	8-10-48	Mbc
27ab	Bert Brasket	1906	Dr	165	6	P	Cy, E	D, S	L		5,112.34	16		
27ad	Elmer Farrans		Du	18.0	22	Od	P, H	S, O	Tod	1.3	5,063.43	10.15	8-10-48	
27bb	U.S. Geological Survey	1951	J	25	¾	P	N	O	Tca	2.6	5,080.7	8.65	3-30-51	L
35aa	Evelyn Delfelder	1944	Dr	400	5	P	Cy, E	D, S, O	Tca	.5	5,057.56	10.43	8-10-48	
36ba	R. M. Pickett	1945	Dr	500		P	J, E	D, S	L		5,054.59	30		
A1-4-1ab	Devere Trimmer	1909	Du	60	6	P	Cy, E	D, S	Tca	1.0	4,932.70	7.70	6-23-49	
1ad1	E. M. Miller		Dr		4	P	Cy, H	N						
1ad2	do		Dr			P	J, E	D, S	L			100		
1bb	W. L. Shriner	1940	Dr	84	6	P	Cy, E	D, S, O	Tca	2.6	4,969.06	16.47	6-23-49	
1da	Al Hursh	1947	Dr	500	10, 8	P	J, E	D, S	L		4,890.07	3		L
2aa1	Donald Brownfield		Dr	190 (?)	4	P	J, E	D, S						
2aa2	Earl Givens		Dr	144.0	6	P	Cy, E	D, S	Tca	1.5	4,981.76	8.70	6-21-49	
2ad1	Ray Short		Dr	20.0	5	P	N	N	Tca	—.5	4,945.66	2.38	6-21-49	
2ad2	do	1947	Dr	176.0	6	P	Cy, H	D, S	Tca	.6	4,980.13	54.80	6-21-49	
2bc1	Bertha M. Johnson		Dr	96 (?)	6	P	Cy, E	D, S						
2bc2	do		Dr		6	P	N	N						P
2cc	Vern Dougherty	1932 (?)	Dr			P	J, E	D, S						
2dc	S. W. Samuelson	1909	Du				J, E	D, S	L			50		
2dd1	do	1909	Du	25	36	C, W	Cy, H	D, S	L		4,935.29	6		
2dd2	do		Du	10.3	36-48	C	N	N, O	Tc	.3	4,935.95	3.38	6-24-49	Oc
3aa	Glenn Darnall		Dr	74	4	P	J, E	D, S	L		5,076.52	61		
3ca	M. Detlefsen	1939	Dr	22	6	P	Cy, G	N	L			15		
3da	Glenn Darnall		Dr	30	5	P	N	N	Tca	.5	5,035.85	24.01	6-22-49	
3dd	do		Dr	124.0	6	P	Cy, H	D, O	Tca	1.2	5,019.13	35.10	10-20-48	GC
10aa	O. E. Cover	1919	Du	14.0	42	G	N	D	Tca	—2.0	4,985.69	7.33	6-28-49	
10ad	O. M. Dalley	1919	Dr	58.5	5	P	Cy, E	D	Pb	.2	4,987.72	15.97	6-28-49	
10ba	O. W. Huntley	1939	Dr	58.5	6	P	Cy, H	N	Tca	.4	5,076.43	23.04	6-22-49	
10cc	Jake Haun, Jr.	1941	Dr	270	6	P	J, E	D, S	Tca	—6.0	5,054.53	29.50	7- 6-49	
10da	Donovan Trust		Dr	86.5	6	P	Cy, E	D, S	Tpl	1.8	4,968.92	6.53	6-28-49	
10db	do		Dr		6	P	Cy, H	N	Tca	.0	5,002.24	28.43	6-28-49	

11aa1	Fred Goens	1910	Dr	30.5		P	Cy, H	D, S	Bp	1.1	4,935.68	8.98	6-24-49	
11aa2	do		Du	15	36	N	Cy, H	N	Pb	.6	4,938.45	9.22	6-24-49	
11aa3	do	1950	Dr	84	7-4½	P	J, E	D, S	L		4,936	15		L
11aa4	U.S. Geological Survey	1951	J	22.0	¾	P	N	O	Tca	3.6	4,938.3	14.62	3-30-51	
11ad1	Fred Goens	1910 (?)	Dr	57	6	P	C, Cy, E	D	L		4,925.77	5		
11ad2	do	1926	Dr	18.3	6	P	Cy, E	D, S	Tpl	1.7	4,930.11	5.27	6-24-49	
11cb	Donovan Trust		Dr	300 (?)	6	P	Cy, H	D	Pb	.7	4,963.61	35.23	6-28-49	
11dd	O. W. Nicholson	1919	Dr	55.6	6	P	Cy, H	N	Pb	1.2	4,918.34	16.74	6-27-49	
12ac	Josephine Brenneman	1944	Dr	67.0	6	P	Cy, H	D, S	Hpc	2.5	4,902.69	12.80	6-24-49	
12bb1	Delfelder Hall		Dr	39.8	4	P	N	O	Tca	.2	4,935.56	6.71	7-15-48	
12bb2	do	1946	Dr	102.0	6	P	Cy, H	D	Bpl	.3	4,935.66	19.89	8- 8-48	
12bd	C. V. Jennings	1942	Dr	65	6		J, E	D, S	L		4,906.21	5		
12ca	Roy Forbis	1916 (?)	Dr	92.5	6	P	Cy, H	D	Pb	.6	4,903.60	12.80	6-24-49	
12cc	do	1933	Dr	64.0	6	P	Cy, H	O	Tca	.7	4,915.57	17.47	10-21-48	GC
12dc	Don Bracken		Dr	71.0	8	P	Cy, H	D	Tca	.4	4,880.56	7.50	6-24-49	
13ad	Susie Eagle		Sp				D							
13ba	Josephine Brenneman		Dr	13.5	6	P	N	N	Tca	−1.5	4,899.50	7.38	6-27-49	
13bc	O. W. Nicholson		Dr	160	8	P	Cy, E	D, S	Hpc	2.7	4,905.57	14.84	6-27-49	
13cc	do		Dr	310	6, 4	P	F, J, E	D, S			4,893.40			
13db	do		Sp				N							
13dc1	Bill Todd		Sp				F (8)	D			4,859.71			
13dc2	do		Sp					S						
14aa	Roy Forbis		Dr	132.0	6	P	J, E	D, S	Tca	−5.2	4,921.58	17.48	6-27-49	
14cd	State of Wyoming	1932	Dr	250	8 (?)	P	J, E	D, S						
15ad1	J. R. Pitts	1907 (?)	Dr	150	8	P	J, E	D						Ff
15ad2	do		Dr	480	8	P	J, E	D		−4.0	4,967.31	14.98	6-28-49	
15bb1	Paul S. Tanner		Dr	120	6, 4	P	Cy, H	D	Tca	1.1	5,058.00	48.70	7- 6-49	
15bb2	P. B. Torpey	1935 (?)	Dr	59	6	P	J, E	D, S	L		5,055.35	45		
15bd	Jake Haun, Sr.		Du	13 4	42	C	N	N	Bc	.3	4,995.04	4.75	7- 7-49	
15cc1	do		Dr		6	P						50		P17
15cc2	do	1933	Dr	416	6	P	J, E	D, S	L		5,028.27	80		
15dd1	Peter Berlin	1908	Dr	36 0	4	P	N	O	Tca	.1	4,959.30	5.42	11-17-49	
15dd2	do	1942	Dr	165	6	P	Cy, E	D, S						
15dd3	U.S. Geological Survey	1951	J	26 3	¾	P	N	O	Tca	3.7	4,961.6	9.33	3-30-51	L
16aa1	Frank B. Larson	1944	Dr	290	6	P	J, E	D, S	Tca	−5.5	5,063.30	54.36	7- 6-49	
16aa2	do		Dr	150	4	P	N	N	L			50		
16bd	A. M. Suverkrubbe		Dr	200		P	Cy, E	D, S						
16cd	John F. Cram	1929 (?)	Dr	250	6	P	Cy, E	D, S						
16da	Elmer Dewey		Dr	118.0	6	P	Cy, H	S		1.6	5,046.06	34.59	7- 7-49	
16dd	Fred W. Lytle	1946	Du	5.4	26 x 26	W	N	S		.7	5,031.06	.70	7- 7-49	
17dd1	C. E. Barnes		Dr	24.5	5	P	Cy, H	S, O		1.0	5,130.32	7.19	7- 7-49	
17dd2	do			76.0	5	P	N	N						
18cb	City of Riverton	1950	Dr	600	8	P	Cy, E	PS,	L		5,452.3	400		L
20dd	R. L. Foster		Dr	210	5	P	Cy, E	D, S	L			160		

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (—) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A1-4-21ca	Henry Blumenshine		Dr	450	5	P	Cy, E	D, S	Tca	−3.0	5,089.17	108.00	7- 8-49	
21da	Mildred Smith		Dr	180		P	Cy, E	D						
21db	Dave Blumenshine		Dr	400	5	P	Cy, E	D, S	L		5,086.04	100–125		
21dd1	B. Beck	1935	Dr	66	5	P	Cy, H	D, S	Tpl	.4	5,084.83	16.02	7- 8-49	
21dd2	Chas. Cook	1915	Dr	36.2	7	P	Cy, E	D, S	Tca	—.2	5,038.63	8.70	7- 8-49	
22aa	Jake Fabrizius	1945	Dr	169	10, 6	P	J, E	D, S	L		4,955.78	9		L
22ad	do		Dr	40 (?)	5	P	Cy, E	S						
22bc	do	1919	Dr	500	5	P	Cy, E, G	D, S	L			40		
22cb	J. Ekman	1941	Dr	25.4	5	P	Cy, H	D, S	Tca	.4	5,028.94	9.97	7- 8-49	
22cc	Wm. Wood		Dr	53	4	P	Cy, H	D						
22cd	W. J. Webb	1945 (?)	Dr	90–100	5	P	J, E	D, S						
22da1	Jacob Schmidt		Dr			P	Cy, E	S						
22da2	do		Dr	212	6, 4	P	J, E	D	Tca	.2	4,949.88	5.37	7-11-49	
23ab	Pete Litzenberger		Dr	59.0	6	P	Cy, H	D	Tca	.4	4,921.11	15.48	7-11-49	SC
23cd	Pure Gas Service Co.	1951	Dr	150	6, 8	P	J, E	In	L		4,938.4	20		L
23db	Gerald Loghry		Dr	200 (?)	8	P	J, E	D, S	L		4,930.79	20		
23dd	Reuben Rowse	1910 (?)	Dr	125	4	P	J, E	D, S						
24ca	Don Murphy	1939	Dr	40	4	P	Cy, H	O	Tca	.4	4,881.80	3.77	7-15-48	GC
24cb	do	1939	Dr	180	6, 2	P	F, J, E	D			4,895.26			
24cc	Charles Forbis			65	8	P	J, E	D, S	L		4,895.85	10		Ff
24cd1	Francis Lucas		Dr	28.0	4	P	Cy, H	S	Pb	.9	4,889.67	6.87	7- 8-49	
24cd2	do	1939	Dr	69.0	4	P	J, E	D	Tca	−1.0	4,884.75	1.89	7- 8-49	
24da	Jacob Wisheim	1947	Dr	100	6	P	Cy, H	D, S	Tpl	.8	4,864.08	5.54	7- 8-49	
24dd	do	1946	Dr	98.0	12.8	P	N	N	Tca	2.5		2.54	7- 8-49	
25ab	Byron Wanstall heirs		Sp								4,873.71			
25ac	Nora Bearing		Sp											
25bb	Ivan Fullerton	1948	Dr	100	6		J, E	D, S	L		4,915.93	15		
25cb	J. L. Selby						Cy, E	D						
25dc	Albert Medecine	1921 (?)	Dr				F	N						Ot
25dd	J. E. Geslin	1945	Du	9.5		G	N, H	D, S	Tca	1.0	4,879.22	7.70	7-12-49	
26ab	Joe Thompson	1933	Dr	64	6	P	J, E	D, S	L		4,931.93	5		
26ac	do	1939	Du	11.5	24	G	N	N	Tca	1.5	4,943.00	2.69	7-11-49	
26ba1	Cecil Wood		Dr	200+	6	P	Cy, E	D, S	Tca	.7	4,944.39	7.98	7-11-49	Ff

26ba2	do		Dr		6	P	N	N						P
26bc	John Real	1946	Dr	242	8	P	J, E	D	L	−4.0	4,949.74	60		L
26dc	Cecil Wood	1949	Dr	500	4	P	J, E	D, S	Tca	−3.6	4,933.66	7.55	7-12-49	
27aa1	M. T. Johnston	1947	Dr	135	5	P	J, E	D	L		4,953 37	35		
27aa2	C. J. Snyder		Dr	90	4	P	Cy, H	N	L		4,949.88	12		
27aa3	Robert Spencer	1946	Dr	300	5	P	J, E	D	L		4,952	30		L
27aa4	Earl Sullivan	1946	Dr	285	5	P	J, E	D	L		4,951.40	55		SC, L
27aa5	Frank Boyd	1948	Dr	260	4	P	J, E	D	L			55		
27ab	Carlos Apodaca		Dr	219	12, 6	P	Cy, H	D	L		4,961.4	7		L
27ad1	Earl Sullivan	1949	Dr	160	4	P	N	D	Tca	1.5	4,956.44	72.87		L
27ad2	C. E. Logan	1913	Dr	91	6	P	J, E	D	L		4,973.21	15-20		
27ad3	Frank McIrvin	1948	Dr	197	4	P	J, E	D	L		4,959.11	30		
27bb1	Ray Marshall	1949	Du	9	18		J, E	D, S	L		5,022.37	5		
27bb2	E. E. Davis	1948	Dr	190	8, 6	P	J, E	D, S			5,022.29			L
27bc	Elmer Peterson	1946	Dr	180	8, 6	P	J, E	D, S	L		5,015.18	45		L
27bd1	Harry Moss	1945	Dr	150	10, 6	P	J, E	D, S	L	−7.3	4,984.62	5.42	7-12-49	Mbc
27bd2	C. Johnson	1936 (?)	Dr	190	6	P	Cy, E	D, S	L		4,999.76	45		
27ca1	C. E. Matteson	1918	Dr	75.0	4	P	Cy, H	D, O	Tca	.4	4,989.87	9.30	7-12-49	
27ca2	John F. Jones		Dr	129.0	4	P	Cy, H	D	Tpl	.2	5,000.70	34.10	7-12-49	
27ca3	Ruth Samuelson		Dr	98.0	4	P	J, E	D	Tca	−1.0	4,999.56	30.00	7-12-49	
27ca4	Eldin Robertson	1949	Dr	166	8, 6	P	T, E	D	L		5,009.9	50		L
27cb1	Lon Wagoner		Du	9.5	48 x 48	W	Cy, E	S		.8	5,010.88	7.89	7-12-49	
27cb2	do	1947	Dr	185	6, 4	P	J, E	D	L		5,015.71	45		L
27cd1	City of Riverton	1947	Dr	645	14, 10, 8	P	T, E	PS	L		4,983.37	35		L
27cd2	Bertha Berlin	1910	Dr	108.5	5	P	N	O	Tca	.1	4,985.68	39.22	7-14-49	
27da1	E. T. Abra	1915	Dr				Cy, H	S						
27da2	Geo. Neiberger, Jr.		Dr	124.5	7, 4	P	Cy, E	D	Tca	2.0	4,957.29	4.27 (7″)	7-12-49	
												71.00 (4″)		
27da3	P. M. Drake		Dr	76.0	4	P	Cy, H	N	Tca	.7	4,969.77	26.80	7-12-49	
27db	Burlie Hague		Dr				J, E	D						
27dc	City of Riverton	1947	Dr	585	10, 8	P	T, G	PS	L		4,969.90	27		L
27dd	do	1947	Dr	600	10, 8	P	T, E	PS			4,954.93			GC, L
28aa1	C. E. Barnes	1942	Dr	22.0	12.8	P	J, E	D, S	Tca	.0 (12″)	5,028.09	2.16	7-11-49	
										.8 (8″)		7.74		
28aa2	do		Du	9	12		J, E	D	L			6		
28aa3	Eugene Gassel		Dr	76.5	4	P	Cy, H	S	Tca	.2	5,053.08	14.19	7- 8-49	
28aa4	do	1950	Dr	217	6	P	J, E	D, S	L		5,053	84		L
28ab	U.S. Geological Survey	1951	J	9.2	¾	P	N	O	Tca	4.0	5,062.2	11.23	7- 1-51	L
28ad	C. Witt Anderson	1948	Dr	200	10, 6	P	J, E	D	L		5,025.39	45		L
28ba1	Leslie Major		Du	24.0	10	C	N	O	L	.0	5,063.36	13.50	7- 8-49	
28ba2	do	1947	Dr	234	6	P	J, E	D, S	L		5,063.36	60		SC
28cd	E. F. Sackman		Dr	128.0	5	P	J, E	D, S	Tca	−6.0	5,045.43	4.05	7-14-49	
28da	John Stork	1945	Dr	176	8	P	Cy, E	D, S	L		5,025.79	10		
28dc1	L. E. Peck	1919	Dr	206	6	P	J, E	D, S, In	L		5,038.36	10		

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift: type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (−) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A1-4-28dc2	do	1949	Du	15			J, E	S, In	L		5,037.99	12		
29bd1	B. F. Pentecost	1939	Dr	105.0	6	P	Cy, G	S	Pb	0.5	5,166.19	22.68	7-13-49	
29bd2	City of Riverton	1947	Dr	578	12	P	N	O	Tca	1.8	5,184.60	194.47	7-13-49	L, Ari
29cb	Harold Saur		Sp					P			5,097.40			
29cc	U.S. Geological Survey	1951	J	12.7	¾	P	N	O	Tca	2 0	5,041.4	6.89	3-30-51	L
29cd	Ed Chopping	1947	Dr	612	6	P	Cy, E	D	L		5,137.69	100±		
29dd1	Wilbur Mund	1936	Dr	86	6	P	Cy, E	D, S	L		5,096.21	40		
29dd2	do	1949	Dr	100.0	6	P	J, E	D	Tca	−6.8	5,082.09	52.76	7-13-49	
30ca	Chas. Ridgeway	1947	Dr	538	6, 4	P	N	N	L		5,095.40	80 00	10- -47	L
30cd	Eliz. Whittemore		Dr	64.5	6	P	Cy, E	S	Tpl	.6	5,081.72	7.84	8-10-48	
30da	Adam Sedlacek		Sp											
31bc	I. D. Woodward	1946	Dr	360	10, 4	P	Cy, H	D	L		5,035 47	27		L
32ad	Chas. Bryant		Du	11.6	12	C	Cy, H	D, O	Tca	1 0	5,006.16	2.98	8-10-48	GC
32ba	Thomas Fike	1945	Dr	365		P	Cy, E	D, S						
32bd	Adam Befus	1947	Dr	367	6	P	Cy, H	D	Tca	.1	5,007.53	22.87	8-10-48	GC
32dc	George Rein	1942	Dr	330	6	P	J, E	D, S			4,990 68			Ff, L, SC
32dd	do	1923	Dr	130	6	P	Cy, H	S	Pb	1 0	4,989.43	32.43	8-10-48	
33aa	Robert Bell	1948	Dr	27.0	5	P	Cy, E	D	Tca	5.0	5,032.27	11.19	7-14-49	
33ab1	H. M. Griggs	1949	Dr	249	6	P	J, E	D	L		5,041.47	20		
33ab2	do	1949	Dr	339	6	P	J, E	D	L		5,041.47	1.06		
33ab3	Ken McLeod		Dr	40		P	Cy, H	D			5,002.34			
33ad	H. H. Herman		Dr	180	6	P	J, E	D, S	L		5,087.53	20		
33ba1	F. W. Chopping	1946	Dr	241	4	P	J, E	D						
33ba2	Forrest Loper	1949	Dr	269	8	P	J, E	D	L		5,052.40	60		
33ba3	Wm. Mund	1947	Dr	280	8, 4	P	Cy, E	D	L		5,067.87	100±		L
33cd	Geo. Rein	1907 (?)	Dr	87.0	5	P	Cy, H	N	Tca	.9	4,981.34	4.06	8-10-48	
33dd	Morris Kline	1944	Dr	435	10	P	N	O	Tca	.0	4,969.58	42.79	2- 6-51	Ari
34ad	City of Riverton	1947	Dr	609	10, 8	P	F, T, E	PS			4,934.24			L, GC
34ba1	do	1937	Dr	535	10, 6	P	T, G	PS	L		4,969.00	12		L
34ba2	C. & N.W. Railroad		Dr		12	P	T, E	RR	Tca	−13.9	4,938.9	11.67	3-14-51	
34bb1	City of Riverton	1945	Dr	662	10, 8	P	T, G	PS			5,030.15			L
34bb2	do		Dr	660	10, 8	P	T, G	PS	L		5,022.87	75		L, GC
34bc1	Alex Stewart		Dr	15.45	5	P	Cy, E	S	Tca	−6.0	5,078.35	6.00	7-14-49	

34bc2	S. Williard		Dr				Cy, H	N						
34ca	City of Riverton	1943	Dr	525	10	P	T, E	PS			4,963.24			L
34da	Ed. Cunningham	1948	Du, Dn	10	1.5	P	P, H	D	L		4,928.21	4		
34dd	City of Riverton (Rodeo Grounds).	1951	Dr	79	6	P	N	N	L		4,930.6	3		LB,C
35ab1	Mary Peckham	1911 (?)	Dr	35.5	5	P	Cy, H	D	Tca	.3	4,926.49	11.40	7-14-49	
35ab2	Jim Petsch	1951	Dr	158	6	P	J, E	D, S	Tca	−5.2	4,930.3	26.30	10-16-51	
35ac1	O. H. Heatherington	1936	Du	6.7	13 x 13	W	Cy, H	D, S	Pb	1.2	4,918.03	4.82	7-12-49	
35ac2	Ben Carrasco		Du	10.0	40 x 40	W	P, H	O	Tc	1.1	4,915.07	8.00	11-17-48	L
35ac3	do	1948	Dr	116.0	6, 4	P	Cy, H	D, S	Tca	.2 (6") .3 (4")	4,913.31 4,913.41	7.16 19.80	7-13-49 7-13-49	
35ba1	James W. Kayser	1925	Dr	135	5	P	J, E	D						
35ba2	Joe Ray			75	5	P	Cy, H	D	Tca	1.2	4,937.59	19.58	7-12-49	
35bb1	City of Riverton	1922	Dr	398	5	P	T, E	PS			4,947.61			
35bb2	do	1922	Dr	385	6	P	T, E	PS	L		4,946.65	18		
35ca1	Phil Hays		Du	6	30	G	N	S	Tca	.9	4,922.13	5.47	7-13-49	
35ca2	do		Du	5.3	42 x 42	W	N		Tc	1.0	4,920.67	4.40	7-13-49	
35cb1	Ed. Cunningham	1949	Dr	80	10, 6	P	J, E	D	L		4,928.59	12		
35cb2	Pat and Tom Cunningham	1948	Du, Dn	15 (?)	1.5	P	P, H	D						
35cb3	do	1948	Du, Dn	15 (?)	1.5	P	P, H	D						L
35cc1	Tom Knight	1949	Dr	100	8, 5	P	J, E	D	L		4,925.51	7		
35cc2	I. J. King	1949	Dr	190	8, 6	P	J, E	D	Tca	.4	4,927.6	9.17	12-22-49	L
35cc3	John Piggott	1937	Dr	68	6	P	Cy, E	D, S	L		4,924.56	8		L
35cd	Art Beer	1946	Dr	156	8	P	J, E	D, S	L		4,924.40	10		
35db	Harvey Lough	1939	Dr	215	6	P	Cy, E	D, S	Tca	2.7	4,919.06	27.74	7-13-43	
A1-5-6ab	L. D. Laue		Dr	86.0	6 (?)	P	Cy, E	S	Hpc	1.2	4,887.93	5.83	6-23-49	L
6bb	Hayden Hill		Dr	98.0	6	P	Cy, E	D, S	Tca	1.3	4,914.03	5.17	6-23-49	Ff
6bd	L. D. Laue		Dr	100		P	Cy, E	D, S	Hpc	1.7	4,878.19	8.85	6-23-49	
6ca	E. M. Miller		Dr	83.0	6	P	Cy, H	N	Tca	1.5	4,884.84	34.16	6-23-49	
6dd1	B. J. Beecham	1947	Du	4.7	22	G	N	N	Tca	1.1	4,828.15	3.08	6-23-49	
6dd2	do		Sp					D						SC
A2-1-1aa	U.S. Bur. of Reclamation	1949	Dr	19.5	3	Pl	N	O	Tca	1.5	5,215.7	8.70	3-30-51	
2bb1	Morton School	1941	Dr	162	6	P	J, E	D						L
2bb2	do	1950	Dr	370	6	P	N	PS	L		5,401.2	120		
2cc	Frank Erickson		Dr	81.0	4	P	Cy, H	N	Tca	.8	5,363.00	32.02	10- 8-48	
3aa	Fred Anderson		Dr	17.0	6	P	Cy, H	N	Tca	.9	5,366.33	12.74	10- 8-48	SC, L
3ac	August Karel		Dr	20.0	6	P	Cy, H	S, O	Tca	.8	5,356.69	7.25	10- 7-48	
3ad	Glen Rodgers	1933	Dr	110	6	P	Cy, E	D, S	L		5,368.31	50		
3cd	do		Du	8.0	36	G	P, H	N	Tg	1.3	5,348.19	4.80	10- 8-48	
3da1	Frank Erickson	1943	Dr	94	8, 6	P	J, E	D, S	L			7		
3da2	do		Du	8			Cy, E	S	L			6		
4aa	Alex Knoll		Du	8.0			Cy, H	S	Tpl	.2	5,356.82	4.68	10- 8-48	
10ad	E. T. Woolery	1947	Dr	200	6	P	Cy, H	D, S						
11ab1	Earl Gardner	1947	Dr	352	8	P	Cy, E	D, In	L		5,398.66	80		
11ab2	A. R. King		Dr	91	6	P	Cy, E	D, S			5,347.10			

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (−) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A2-1-11cb	E. T. Woolery		Du	8.0	36	G	Cy, H	D, S, O	Tpl	.2		7.03	10- 8-48	L
11da	Rosie Yourick	1927	Dr	121.0	6	P	Cy, G	D, S	Tca	.1	5,356.27	44.05	8-17-48	
11dd	L. P. Griebel		Dr	105	6	P	Cy, E	D, S	L		5,331.27	25		
13ca	John Cunningham	1928	Dr	175	6	P	F (3)	D, S						
A2-2-4bc1	Sherman Johnson	1942	Dr	105.0	6	P	Cy, H, E	S	Tca	.6	5,294	33.70	9-21-48	
4bc2	do	1950	Dr	396	6	P	Cy, E	D, S	L		5,292	84.00		L
4cb	do	1940	Dr	123.0	6	P	Cy, E	S	Tca	.6	5,297	47.30	9-21-48	L
4dc	Lester Russell	1947	Dr	40.0	4	P	Cy, H	S, O	Tca	.8	5,245	6.97	9-20-48	GC
5aa	Martin Stuhr	1935	Dr	90.0	6	P	Cy, E	D, S	Tca	1.0	5,320	51.80	9-21-48	Ca
5ad1	Floyd Miller	1934	Dr	165	8	P	Cy, E	D, S			5,312			
5ad2	do	1945	Dr	60	6	P	Cy, E	S			5,312			
5ba1	Jake Korell	1939	Dr	90	6	P	Cy, E	D	L		5,337	40		
5ba2	do	1944	Dr	50	6	P	Cy, E	S	L		5,339	12		
5cb	Helen Dierks	1936	Dr	200	6	P	J, E	D, S	L		5,345	40		
5dc	H. C. Schmidt	1942	Dr	275	6	P	Cy, E	D, S	L		5,337	70		
6ca1	David Anderson	1932	Dr	22	6	P	Cy, E	S	L		5,408	10		
6ca2	do	1935	Dr	33	6	P	J, E	D, S	L		5,407	12		
6ca3	do	1942	Dr	36	6	P	J, E	S	L		5,408	10-15		
6dd1	Kenneth Fleenar	1935	Dr	53	6	P	Cy, H	N	L		5,421	40		
6dd2	do	1949	Dr	505	4	P		D	L		5,421	8		L
7ad	C. K. Durant		Dr	42.5	4	P	Cy, H	D, S, O	Tca	.5	5,403	11.70	9-21-48	SC
7da	A. J. Meredith		Dr	550	6	P	Cy, E	D, S			5,403			
8ac	Roy Henry	1940	Dr	114	6	P	Cy, E	D, S			5,333			
8bb	Carl Henry	1938	Dr	34.0	6	P	Cy, H	S	Tpl	.2	5,386	22.93	9-28-48	
8ca	Vernon Day	1939	Dr	445	6, 4	P	Cy, G, E	D, S	L		5,375	100		SC, L
8da	M. C. Cunningham	1946	Dr	150	6	P	Cy, E	S			5,322			
9ad	Dr. N. E. Morad		Dr	65	8	P	N	N			5,267			
9bc	Ernest Stuhr	1946	Dr	395	6	P	Cy, E	D, S			5,297			L
9cb1	William Brush		Dr	73.0	6	P	Cy, E	S	Tca	.6	5,307	30.00	9-22-48	
9cb2	do	1939	Dr	398	4	P			L		5,307	60		SC, L
9cb3	do	1932	Dr	130	6	P	Cy		L		5,307	62		SC, L
9cc	U.S. Bur. of Reclamation	1948	Dr	9.0	3	Pl	N	O	Tca	.4	5,303.6	6.94	3-30-51	L

A2-2-9da	Walter Neiberger		Dr	130.0	6	P	Cy, E	D, S	Tca	.3	5,276	39.42	9-22-48	
10cb	Charles Stickney	1935	Dr	85	8	P	Cy, E	D, S	L		5,263	20		
10da	Ezra Lyons	1942	Dr	186	8, 6	P	F, J, E	N, D			5,233			
10dd	F. C. Hoffman		Dr	15.0	5	P	Cy, E	S, O	Tca	.3	5,259	4.18	9-29-48	
11cb1	Earl Stultz	1939	Dr				F (4)				5,230			
11cb2	do	1947	Dr	172	8, 6	P	F, J, E	D			5,230			
13ad	A. Peterson		Dr	97.0	9	P	Cy, H	O	Tca	.9	5,269	47.50	7-19-48	
13bc1	Hugh Foster	1934	Dr	105	6	P	Cy, E	S			5,263			SC
13bc2	do	1940	Dr	137	6, 4	P	Cy, E		Tca	.4	5,263	25.60	9-28-48	SC, L
13cc	B. Anderson		Dr	88.0	5	P	Cy, H	O	Tca	.5	5,289	2.59	7-19-48	
13cd	H. C. Meyer		Dr	20	6	P	Cy, H	N			5,288			
13dc	Howard N. Gould	1944	Dr	208	10, 7	P	Cy, E	D, S	Tca	1.4	5,295	81.54	9-28-48	L
14ad1	D. O. Spears		Du	15.0	48	C	Cy, H	S	Tpl	.2	5,268	7.85	9-29-48	
14ad2	do	1938	Dr	189.0	6	P	N	O	Tca	.8	5,269	5.20	9-29-48	
14bb	C. H. Dechert		Dr	71.0	6	P	Cy, H	S	Tca	.3	5,273	32.07	9-28-48	
14cc	A. L. Brown		Dr	51.0	6	P	Cy, E	N	Tca	.8	5,334	22.40	9-27-48	
14dc	Peter Heil		Dr		6	P	Cy, E	D, S			5,313			
15ad	Ivan Riese	1939	Dr	233	4	P	Cy, G	S			5,295			SC, L
15bb1	G. W. Troxell	1942	Du	30.0		N	Cy, H	D, S, O	Tpl	.1	5,304	17.89	9-27-48	
15bb2	do		Dr	120	4	P	N	N			5,303			
15ca1	G. W. Groathouse	1938	Dr	72	4	P	Cy, E	D, S	L		5,353	30		
15ca2	do	1948	Dr	100	6	P			L		5,353	40		L
15dc	H. B. Brown	1938	Dr	22.0	6	P	J, E	D, S	Tca	−5 5	5,341	7.26	10-18-48	GC
16ad	C. Snyder	1940	Dr	15	6	P	Cy, H	D, S	L		5,321	4		
16bc1	J. B. Andrews	1939	Dr	440	4	P	Cy, G	D	L		5,363	162		SC, L
16bc2	do	1948	Dr	52	6	P	Cy, H	S	Tca	.7	5,361	13.82	9-22-48	
16ca1	C. E. Clapp	1940	Dr	49.0	6	P	Cy, H	D	Tca	.2	5,365	19.56	9-27-48	
16ca2	do		Dr	60	6	P	J, E	S	L		5,365	15-20		
16cd	Sunnyside Church	1943	Dr	65	6	P	Cy, H	D	L			20		
16dd	Merle Short	1940	Du	30	36	C	Cy, H	D, S	L		5,374	12.40	9-28-48	
17aa	John A. Corkill	1940	Dr	500	6	P	Cy, E	D, S	L		5,325	96		GC,SC,L
17ad	H. J. Hileman		Dr	48.0	6	P	Cy, H	O	Tca	1.0	5,365	21.54	9-22-48	
17bc	Fred Ellerbruch	1939	Dr	388	6	P	Cy, E	D, S	L		5,395.69	160		SC, L
17cc	Floyd Real	1945	Dr	326	6	P	J, E	D, S	L		5,362.53	130		L
17da1	R. E. Novatny	1947	Dr	52	6	P	Cy, H	N	Tca	2.0	5,378.05	14.98	9-29-48	L
17da2	do	1948	Dr	30	6	P	Cy, H	D	L			8		
17db1	John Wright	1938	Dr	152	6	P	N	N			5,385.21			P
17db2	do	1947	Dr	63	6	P	J, E	S	L		5,385.21	16		
17dc	do		Dr	65.0	4	P	N	O	Tca	−.5	5,347 99	4.47	9-29-48	
18aa	Cl Hudson	1946	Dr	375	4	P	Cy, G	D, S	L		5,383	125		
18ab	J. H. Russell	1947	Du	25			J, E	S	L		5,417	15		L
18ad1	Oscar Lund	1944	Dr	485	6	P	Cy, E	D	L		5,403.59	180		
18ad2	R. W. Philburn	1939	Dr	396	4	P	Cy, G	D, S	L		5,410 05	168		SC, L
18ad3	R. J. Westlake	1948	Dr	45	6	P	Cy, E	In			5,409			
18da	Leo Taylor	1939	Dr	426	4	P	Cy, E	D, S	L		5,378.21	100		SC, L

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (—) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A2-2-20ac	C. M. McCullough	1938	Dr	60	6	P	Cy, E	S	L		5,352.27	10		
20cb	Ernest Laitner	1941	Dr	87.0	7	P	Cy, G	S	Tca	1.0	5,393	51.06	8-17-48	
20db	do		Dr	80	6	P	Cy, W	S	L		5,348	20		
22aa	G. E. Bray	1947	Dr	54.5	7	P	Cy, G	D, O	Tca	—4.0	5,352	3.20	9-27-48	
23aa	U.S. Bur. of Reclamation	1948	Dr	10.0	3	Pl	N	O	Tca	1.7	5,298.5	8 53	3-30-51	
23ad1	A. L. Brown		Dr	50.0	4	P	Cy, H	O	Tca	.3	5,369	4.39	9-27-48	
23ad2	do		Dr	111.0	6	P	J, E	D, S	Pb	1.8	5,373	31 20	9-27-48	
23bd	Lena Bechert		Dr	47.0	6	P	Cy, H	O	Tca	1.0	5,384.64	19.82	9-29-48	
24ab	Bertha Gould	1939	Dr	187	4	P	Cy, E	D, S	L		5,299	77		L
24ba	H. C. Meyer	1939	Dr	185	4	P	J, E	D, S	L		5,294	75		L
24cb	Melvin Riese	1935	Dr	100	6	P	Cy, E	D, S	L		5,361	35		
24dd	John Weber	1941	Dr	330	6	P	Cy, E	D, S	Tca	.7	5,386	180.67	9-28-48	SC, L
29bb	R. H. Miller	1939	Dr	375	4	P	Cy, E	D, S	L		5,393	160		SC, L
A2-3-2aa	Paul Petzoldt	1949	Dr	106.0	4	P	N	N	Tca	—5.6	5,341	65.36	5-19-49	
3aa1	W. C. Womack	1948	Dr	67.5	4	C	Cy, H	D, S	Tca	.2	5,285	32.44	5-19-49	SC
3aa2	do	1950	Dr	61	6	P	N	N	Tca	.9	5,285	24.39	7- 5-51	L
3ab	Arden Anderson	1948	Dr	110	6	P	Cy, H	D, S	L		5,284	40		BC
3bb	U.S. Bur. of Reclamation	1948	Dr	23	3	Pl	N	O	Tca	.8	5,285	12.94	3-30-51	L
3cc	S. E. Clark	1948	Dr	80	6	P	Cy, E	D, S	L		5,324	45		BC, SC
5da	Robert Heumeyer	1948	Dr	200	6	P	Cy, E	D, S	L		5,270	44		BC, L
7da	C. G. Wall	1950	Dr	150	6	P	Cy, E	D, S			5,274			
8bc	Stanley Huffman	1948	Dr	150	6	P	Cy, H	D, S	L		5,290	96		BC, L
8cd	D. F. Hobbs	1948	Dr	144	6	C	Cy, H	D, S	L		5,297	70		
9da	L. G. Edge	1949	Dr	250	6	P	J, E	D, S	L		5,338	66.00	12- -49	BC, L
10bc	Jack Cole	1948	Dr	85.0	6	P	J, E	D, O	Tca	.5	5,331	48.88	10-19-48	GC, L
10cb	K. W. Dickinson	1948	Dr	128	4	P	Cy, E	D, S	L		5,333	40-50	8- -48	
16aa	R. E. Crawford	1948	Dr	139.0	5	P	Cy, E	D, S	Pb	1.0	5,337	67.85	5-20-49	BC
16bb	J. W. Broyles	1948	Dr	120.0	6	P	N	D, S	Tca	.8	5,319	72.15	5-19-49	SC
16bd	H. J. Merrigan	1948	Dr	85.0	5	P	Cy, E	D, S	Tca	.4	5,302	54.50	5-20-49	
16ad	M. M. Mills	1948	Dr	150	6	P	Cy, E	D, S						BC
19ba	H. J. Peterson	1939	Dr	319	4	P	Cy, H	D, S	L		5,325	80		
19bc	George Haines	1945	Dr	360.0	8, 6	P	J, E	D	Tca	1.5	5,361	88.68	9-10-48	SC, L

19dd	John Weber	1940	Dr	228	6	P	Cy, E	D, S	L		5,359	142		SC, L, GC
20cd	Dale M. Ibach	1939	Dr	220	5	P	Cy, E	D, S	L		5,340	56		SC, L
21ad	H. Schott	1950	Dr	115	6	P	N	N			5,331			
21cd	A. J. Gardner	1948	Dr	104	6	P	N	N	Tca	−6.2	5,304	36.68	5-20-49	L
21dd	Walter H. White	1950	Dr	76	6	P	J, E	D, S	L		5,307	22.00	6- -50	L
22bb	U.S. Bur. of Reclamation		Dr	25	3	Pl	N	O	Tca	1.0	5,321	9.20	3-30-51	L
24aa	G. F. Boecking	1936	Dr	34	6	P	Cy, E	D, S	L		5,339	12		
24da	L. L. Cook		Dr	74.0	7	P	Cy, H	D, S	Tca	.9	5,313	15.26	5-24-49	
24db	Bernard McCoy	1935	Dr	120	5	P	J, E	D, S	L		5,340	20		
24dd	Charles Drake		Dr			P	Cy, E	D, S						
25da	O. J. Shafstall	1934	Dr	143	4	P	Cy, E	D, S						
26dc	Leonard Withington	1949	Dr	80.0	6	P	Cy, H	D, S	Tca	.5	5,370	34.92	5-23-49	GC, L
28da1	Harold Holmes	1948	Dr	89.5	5	N	N	N	L		5,344	37.78	5-23-49	
28da2	do	1950	Dr	430	6	P	J, E	D, S	L		5,365	70.00		L, BC
29aa	W. M. Donelson	1943	Dr	112		P	Cy, E	D, S	L		5,304	50		
29bb	Andrew Ibach	1940	Dr	257	6	P	Cy, E	D, S	L		5,361	150		SC, L
29bc	George Hinkle	1940	Dr	469	8, 6	P	Cy, E	D, S	L		5,369	80		SC, L
29cb1	J. J. Portlock	1939	Du	20.0	36	N	Cy, H	N	L		5,363	14.39	5-20-49	
29cb2	do	1946	Dr	65	8	P	J, E	D, S	L		5,363	12		L
29da	W. M. Donelson	1936	Dr	110.0	5	P	Cy, E	D, S	Tca	.9	5,335	24.89	5-20-49	
29dd	Arthur Schaper	1939	Dr	100	6	P	Cy, E	D, S	L		5,317	30		
32ab	W. M. Sollars	1936	Dr	125	6	P	J, E	D, S						
32ad	A. M. Peterson	1942	Dr	72.0	6	P	Cy, E	D, S	Tca	1.6	5,350	5.80	5-23-49	SC, L
33aa	W. R. Skelton	1938	Dr	111	6	P	J, E	D, S	L		5,329	23		
33ad	A. C. Bryant	1939	Dr	183	4	P	Cy, E	D, S	L		5,348	72		SC
33bb1	Henry Johnson	1940	Dr	500	6	P	N	N	L		5,345	14		SC, L, B
33bb2	do	1940	Dr	109.0	5	P	Cy, E	D, S	Tca	1.0	5,346	14.51	5-23-49	S
33cb	H. M. Higgs	1936	Dr	67.5	6	P	Cy, E	D, S	Tca	.8	5,355	9.32	5-23-49	
33cc	M. Hinkle		Du	22.0	12	W	Cy, H	S, O	Tw	.5	5,363	10.51	12- 1-48	
33da	Joe Detimore	1939	Dr	234	4	P	Cy, E	D, S	L		5,349	164		SC, L
34bb	Fackrell	1950	Dr	53	6	P	Cy, H	D, S	L		5,339	16.00	8- -50	
34bc	U.S. Bur. of Reclamation	1951	Dr	8.5	3	Pl	N	O	Tca	.5	5,348.7	6.22	3-30-51	L
34cc1	Henry Bath		Dr	69.5	5	P	Cy, H	N	Tca	1.0	5,359	17.06	5-24-49	
34cc2	do	1941	Dr	402			N	N			5,359			L, B
34cc3	do	1941	Dr	224	6	P	Cy, E	D, S	L		5,358	140		SC, L
34cd	Paul and Andy Peterson	1940	Dr	218	6	P	Cy, E	D, S	L		5,359	90		SC, L
34da	A. J. Campbell		Dr	150.0	5	P	Cy, E	D, S	Tca	.0	5,363	51.47	5-23-49	SC
34db	Miles Peterson		Dr	58.0	5	P	Cy, H	D, S	Tca	.4	5,358	9.73	5-24-49	
35bc	Henry Schaper	1939	Dr	185.0	4	P	Cy, E	S	Tca	.0	5,360	154.67	5-24-49	
35ca1	J. E. McClellan		Du	15.0	24	W	N	O	Tw	.8	5,362	5.93	11-17-48	Ari
35ca2	do	1949	Du	9.5	36	N	P, H	D, S	L		5,364	5.75	5-24-49	
A2-4-1aa	F. W. Marlette		Dr	54.3	9	P	Cy, H	D, S, O	Tca	.3	4,974	6.47	6-13-49	
1bc	A. Weinhold		Dr	212.5	6	P	Cy, E	D, S	Tca	−5.5	4,999	16.89	6-13-49	
1cb	Gerhard Medow		Dr	165	6	P	J, E	D, S	L		5,019	20		L

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point			Depth to water level below measuring point (feet)	Date of measurement	Remarks
									Description	Distance above or below (−) land surface (feet)	Altitude (feet)			
A2-4-1da	Ervin Schmidt	1943	Dr	120	6	P	Cy, E	D, S	L		4,990	18	6- 8-49	SC
1dc	V. B. Plummer	1939	Dr	85.0	6	P	Cy, H	N	Tca	0.8	5,024	31.08	6-13-49	L
2ad	H. M. Currah	1940	Dr	420	6, 4	P	Cy, E	D, S	L		5,011	93		SC, L
2ba	William McDonald	1942	Dr	126	8	P	Cy, E	D, S	L		5,037	60		
2cb	Floyd W. Uglow		Dr	50.0	6	P	Cy, H	O	Ep	.1	5,092	5.64	7-14-48	GC
2cc	C. T. Moody		Dr	70.0	5	P	N	O	Tpl	.7	5,110	31.25	7-14-48	
2da	O. H. Carlson	1940	Dr	90	5	N	Cy, E	S	L		5,019	17		
2dc	Floyd W. Uglow	1940	Dr	158	6	P	Cy, E	D, S	L		5,075	80		SC, L
3aa	J. Suppes	1939	Dr	140	6	P	Cy, E	D, S	L		5,059	40 (?)		
3bb	Ray Hursh	1947	Dr	560	6	P	N	N	L		5,135	180		L
3cc	Larry Barrett	1942	Dr	530	6	P	Cy, E	D, S	L		5,179	150		L
4aa	U.S. Bur. of Reclamation		Dr	24.0	3	Pl	N	O	Tca	1.5	5,115	15.55	3-30-51	L
4dd	I. W. Douglas	1940	Dr	294	6	P	Cy, E	S	L		5,185	180		SC, L
8da1	H. E. Clapp	1947	Dr	50	5	P	Cy, E	S	L		5,313	25 (?)		
8da2	do		Sp				F (⅛)				5,329			
9aa1	Milo Runyan	1941	Dr	478			N	N			5,183			B, L
9aa2	do	1941	Dr	298	6	P	Cy, E	D, S	L		5,183	125		SC, L
9aa3	T. W. Walthers	1941	Dr	299	6	P	Cy, E	S	L		5,190	165		SC, L
9bc	Robert Remery	1935	Dr	98	6	P	J, E	D, S	L		5,292	32		
9cb	Ivan Haggerty		Dr	48	6	P	J, E	D, S						
9cc	J. R. Longfellow	1941	Dr	465	6	P	Cy, E	D, S	L		5,279	220		SC, L
9dd	Ivan Haggerty		Dr	35.5	5	P	Cy, H	O	Tca	.2	5,201	7.72	6-13-49	
10bb	Fred Devish	1941	Dr	300	6	P	Cy, E	D, S	L		5,179	180		SC, L
10bd	Roy Haggerty	1940	Dr	326	6, 4	P	Cy, E	D, S	L		5,185	175		SC, L
10dc	Leonard Templin	1941	Dr	350	6	P	Cy, E	D, S	L		5,171	150		SC, GC, L
11ab1	Arthur Gross	1946	Dr	45	4	P	Cy, E	S	L		5,071	20		
11ab2	do	1944	Dr	42	6	P	F (10)	N			5,033			Rw
11ac	William Rigler		Dr	80	6	P	Cy, E	S	Tpl	.3	5,095	40.80	6-10-49	
11bb	L. Nolan	1939	Dr	150.0	6	P	Cy, H	S	Tca	1.2	5,110	33.50	6-10-49	
11da	Arthur McCoy	1944	Dr	218	5	P	Cy, E	D, S	L		5,073	100		L
11dc	A. O. Brown		Dr	63.5	6	P	Cy, H	S, O	Tca	.5	5,113	7.69	7-15-48	
12bc	Oliver Lund	1941	Dr	190	6	P	J, E	D, S	L		5,060	50		SC, L
12cb	E. T. Steenbock	1941	Dr	188	6	P	J, E	D, S	L		5,073	65		SC, L

13ba	Claude Knapp	1949	Dr	69.0	5	P	N	N	Tca	.6	5,069	17.90	6-13-49	SC
13bb1	John P. Sanders	1941	Dr	500			N	N			5,121			B, L, Dh
13bb2	do	1941	Dr	230	6	P	Cy, E	D, S	L		5,101	80		SC, L
14ba	U.S. Bur. of Reclamation	1949	Dr	31.0	3	Pl	N	O	Tca	1.5	5,120	18.46	3-30-51	L
14bb	Oswald Anderson	1942	Dr	335	6	P	Cy, E	N	L		5,175	150		SC, L
15ab	Charles Wheeler	1940	Dr	175	5	P	Cy, E	D, S	L		5,176	135		SC, L
15ac	Floyd Verley	1941	Dr	330	6	P	Cy, E	D, S	L		5,195	180		SC, L
15bb	Victor C. Hughes	1941	Dr	395	6	P	Cy, E	D, S	L		5,230	90		SC, L
16ab	J. L. Sinner	1941	Dr	403	6	P	Cy, E	D, S	L		5,233	180		SC, L
16ad	R. O. Allbert	1940	Dr	215	8	P	Cy, E	D, S	L		5,219	100 (?)		
16bb	W. C. York	1941	Dr	473	6	P	Cy, E	D, S	L		5,279	229		SC, L
16bc	H. C. Fox	1939	Dr	42	5	P	J, E	D						
16cb	Nick Haverlock		Dr	45	5	P	J, E	N						
16cd	L. V. Douglas	1934	Dr	55	5	P	J, E	D, S	L		5,237	23		
17aa	E. C. Brines	1940	Dr	284	7	P	Cy, E	D, S	L		5,296	75		L
17ad	E. M. Fox	1935	Dr	40.0	6	P	Cy, E	O	Pb	1.0	5,277	3.21	7-15-48	GC
17ba	Oscar Evans	1942	Dr	272	6	P	Cy, G		L		5,353	200		SC, L
17bc	L. C. Padgett	1935	Dr	19.3	7	P	Cy, H	D, S, O	Tca	.6	5,347	6.64	6- 7-49	
17bd	do	1935	Dr	30	7	P	J, E	D, S	Tca	−5.0	5,328	7		
17cd1	L. McCoy	1934	Dr	140.0	6	P	J, E	D, S	Tca	−4.0	5,258	3.80	6- 6-49	
17cd2	do	1939	Dr	20.0	6	P	F	N			5,271			Rw
17da	U.S. Bur. of Reclamation		Dr	8.2	3	Pl	N	O	Tca	1.0	5,262	4.27	3-30-51	L
17dc	Jake Lye		Dr	137.0	5	P	Cy, H	S	Tpl	.8	5,270	54.70	6- 6-49	
17dd1	H. E. Clapp	1941	Dr	225	6	P	Cy, E	N	L		5,243	140		SC, L
17dd2	E. L. Moore	1937 (?)	Dr	98	4	P	J, E	D, S	L		5,249	65±		
18ac	T. B. Loghry	1935	Dr	37.0	4	P	Cy, E	D, S	Tca	−5.0	5,340	1		
18cd1	C. S. Foster	1934	Dr	61.3	8, 4	P	Cy, H	N	Tca	1.5	5,318	4.24	6- 6-49	
18cd2	U.S. Bur. of Reclamation	1948	Dr	8.5	3	Pl	N	O	Tca	1.3	5,302.3	4.27	3-30-51	L
18da	L. McCoy		Dr	87.0	4	P	Cy, H	D, S	Tca	.5	5,297	19.40	6- 6-49	
18dc1	C. C. Williams	1934	Dr	98	6	P	J, E	D, S	L		5,301	20		L
18dc2	do		Du	7.5	30	Od	Cy, H	S, O	Tca	2.0	5,303	3.19	6- 6-49	
19ad	Reuben Schaffer						Cy, E	D, S						
19ba	C. S. Foster		Dr	40	6	P	Cy, E	D, S	L		5,303	5		
19bb	Rush Brown	1934	Dr	61	5	P	Cy, E	D, S	L		5,329	15	6- 6-49	
19bc	C. W. Loghry	1936	Dr	19.4	6	P	Cy, H	D, S	Tca	.8	5,320	4.26	6- 3-49	
19cc	B. L. McCoy		Dr		5	P	Cy, H	S						
19cd	U.S. Bur. of Reclamation		Dr	8.3	3	Pl	N	O	Tca	1.0	5,292.5	3.25	3-30-51	L
19db	H. A. Loghry	1935	Dr	69.0	4	P	J, E	D, S	Tca	−4.0	5,265	4.79	6- 3-49	
19dd	G. Eiseman	1941	Dr	355	6	P	Cy, E	D, S	L		5,294	250		SC, L
20ab	H. F. Loghry	1935	Dr	80	4	P	J, E	D, S	L		5,245	23		
20ac	L. L. Loghry		Dr	55.0	6	P	Cy. H	N	Tca	.4	5,239	16.98	5-25-49	
20ad	Chas. Drake	1934	Dr	45	6	P	Cy, H	S	L		5,223	40		
20ca	Vern Stone		Dr	12.0	6	P	N	N						Dh
20cc	do		Dr	122.0	4	P	C, E	D, S	Tca	−5.5	5,303	71.79	5-25-49	

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point			Depth to water level below measuring point (feet)	Date of measurement	Remarks
									Description	Distance above or below (−) land surface (feet)	Altitude (feet)			
A2-4-21ac	K. R. Loghry	1934	Dr	77	4	P	Cy, E	S	L		5,215	30 (?)		L
21ad	James Knight	1940	Dr	253	6	P	Cy, E	D, S	L		5,229	140		SC, L
21bb	Chas. Drake		Dr	66 (?)	5	P	Cy, H	N	L		5,229	35 (?)		
21ca1	J. D. Verley	1937	Dr	98	6	P	N	N						P
21ca2	do	1941	Dr	550										Dh, B, L
21ca3	do	1941	Dr	90	5	P	Cy, G	D, S	L		5,249	40		SC, L
21cb	Wm. Carpenter	1941	Dr	90	4	P	J, E	D, S	L		5,251	35		
22bc1	Phillip Spencer	1935	Dr	50	4	P	Cy, H	S						
22bc2	do	1935	Dr	102.5	4	P	N	O	Tca	0.4	5,252	44.90	6- 8-49	
22bc3	do	1936	Dr	218	4	P	Cy, E	D, S						
25cc	C. H. Hutchinson	1947	Dr	50	8	P	J, E	D, S	L		5,040	20		
25dd	Archie Maulik	1919	Dr	300	6	P	Cy, E	D, S	L			180		
26dd1	R. R. Trenary	1939	Dr	36.9	4	P	Cy, E	D, S, O	Tca	.4	5,039.76	28.05	6-24-49	
26dd2	do	1944	Dr	118.0	6	P	N	N	Tca	.5	5,082.16	22.95	6-24-49	
26dd3	do	1947	Dr	215.0		N	N	N	L		5,070.04	11.10	6-24-49	
29bb	C. P. Achey	1936	Dr	40	5	P	Cy, E	D, S	L		5,339	20		
30ab1	Tracy Guhl	1943	Du	28	36	T	N	N	L		5,296	5		C
30ab2	do		Dr	130	6	P	N	N						P
30bb	J. S. Draper	1935	Dr	64.0	6	P	Cy, H	O	Hpc	2.0	5,321	10.81	7-14-48	
30ca1	do		Dr	126	4	P	N	N						A
30ca2	do	1941	Dr	430	6	P	Cy, E	D, S	L		5,354	200		SC, L
30cc	William McCoy	1934	Dr	83	5	P	J, E	D, S	L			20		
35ad	Clyde Botts	1918	Dr	101	5	P	Cy, E	D, S						
35cc	W. A. Neal		Dr	103.0	6	P	Cy, E	D, S	Tca	1.0	5,065.15	47.12	6-24-49	
35cd	Earl Davis	1942	Dr	92	6	P	J, E	D, S	L		5,043.75	45		
35da	Harry Coen		Dr	102	5	P	J, E	D, S	L			30		
35dd	Max Detlefson		Dr	87.0	5	P	Cy, H	D, S	Tca	1.0	4,986.13	6.25	7- 7-49	
36ab	Phillip Poffenroth		Dr	117.0	6	P	Cy, H	N	Pb	1.1	5,030.09	46.75	6-24-49	
36bc	C. H. Hutchinson		Dr	64		P	Cy, H	D						
36cc	D. T. Botts	1918	Dr	79	8	P	J, E	D, S	L		4,973.50	25		
36db1	August Siek		Dr	14.7	12	G	Cy, H	D, O	Tca	1.5	4,968.04	5.04	7- 7-49	
36db2	U.S. Geological Survey	1951	J	21.5	¾	P	N	O	Tca	4.1	4,963.9	24.30	3-30-51	L

36db3	W. R. Browne		Dr	21.5	5	P	Cy, H	D, S	Tpl	−6.5	4,949.08	4.16	7-7-49	
A2-5-1cb	Edward Knutson	1951	Dr	312	6	P	J, E	D, S			4,958			
2ab	Joe R. Foster	1942	Dr	306.0	6	P	Cy, H, E	D, O	Tca	.5	4,875	60.90	10-2-47	SC, GC, L
2bb	Elmer Slafter	1942	Dr	264	5	P	J, E	D, S	L		4,865	60		
2ca	do	1948	Dr	130.0	6	P	J, E	D, S	Tca	.0	4,925	45.98	6-15-49	
2dc	A. C. Traweek	1949	Dr	120	4	P	Cy, H	S	Tpl	.4	4,942	36.84	6-16-49	
3ab1	Ernest Pintgetzer	1940	Dr	198	6	P	J, E	D, S	L		4,871	60		SC, L
3ab2	do	1948	Dr	268.0	8, 6	P	J, E	D, S, O	L		4,873	47.38	10-20-48	L
3bb	C. H. Hayen	1942	Dr	248	4	P	Cy, E	D, S	L		4,879	70		L
4aa	E. S. Peltzer	1947	Dr	262	8, 6	P	J, E	D, S	L		4,888	75		L
4bb1	C. B. Brown	1944	Dr	89.4	5	P	N	O	Tca	.8	4,917	22.70	7-15-48	
4bb2	do	1944	Dr	215	7	P	J, E	D, S	L		4,916	40		L
4cb1	D. L. Jarvis		Dr		4	P	N	N						P
4cb2	do	1943	Dr	190	4	P	J, E	D, S	L		4,949	90		
4dd	Elmer Slafter	1944	Dr	233	7	P	Cy, E	D, S	L		5,001	57		
5aa1	R. C. Neal	1936	Dr	44.35	5	P	N	N	Tca	−3.0	4,923	7.75	6-14-49	
5aa2	do	1942	Dr	277	6	P	Cy, E	D, S	L		4,929	65		SC, L
5aa3	U.S. Bur. of Reclamation	1949	Dr	28.5	3	Pl	N	O	Tca	1.4	4,917.4	6.88	3-31-51	L
5ad	Ralph Neal	1943	Dr	257	6	P	J, E	D, S	L		4,924	81		
5ba1	Bernard Stracker		Dr	76.0	6	P	Cy, E	S	Pb	.7	4,943	23.12	6-15-49	
5ba2	do	1932	Dr	280	8, 6	P	Cy, E	D	L		4,943	60		
5cb	H. E. Holliday		Dr	165			J, E	D, S						B
5dd	Harry Waugh		Dr	92	7	P	Cy, H	D, S	L		4,989	60		L
6ad1	R. Shuttlesworth		Dr	56.5	6	P	N	O	Tca	1.3	4,957	10.38	7-15-48	Ari
6ad2	do		Dr			P	Cy, E	D, S						
6ba1	do		Dr	110	6	P	J, E	S	L		4,966	39		
6ba2	do	1948	Dr	325	6	P	J, E	D, S	L		4,966	66		
6bd	Leo Cunningham	1942	Dr	140	6	P	Cy, E	D, S	L		5,001	20		SC, L
6ca	Fred Baalhorn	1940	Dr	92	2	P	Cy, H	D, S						
7bb	C. M. Corr	1941	Dr	105	6	P	Cy, H	D, S	L		5,012	13		SC, L
7bd	John Kobayashi	1950	Dr	200	6	P	N	N	Tca	.1	5,024	49.35	10-25-50	L, BC
8bb	Roy J. Eells	1941	Dr	110	6	P	Cy, E	D, S	L		5,007	50		SC, L
10ac	Y. W. Causey	1950	Dr	360	6	P	Cy, E	D, S	L		4,999	180		L
10bb	Irl Pintgetzer	1950	Dr	287	6	P	S, E	D, S	L		4,999	180		L
11bb1	Lincoln Todd	1951	Dr	347	6	P	S, E	D, S	L		4,964	130		L, BC
11bb2	Claude Briddle	1949	Dr	160.0	6	P	Cy, E	D	Tca	.2	4,979	40.83	6-16-49	
12bb	Geo. English	1948	Dr	300	9	P	Cy, H	D, S	L		4,983	180		L
19dc	C. K. Rock	1935	Du	12	36	P	Cy, J, H, E	D, S	Tpl	1.0	5,008.05	6.66	6-24-49	
20ca	C. E. Wilson	1937	Dr	116	6	P	Cy, E	D, S, O	Tca	1.2	5,035.69	55.76	6-23-49	
20cb	Bessie M. Miller		Dr	106.0	6	P	Cy, H	D	Tca	1.0	5,030.97	49.30	6-23-49	
20da	Al Reuber	1939	Dr	137	6	P	Cy, E	D, S	L			15		
20dc1	Paul Madlock	1945	Dr	70.0	6	P	Cy, E	D, S	Tca	−5.0	4,981.17	15.46	6-23-49	L
20dc2	L. R. Wenner	1935 (?)	Dr	68.0	8	P	J, C, E, H	D, S	Tca	−5.0	4,978.81	11.95	6-23-49	
21ca	Paul Brownfield	1946	Dr	190		P	J, E	D, S						
21cb	C. R. Cantrell	1936	Dr	40		P	J, E	D, S	L			10 (?)		

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (−) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A2-5-27ab	Ray Schmoyer	1948	Dr	100	6	P	N	N	Tca	1.0	4,842.51	33.98	6-20-49	
27ca	N. R. Shelly	1945	Dr	180	10, 6	P	J, E	D, S	L		4,829.97	28		L
28ab	S. W. Von Krosick	1935	Dr	125		P	Cy, E	D, S	L		4,930.18	30		
28ca	U.S. Geological Survey	1951	J	17.7	¾	P	N	O	Tca	4.1	4,864.2	17.22	3-30-51	L
28cb1	Harry Littlefield	1918	Dr	115		P					4,882.78			B
28cb2	do	1947	Dr	170	7	P	J	D, S	L		4,882.78	25		L
28cc	Reuben Schriner		Dr	175	6	P	Cy, E	D, S						
29ba	C. R. Shelly		Dr			P	Cy, E	D						
29cd	Harry Littlefield		Dr	88.0	4	G	Cy, H	N	Tca	.0	4,910.81	16.20	6-21-49	
29dd	do	1947	Dr	48	8, 6	P	Cy, E	D, S	L		4,871.50	8		L
30ad	Leo Kehm	1942	Dr	170	6	P	Cy, E	D, S	L		5,005.64	100		SC, L
30ba	R. C. Dalley		Dr	85	6	P	J, E	D, S	L		5,025.20	60		
30ca	Lowell Lund		Dr	190.0	6, 4	P	N	N	Tca	.8	5,014.32	116.80	6-24-49	
30cd1	do	1945	Dr	71.0	6	P	N	N	Tca	−5.0	4,962.55	57.57	6-24-49	
30cd2	do	1948	Dr	177	8, 6	P	T, E	D, S	Tca	−5.0	4,957.55	77.28	6-24-49	GC, L
30da1	O. J. Olson		Sp								4,934.63			
30da2	do		Du	16.0	4	P	Cy, E, H	D, S	Tca	−1.0	4,959.55	9.89	6-23-49	
30da3	L. N. Plummer	1945	Dr	40	5	P	J, E	D, S	L		4,961.98	16		
30da4	do	1939	Dr	38	5	P	Cy, H	D	L		4,934.10	16		
31aa	Camille Mazet		Dr	75	5	P	J, E	D	L			40 (?)		
31bb	Lawrence Smith		Dr	51	8	P	Cy, H	D, S	L		4,964.47	7.5		
31cc	C. P. Fuller		Dr	7.0	6	P	Cy, H	O	Pb	1.5	4,914.73	1.5	2- -44	
31da	Howard Hill	1938	Dr	18	3	P	P, H	D	L			12		
32ab	C. M. Dahl		Dr	35	8	P	Cy, E	D, S	L			20		
32ba	Camille Mazet		Dr	42.0	5	P	Cy, H		Tca	.4	4,887.26	3.02	6-21-49	
32da	Ray Bracken		Dr	224.0	3	P	Cy, H	D	Tca	.5	4,856.33	11.38	7- 6-49	
33aa	John Arbens		Dr	60		P	Cy, E							
33bd	Guy Ugarisa		Dr	59.0	5	P	Cy, H	D	Tca	.5	4,846.60	24.77	6-20-49	
A2-6-6da	L. O. Allread	1950	Dr	190	6	P	Cy, H	D, S	L		4,829	110		L
6dd	A. R. Morse	1950	Dr	570	6, 8	P	Cy, H	D, S			4,839			L, SC
7cd	Sam Schrinar	1949	Dr	128	6	P	Cy, G	D, S	Hpc	1.7	4,866	6.02	6-20-49	GC, L
7db	Howard Edwards	1950	Dr	70	6	P	N	N	Tca	.3	4,809	37.00	10-13-50	L, BC
18aa	R. H. Keller	1950	Dr	52	8	P	J, E	D, S			4,810			

18ad	M. Marlowe	1948	Dr	405	6, 8	P	F, Cy, H	D, S	Pb	.0	4,808	.00	6-20-49	L
18ba	B. G. Gillette	1948	Dr	105	6	P	Cy, H	D, S	L		4,854	65		L
18ca	Mel. Devish	1948	Dr	103	6	P	J, E	D, S	L		4,843	50		L
18cd	E. H. Marlatt	1948	Dr	111			J, E	D, S	L		4,835	60		L
18da	U.S. Geological Survey	1951	J	21.8	¾	P	N	O	Tca	2.8	4,817.4	16.91	3-30-51	L
19ba	Ira D. Ablard	1948	Dr	140	8, 6	P	J, E	D, S			4,828			L
19bd	T. H. Coleman	1948	Dr	277	6, 4	P	J, E	D, S	Tca	2.5	4,836	33.50	6-20-49	L
19cb	E. M. Dixson	1948	Dr	282	6	P	Cy, H	D, S	Tca	.4	4,833	28.43	6-20-49	L
19da	G. Davison	1948	Dr	360	8, 6	P	F	D, S	Op	3.7	4,805	.00	6-20-49	GC, L
A3-1-12ad	Clifford Fry	1939	Dr	90	6	P	J, E	D, S			5,538			
12cc	Constance Noble	1936	Dr	70	6	P	Cy, E	D, S	L		5,523	8-10		
12cd	E. N. Rockney	1943	Dr	190	6	P	Cy, E	D, S	L		5,507	13		
12dc	H. M. Smith	1934	Dr	100	6	P	Cy, H, E	D, S	L		5,509	12-15		
12dd1	Andrew Harrington	1941	Dr	100	6	P	Cy, H	D, S	Tca	1.0	5,484	12.00	8-31-48	SC, L
12dd2	Amil Nygaard	1945	Dr	100	6	P	F, J, E	D, S			5,475			
13bb	K. L. Morris		Dr	240	6	P	Cy, E	D, S	L		5,499	50		
13cc	A. F. Olheiser	1937	Dr	80.0	6	P	Cy, E	S	Tca	1.0	5,492	47.00	8-29-48	
13cd	U.S. Geological Survey	1951	J	16.4	6	P	N	O	Tca	5.1	5,457	6.63	3-30-51	L
13dd1	Ray Walker	1940	Dr	85	6	P	J, E	D, S	L		5,415	10		SC, L
13dd2	do		Dr	51.0	4	P	N	O	Tca	.5	5,415	6.30	9-18-48	
14aa	Arthur Olson	1942	Dr	37	10	P	Cy, E	D, S	L		5,529	8		L
14ab	Jim Mariner	1945	Dr	72	8	P	Cy, H	D	L		5,546	8		
15db	W. S. Wall	1941	Dr	160	6	P	Cy, H	D, S	L		5,540	27		
16cd1	Fred Ahrens	1937	Dr	100	6	P	N	N			5,537			P
16cd2	do	1942	Dr	171	7	P	Cy, E	D, S	Tca	1.5	5,538	88.80	8-25-48	L,SC
19cc	Elhart and Ben Hubenka	1948	Dr	20	6	P	Cy, H	D, S	Tca	.5	5,525.82	7.70	8-24-48	
19cd	Everett Hutchinson		Dr	455	8, 4	P	N	N			5,520			P, L
21ad	Herb Lemming	1939	Dr	226	4	P	J, E	D, S	Tca	—5.0	5,519	78.24	8-25-48	GC, L
21ba1	Kenneth Westlake	1947	Dr	40.0	6	P	Cy, H, E	S	Tca	.2	5,539	11.95	8-25-48	GC
21ba2	do	1942	Dr	430	6	P	N	O	Tca	.8	5,543	23.12	8-25-48	L
21dd1	F. C. Aydelotte	1944	Dr	75.0	5	P	Cy, H	O	Tca	.5	5,453	19.57	7-16-48	GC
21dd2	do	1941	Dr	323	7	P	Cy, E	D, S	L		5,457	30		L
22bb	F. M. Duvall	1941	Dr	210	6	P	Cy, G	D, S	L		5,539	75		SC, L
22cc	Clinton Westlake	1947	Dr	41.0	6	P	Cy, H	S	Tca	.3	5,451	11.82	8-26-48	
22da	Henry E. Parker	1941	Dr	133	6	P	Cy, G	D, S	L		5,487	38		SC, L
24ad	Lyle Williams	1947	Dr	90	6	P	Cy, H, G	D, S			5,428			
24bb	A. F. Olheiser	1938	Dr	90	6	P	J, E	D			5,497			
24cc	H. O. Capellan	1938	Dr	336	6	P	Cy, G	D, S	L		5,533	200		
24db	Vern Dickman	1944	Dr	60	6	P	Cy, E	D, S			5,484			L
25ad	A. L. Bower	1938	Dr	214			Cy, E	D, S			5,423			
25bc	Frank Wagner	1936	Dr	66.0	6	P	Cy, E	S, O	Tca	.4	5,453	14.89	8-27-48	GC
25bd	C. S. Stephens	1942	Dr	252	6	P	Cy, G	D, S	L		5,446	115		SC, L
25cb	R. L. Bisbee	1934	Dr	35	6	P	Cy, H	D, S	Tca	.5	5,432	9.22	8-27-48	

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (—) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A3-1-25da	Alva Gray	1945	Dr	350	6	P	Cy, E	D, S	L		5,383	137		L
26ba	O. A. Neil	1942	Dr	212	6	P	Cy, G	D	L		5,484	70-75		
26bc1	C. H. Brothwell		Dr	35.0	6	P	N	O	Tca	0.2	5,447	3.73	8-26-48	
26bc2	do	1947	Dr	164	4	P	J, E	D, S	L		5,447	86		
26bd1	Ross Bisbee	1949	Dr	70	6	P	Cy, E	S	L			13		L
26bd2	U.S.Geological Survey	1951	J	12.5	¾	P	N	O	Tca	5.0	5,454	16.60	3-30-51	L
26ca	Mark E. Pickett	1934	Dr	47.5	6	P	Cy, E				5,455			
26cb	C. H. Brothwell	1945	Dr	148	6, 4	P	Cy, H	D	Tca	.3	5,445	59.22	8-26-48	
26da	Ross Bisbee	1931	Dr	140	6	P	J, E	D, S	L		5,436	35		
26db	Ed Rosser	1935	Dr	50	6	P	Cy, E	D, S	L		5,459	12-20		
27bc	C. T. Ekholm		Dr	61.0	8	W	Cy, G	N	Tw	.2	5,459	29.86	8-25-48	
27cb1	Dr. O. K. Westling	1927	Dr	438	6, 4	P	Cy, E	D	L		5,455	37		
27cb2	do	1933	Dr	150	6	P	Cy, E	S	L		5,452	30		
28cc1	Leo R. Schenck	1945	Dr	187	7	P	J, E	D	L		5,508.27	96		L
28cc2	do	1930	Dr	78.0	6	P	N	O	Tca	.0	5,507.85	10.98	8-25-48	
29dd	Earl Kelly	1920	Dr	400	6	P	Cy, E	D, S			5,509			
30ba	Robert Ingwerson		Du, Dn	20	2	P	P, H	D, S	Tpl	.0	5,520.22	6.71	8-24-48	
33ca	Kiah Lambert	1933	Dr	27.00	4	P	J, E	D, S	Tca	-6.0	5,379.35	13.31	8-25-48	
33db	do		Du	7.0	60	M	N	N	L		5,372.87	3.25	8-25-48	
34aa	Troy Evans		Dr	47.0	6	P	N	O	Tca	0.2	5,423	10.82	8-26-48	
36ad1	E. R. Schamber	1944	Dr	307	6	P	Cy, E	D, S	L		5,355	180		
36ad2	do	1936	Dr	77.0	6	P	Cy, E	D, S, O	Pb	1.1	5,352	16.88	8-24-48	GC
36ba	Amos Wisdom	1947	Dr	158	6	P	Cy, E	D, S	L		5,389	41		L
36cb	Art Fisher	1940	Dr	460		P	Cy, G	D, S	L		5,411	175		SC, L
36dd1	Marion Schmuck	1939	Dr	410	4	P	N	N	L		5,366	98		B, SC, L
36dd2	do	1939	Dr	440	6	P	Cy, E	D, S	L		5,366	130		SC, L
A3-2-2cd	Ruben Yaunkin	1950	Dr	205	6	P	N	N	Tca	1.0	5,338	156.20	10-10-50	L, BC
2dd	M. A. Wright	1950	Dr	108	6	P	Cy, H	D, S	Tca	1.2	5,338	38.01	10-10-50	B, C
5bc	Ted E. Aston	1950	Dr	100	8	P	Cy, E	D, S	L		5,451	68		L, GC
6ac	U.S. Bur. of Reclamation	1951	Dr	41	3	Pl	N	BO	Tca	1.0	5,525	5.35	6-19-51	GC
6ba	Tom E. Bullington	1950	Dr	104	6	P	J, E	D, S	L		5,549	58		L, BC
6cb	Ted H. Gies	1950	Dr	130	6	P	N	N	Tca	.4	5,537	91.45	9- 7-50	L, BC
6db	L. Montgomery	1950	Dr	149	6	P	N	N	Tca	.5	5,539	96.90	9- 7-50	L, BC

7ab	Everett Whitehead		Dr	57.0	6	P	Cy, H	D	Tca	.3	5,484	13.04	9-14-48	
7ad	Glen Cox		Dr	54.0	6	P	Cy, H	D, S	Tca	.5	5,453	16.49	9-14-48	
7bc	Morris and Knudson		Dr	100	6	P	J, E	In	L		5,525			L
7cc1	U.S. Bur. of Reclamation	1937	Dr	380	6	P			L		5,479			L
7cc2	do	1948	Dr	398	7	P	T, E	P	L		5,479			L
7dd	Mike Sauter	1946	Dr	36	6	P	J, E	D, S	L		5,425	12		GC, L
8ad	John Thompson		Dr	100	6	P	Cy, E	D, S			5,430			
8cc	T. A. Blackmore	1938	Dr	253	6	P	Cy, E	D, S	L		5,416	100		
9aa	C. Fike	1939	Dr	72.0	6	P	Cy, H	N	Tca	.4		13.43	11-21-49	
9ab	Arthur Maxson	1940	Dr	30.0	6	P	Cy, H	N	Tca	.2	5,392	17.58	9-14-48	
10cd1	J. F. Wempen	1936	Dr	65	8	P	N	N	Tca	.5	5,375	22.39	9-16-48	
10cd2	do	1939	Dr	123	6	P	Cy, H	N	Tca	.3	5,365	37.52	9-16-48	
10cd3	do	1943	Dr	268	6	P	Cy, E	D, S	L		5,365	152		L
10db1	A. B. Miller	1934	Dr	283	6	P	N	O	Tpl	.5	5,404	63.10	9-14-48	
10db2	do	1941	Dr	482	6	P	Cy, E	D, S	Tca	.9	5,405	218.00	12- 2-48	GC, SC, L
11ba	P. H. Seyler	1936	Dr	70	6	P	Cy, H	S	L		5,355	15		L
11bb	do	1933	Dr	60	6	P	Cy, H	S			5,360			
11cb	J. W. Fike		Dr	99.0	6	P	Cy, E	N	Tca	.0	5,357	20.60	9-17-48	
11dc	E. M. Campbell		Dr	92.0	6		Cy, H	N	Tca	.3	5,384	11.44	9-16-48	
12bb	Robert L. Crawford	1950	Dr	280	6	P	S, E	D, S	L		5,349	155	8-12-50	L
12bd1	Elton Williams	1939	Dr	65.0	6	P	Cy, H	N	Tca	1.0	5,323	19.41	9-14-48	
12bd2	do	1949	Dn	132	6	P	Cy, E	D, S	L		5,322	40	10- -49	SC, L
12cc	Ora Wells	1937	Dr	97	6		Cy, E	S	L		5,324	40		
12dc	Charles Wilson	1939	Dr	449	6	P	Cy, E	D, S	L		5,311	113		SC, L
13ad	I. E. Fike		Dr	79.0	6	P	Cy, N	N	Tca	.1	5,297	13.70	9-18-48	
13ba1	Ralph Hunt	1937	Dr	175	6	P	Cy, E	D, S	Tca	.1	5,319	12.92	9-18-48	
13ba2	do	1947	Dr	48	6	P	Cy, H	D, S	L		5,319	20		
13bc	William Hippe	1935	Dr	42	6	P	J, E	D, S			5,308			
13dd	R. W. White	1937	Dr	70	6	P	Cy, E	S	Tca	.4	5,288	15.00	9-18-48	
14aa1	William Cooper	1942	Dr	62.0	10	P	Cy, E	S	Tca	.4	5,332	29.11	9-16-48	
14aa2	do	1946	Dr	40.0	6	P	Cy, H	D, O	Tca	.4	5,325	8.72	9-16-48	GC
14ba	Fred Wempen	1937	Dr	180.0	6	P	Cy, E	S			5,366			
14cc1	A. E. Kintzler	1936	Dr	40	4	P	N	N			5,303			
14cc2	do	1943	Dr	302	7	P	Cy, E	D, S	L		5,301	102		SC, L
14db	Ivan Lawlis		Dr	134.0	6	P	Cy, H	N	Tca	.2	5,331	22.11	9-17-48	
14dc	Edward Clapp		Dr	76.0	6	P	Cy, H	S	Tca	.2	5,296	14.99	9-17-48	
15bb	U.S. Bur. of Reclamation	1949	Dr	34.1	3	Pl	N	O	Tca	1.5	5,377	17.18	3-30-51	
15cc1	Rufus Vermillion	1942	Dr	24.0	6	P	Cy, H	D, O	Tca	.5	5,363	6.64	9-17-48	
15cc2	do		Dr	190	4	P	Cy, E	S			5,371			
15dc	J. R. Newberry	1943	Dr	338	7	P	Cy, E	D, S	L		5,339	142		L
16ab1	Herbert Hollenbeck	1940	Dr	30		P	P, H	D			5,431			
16ab2	do	1945	Dr	115	6	P	Cy, E	S			5,426			
16bb	Harold Six		Dr				J, E	D, S			5,397			
16cc1	J. N. Pickinpaugh	1936	Dr	42.5	5	P	N	O	Tca	1.3	5,355	12.20	9- 3-48	

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (−) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A3-2-16cc2	J.N. Pickinpaugh	1947	Dr	227	6	P	J, E	D, S	Tca	−6.0	5,348	31.00	9- 3-48	
16db	Clifford Fike	1929	Dr	160	6	P	Cy, E	D, S	L		5,419	30		
17ab	May Neal		Dr				Cy, E	D, S			5,372			
17cb	Frank Goertzen	1942	Dr	335	6	P	Cy, E	D, S	L		5,423	200		SC, L
17db	Pete Yaeger		Dr	40.0	5	P	Cy, H	O	Pb	1.2	5,362	20.88	7-16-48	
18ab	L. E. Stairs		Dr				Cy, H	N			5,434			
18ac	Lynn Moore	1941	Dr	100	6	P	Cy, E	D, S	L		5,449	25		SC, L
18ba	U.S. Bur. of Reclamation	1949	Dr	8	3	Pl	N	O	Tca	1.5	5,445	2.90	4-28-51	L
18bd	John Heath	1942	Dr	105	6	P	Cy, H	D, S	Tca	1.3	5,452	17.95	9-16-48	SC, L
18cb	Elmer Portlock	1938	Dr	60	6	P	Cy, E	D, S			5,433			
18da	Leroy Justice		Dr	180			Cy, E	D	L		5,435	80		L
19bb	Edward Shipper	1942	Dr	100	6	P	Cy. E	D, S	L		5,413	15		SC, L
19cd	M. E. Harris	1943	Dr	460	6	P	Cy, E				5,419			
19dc	William Gies	1944	Dr	130	6	P	Cy, G	S	L		5,421	100		
20aa	Pete Yaeger	1937	Dr	40	8	P	Cy, H	D, S	Tca	.7	5,335	1		L
20ac	John W. Fink	1939	Dr	137	6	P	Cy, E	D, S	L		5,334	30		SC, L
20ca	L. E. Gordon	1943	Dr	230	6	P	Cy, E	D, S			5,346			L
20cb	do	1937	Dr	180	6	P	Cy, W	S	L		5,352	18		
20cd1	Joe Eiseman		Dr	48.0	8	P	N	O	Tca	1.7	5,351	21.32	7-16-48	Ari
20cd2	U.S. Bur. of Reclamation	1949	Dr	31.0	3	Pl	N	O	Tca	1.5	5,448.7	16.65	3-30-51	L
20dd	Ned Case	1938	Dr	130	6	P	J, E	D, S	L		5,323	6		
21aa	O. C. Maxson		Dr	199.0	6	P	Cy, H	N	Tca	.9	5,348	119.20	9-17-48	SC, L
21ac	do	1943	Dr	310	6	P	Cy, H	N	L		5,359	118		L
21cb	do	1939	Dr	49.0	6	P	Cy, H	S	Tca	.8	5,320	17.92	9- 3-48	
21dc	Laverne Randolph	1940	Dr	45 0	6	P	Cy, H	S	Tca	.5	5,274	6.65	9- 1-48	
22ac	Hogan Dudley		Dr	80.0			Cy, E	D, S			5,351			
22ba	Hugo Carlson		Dr	17.0	4	P	N	N	Tca	1.0	5,357	6.22	9-17-48	
22cb	W. F. Boyd		Dr	27.0	8	P	N	O	Tca	.5	5,307	15.89	7-16-48	
22cd	do	1941	Dr	358	6	P	Cy, H		Tca	1.0	5,394	74.32	7-16-48	SC, L
22dc	Samuel L. Moore	1935	Dr	68	6	P	Cy, E	D, S			5,275			L
23ba	Edward Clapp		Dr	47.0	8, 6	P	N	O	Tca	.5	5,283	5.05	9-17-48	
23bc	Mrs. Jones		Dr	63.0	6	P	N	O	Tca	.5	5,311	16.64	7-15-48	SC

23cc	Raymond Roden	1926	Dr	265	6	P	Cy, E	S	L		5,289	90		
23db	Arthur Jacox	1942	Dr	300	6	P	Cy, E	D, S	L		5,252	112		L
24dc	Jacob Gradwohl	1937	Dr	85	6	P	Cy, E	S	L		5,245	20		
25aa	C. B. Synder		Dr	45.0	6	P	Cy, H	O	Tca	.7	5,238	7.86	7-14-48	
26aa1	E. C. Gordon	1938	Dr	45	6	P	Cy, E	D, S	L		5,274	18		
26aa2	do	1941	Dr	80	6	P	Cy, E	S	L		5,275	40		
26ab	C. A. Elkins	1940	Dr	80	10	P	N	N			5,275			P
26ad	S. K. Abernathy		Dr	321	4	P	J, E	D, S	Tca	1.0	5,265	50.70	10-18-48	GC, L
27aa	Earl Stultz	1949	Dr	95	6	P	Cy, E	D	L		5,280	18		L
27ab1	M. C. Cline		Dr	48.0	5	P	Cy, H	O	Tca	.8	5,270	15.46	7-16-48	Ari
27ab2	U.S. Bur. of Reclamation	1949	Dr	28	3	Pl	N	O	Tca	1.5	5,260.6	7.93	3-30-51	L
27ba	J. H. Preston	1937	Dr	57.0	6	P	Cy, H	S	Tca	1.0	5,251	4.75	9- 1-48	GC, SC
27bb1	F. R. Randolph	1940	Dr	53.0	6	P	Cy, H	S	Tca	.4	5,261	7.95	9- 1-48	
27bb2	do	1948	Dr	256	4	P	N	N	L		5,261	18		
28ad	Alex Weitzel	1937	Dr	57	6	P	Cy, H	D, S			5,283			
28ba	E. C. Read		Dr	80	6	P	Cy, E	D, S	L		5,275	20		
28bb	H. J. Schneider	1937	Dr	50	10	P	Cy, E	D, S	L		5,311	20		L
28cb	Bert Green	1940	Dr	125	6	P	Cy, G	D, S	L		5,334	50		SC, L
28dd	A. H. Kenyon	1948	Du	20.0	36	G	Cy, H	S, O	Tg	.5	5,269	13.23	9- 1-48	
29ab	Henry Weliever	1940	Dr	59.0	8	P	J, E	D, S	Tca	−5.0	5,334	8.05	9- 2-48	
29bb	Clarence C. Clark	1942	Dr	247	6	P	Cy, E	D, S	L		5,391	156		SC, L
29cb	George E. Case	1939	Dr	133	4	P	Cy, G	S	L		5,372	33		SC, L
29cd	W. C. Grable	1938	Du	13.0	36		P, H	D, S O	Pb	1.4	5,346	4.42	9- 2-48	
30aa1	Henry Lissman	1940	Dr	422	6, 4	P	Cy, E	D, S	L		5,400	225		SC, I
30aa2	do	1941	Dr	80	6	P	Cy, H	S			5,401			
30bb1	Eldon Harris	1934	Dr	86	8	P	Cy, E	S			5,400			SC
30bb2	U.S. Bur. of Reclamation	1949	Dr	35.5	3	Pl	N	O	Tca	1.5	5,415.3	15.33	3-30-51	L
30cb1	George H. Bower	1935	Dr	200	6	P	N	N	L		5,379	40		P
30cb2	do		Dr	51.0	6	P	Cy, H	S	Tca	.7	5,375	12.37	9- 3-48	
30cc	James Davis	1932	Dr	63.0	6	P	Cy, H	S	Tca	.5	5,356	10.23	9- 3-48	
30db	Clair Day	1938	Dr	138	6	P	Cy, G	S			5,384			P
30dd1	do	1939	Dr	146	4	P	Cy, G	S	L		5,379	51		L
30dd2	do	1941	Dr	500			N	N			5,379			P, L
30dd3	do	1941	Dr	582	6	P	Cy, E	S	L		5,379	72		SC, P245, L, GC
31ad	Carl G. Welty	1940	Dr	468	4	P	Cy, G	D, S	L		5,335	175		SC, L
31bb	C. F. Schmuck	1939	Dr	112	4	P	Cy, E	D	L		5,353	33		SC, L
31ca	R. B. Gallegos	1941	Dr	445	6	P	Cy, G	D, S	L		5,355	150		SC, L
31cc	L. R. Anderson		Dr	54.0	5	P	Cy, H	O	Tca	.5	5,359	5.12	7-19-48	
32aa	H. A. Stearns	1942	Dr	245	7	P	Cy, E	D, S	L		5,359	116		L
32cb	T. R. Stearns	1935	Dr	89.0	4	P	Cy, E	D, S	Tca	2.0	5,353	36.16	9- 1-48	
32dd	U.S. Bur. of Reclamation	1949	Dr	27.0	3	Pl	N	O	Tca	1.5	5,285.7	6.95	3-30-51	L
33a2	A. Rohn	1940	Dr	102			Cy, E	S	L		5,289	85		L
33bb	Gotlief Gabrielson		Dr	114	4	P	Cy, E	D, S	L		5,339	67		
33cc	Ted Ludeman	1938	Dr	33.0	8	P	Cy, H	S, O	Tca	1.4	5,282	9.37	9- 1-48	

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (−) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A3-2-33dd	Ben Espinosa		Dr	20	6	P	N	N	Tca	0.6		11.64	11-22-49	
A3-3-6aa	J. C. Hayes	1950	Dr	230	6	P	N	N	Tca	.4	5,331	151.30	10- 9-50	
6ba	Lawrence Williams	1951	Dr	350	6	P	Cy, E	D, S	L		5,340	150		L, BC
6cc	Kenneth Heald	1950	Dr	270	6	P	S, E	D, S	L		5,346	180		L, GC
6dc	Lloyd G. Foster	1950	Dr	204	6	P	S, E	D, S	L		5,308	130		L, BC
7aa	William Dalluge	1950	Dr	290	6	P	S, E	D, S	Tca	.3	5,302	50.57	6-14-51	BC
7bb	Blake P. Helberg	1951	Dr	310	6	P	N	N	Tca	.1	5,336	80.98	6-12-51	L, BC
7ca	Raymond Bond	1941	Dr	310	6¼	P	Cy, G	D, S	L		5,293	132		SC, L
8cc	B. Walker	1941	Dr	73.0	6	P	Cy, E	S	Tca	.9	5,275	16.50	5- 9-49	
13ad	U.S. Bur. of Reclamation	1949	Dr	427	5	P	N	N	L		5,309	220	10-15-49	BC, L
15cc	Howard F. Meyer		Dr	100.0	5	P	Cy, E	S, O	Tca	.6	5,212	17.71	5- 9-49	
16bc	H. L. Fike		Dr	121.5	6	P	Cy, E	S	Tca	1.2	5,244	14.50	5- 9-49	
16cb	Richard Pattison	1948	Dr	360	6, 4	P	Cy, H	D, S	Tca	1.2	5,237	84.15	10-18-48	GC, L
17aa	do	1935	Dr	435	6	P	Cy, E	D, S	Tca	−4.7	5,243	105.20	5- 9-49	L
17ad	do		Dr	370	6, 4	P	Cy, E	D, S			5,254			L
17bb	do		Dr	575	4	P	Cy, E	N						
18ab	W. S. Pattison	1939 (?)	Dr	422	4	P	Cy, E	D, S	L		5,287	124		
18ad	Smith Pattison	1942	Dr	575	4	P	Cy, E	D, S	L		5,281	150		L
18bc	Chester Fike	1946	Dr	256	4	P	Cy, E	D, S	L		5,294	75		
18dd1	C. Miranda	1935	Dr	53.0	5	P	N	N, O	Tca	.0	5,283	7.49	7-16-48	
18dd2	do	1943	Dr	80.0	7	P	Cy, E	D, S	Tca	−6.0	5,277	10.15	5- 9-49	L
19ba1	A. A. Sanders		Dr	27	8	P	Cy, E	D						
19ba2	do	1949	Dr	44.5	4	P	Cy, E	S	Tca	.7	5,283	12.94	5- 9-49	
19dc1	R. White		Du	10.5	48	C	P, H	N	L		5,276	3.66	5-11-49	
19dc2	do	1948	Dr	45.0	6	P	N	N	Tca	1.0	5,280	13.52	5-11-49	
20ab	S. A. Stark	1940	Dr	70.5	6	P	Cy, E	D, S	Tca	.5	5,268	26.50	5-10-49	
21ac1	Harvey Roland	1937	DD	Du to 25.5; Dr to 114.0	6	C to 25.5; P to 114.0	Cy, H	S	Tpl	.7	5,257	24.20 in Du; 34.10 in Dr	5-11-49	SC
21ac2	do		Dr	150	6	P	Cy, E	D, S	L		5,261	80		SC
21ad1	do	1938	Dr	79.0	6	P	N	N	Tca	.5	5,273	28.41	5-11-49	SC
21ad2	Harvey Roland	1940	Dr	425	6	P	N	O	Tca	.0	5,273	147.21	12- 2-48	SC, L

21bb	Melvin Wolf	1935	Dr	84			J, E	D, S						
22ab	Bryan Annon	1940	Dr	460	5	P	Cy, E	S	Tca	1.2	5,199	25.02	5-10-49	SC, L
22bd	D. N. Cunningham	1942	Dr	121.5	6	P	Cy, W	D, S	Tca	.7	5,270	57.48	5-10-49	SC
22cc	Midvale Store (Stubbs and Lund).	1948	Dr	195	4	P	J, E	D	L		5,268	36		L
22cd	Henry Jaeger	1942	Dr	183	7	P	Cy, E	D, S	L		5,263	66		L
22dc	Otis Williams	1939	Dr	149	8, 5	P	Cy, E	D, S	L		5,236	60		SC,L
23bb1	Wm. Eaton		Dr	500		P		N			5,183			B, L, Dh
23bb2	do		Dr	58.0			Cy, H	O	Pb	.2	5,181	22.16	5-10-49	
23cc	Otis Williams		Dr	129.0	6	P	Cy, H	N	Tca	.3	5,187	45.41	7-14-48	SC, L
23dc	Emil Leonhardt	1940	Dr	251	6	P	Cy, G	D, S	L		5,159	70		SC, L
24cc	R. W. White	1940	Dr	50	6	P	Cy, H	S, O	Hpc	1.5	5,151	11.95	10-20-48	GC, L
25ba	Arno F. Huenefeldt	1940	Dr	215	8, 6	P	Cy, E	D, S	L		5,142	70		SC, L
25bb	U.S. Bur. of Reclamation	1949	Dr	27.5	3	Pl	N	O	Tca	1.5	5,150.8	14.62	3-30-51	L
25bc	F. Gale	1934	Dr	75			Cy, E	D, S						
25da	V. C. Anson	1935	Dr	100+	4	P	Cy, H	D, S	Tca	.3	5,133	4.27	5-16-49	
25dd	Geo. Wagner		Dr	92.5	5	P	Cy, E	S	Tca	.5	5,177	19.78	5-16-49	
26ab1	Carl Leonhardt	1939	Dr	131.0	6, 4	P	N	N, O	Tca	.7	5,155	9.49	5-16-49	SC, L
26ab2	do	1941	Dr	244	6	P	Cy, E	D, S	L		5,154	68		SC, GC, L
26bb	Paul Leonhardt		Dr	107.0	6	P	Cy, H	S, O	Tca	.9	5,183	24.86	11-31-48	
26cc	Archie N. Hain	1948	Dr	161.0	5	P	J, E	D, S	Tca	.0	5,226	30.96	5-13-49	
26cd	C. H. Kisner	1948	Dr	334	6	P	Cy, H	D, S	Pb	.0	5,222	32.89	5-13-49	
27ab1	Herbert T. Burton		Dr	100	6	P	N	N						
27ab2	do	1948	Dr	192	6	P	J, E	D, S	L		5,201	58		L, SC
27bb	Jerry Lathrop	1942	Dr	190	7	P	Cy, H	D, S	Tca	.9	5,260	65.10	5-12-49	L
27bc1	Robert Taylor	1935	Dr	70	4	P	Cy, E	S	L		5,246	20		
27bc2	do	1948	Dr	193	6	P	J, E	D, S	L		5,249	60		L
28bc	Art Lindholm		Dr	100	4	P	Cy, E	D, S	L		5,261	29.72	5-12-49	
28cb	H. A. Plummer	1938	Dr	125	10, 8, 6, 4	P	Cy, E	D, S	Tca	.3	5,260	16.20	5-12-49	
28dd	Richard Pattison	1948	Dr	240	4	P	Cy, E	D, S	L		5,245	70		
29ac	I. D. White	1941	Dr	121.0	6	P	Cy, E	D, S	Tca	.9	5,282	24.41	5-12-49	SC, L
29ca1	N. R. Phillipi	1938	Du	10.0		W	N	N	L		5,269	2.09	5-12-49	
29ca2	do	1945	Dr	64.0	4	P	Cy, H	D	Tpl	.3	5,275	10.47	5-12-49	
30ab1	M. J. Kessenger		Dr	41.0	5	P	P, H	S, O	Tmc	.9	5,274	3.20	7-14-48	
30ab2	U.S. Bur. of Reclamation	1949	Dr	30.7	3	Pl	N	O	Tca	1.5	5,275	9.11	3-30-51	L
30ad	J. I. Stubbs	1940	Dr	203	4	P	Cy, E	D, S	L		5,273	60		L
30bb	H. Leaming		Dr	116.0	5	P	Cy, H	N	Tca	.5	5,268	27.48	5-11-49	
32aa	B. H. Smerud	1948	Dr	129.0	6	P	Cy, H	D, S	Pb	1.0	5,269	45.17	5-12-49	BC
33aa	C. J. Burton	1949	Dr	74.0	4	C	N	N	Tca	.9	5,239	23.07	5-13-49	BC
34ad	John Hagel	1950	Dr	74	6	P	Cy, E	D, S	L		5,258	65		L
34bb	U.S. Bur. of Reclamation	1949	Dr	27	3	Pl	N	O	Tca	2.0	5,231.6	8.42	3-30-51	L
34cc	D. H Wedge	1948	Dr	59.0	4	C	N	N	Tca	.9	5,281	33.60	5-13-49	
35ba	H . Alvey	1948	Dr	116.0	6	P	Cy, H	D, S	Tca	1.4	5,224	20.05	5-13-49	
35bc	Harry Daugherty	1948	Dr	100.0	5	N	Cy, E	D, S	Tpl	.5	5,249	46.82	5-13-49	

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (—) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A3-3-35dd	K. E. Cardwell	1948	Dr	100.0	4	C	Cy, E	D, S	Tca	1.3	5,336	67.40	5-13-49	
36aa	Guy Rhodes	1940 (?)	Dr	120	5	P	Cy, E	D, S						
36ad	Boyd Mason		Dr	45.6	5	P	Cy, H	N, O	Tca	.3	5,233	13.85	5-16-49	
36bd	do	1941	Dr	156	6	P	Cy, G	S	Tca	.7	5,232	69.08	5-16-49	SC, L
A3-4-28dc	W. M. Starrett	1937	Dr	440	6	P	Cy, E	D, S	L		5,100	200		
29aa			Dr	51.6	5	P	N	N						P52
29cc	Geo. Dewey	1935	Dr	71.0	5	P	Cy, H	O	Hpc	1.4	5,135	7.30	7-14-48	
29cd1	M. G. Devish		Dr	76.0	5	P	Cy, H	S	Pb	.8	5,133	7.36	6-10-49	GC
29cd2	do		Dr	100	5	P		S						
29dc	G. Mueller	1934	Dr	70 (?)			Cy, H	D, S						
29dd	David Dewey	1939	Dr	250	6	P	Cy, G	D, S	L		5,115	40		SC, L
30bc1	Walter H. Dudley	1937	Dr	46.0	5	P	Cy, H	O	Pb	1.0	5,127	34.06	6-9-49	
30bc2	do	1944	Dr	54.0	5	P	Cy, E	D, S	Tca	—6.0	5,121	11.51	6-7-49	
30cc	Geo. Wagner	1937	Dr	125	5	P	Cy, E	S						
30da	E. D. Sargent	1936	Dr	35.0	4	P	Cy, H	S	Tca	.9	5,137	6.04	6-8-49	
30db	Gabriel Larson	1935	Dr	63	4	P	J, E	D, S	L		5,133	8		
30dc	James H. Arnold	1936	Dr	89	6	P	Cy, E	D, S	L		5,158	30		
31aa	Harvey Stone	1944	Dr	550	6	P	J, E	D, S	Tca	—4.5	5,149	143.79	6-7-49	L
31ba	Enid Wagner	1940	Dr	250	6	P	Cy, E	D, S			5,176			SC, L
31bb	Gabriel Larson	1949	Dr	95.0	5	N	N	N	L		5,193	28.96	6-7-49	
31da	Chas. H. Dechert	1944	Dr	125		N	J, E	D, S	L		5,229	60		
32ab	Wilbur Wagner	1948	Du	10.0	36	C	J, E	D, S	Tca	.5	5,133	6.34	6-9-49	
32ba1	Howard Dewey	1945	Dr	360	6	P	Cy, E	D, S	L		5,139	150		L
32ba2	U.S. Bur. of Reclamation		Dr	28.0	3	Pl	N	O	Tca	1.5	5,136.5	9.63	3-30-51	L
32cc	T. V. Dechert	1948	Du	21.0	36	C	J, E	D, S	Tca	.4	5,234	17.05	6-9-49	
32da	Chas. H. Dechert		Dr	82.0	5	P	Cy, H	N	Hpc	1.5	5,174	27.10	6-13-49	
33ba	Fred Anglen	1936	Dr	155	6	P	Cy, E	D, S	L		5,087	130		
33dd	Earl Dietrich	1944	Dr	515	7	P	N	N	L		5,115	150		L
34bc	Dean Dietrich	1938	Dr	88.0	4	P	N	O	Tca	.0	5,052	53.87	7-15-48	
34bd	W. E. Partridge	1943	Dr	440	6	P	Cy, E	D, S	L		5,047	100		L
34cb	Dean Dietrich	1941	Dr	406	4	P	Cy, E	D, S	L		5,076	150		
34cc	Clair Wheeler	1948	Dr	433	6	P	Cy, E	D, S	L		5,094	150		L
34db	Larry Barrett	1941	Dr	405	6	P	Cy, G	D, S	L		5,048	144		SC, L

34dd1	Geo. Brown		Dr	84.0	6	P	N	N	Tca	−5.5	5,046	50.62	6-17-49	
34dd2	do	1943	Dr	300	7	P	J, E	D, S	L		5,052	68		L
35ca	do		Dr	29.5		N	N	N						Dh
35dc1	John Brockman		Dr	98.5	6	P	Cy, H	O	Pb	1.0	5,015	38.53	7-15-48	
35dc2	do	1942	Dr	300	6	P	J, E	D, S	L		5,011	50		L
36bb			Dr		5	P	N	N						P5
36cd	Joseph A. Downey	1941	Dr	160	6	P	Cy, G	S	L		4,974	30		SC, L
36dc	U.S. Bur. of Reclamation	1949	Dr	31.0	3	Pl	N	O	Tca	1.5	4,972.9	6.76	3-30-51	L
A3-5-16da			Dr	96.0	5	P	N	O	Tca	1.5	4,918.3	29.61	10- 1-47	
25ad	Elmer Slafter	1944		322	5, 4	P	J, E	D, S	L		4,804	31		SC
31cb1	Fred Colman	1941	Dr	211	5	P	N	N	Tca	1 0	4,977	69.37	6-14-49	SC, L
31cb2	do	1915 (?)	Dr	15.5	14	P	N	N			4,958			Ot, Dh, P
31cb3	do	1915 (?)	Dr	4.5	7	P	N	N			4,958			Ot, Dh, P
31cc	W. S. Parkhurst	1940	Dr	220	6	P	Cy, G	D, S	Tca	.7	4,991	58.60	6-14-49	SC, L
31da	Arthur Hensleigh	1940	Dr	160	6	P	Cy, E	D, S	L		4,953	50		SC, L
32bd	do		Dr	55.5	4	P	N	N	Tca	.5	4,922			Dh
32da1	Lillian B. Downey	1937	Dr	60	5	P	N	N	Tca	.3	4,906	2.28		
32da2	do	1942	Dr	255	6	P	Cy, E	D, S	L		4,905	50		SC, L
32dd	U.S. Bur. Indian Affairs		Dr	120	4	P	N	N	Tca	.0	4,905	4.44	6-14-49	Ot
33cc1	Henry Willman	1937	Dr	66.9	5	P	N	O	Tca	.9	4,915	6.33	6-15-48	
33cc2	do	1946	Dr	269	6	P	J, E	D, S	L		4,912	60		
33dc	Bernard Brown		Dr	35	7	P	F	N			4,886		6-15-49	F, GC, Rw
33d	do		Dr	35	6	P								Rw, Sdh
33dd	do		Dr			P	N	N	L	.3	5,879	7.03	6-15-49	Ot, P8
34bc1	J. K. Waugh		Dr	90 (?)	4	P	N	N						P
34bc2	do		Dr	310	7	P	Cy, E	D, S	Hpc	2.3	4,874	38.67	6-15-49	L
34cd1	Katherine Lane	1939 (?)	Dr	90	4	P	N	N						
34cd2	do	1944	Dr	255	7	P	Cy, E	D, S	L		4,867			
34dc	C. E. Lossner	1948	Dr	275	8, 6	P	Cy, E	D, S	L		4,866			L
35bb	Elmer Slafter	1943	Dr	246	6, 4	P	J, E	D, S	Tca	1.0	4,849	17.40	6-16-49	
35cc	Harry Waugh	1943	Dr	160	7	P	Cy, E	D, S	L		4,863	20		L
35dc	D. D. Jarvis	1938	Dr	267	6	P	Cy, E	D, S	Hpc	1.5	4,865	30.13	6-16-49	
35dd	H. H. Harry	1945	Dr	336	6	P	Cy, H	D	L		4,878	65		L
36ab	Harry Waugh	1947	Dr	208	6	P	Cy, E	D	L		4,854	93		L
36cb	D. D. Weideman	1941	Dr	270	6	P	Cy, E	D, S	L		4,861	60		SC, L
36cc	Tom Fike	1947	Dr	350	6	P	N	N						
36cd	U.S. Bur. of Reclamation		Dr	21	3	Pl	N	O	Tca	1.5	4,909.1	10.74	3-30-51	
A3-6-5ab	do		D				Cy, H	N						
5ad1	do		Du	31.6	48	G	T, G	I, O	Tca	1.4	4,684	8.98	6-17-49	
5ad2	do		Du		48	G	T, G	I			4,683			
5ad3	do		Du	32.6	48	G	T, G	I	Tca		4,683	9.80	6-17-49	
9bb1	John Herbst	1932	Du, Dn	15	36 x 36	W, P	Cy, W	N	L		4,684	3.71	6-17-49	
9bb2	do	1948	Dr	500	4	P	F	D, S			4,686			L
9bb3	do		Dr		4	P	N	N						
20cb	R. I. Siebell	1950	Dr	360	6	P	Cy, E	D, S			4,808			

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point: Description	Measuring point: Distance above or below (—) land surface (feet)	Measuring point: Altitude (feet)	Depth to water level below measuring point (feet)	Date of measurement	Remarks
A3-6-30ba	Don Lockhart	1950	Dr	345	6	P	J, E	D, S			4,782			BC
30bc	V. A. Friend	1948	Dr	324	6	P	J, E	D, S	Tca	—7.0	4,796	14.80	6-16-49	L
31dd	Hersey Roberts	1949	Dr	189	6	P	Cy, E	D, S	L		4,829	100		L
32bb	Carl Ferguson	1950	Dr	205	6	P	J, E	D, S	L		4,785	80		L
32cd	Talbert	1950	Dr	194	6	P	F	D, S	Tca	1.0	4,769	0		L
A4-1-25dd	Herman Funk	1950	Dr	240	6	P	N	N	L		5,518	72		L
A4-2-11dd	U.S. Bur. of Reclamation	1948	Dr	28.7	3	Pl	N	O	Tca	1.4	5,394	14.66	6-30-51	
14aa	Grant Butler	1951	Dr	387	6	P	N	N	Tca	1.1	5,386	128.80	9-12-51	L
27cc	Virgil Major	1950	Dr	406	6	P	N	N	Tca	.0	5,454	110.10	10-23-50	L, BC
28dc	Harvey Waugh	1950	Dr	100	6	P	Cy, H	D, S	L		5,455	52		L, BC
29ab	Eugene Talman	1950	Dr	171	6	P	S, E	D, S	L		5,509	80		L
29ba	Gene Beck	1950	Dr	151	6	P	S, E	D, S	L		5,505	40		L
29cc	Clarence Blair	1951	Dr	480			N	N			5,464			L, BC
29db	Gordon Harris	1950	Dr	260	6	P	S, E	D, S	L		5,477			L, GC
29dd	U.S. Bur. of Reclamation	1949	Dr		3	Pl	N	O	Tca	1.5		14.44	3-30-51	
31dc	Melvin Johnson	1950	Dr	136	6	P	N	N	Tca	.2	5,503	96.50	9- 7-50	L, SC
32dd	J. H. Gitlins	1951	Dr	160	6	P	N	N	Tca	.8	5,437	43.36	7- 3-51	L, BC
34ad	Van C. Sorenson	1950	Dr	103	6	P	S, E	D, S	L		5,425	19.50	6- -50	BC
34dd	S. T. Prociw	1950	Dr	80	6	P	N	N	Tca	.4	5,400	7.52	10-22-50	L, BC
35bc1	Waynard Jensen	1950	Dr	107	6	P	S, E	D, S	L		5,428	30		BC
35bc2	Walter A. Boehm	1951	Dr	310	6	P	N	N	L		5,432	220		L, BC
35cb	Charles G. Taylor	1951	Dr	376	6	P	Cy, E	D, S	L		5,423	180		L, BC
35cc	U.S. Bur. of Reclamation	1949	Dr		3	Pl	N	O	Tca	1.5	5,394	13.50	4- 1-51	
36bc	J. W. Breider	1951	Dr	395	6	P	N	N	Tca	1.1	5,400	200.50	12-13-51	L, BC
36da1	B. L. McLaurin	1950	Dr	280	6	P	N	N	Tca	.6	5,381	220		L, P (280)
36da2	Martin Hansen	1950	Dr	372	6	P	N	N	L		5,379	170		L
A4-3-5dd	U.S. Bur. of Reclamation	1949	Dr	29.6	3	Pl	N	O	Tca	1.4	5,338	11.45	9- 7-51	
11ab	U.S. Bur. Indian Affairs	1947	Dr	500	5	G	Cy, W	S, O	Tca	.3	5,130.1	.71.60	9-30-47	
11db	Robert Madsen	1951	Dr	347	6	P	N	N	L		5,155.2	78.00	7-10-51	L, BC
13dc1	C. G. Butler	1951	Dr	465	6	P	S, E	D, S	L		5,152.7	85.00	4- -51	L, BC, GC
13dc2	Dale Smith	1951	Dr	137	8	P	N	N	Tca	1.0	5,125.5	87.56	6-13-51	L, SC
15ad	Ben Wilkinson	1951	Dr	330	6	P	N	N	Tca	.2	5,239	100.57	9-12-51	L, SC
18cb	U.S. Bur. of Reclamation	1948	Dr	27.3	3	Pl	N	O	Tca	1.1	5,340	8.92	7-30-51	

21bd	Ray Guthridge	1951	Dr	465	6	P	Cy, G	D, S	Tca	.8	5,222	42.20	7-10-51	L, BC
31ad	Ralph Stear	1950	Dr	60	6	P	N	N	Tca	.6	5,411	36.19	8- 8-51	L, SC
31cd	A. J. Jarnagin	1950	Dr	200	6	P	S, E	D, S	Tca	.2	5,343	155.44	12-13-51	L, BC
31db	U.S. Bur. of Reclamation		Dr	32.6	6	P	N	O	Tca	1.5	5,369.2	5.30	8-18-51	
32bb	do	1951	Dr	509	6	P	Cy, E	D	L		5,424	22.00	7- 3-51	L, P (350)
34ad	Delbert Edwards	1951	Dr	305	6	P	Cy, E	D, S	Tca	1.1	4,995	100.26	6-13-51	L, BC, GC
35bb	Arnold L. Wurston	1951	Dr	600	6	P	N	N	L		4,988	80		L, BC
35da	C. W. Ferguson	1951	Dr	305	6	P	Cy, E	D, S	L		5,007	110.00	9- -51	L, BC
A4-4-20da	U.S. Bur. of Reclamation	1951	Dr	234.5	6	P	N	N	L		5,100	148.00	5- -51	L, GC
23ac	do	1951	Dr	23	3	Pl	N	BO	Tca	1.5	5,515	11.80	12-17-51	L, GC
23db1	do	1951	Dr	621	8	P	N	N	L		5,009	121.00	7- 3-51	L, BC, GC
23db2	do	1951	Dr	20	3	Pl	N	BO	Tca	1.5	5,514	10.20	12-17-51	L, GC
28cd	U.S. Bur. Indian Affairs		Dr		6	P	F	S	Tca	3.0	5,001			F, GC
A4-5-7bb	do	1937	Dr	155.5	10	P	W	S	Tpl	.9		47.41	8-17-49	
18dc	do	1947	Dr	168.0	5	P	Cy, G	S, O	Tca	.3	4,936	75.37	10- 1-47	
A4-6-29dc	U.S. Bur. of Reclamation		DD			P	Cy, H	N						
32dc	do		Du				Cy, G	S	L	.0	4,682	6.00	6-17-49	
B3-1-15dc	T. P. Haslin	1926	Du	16.8	36	G, C	N	O	Tg	.1	5,490.29	11.15	10- 7-48	
19aa	Frank Laitner		Dr	60		P	J, E	D, S			5,562			
19ba1	Robert N. Harris		Dn	20	2	P	P, H	D, S			5,548			
19ba2	do	1950	Dr	194	6, 8	P	S, E	D, S	Tca	1.1	5,551.6	7.89	7- 5-51	L
21bd1	W. E. Smith	1926	DD	9.5	36, 12	P	P, H	D	Tpl	.3	5,503.76	6.83	10- 6-48	Wcs, L
21bd2	do		Dr	7.0	4	P	N	O	Tca	—.3	5,500.22	4.76	10- 6-48	
21bd3	do		Dr	24.5	2.5	P	N	N	Tca	.3	5,500.12	6.80	10- 6-48	
23ad	H. Ingwerson	1937	Dr	32	4	P	J, E	D, S	L		5,555	20		
23cd1	D. Hurtado	1908	Du	7.5	36	R	N	D	L		5,462.18	5.89	8-24-48	
23cd2	do	1908	Du	9.5	48	R	N	D, S	L		5,462.49	7.50	8-24-48	
24ab	Harry Maxson		Dr		6	P	N	N						P (16)
24cd1	do		Dr	40	8	P	Cy, E	D	L		5,537.48	25		
24cd2	do	1943	Dr	40	8	P	Cy, E	S	Tca	1.0	5,537.62	6.42	8-24-48	GC
24cd3	do		Dr	8.0	4	P	N	O	Tca	—1.0	5,537.73	3.23	8-24-48	
24da	U.S. Geological Survey	1951	J	8.0	¾	P	N	O	Tca	2.5	5,535.7	5.01	7-31-51	
25aa	Lee Ingwerson		Sp					N			5,530			
26ba1	C. G. Stevenson		Du	5.0	20		Cy, E	S	Tpl	.8	5,460.43	2.58	8-24-48	
26ba2	do		Du				Cy, H	S	L		5,459.63	4.42	8-24-48	SC
B3-2-24bb1	George McCollough		Dr			P	C, G	D						
24bb2	do		Du	12.0			Cy, H	O	Tpl	.5	5,563.92	5.54	10- 6-48	
B4-1-31da1	British American Oil Co.	1944	Dr	384	10-7	P	Cy, G	I			5,700			GC
31da2	do	1944	Dr	382	10-8	P	Cy, G	In			5,700.00			GC
D1-4-2aa1	George Dechert	1949	Dr	27.5	6	P	J, E	D	Tca	.6	4,914.24	13.12		
2aa2	do	1935	Dr	70	6	P	J, E	D	L		4,915.25	16		
2aa3	do		Du	5.0	20	G	N	S	Tca	.0	4,900.39	1.77	7-14-49	
2ab	Hans J. Blond	1918	Dr	122	6	P	J, E	D, S	L		4,918.19	8		
2ba	Kiva Sproule	1946	Dr	143	8, 4	P	Cy, H	D	Tca	.4	4,919.22	13.10	7-14-49	L

TABLE 18—*Records of wells and springs*—Continued

Well No.	Owner or tenant	Year drilled	Type of well	Depth of well below land surface (feet)	Diameter of well (inches)	Type of casing	Method of lift; type of power	Use of water	Measuring point			Depth to water level below measuring point (feet)	Date of measurement	Remarks
									Description	Distance above or below (—) land surface (feet)	Altitude (feet)			
D1-4-2bb1	Marion Petsch	----	Dr	78	6	P	J, E	D, S	Tca	0.5	4,925.82	15.57	7-14-49	
2bb2	do	1945	Dr	24	8	P	Cy, E	S	----	----	----	12	----	
2bb3	do	1940	Dr	70.7	7	P	J, E	In, O	Tca	.4	4,925.66	14.46	6-14-49	

[1] Estimated.

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