Geology and Ground-Water Resources of Platte County, Wyoming

By DONALD A. MORRIS *and* HORACE M. BABCOCK

With a section on

CHEMICAL QUALITY OF THE WATER

By RUSSELL H. LANGFORD

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GEOLOGY AND GROUND-WATER RESOURCES OF PLATTE COUNTY, WYOMING

By DONALD A. MORRIS and HORACE M. BABCOCK

ABSTRACT

Platte County, Wyo., has an area of 2,114 square miles and, in 1950, had a population of 7,925; it lies within parts of two major physiographic provinces, the northern extension of the Southern Rocky Mountains and the northwestern part of the Great Plains. The Laramie Range and related structures lie along the western margin of the county and constitute the eastern limit of the Rocky Mountain Front Range. The High Plains section of the Great Plains province extends eastward from the Laramie Range over the remainder of the county. The original surface of the High Plains has been deeply eroded, and in the northeastern part of the county it is broken by the broad uplifted structural platform of the Hartville Hills. The North Platte River and its tributaries have entrenched their channels as much as 1,000 feet into the plains, leaving wide, very flat intervalley areas that are interrupted by a few isolated buttes and outlying ridges. Well-defined terraces, locally called the Wheatland Flats, have been formed in central Platte County. The climate is semiarid, the average annual precipitation being about 15 inches. Farming and stockraising are the principal occupations in the county.

Most of the rocks exposed in the county are of Tertiary and Quaternary age, although rocks as old as Precambrian crop out locally. The Arikaree and Brule formations and younger deposits, including Tertiary(?) deposits (undifferentiated) and terrace, flood-plain, and other alluvial deposits, underlie more than two-thirds of the county. Mesozoic, Paleozoic, and Precambrian rocks crop out in the other third and underlie the younger rocks at great depths elsewhere.

Small supplies of ground water adequate for domestic and stock use can be obtained from shallow wells in the Casper, Hartville, Cloverly, Brule, and Arikaree formations and in the terrace and flood-plain deposits. Small to moderate amounts of ground water can be obtained from the "Converse sand" of the Hartville formation. Several flowing wells obtain water from this sand near Glendo. Moderate to large supplies of ground water adequate for small-scale irrigation or industrial uses or for public supply can be obtained from properly constructed wells penetrating thick saturated sections of the Arikaree formation and from the terrace and flood-plain deposits. Large supplies of ground water can be obtained from the flood-plain deposits of the North Platte River near Guernsey, where wells commonly yield more than 1,000 gpm. (gallons per minute). The aquifers with greatest potential for additional ground-water development in Platte County, in decreasing order of importance, are the flood-plain deposits along the North Platte River and its tributaries, the Arikaree formation and terrace deposits in parts of the Wheatland Flats, and the "Converse sand" in the general vicinity of Glendo.

The depth to the water table ranges from less than 5 feet in the Wheatland Flats area to more than 250 feet in the east-central part of the county. The water in the Tertiary and Quaternary rocks moves generally eastward across the county.

The ground-water reservoir in Platte County is recharged by precipitation that falls within the area, by seepage from streams entering the area from the north, west, and south, and by seepage from irrigation. Most of the ground-water recharge to the terrace deposits underlying the Wheatland Flats area is derived from irrigation seepage. Owing to the lack of surface irrigation water in the dry years preceding and during this study, the water table has declined and the yields of irrigation wells have decreased. Ground water is discharged from the ground-water reservoir by seepage into perennial streams, by evapotranspiration in areas of shallow water table, by underflow into adjacent areas to the east, by flow to springs, and by pumping from wells.

Most wells in the county were drilled but a few were dug. Of the 491 wells listed in this report, 334 were domestic and stock wells, 75 were irrigation wells, 6 were industrial wells, and 16 were public-supply wells; the remainder were unused. Water from many springs in the county is used for stock and domestic water supplies.

Ground water in Platte County generally is moderately mineralized, containing about 200 to 800 ppm (parts per million) of dissolved solids, hard, and of the calcium bicarbonate or calcium sulfate type. The chemical composition of water from terrace deposits underlying irrigated lands resembles that of the applied surface irrigation water; calcium and magnesium bicarbonates and sulfates are the major dissolved salts. Concentrations of dissolved salts are somewhat higher in the ground water from the terrace deposits than in the applied surface irrigation water; the concentration increases with increased distance of ground-water movement away from the irrigated area. Water from flood-plain deposits in Horseshoe, Bear, and Cottonwood Creek valleys and from the Arikaree, Brule, Cloverly, and Hartville formations generally is of the calcium bicarbonate type but locally contains sulfate in excess of bicarbonate.

The ground water is of excellent quality for irrigation except for its medium to high salinity. The concentration of boron is less than 0.5 ppm, and the maximum sodium-adsorption ratio is 2.4. Because of its salinity, the water should be used for irrigation only on soils having good subsurface drainage and for plants having a moderate to high salt tolerance, such as grains, sugar beets, and alfalfa. The water is suitable for domestic and some industrial uses except locally where its iron content is high. Because the water is generally very hard, it would require treatment before it could be used for many industrial purposes.

INTRODUCTION

PURPOSE AND SCOPE

A program of ground-water investigations in Wyoming was begun in November 1940 by the U.S. Geological Survey in cooperation with the Wyoming State Planning and Water Conservation Board. The cooperation was transferred from the State Planning and Water Conservation Board to the office of the Wyoming State Engineer on July 1, 1945, as a result of curtailment of activities by the planning board.

Ground water is one of the principal natural resources of Wyoming. In Platte County, almost the entire population obtains its water supply from wells. Wells supply water also for most of the livestock and for some irrigation. The number of irrigation wells increased about 66 percent from 1953 to 1955. Wells have been constructed to irrigate additional land and to provide supplemental water for land irrigated by surface water. The most notable increase in irrigation from wells in Platte County occurred in the area locally known as the Wheatland Flats to supplement the usually inadequate surface-water supply.

The study of Platte County was begun in June 1952 by J. R. Rapp. Its purpose was to evaluate the ground-water resources of the county by determining the character, thickness, and extent of the principal water-bearing materials; the source, occurrence, movement, quantity, and quality of the ground water; and the possibility of developing additional ground water. The study was temporarily discontinued in June 1953 and was renewed by D. A. Morris in the fall of 1953.

The work was done under the supervision of H. M. Babcock, the junior author, who at that time was district engineer of the Ground Water Branch of the Geological Survey for Wyoming. The quality-of-water studies were made under the supervision of P. C. Benedict, regional engineer of the Quality of Water Branch, Lincoln, Nebr.

LOCATION AND EXTENT OF AREA

Platte County, in southeastern Wyoming, is bounded on the east by Goshen County, on the south by Laramie County, on the west by Albany and Converse Counties, and on the north by Converse and Niobrara Counties (fig. 1). It is rectangular in shape, measuring about 66 miles in a north-south direction and about 32 miles in an east-west direction, has an area of 2,114 square miles, and contains 44 complete townships and parts of 22 others.

PREVIOUS INVESTIGATIONS

Several investigations of the geology and water resources of parts of Platte County and of adjacent areas have been made previously. The reports on these studies proved helpful in the preparation of this report and many references are made to them. The geologic map prepared for this report was compiled in part from existing maps and in part from additional geologic mapping.

The geology of the Hartville quadrangle, which includes much of the eastern part of the county, was described by Smith (1903). A soil survey of the Wheatland area was made by Carpenter (Carpenter and others, 1926). In 1934 the Geological Survey of Wyoming pre-

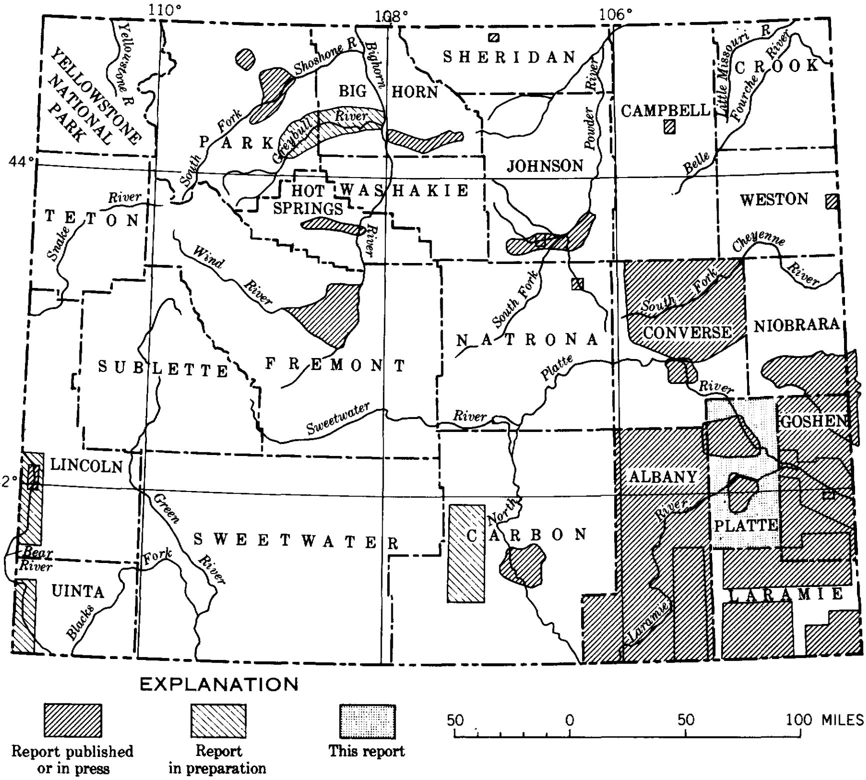

FIGURE 1.—Index map of Wyoming showing area covered by this report and other areas in which ground-water investigations have been made.

pared a map (unpublished) of the geology in the vicinity of the Cottonwood Creek tunnel along the western margin of Platte County on upper Cottonwood Creek (sec. 14, T. 27 N., R. 70 W.). Schlaikjer (1935a, b) studied the stratigraphy and paleontology of the Goshen Hole area, which includes a narrow strip along the eastern margin of Platte County. The report on geology and water resources of the Horse and Bear Creek valleys in southeastern Wyoming by Dockery (1940) pertains primarily to an area south and east of Platte County but includes a narrow strip along the southern border of the county. A report by Edwards (1941) on the ground-water resources of the valleys of Chugwater Creek and of the Laramie and the North Laramie Rivers describes a large section in the eastern and southeastern parts of the county. Pennington [1] defined the geology of the Horse Draw area, which is near the western border of Platte County on upper Horseshoe Creek. Master's theses by Jenkins (1938), Lynn (1947), Haun (1948), and Hammond (1949) describe the geology

[1] Pennington, J. J., 1946, Geology of the Horse Draw area: Wyoming Geol. Survey (Ms. rept.).

along the east flank of the Laramie Range in western and southwestern Platte County. Love, Denson, and Botinelly (1949) and Denson and Botinelly (1949) mapped the geology of the Glendo area and of the Hartville uplift, which includes most of the northern part of the county. A master's thesis by McGrew (1953) describes the Grayrocks area just north and east of Wheatland. Rapp, Visher, and Littleton (1957) studied the geology and ground-water resources of Goshen County, which borders Platte County on the east.

Data included in earlier reports by Littleton (1950) and by Rapp and Babcock (1953), which discuss the ground-water resources of the Wheatland Flats area and of the Glendo-Wendover area, respectively, have been incorporated in this report.

METHODS OF INVESTIGATION

Records of 532 wells and springs in Platte County were studied. Data on the character and thickness of the water-bearing formations tapped by wells and on the discharge of the wells was obtained from drillers and owners. An attempt was made to include in the inventory all wells of large discharge and all public-supply wells. The depth to water below a fixed point, generally the top of the well casing, in 331 wells was measured with a steel tape. Reported data on water level are listed for most of the wells that could not be measured. The discharge and drawdown were recorded for as many of the irrigation wells as possible, and for a few of the domestic and stock wells. The measurements, as well as other information about the wells, are included in table 10 (p. 113). The depth to water in several wells and pits in the Wheatland Flats was measured to obtain additional data needed for control in drawing the contours on the water table. These data are not given in the table of well records, as only a small amount of data was obtained regarding each such well or pit.

Chemical analyses were made of 34 water samples collected from wells, springs, and streams in the area. Tests to determine the hydrologic properties of the aquifers were made at 14 wells.

Samples of drill cuttings from 73 test holes, aggregating 3,500 feet of drilling, were collected and studied by J. R. Rapp. Additional logs of wells and test holes drilled in the area were obtained from well owners and drillers. These logs are given in table 11 (p. 145).

During the investigation the surface geology of parts of the county was mapped. Part of the geology shown on plate 1 is based on original fieldwork and part is adapted from published and unpublished geologic maps.

The geologic and hydrologic field data were recorded on aerial photographs and then transferred to a base map adapted from the

Wyoming State Highway planning map. The wells shown on plate 1 were located within the sections by means of an automobile odometer and by inspection of the aerial photographs; their locations are believed to be accurate within 0.1 mile.

WELL-NUMBERING SYSTEM

The wells are numbered according to their location within the U.S. Bureau of Land Management's system of land subdivision. All wells are in the sixth principal meridian and baseline system. The well number shows the location of the well by township, range, section, and position within the section (fig. 2).

The first numeral of a well number indicates the township, the second the range, and the third the section in which the well is located.

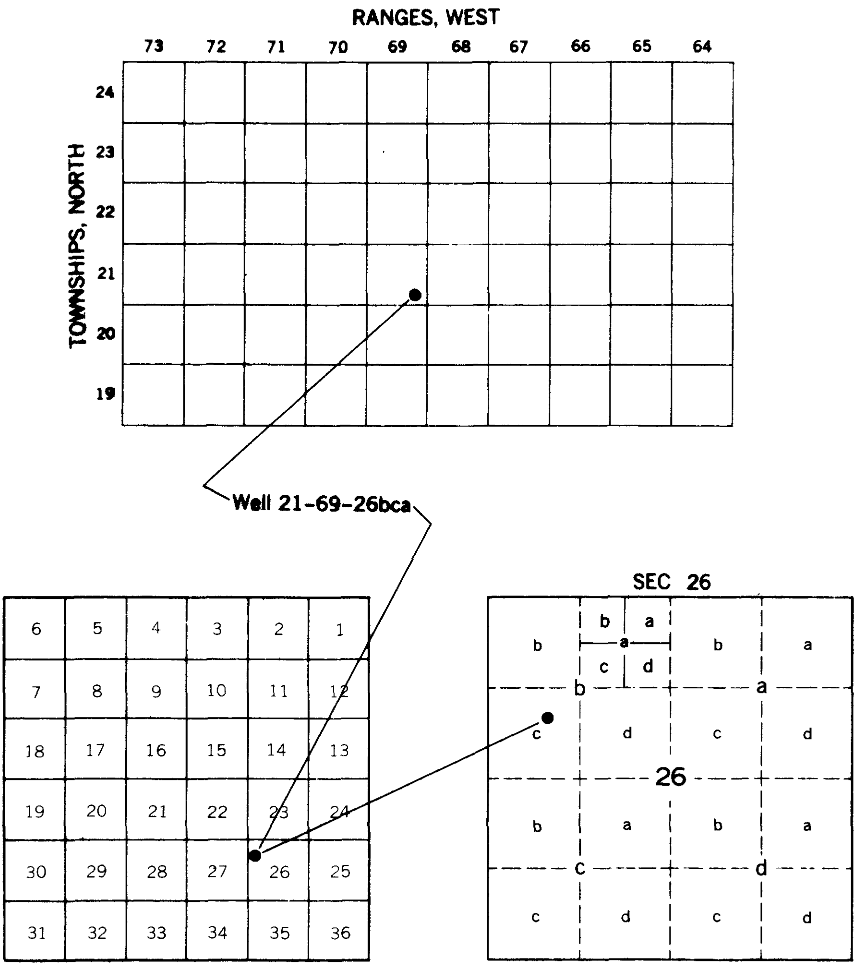

FIGURE 2.—Sketch showing well-numbering system.

The lowercase letters following the section number indicate the position of the well within the section. The first letter denotes the quarter section, the second the quarter-quarter section, and third the quarter-quarter-quarter section (10-acre tract). The subdivisions of the sections are lettered a, b, c, and d in a counterclockwise direction, beginning in the northeast quarter. If more than one well is listed in a 10-acre tract, consecutive numbers beginning with 1 are added to the well number.

This numbering system is used also to designate test holes, springs, and locations where surface-water samples were collected for chemical analysis.

ACKNOWLEDGMENTS

Drillers in the area supplied logs for many of the wells and test holes listed in this study. The residents of the area supplied information about their wells and gave permission for the measurement of their wells, and for the drilling of the test holes on their land. Information on public-supply wells was given by town officials of Wheatland, Guernsey, Hartville, Chugwater, and Glendo. L. C. Bishop, State Engineer of Wyoming and Frank Murphy, Chief Hydrographer in the office of the State Engineer gave assistance and helpful suggestions, and permitted access to State records of wells and of streamflow in the area.

GEOGRAPHY

HISTORY

The settlement and development of the western part of the United States took place gradually in several distinct stages, beginning with the prehistoric peoples and the modern Indians. Because the North Platte River offered an easy route for travel across the southern part of Wyoming, Platte County shares intimately in the history and development of the West. The following summary of the history of Platte County is abstracted in part from accounts of the early history of Wyoming by Bartlett (1918) and by Trenholm (1954).

As early as 1892, aboriginal quarries, called the "Spanish Diggings" (fig. 3), were known to exist about 20 miles north-northwest of Hartville. Members of scientific expeditions to these ancient village and quarry sites and to others farther south near Sawmill Canyon (T. 28 N., R. 67 W.) have studied the artifacts that were fashioned primarily from quartzite and jasperoid rock. Many scholars have speculated about the culture and history of these early people; in general, they agree that the people represented a race that roamed the land long before the modern Indians made their appearance.

Arrowheads and tepee rings indicate that Platte County once was occupied by the nomadic Plains tribes (Trenholm, 1954, p. 84). Early records show that the Comanche horsemen were the first modern Indians to inhabit southeastern Wyoming. When they moved southward, in the early 1700's, they were replaced by the Kiowas. About 1800, the Cheyennes moved from the Black Hills of the Dakotas into central Wyoming, where they absorbed a small but fierce band of Straitan Indians and pushed the Kiowas from the southeastern part of the State. By 1830 the Sioux, who had followed the Cheyennes from the Black Hills, also laid claim to this region. The Arapahoes, having moved down from Montana, were established in northern Colorado. The alliance between these Platte Indians—the Cheyenne, Sioux, and Arapahoe—lasted until the Indian Wars of 1876. Other tribes wandered into the area from time to time but were driven away.

After the Louisiana Purchase, Americans began to exploit the fur resources of the Rocky Mountains and the Great Plains. In 1812, Robert Stuart and his followers, traveling eastward from Astoria at the mouth of the Columbia River, were the first white men to enter Platte County. They apparently were the first white men to discover the North Platte River and to break the path for what later was to be known as the Oregon Trail. During their passage through Platte County they camped near what is now Cassa and again at the mouth of Cottonwood Creek. Although few records are available of the trappers who first explored the Platte County streams, Jacques La Ramie is known to have been one of them. Little is known of his life and death but his name (now spelled Laramie) caught the public fancy and was given to more landmarks than any other name in Wyoming history. General William H. Ashley, who is credited with organizing the fur-trading industry, brought many important fur traders to the west in his expeditions and, by amassing a great fortune, provided encouragement for others to follow. His best known followers in this locality were Robert Campbell and William L. Sublette, who founded Fort Laramie, a fur-trading post near the junction of the North Platte and Laramie Rivers.

The history of the Oregon Trail as a wagon route began in 1830 when a party of trappers under the leadership of William Sublette returned to St. Louis from the Wind River area in Wyoming by way of the North Platte River valley. In 1832 Captain Bonneville, acting under secret orders from Washington, lead a wagon train to Oregon. In 1841 the first organized band of homeseekers, consisting of about 80 people, passed through the area bound for California and the Oregon country. Thereafter, countless emigrants moved westward while the Indians watched with rising resentment. In 1843 the first large-scale migration crossed what later became Platte County, and in 1845 about 3,000 men, women, and children passed through the area. In 1847 Brigham Young and his followers passed through the area on their way to Salt Lake Valley in the Utah territory. They paused long enough in this locality to establish a station on Horseshoe Creek, where irrigation was practiced by white men for the first time in Platte County. This station was abandoned 10 years later. During the next quarter century annual caravans and scores of independent companies took tens of thousands of emigrants westward to build new States in the Rocky Mountain country and on the Pacific coast. The year 1849 probably was the most important year in the history of the Oregon Trail because of the discovery of gold in California. From May until October of that year, between 30,000 and 100,000 "forty-niners" passed through Wyoming. The trail remained the great thoroughfare to the West for the covered wagon until the Union Pacific Railroad was built in the late 1860's; however, wagons continued to follow the trail until late in the 1880's.

The rapid growth of American settlements in California, Oregon, and Utah led to the establishment in 1850 of the Overland Stage, a mail service between Independence, Mo., and Salt Lake City, Utah. Regular mail schedules were difficult to maintain, and mail service was slow and irregular. Not until the Pony Express was established in April 1860 was a fast and reliable mail service established in the West. However, the Pony Express could not compete with the Overland Telegraph, and it was abandoned upon completion of the telegraph line in October 1861.

Permanent settlers followed the trappers, traders, and emigrants to the West. Among the earliest known settlers in Platte County were the so-called squaw men, Cooney, Ecoffey, Richeau, the Janis brothers, and Bordeaux. The allegiance of these men to the tribes to which their wives belonged was evidenced by the family feuds between them. Though many early settlers lost their scalps and several wagon trains were burned, only one battle of consequence occurred between the Indians and the white men in Platte County, a 3-day encounter at Horseshoe Creek. Many cattle ranches were established along the creeks and rivers in the late '60's and early '70's; one of the most important was the Kelly ranch near Chugwater. Other important livestock ventures in Wyoming were those of the Swan Land and Cattle Co., organized in 1883 with headquarters at Chugwater, and the Duck Bar Co. at Uva.

The first extensive irrigation development in Platte County, and one of the first in the State, was begun on the Laramie River by the Wyoming Development Co. in 1883. This was the Wheatland Flats project, first conceived in 1879 and put in motion by Joseph M. Carey through the Carey Act. The following brief history of the Wheatland project was abstracted from a report by J. A. Elliot,[2] formerly an engineer with the Wheatland Development Co.:

[2] Elliot, J. A., 1944, Brief report on the Wheatland project enclosed with a personal letter to Senator F. A. Barrett.

Construction of 2 canals and a 2,380-foot tunnel from the Laramie River to Bluegrass Creek originally cost about $479,000, but later changes increased the total cost of the project to about $1,370,000. The direct streamflow rights covered 58,803 acres of land, claimed under the desert land laws. Because the entrymen were not required by law to develop the property after they had secured title to the land, many waited for neighbors to do the pioneering work. As a result, the entire project came to a standstill; and, on the recommendation of Elwood Mead, the State Territorial Engineer, the Wyoming Development Co. purchased the land from the entrymen and started a colonization program selling direct streamflow rights for $15.00 per acre. In the middle 1890's between 30,000 and 40,000 acres of land was settled. Although large quantities of water were available during the spring, direct-flow water was found to be insufficient for irrigation late in the growing season. The settlers then petitioned the company to construct a system of reservoirs to store water during the nonirrigation season. Because the company was reluctant to incur additional expense, a new corporation called the Wheatland Industrial Co. was organized to finance the reservoir construction, under an agreement that the settlers were to pay $2.50 per acre for rights in the reservoirs.

The new project was to have a maximum size of 63,560 acres; the company was given the right to acquire additional land to bring the project to this total acreage. Wheatland Industrial Co. Reservoir 1, with a usuable capacity of about 5,300 acre-feet, was constructed in 1894, and Wheatland Reservoir 2 (in north-central Albany County about 35 miles west-southwest of Wheatland), with a usable capacity of 120,400 acre-feet, was completed in 1901, the two at a combined cost of about $165,000. Upon the completion of these reservoirs, two additional tracts of land were added to the project under the Carey Act; however, only 2,800 acres of land (the Bordeaux tract) along Chugwater Creek near the town of Bordeaux was in the project at the time of this investigation.

The increase in farm acreage after completion of the Wheatland Flats irrigation system resulted in a temporary increase in farm population in Platte County, which in turn increased the population of Wheatland. However, a diminishing surface-water supply from the Laramie River has been costly to the entire irrigation project. According to the 1950 census, the population of Platte County decreased from 9,695 in 1930 to 7,925 in 1950. This was a decrease in rural, rather than urban, population because Platte County towns generally have increased in population during the same period. In 1950 Wheatland, the county seat, had a population of 2,286, which was almost one-third of the total population of the county.

SURFACE FEATURES

LANDFORMS

Platte County lies within parts of two major physiographic provinces, the northern extension of the Southern Rocky Mountains and the northwestern part of the Great Plains.

The Southern Rocky Mountains province lies principally in the State of Colorado but it includes short extensions into southern Wyoming and northern New Mexico. It encompasses an area of about

50,000 square miles and includes 17 mountain ranges separated by 6 principal intermontane valleys. In most places the mountain chain rises abruptly from the Great Plains, from altitudes of 4,000 to 6,000 feet above sea level to a general altitude of 10,000 feet, and many summits attain altitudes ranging from about 11,000 to 14,500 feet. The province is characterized by numerous ridges which differ in width and length, though most extend for several hundred miles in an approximate north-south direction. These ridges were caused principally by anticlinal uplifts of Precambrian and younger rocks. The mountaintops, remnants of the Rocky Mountain peneplain, rise to an almost uniform height over extensive areas throughout the province. Other ranges which are remnants of older mountains rise several thousand feet above the common level.

The Great Plains province extends eastward from the Front Range of the Rocky Mountains to the Central Lowland province along the Mississippi valley, and from the Rio Grande on the south to the Canadian boundary on the north. The High Plains section of the Great Plains province lies in eastern Wyoming, Colorado, and New Mexico and in western Texas, Oklahoma, Kansas, and Nebraska. The characteristic landscape of the northern part of this section is a uniformly sloping erosional plain formed mainly on Miocene sediments. Few streams cross these gently rolling tabular upland areas, and there are wide, very flat intervalley areas interrupted by a few isolated buttes and outlying ridges. In Platte County, the original High Plains surface has been deeply eroded as the result of uplift. The North Platte River and its tributaries have cut their valley as much as 1,000 feet into the plains, leaving incompletely eroded tablelands and lower buttes and ridges.

Platte County can be separated into seven main physiographic units: the Laramie Range, the foothills, the Wheatland Flats, the Plains area, the Hartville Hills, the western part of the Goshen Hole lowland, and the valley of the North Platte River (fig. 3).

LARAMIE RANGE

The Laramie Range lies along the western margin of Platte County. It constitutes the eastern limb of the Rocky Mountain Front Range and is an asymmetrical arch flanked on both sides by Paleozoic and younger sedimentary rocks. The range trends northward from near the Colorado-Wyoming border to the vicinity of Laramie Peak and then northwestward to Casper Mountain south of Casper. The sedimentary rocks on the west flank of the range have relatively low dips, whereas those on the east and north flanks are steep to overturned; faulting is common on the east and north flanks. The relief is moderate, and no large part of the Laramie Range rises above the

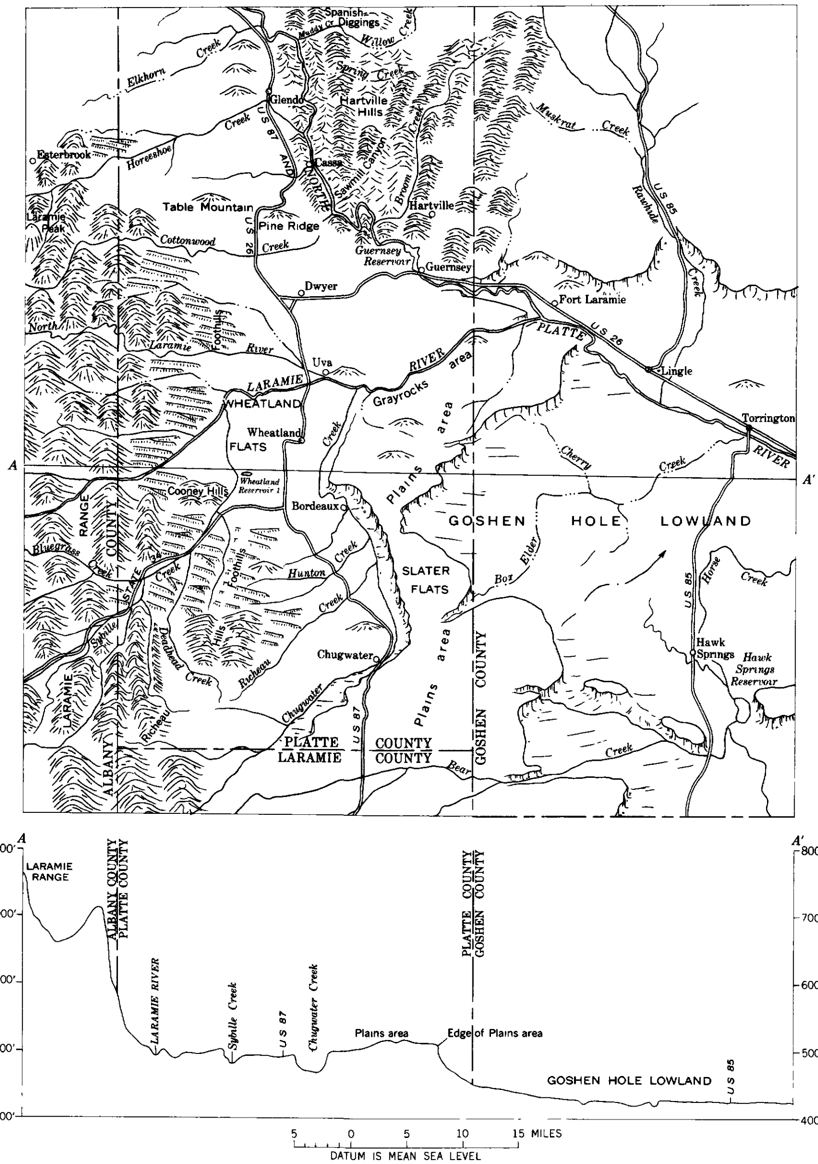

FIGURE 3.—Generalized relief map and cross-section of part of southeastern Wyoming.

Rocky Mountain peneplain. The top of the range is a plateau whose altitude ranges from 8,500 to 9,000 feet. The surface, cut by many canyons, rises in places to form knobs and short ridges. In many local areas between the streams the land is smooth or gently rolling and the ridges have rounded summits. In other places a few rugged peaks, such as Laramie Peak which has an altitude of 10,272 feet, rise about

1,000 feet higher than the common peneplain level. On the whole, however, the surface is a remarkably even plain sloping slightly to the east. The maximum difference in altitude between the Great Plains and the mountain summits in Platte County is about 5,000 feet.

FOOTHILLS

The foothills border the Laramie Range to the east. In Platte County the foothills are made up of two distinct units, an irregular and discontinuous series of ridges extending eastward at right angles from the mountains, and the Richeau Hills, the Cooney Hills, and related structures which border the Laramie Range but are partly separated from it.

The highly dissected foothill ridges sloping away from the Laramie Range probably represent the remnants of a former depositional surface. As debris-laden streams debouched from the mountains onto the plains, their loads were deposited in a series of coalescing alluvial fans, which locally formed bajadas along the foot of the range. Then, owing to climatic changes, uplift, or both, the streams began to degrade; in crossing the bajadas from west to east they dissected the alluvial-fan material and left a series of narrow, parallel, dendritically eroded ridges perpendicular to and merging with the mountains. The tops of these ridges are flat to rounded; they slope eastward about 75 to 100 feet per mile and usually reach altitudes of 4,800 to 6,000 feet.

The Richeau and Cooney Hills in southwestern Platte County (pl. 1) are the southernmost topographic expression of uplifted Precambrian and post-Precambrian sedimentary rocks that form a southwestward-trending spur of the Hartville uplift. The Richeau Hills have a rough topography developed mainly in limestone and sandstone of the Casper formation. On the northwest and west are two basins excavated in the relatively soft Chugwater formation, separated by a low, broad, dome-shaped anticlinal hill capped by the Casper formation, which extends eastward. The basins are connected at their western extremities by a northward-trending valley underlain by the Chugwater formation, into which northward-flowing Deadhead Creek is entrenched. This valley is bounded on the west by high northward-striking hogbacks of the steeply dipping Casper formation, west of which lies the dissected peneplain surface of the Laramie Range. On the south, the Richeau Hills are characterized by a relatively broad basin developed in the Tertiary and Triassic rocks along North Chugwater Creek. This basin is bounded on the west by northward-trending hogbacks of the Casper formation, which stand almost vertically against the Precambrian rocks to the west, and on the south by steeply dipping Mesozoic rocks. The altitude of the Richeau Hills ranges from 5,400 to 6,900 feet. Lower structural highs exposing folded Paleozoic and Mesozoic rocks lie also along upper Cottonwood and middle Horseshoe Creeks.

The rugged Cooney Hills and other smaller isolated inliers of Precambrian rocks surrounded by younger sedimentary rocks form part of the foothills along the Laramie Range in the southern part of the area. They are separated from the main range. The Precambrian rocks, buried during early and middle Tertiary time, have been only partly exhumed and sculptured. In general, these remnants range in altitude from 5,200 to 5,900 feet.

WHEATLAND FLATS

The Wheatland Flats (pl. 2; fig. 3) in central Platte County comprise seven distinct terraces, which lie along the Laramie River and along Sybille and Chugwater Creeks near their confluence with the Laramie River. The terraces are a series of gently sloping surfaces about 25 feet to about 160 feet above the present level of the streams. They parallel the present streams and form steps to the south and east from the alluvial bottoms of the streams. Few streams cross these terraces, and little erosion of their surfaces has taken place.

PLAINS AREA

The Plains area in Platte County lies east of the Laramie Range and foothills area (fig. 3). In the southeastern part of the county it forms the divide area between Chugwater Creek, the Laramie River, and Goshen Hole. Here it consists of a gently rolling tableland bounded by steep escarpments. As the area is underlain mainly by permeable materials, little or no water runs off its surface; consequently, the old tableland surface has been only moderately eroded by stream action. To the west and to the northwest in the area surrounding the Hartville Hills, the Tertiary deposits forming the plains have been dissected into moderate relief by the North Platte and Laramie Rivers and their tributaries.

HARTVILLE HILLS

In the northeastern part of Platte County the relatively gentle topography of the Plains area is broken by the Hartville Hills, a broad uplifted structural platform approximately 45 miles long and 15 miles wide. This range of hills is comparatively rugged owing to the differential weathering and erosion of the Precambrian and Paleozoic rocks. Though the range has a mountainous appearance, its total relief is only moderate. The hills project about 1,500 feet above the surrounding plains and their maximum altitude is about 6,100 feet. The area has been dissected by the North Platte River, which crosses the southern part of the uplifted area, and by many small streams; some of the small streams have steep, narrow valleys, others have relatively broad, flat valleys. Most of the valleys have been incised into Tertiary rocks which overlap the older rocks on all sides of the uplifted area.

GOSHEN HOLE LOWLAND

Along the eastern margin of Platte County northeast of Chugwater, the Plains area is terminated abruptly by an east-ward facing escarpment overlooking the westernmost extension of an erosional feature known as the Goshen Hole lowland (see fig. 3). This lowland is a great wedge-shaped widening of the valley of the North Platte River and is represented in Platte County only by its uppermost pediment slopes and rimming escarpment.

VALLEY OF NORTH PLATTE RIVER

Throughout its broader areas in Platte County northwest and southeast of the Hartville Hills, the valley of the North Platte River consists of an inner valley and a series of bordering pediments. The inner valley is composed of a flood plain bordered by 1 to 3 alluvial terraces. The terraces grade into a series of sweeping pediments which extend away from the river to the upland. The North Platte River has cut rather steep canyons where it has entrenched itself in the older rocks along the margin of the Hartville Hills.

DRAINAGE

Platte County is drained by the North Platte and Laramie Rivers and their tributaries.

The North Platte River flows southeastward across the northern part of the county and, with its numerous tributaries, drains approximately the northern half of the county. The area east of the river is drained by many small washes and short intermittent streams. The largest of the intermittent streams are Muddy, Spring, and Broom Creeks.

Most of the area west of the river is drained by Elkhorn, Horseshoe, and Cottonwood Creeks, which head in the Laramie Range and flow eastward to their confluence with the Platte River. These streams derive most of their summer and fall flow from ground water.

The southern half of the county is drained by the Laramie River and its main tributaries—the North Laramie River and Sybille and Chugwater Creeks—all of which are perennial throughout their courses in the county. The Laramie River, which heads in northern Colorado, flows northward along the floor of the Laramie Basin on the west side of the Laramie Range, turns abruptly east about 15 miles west of Platte County, cuts through the range in a granite gorge more than 1,000 feet deep, and enters the county near the middle of the western boundary. It then flows across Platte County in an easterly direction toward its confluence with the North Platte River in Goshen County.

The North Laramie River, which drains the area immediately north of the Laramie River, rises in the Laramie Range and flows southward about 15 miles along the west slope of the range to near Garrett, Wyo., where it turns almost due east through the range and empties into the Laramie River in about the center of the county. Sybille Creek, which drains the southwestern part of the county, rises in the Laramie Range and flows northeastward to its confluence with the Laramie River in the west-central part of the county. Chugwater Creek, which drains the southeastern part of the county, rises in the Laramie Range south of Sybille Creek and flows northeastward to the town of Chugwater, where it turns and flows northward to its junction with the Laramie River.

CLIMATE

The climate of Platte County is semiarid and characteristic of that of the northern High Plains. It is characterized by low precipitation, a high rate of evaporation, and a wide range in temperature. The annual precipitation during the period of record and the normal monthly precipitation (computed through 1952) for the weather stations at Wheatland and Chugwater are shown graphically in figure 4.

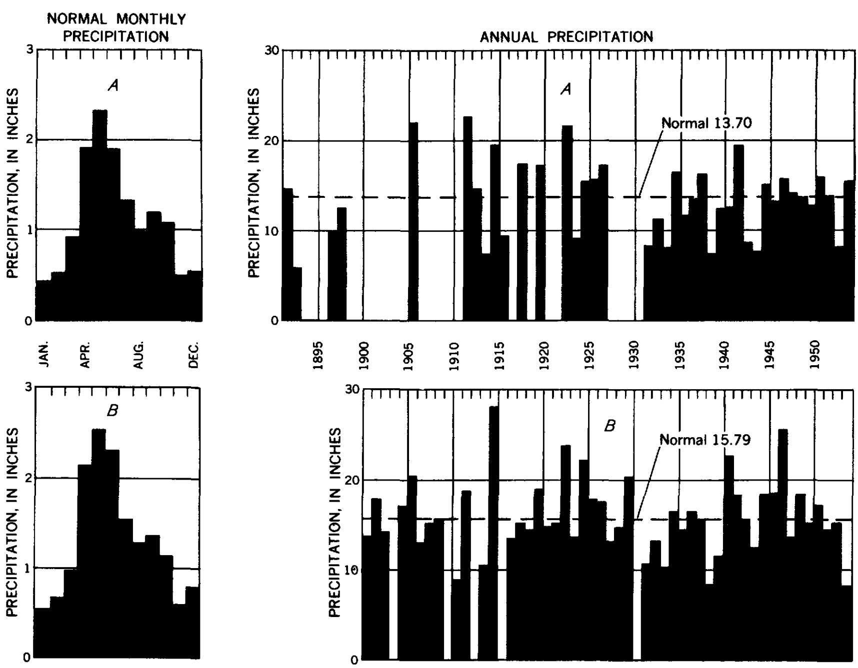

FIGURE 4.—Graph showing precipitation at *A*, Wheatland and *B*, Chugwater, Wyo. (Data from the U.S. Weather Bureau.)

The normal precipitation is 13.70 inches at Wheatland and 15.79 inches at Chugwater. Deviations from the normal are frequent, as shown on figure 4. The highest recorded annual precipitation is 22.58 inches at Wheatland and 28.00 inches at Chugwater; the lowest is 5.92 and 8.37 inches, respectively. The total precipitation is not shown for those years in which only partial records were kept. About 45 percent of the annual precipitation occurs during April, May, and June; only about 16 percent occurs during November, December, January, and February, when it generally is in the form of light dry snow.

The normal rainfall during May, the wettest month, is about 2.4 inches; during January, the driest month, it is only about 0.5 inch. The summer rains, which usually are sporadic and unevenly distributed, occur largely as thundershowers. These storms are accompanied occasionally by strong winds and hail, which cause considerable damage to crops.

The mean annual temperature is 48.8° F. at Wheatland and 45.8° F. at Chugwater, and the length of the growing season usually is 130 to 140 days at Wheatland and 100 to 110 days at Chugwater. The difference between the maximum summer and the minimum winter temperatures, and also between maximum daytime and minimum nighttime temperatures, is large.

POPULATION, AGRICULTURE, AND INDUSTRY

According to the 1950 census, the population of Platte County was 7,925. Approximately 59 percent of the people live in rural areas; however, many who live in the towns own and operate farms or ranches, and consequently a large majority of the county's inhabitants make their living from agriculture. The 1950 census listed the population of the five largest towns in the county as follows: Wheatland, 2,286; Guernsey, 721; Chugwater, 283; Hartville, 229; and Glendo, 215.

The agricultural economy of the county has been developed principally by irrigation, dry farming, and stockraising. The irrigated areas are generally restricted to the stream valleys, with the exception of the Wheatland Flats Irrigation System. Approximately 50,000 acres of land, which constitutes the major part of the irrigated area in Platte County, was under cultivation in the Wheatland Flats area in 1953.

The supply of surface water in the small streams usually is sufficient for irrigation during the early part of the growing season, but shortages frequently occur during periods of low streamflow in the late summer and fall. To overcome this shortage some farmers have constructed irrigation wells to supply supplemental water.

The economy of the Wheatland Flats area and of the town of Wheatland depends primarily upon irrigation. Like many other irrigated areas, the Wheatland Flats area is beset with problems of waterlogging, variable climate, and a shortage of water for late-season irrigation, the last being the most serious. Shortages occur during years of low runoff in the Laramie River basin. Elliot [3] estimated that water shortages cost farmers in the Wheatland Flats area $4,000,000 between 1930 and 1940. These losses are of such magnitude that considerable effort could be expended within sound economic limits toward increasing the water available for irrigation. Since 1953, the surface-water supplies have been augmented by pumping some ground water from the relatively thin terrace deposits that underlie most of the Wheatland Flats.

The irrigated lands in the county are suitable for growing hay, grain, and row crops. The Great Western Sugar Corp. built a sugar mill at Wheatland in 1930, after which much of the Wheatland Flats area was planted to sugar beets. However, the acreage of sugar beets has been greatly reduced because recurrent droughts have reduced the surface-water supply so much that it is insufficient to insure a satisfactory yield of beets; consequently, the mill has been idle since 1939. Most of the land has since been planted to hay, corn, or small grain because those crops require less water than beets.

Most of the land in the county that does not have surface water for irrigation is dry-farmed (mostly winter wheat) or used to graze cattle.

Various metallic and nonmetallic minerals are found in Platte County, mainly within or along the Laramie Range and the Hartville Hills. Most of the minerals have been produced only in small quantities because of the limited amounts available, their low price or grade, the high cost and difficulty of separation or transportation, and the problems involved in marketing them. However, limestone and granite are quarried extensively and iron has been mined since about 1900 at the Sunrise Mine east of Hartville. In 1953 the high-grade iron ore (hematite) in the Precambrian limestones and schists was being shipped by the Colorado Fuel and Iron Co. at a rate of about 3,000 tons a day. The anorthosite in the Laramie Range, although it has not yet been mined, is a potential source of aluminum.

TRANSPORTATION

Platte County is served by two railroads. The Casper branch of the Chicago, Burlington, and Quincy Railroad follows the North Platte River across the northern part of the county. The Colorado

[3] See footnote, p. 9.

and Southern Railway serves the southern part of the county, paralleling Chugwater Creek to Wheatland and then running north to join the C. B. and Q. at Wendover.

Three main highways traverse the county: U.S. 26 and Wyoming 34 in an east-west direction, and U.S. 87 in a north-south direction. Several State and county blacktop roads and county graveled roads are maintained throughout the year.

GENERAL GEOLOGY

The logs of several deep wells in Platte County and adjacent areas indicate that the county is underlain by sedimentary rocks which overlie igneous and metamorphic rocks. The sedimentary rocks range in age from Devonian to Recent; the igneous and metamorphic rocks are of Precambrian and Cambrian age. The age, thickness, physical character, and water-bearing properties of these formations are summarized in table 1 and on plate 1. A more detailed discussion of the principal water-bearing formations is given on p. 28. The areas of outcrop of the formations and their stratigraphic relationships are also shown on plate 1. Plate 2 is a detailed geologic map of the Wheatland Flats showing the terraces and the configuration of the surface of the underlying bedrock.

GEOLOGIC HISTORY

The geologic history of Platte County is similar to that of the rest of the area along the Front Range of the Rocky Mountains. Platte County is underlain by marine and continental deposits of limestone, conglomerate, sandstone, siltstone, shale, clay, silt, sand, gravel, and some boulders. These deposits range in thickness from 0 over the Laramie Range, the Hartville uplift, and related structural features to about 10,000 feet in the east-central and southeastern parts of the county. Much of the early geologic history can be inferred by studying logs of deep oil-test holes. Later geologic history is interpreted from the study of the physiography of the area as well as from the rocks. Table 2 gives a summary of the geologic history of the area. Part of the following discussion of the geologic history of Platte County is abstracted from a report by Thomas (1949, p. 12–28).

The oldest rocks exposed in the county which are igneous and metamorphic rocks of Precambrian age, are in the mountainous and structurally complex areas. Paleozoic and Mesozoic rocks adjoin these older rocks. Tertiary and Quaternary rocks of the Cenozoic era underlie most of the county east of the Laramie Range, except the Hartville Hills in the northeastern part of the county.

TABLE 1.—*Generalized section of the geologic formations in Platte County, Wyo.*

Era	System	Series	Subdivision	Thickness (feet)	Physical characteristics	Water supply
Cenozoic	Quaternary	Recent	Landslide material and alluvial-fan deposits	0–30±	Locally derived sand, gravel, conglomerate, and diversified rock debris.	Usually lie above water table; not an important source of ground water in Platte County.
			Dune sand	0–50±	Fine windblown sand.	Infiltration areas for recharge from precipitation.
			Slope wash	0–30	Clay, silt, sand, and gravel.	Not a source of water in Platte County.
		——?——	Flood-plain deposits	0–90	Fine to very coarse sand and gravel contain lenses and beds of fine sand, silt, and clay; large chunks of limestone; sandstone and siltstone; and cobbles and boulders.	Yield moderate to large quantities of water to wells.
		Pleistocene	Terrace deposits	0–100	Sand, gravel, cobbles, and boulders; contain some lenses of clay and silt.	Yield water to many domestic and stock wells; yield moderate amounts of water to many irrigation wells in the Wheatland Flats.
	Tertiary	Pliocene	Channel deposits	0–60	Poorly to moderately cemented sand and gravel; contain cobbles and boulders.	Not a source of water for wells in Platte County.
		Miocene	Arikaree formation	0–1,200	Loose to moderately cemented very fine to fine white to gray sand and silt containing many layers and concretions of hard, tough sandstone. The basal unit consists mainly of coarse channel conglomerate.	Yields small amounts of water to many wells; if sufficient saturated thickness is penetrated, will yield moderate to large quantities of water.
		Oligocene	Brule formation	0–420	Moderately hard brittle argillaceous siltstone; contains channel deposits of sand and sandstone, localized beds of limestone, moderately thick beds of clay, and a few beds of volcanic ash.	Yields small quantities of water to wells from fissures or saturated lenses of sandstone and conglomerate.
			Chadron formation	0–700	Consists mainly of green, red, buff, or brown loosely to moderately cemented bentonitic clay and silt; contains channel deposits of sandstone and conglomerate and a lower unit of variegated fluviatile deposits.	Yields water under artesian pressure from coarse-grained channel deposits to many wells in Goshen County. Ground-water possibilities in Platte County not known.

Mesozoic	Cretaceous	Upper Cretaceous	Lance formation	0-1,400±	Upper unit consists of a sequence of beds of variegated sandstone and shale; contains a few thin beds of coal and a few thin beds of impure limestone containing oyster shells, and brownish chert pebbles, cobbles, and boulders. Lower unit consists of a thick sequence of beds of carbonaceous shale, gray siltstone, and dark- to light-gray sandstone; contains thin beds of coal which are more numerous in the lower 300 feet of the unit.	Yields small quantities of water to wells in Goshen County. Generally deeply buried in Platte County. Ground-water possibilities unknown.
			Fox Hills sandstone	0-190	Gray medium-grained sandstone that contains pyrite; is finer grained in its lower part; the basal unit is very limy and is greenish-gray in spots.	Not exposed at surface in Platte County. Ground-water possibilities unknown.
			Pierre shale	0-5,620	Predominantly dark-gray shale containing thin to moderately thick beds of sandstone.	
			Niobrara formation	0-500±	Speckled calcareous black shale containing a 20-foot bed of nearly pure chalk near its middle; has a 25-foot bed of dense light-buff limestone at its base.	
			Frontier formation	0-700±	Dark shales, containing sand in the upper part and septarian concretions near the base.	
		Lower Cretaceous	Mowry shale	0-1,100±	Mainly dark-gray to black siliceous shale containing numerous beds of bentonite.	Generally deeply buried. Ground-water possibilities unknown.
			Thermopolis shale		Fissile black shale, which contains thin partings of bentonite, sandstone, and ironstone, capped by a medium-grained, gray sandstone.	
			Cloverly formation	0-260	Upper and lower sandstone units separated by a thin sequence of beds of dark-gray to black shale; the sandstone contains some shale fragments.	Sandstones yield water to springs.

TABLE 1.—*Generalized section of the geologic formation in Platte County, Wyo.*—Continued

Era	System	Series		Subdivision	Thickness (feet)	Physical characteristics	Water supply
Mesozoic—Continued	Jurassic			Morrison formation	0–250	Dull variegated claystone, fine-grained fresh-water limestone, and lenticular sandstone.	
				Sundance formation	0–550	Glauconitic green shale and shaly sandstone overlying red to yellowish-tan and buff sandstone. In upper and lower part contains shale overlying tan to white fine- to coarse-grained massive to crossbedded sandstone.	
	Triassic			Chugwater formation	0–675	Red siltstone containing small amounts of red shale, fine-grained red silty sandstone, and thin seams of gypsum or anhydrite.	Generally deeply buried. Ground-water possibilities unknown.
	?	?					
Paleozoic	Permian			Gypsum and red-shale sequence	0–310	Red shale, gypsum, or anhydrite; soft silty shale; gray dolomite; gray to pink coarsely crystalline crinkled limestone; and layers of pink and gray chert.	
				Minnekahta limestone	0–40	Purple to bluish slabby thin-bedded limestone and yellow to pink slabby silty limestone.	
				Opeche shale	0–75	Bright-red silty shale and yellow to red sandstone; contains geodes and thin lenses of purple, red, and gray chert.	
	?	?		Hartville formation / Casper formation	0–1, 050±	The formation consists primarily of limestone, with a 100- to 120-foot bed of soft white to yellow porous sandstone called the "Converse sand" at the top and beds of cherty dolomitic red sandstone and thin beds of dolomite and breccia throughout. This limestone facies intertongues with a predominantly sandstone facies (Casper formation) which consists of arkosic quartzitic crossbedded sandstone interbedded with gray fossiliferous limestones.	Yield small quantities of water under artesian pressure from the "Converse sand." Ground-water potentials of other parts of formation are unknown. / Ground-water potentials unknown.
	Carboniferous: Pennsylvanian						
	?	?					
	Carboniferous: Mississippian			Guernsey formation	0–200±	Hard gray moderately cherty coarsely bedded limestone; thin-bedded slabby very fine-grained hard brittle silty purple to gray dolomite; and hard dolomitic purple shale and siltstone.	Generally deeply buried. Ground-water possibilities unknown.
	?	?					
	Devonian						
	?	?					
	Cambrian			Quartzite	0–60±	Hard coarse-grained partly conglomeratic reddish-brown.	Generally deeply buried. Ground-water possibilities unknown.
	?	?					
	Precambrian			Igneous and metamorphic rocks		Complex sequence of gneiss, schist, phyllite, quartzite, and limestone; intruded by coarse-grained granite, ultrabasic rocks, and pegmatite dikes.	

TABLE 2.—*Summary of geologic history, Platte County, Wyo.*

Era	Period		Epoch	Time since beginning of period, in millions of years	Geologic events
Cenozoic	Quaternary		Recent and Pleistocene	[1] 1	Periodic regional uplift; terraces formed, stream flood plains modified; slope wash, landslide debris, and dune sand accumulated; alluvial fans formed.
	Tertiary		Pliocene	[1] 12	Regional uplift; streams degrading; coarse channel deposits laid down locally.
			Miocene	[1] 28	Renewed uplift; rejuvenation of streams which first deposited coarse sand and gravel and then fine sand.
			Oligocene	[1] 40	Continued diastrophism accompanied by stream erosion and deposition of stream and lake sediments in large regional basin east of the Laramie Range.
			Eocene and Paleocene	[1] 60	
Mesozoic	Cretaceous			[1] 130	Period opened with continuing uplift to west followed by widespread submergence; thick deposits of sand and clay laid down. Gradual withdrawal of sea, accompanied first by the deposition of sand and then, under swampy conditions, by the deposition of sand, clay, and carbonaceous material. Emergence was completed and continental deposition was resumed. Period ended with extensive folding and faulting during which the Laramie Range was formed.
	Jurassic			[1] 155	Submergence accompanied by deposition of sand and clay, followed by emergence; deposition of fresh-water sand, clay, and limestone.
	Triassic			[1] 185	Emergence accompanied by continental deposition of sand, silt, and clay. Period closed with regional uplift.
Paleozoic	Permian			[1] 210	Continued uplift and periodic total emergence; interbedded red shale and limestone formed.
	Carboniferous	Pennsylvanian.		[2] 235	Gradual uplift and emergence accompanied by deposition of sandy and limy sediments and interfingering of facies.
		Mississippian.		[2] 265	
	Devonian			[1] 320	Continued erosion followed by submergence; deposition of limy sediments.
	Silurian			[1] 360	Prolonged erosion.
	Ordovician			[1] 440	Emergence and prolonged erosion.
	Cambrian			[1] 520	Prolonged erosion followed by submergence; deposition of thin sandstone, later altered to quartzite, in northwestern Platte County.
Precambrian				[1] 2,100+	Long period of igneous activity, sedimentation, metamorphism, folding, and subsequent erosion

[1] Report of the National Research Council, Committee on the Measurement of Geologic Time, 1949–50.
[2] Estimate of J. P. Marble, Chairman of Committee on Measurement of Geologic Time, March 17, 1954.

PRECAMBRIAN TIME

The Precambrian rocks in Platte County are exposed in the core of the Laramie Range in the Hartville uplift and related structural features, and as isolated inliers in younger sediments throughout the county. These oldest rocks consist of great thicknesses of sediments that were deposited on an unknown surface and later folded and metamorphosed. During metamorphism this complex sequence of gneiss, schist, phyllite, quartzite, and limestone also was intruded by coarse-grained granite, ultrabasic rocks, and pegmatite dikes. The region was then subjected to erosion, the mountains were worn away, and, by the beginning of the Paleozoic era, the region had been reduced to a peneplain.

PALEOZOIC AND MESOZOIC ERAS

In the Platte County area the Paleozoic era opened with erosion. Although most of the area was being eroded, the Late Cambrian sea probably reached the northwestern corner of the area and a sand that later became a thin quartzite (Denson and Botinelly, 1949) may have been deposited at or near the shore of this sea during this period. No rocks of Ordovician, Silurian, or Early Devonian(?) age are present in the area; if any sediments were laid down during those intervals, they were subsequently removed by erosion. The sea again invaded the area during Late Devonian(?) and Mississippian time, and thick deposits of almost pure limestone were laid down to form the Guernsey formation. Then the sea withdrew and, after the land was partly dissected, again encroached upon the area. During later Mississippian(?), Pennsylvanian, and Permian time, the sea became shallower, probably because the land was uplifted gradually; beds of sand, sandy limestone, limestone, and marine clay were deposited to form most of the Hartville and Casper formations. As the land continued to emerge, shoreline conditions prevailed and the sand at the top of the Hartville formation was deposited. These Mississippian(?), Pennsylvanian, and Permian rocks in Platte County may be considered as constituting two distinct facies of contemporaneous deposition, one a limestone and the other a crossbedded sandstone facies. With paleogeographic changes, lateral shifting of the physical environments resulted in the thinning and interfingering of these major facies. Consequently, the Hartville formation of eastern Platte County is mainly limestone that contains thin tongues of sandstone, and the contemporaneous Casper formation of southwestern Platte County is principally sandstone intertongued with some limestone. Total emergence of the land during early Permian time is indicated by the continental reddish-brown deposits of mud, silt, and sand that constitute the Opeche shale. As these beds were being deposited in the

Platte County area, the sea advanced into western Wyoming and deposited about 300 feet of the marine Phosphoria formation. The Minnekahta limestone was deposited during a temporary eastward advance of the sea. Later in Permian time the land again completely emerged and wide mud flats were formed. During this time the climate was arid and part of the mud, silt, and gypsum of the gypsum and red-shale sequence were laid down. The Paleozoic era closed quietly with no folding and the Mesozoic rocks lie concordantly on the Permian rocks.

The climate during the Triassic period of early Mesozoic time, as during the Permian period, was generally arid, and local shallow basins and extensive mud flats predominated. The gypsum and gypsiferous red clay, silt, and sand of the Chugwater formation were laid down during the Triassic period, but the boundary between the Paleozoic and Mesozoic rocks is indistinct as it is concealed in a homogeneous red-shale sequence of both eras. Some time after the Chugwater formation was deposited, regional uplift resulted in general planation, which continued into Jurassic time. The land was submerged again by the sea advancing from the north and west during Early Jurassic time; this advance of the sea was its last invasion from the west. Under shoreline conditions, the sand and clay of the Sundance formation were deposited. Shoreline conditions were replaced by continental conditions and, in a humid climate, the fresh-water clay, sand, and limestone of the Morrison formation were laid down.

At the beginning of Cretaceous time there was continuing uplift to the west, after which nearshore deposits of sand were laid down to form the Cloverly formation. The sea then advanced from the south and east and, during the remainder of Early and most of Late Cretaceous time, several thousand feet of massive clay and sand were deposited. These deposits comprise the Thermopolis and the Mowry shales, the Frontier and the Niobrara formations, and the Pierre shale, all of which interfinger west of Platte County with clastic rocks derived from more western sources. The sea then began to retreat and a considerable thickness of sand, the Fox Hills sandstone, was laid down under nearshore conditions on the thick series of marine clay and sand.

After the Cretaceous sea withdrew, the area was occupied by extensive swamps, first of brackish water and later of fresh water, in which were deposited the sand, clay, and carbonaceous material of the Lance formation. The Lance formation is thickest in the Hanna Trough west of Platte County; the formation is about 1,400 feet thick under eastern Platte County and western Goshen County. The Cretaceous sea was the last to invade the Platte County area. Subsequently, continental deposition was resumed and the Cretaceous period ended with the extensive folding and faulting of the Laramide Revolution, during which time the Laramie Range, the Hartville uplift, and related structural features were formed in the Platte County area.

CENOZOIC ERA

The folding and faulting of the Laramide Revolution continued locally into early Tertiary time and died out gradually during Eocene time. During Paleocene and Eocene time, the Platte County area was uplifted and then eroded by streams.

Oligocene time began with erosion. Streams eroding the eastern side of the Laramie Range built fans about their margins and spread alluvial deposits over a large regional basin, which extended eastward into the central plains of Nebraska. Locally, some of these stream deposits, which constitute the lower unit of the Chadron formation, probably are reworked rocks of the Lance formation; however, the principal source of the materials is not known. Deposition continued and the streams began to meander, as evidenced by sinuous channel sandstones in the upper unit of the Chadron formation. During this period, stream and lake deposits of clay, silt, and scattered limy beds were laid down and later were consolidated to form the claystone, siltstone, and limestone of the upper unit of the Chadron formation. The rocks of the Brule formation were deposited during late Oligocene time under conditions that generally were similar to those prevailing during the deposition of the upper unit of the Chadron formation; thus, the contact between the two formations is indistinct. However, the larger grain size of the materials that compose the Brule formation indicates that renewed uplift or volcanism, or both, also took place west of the Platte County area during late Oligocene time. The character of the sediments comprising the Brule formation indicates also that they were deposited in a large basin which contained meandering streams and small fresh-water lakes and mud flats.

At the beginning of Miocene time, uplift in the Laramie Range rejuvenated the eastward-flowing streams and very coarse materials were deposited in their channels. These coarse materials make up the basal unit of the Arikaree formation. Subsequently, the fine sand of the upper part of the Arikaree formation was deposited by widely meandering streams and to a minor extent by wind. This period of combined erosion of the mountains and structural highs and the deposition of debris in the basin resulted in the formation of a peneplain perhaps 2,000 to 3,000 feet above sea level. At this time the Laramie Range probably existed as a series of rounded monadnocks rising above the aggraded plain.

During Pliocene time and contemporaneous with the Cascadian Revolution in the western United States, the entire Rocky Mountain area was uplifted to form a low arch hundreds of miles across. This uplift culminated during late Pleistocene time when the peneplained surface of the Rocky Mountains, of which the Laramie Range is a part, was raised along the Continential Divide to an elevation of 10,000 to 11,000 feet. The uplift and accompanying climatic change again rejuvenated the streams. Locally, coarse channel deposits were laid down during short periods of Pliocene time, and during early and middle Pleistocene time the North Platte River occupied a flood plain about 200 feet higher than its present level; however, the streams generally were deepening their valleys and again began to excavate the great basin and to exhume and sculpture the ancestral Laramie Range.

The present courses of the major streams probably reflect their position on the early Cenozoic fill. As this fill was removed as a result of intermittent upwarping and rejuvenation, the Laramie River was superposed from the graded plain on which it flowed prior to Pliocene time across the Laramie Range, into which it has now cut a granite gorge more than 1,000 feet deep. The North Platte River probably cut its present 350-foot canyon across the Hartville uplift in a similar manner.

During the latter part of Pleistocene time, the North Platte River and its tributaries periodically entrenched themselves to temporary local base levels, after which they filled or partly filled their valleys with alluvium. The streams meandered, widened and leveled their valley floors, and deposited the gravel that now underlies the terraces. The terraces that now border the streams were formed during the repeated cycles of downcutting and valley widening. Each terrace represents a period during which a stream was relatively stable and was enlarging its flood plain. The scarps between terraces indicate periods during which the stream was relatively unstable and was entrenching itself. Each terrace thus marks a major change in the regimen of the stream. The scope of this report does not include a detailed study of the geomorphology of the terraces or their exact dating.

Concurrent with the action of the major streams during late Pleistocene time, the ephemeral tributaries and rill and sheet erosion produced extensive badlands in some places and, by contributing to escarpment retreat, assisted in forming pediments at the base of the many escarpments.

Locally, during Pleistocene and Recent time, slope wash was deposited on bedrock slopes bordering the streams, alluvial fans were

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built on the Recent flood plains, and landslide debris accumulated at the base of steep escarpments. In some areas, wind scoured out small depressions in the soft Tertiary siltstone and sandstone and removed and redeposited silt and sand to form sand dunes.

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

PRE-TERTIARY ROCKS

Rocks of pre-Tertiary age exposed in Platte County include those from Precambrian to Late Cretaceous. The age, thickness, physical characteristics, and water-bearing properties of these rocks are summarized in table 1; only the Hartville and Cloverly formations are known to produce water. Although other pre-Tertiary formations in the area may contain some water, data were insufficient to ascertain their water-bearing properties. Therefore, the Hartville and Cloverly formations are the only pre-Tertiary formations discussed further in this report.

HARTVILLE FORMATION

Character and thickness.—The Hartville formation in Platte County consists of a sequence of beds of red porous cherty dolomitic sandstone, cavernous limestone, shale, dolomite, and breccia. The upper part of the formation is a soft white to yellow sandstone that generally weathers light yellow to gray. This sandstone, locally called the "Converse sand," consists of fine- to medium-grained subangular to rounded quartz sand. Locally, the sand is crossbedded and contains thin partings of limy sandstone.

In northern Platte County, the thickness of the Hartville formation ranges from 859 feet near the western edge of the county to about 1,050 feet near the eastern edge. The Hartville formation thins southward and southwestward, and along the northern Laramie Range intertongues with a sandier facies called the Casper formation. This facies consists of arkosic and quartzitic crossbedded sandstone interbedded with gray fossiliferous limestone. The "Converse sand" is about 100 feet thick where it is exposed along upper Horseshoe Creek and about 50 feet thick where it is exposed west of the town of Glendo. The log of well 29–68–20bac indicates that it is 120 feet thick (between depths of 340 and 460 feet) and that a 1-foot bed of limestone lies 9 feet below the top.

Distribution and surface form.—Although the Hartville formation underlies most of Platte County, it is at great depth except in the north-central part of the county where it forms the immediate bedrock floor or is exposed at the surface. The formation is particularly well exposed in the form of cuestas along the flanks of the Hartville structural dome. In places, the North Platte River and its tributaries have cut deep boxlike canyons in the formation.

The "Converse sand," the uppermost part of the formation, is exposed principally along the axes of the Broom Creek syncline and the Cassa anticline and in the area north and west of Glendo (along and adjacent to Elkhorn anticline) where the sand constitutes the major part of the outcrop. Elsewhere in places where the Hartville formation is exposed, the "Converse sand" has been removed by erosion; on plate 1 it is mapped as a part of the Hartville formation.

The Casper formation, the sandy facies (table 1), crops out extensively in the Richeau Hills along the Laramie Range in southwestern Platte County.

Age and correlation.—Smith (1903, p. 3) named the Hartville formation and included in it the rocks lying between the Guernsey formation and the Opeche shale. Condra and Reed (1935) separated the formation into six divisions, which subsequently were named by Condra, Reed, and Scherer (1940). Smith (1903, p. 3) dated the formation as Pennsylvanian but Love, Denson, and Botinelly (1949) considered it to be Late Mississippian(?), Pennsylvanian, and Permian(?). They referred to the upper sand as "Division I" and stated that it is probably correlative with the Converse oil sand of the Lance Creek area. The upper sand is referred to in this paper as the "Converse sand."

The Casper formation intertongues with the Hartville formation and is of approximately the same age.

Water supply.—The best producing aquifer in the Hartville formation in Platte County is the "Converse sand." It yields water to four flowing wells on lower Horseshoe Creek and to the town of Glendo's public-supply well. Other sandstones lower in the Hartville formation or in the Casper formation probably contain water. However, nothing is known at present about their water-bearing properties.

Many springs issue from the Hartville and Casper formations, but most of them yield only small amounts of water.

CLOVERLY FORMATION

Character and thickness.—The thickness of the Cloverly formation ranges from 0 to about 260 feet. The formation consists of a lower sandstone unit, a thin middle shale unit, and an upper sandstone unit.

The lower sandstone unit ranges from 50 to 75 feet in thickness and consists of clean medium-grained resistant noncalcareous sandstone which locally has been altered to form quartzite. The sandstone is gray but weathers to buff or tan. Thin beds of chert-pebble conglomerate are common in places near the base of this sandstone. The middle unit, which ranges in thickness from 0 to 50 feet, consists of a plastic, waxy shale interbedded with thin layers of sandstone and siltstone. The materials generally are gray but in a few places they are black or pale pink. In some areas this shale unit is absent and the entire formation consists of sandstone. The upper sandstone unit, which ranges in thickness from 70 to 135 feet, usually is more shaly and ferruginous and is thinner bedded than the lower unit. The sandstone contains many worm trails, especially near the top. However, at places where the middle shale unit is absent, the upper and lower sandstone units can be distinguished only with difficulty.

Distribution and surface form.—In Platte County, the Cloverly formation crops out primarily on the west flank of the Hartville uplift near Glendo, but a few small remnants are exposed along the north-central and south-central margins of the county. It forms conspicuous escarpments throughout this area and is the resistant cap rock along the North Platte River canyon southeast of the town of Glendo near the Glendo dam site.

Age and correlation.—On the basis of surface and subsurface sections of the formation west and northwest of the county, Denson and Botinelly (1949) dated the Cloverly formation as Early Cretaceous. In a general way, the formation also is correlative with the Lakota, Fuson, and Fall River strata in the Black Hills of South Dakota. It lies unconformably upon the Morrison formation but is conformable with the overlying Thermopolis shale. The lithologic character of the rocks overlying and underlying the Cloverly formation is markedly different from the rocks of that formation.

Water supply.—The Cloverly formation, probably the lower sandstone unit, yields water to a group of springs locally called Twin Springs (29–68–35cbb). The measured discharge of these springs on September 20, 1949, was 33 gpm. No attempt has been made to develop ground water from this formation in Platte County; however, it is probable that adequate water for stock and domestic use can be developed at places where the formation can be reached at practical drilling depth.

TERTIARY SYSTEM

The Tertiary rocks in Platte County include the Chadron and Brule formations of Oligocene age, the Arikaree formation of Miocene age, channel deposits of Pliocene age, and undifferentiated alluvial deposits considered to be of Tertiary age. The ages of the Oligocene and Miocene deposits have been determined by study of vertebrate fossils found in them, and by their lithology and stratigraphic position. However, no fossils were found in the Pliocene channel deposits and the undifferentiated deposits, and their age has been estimated wholly on the basis of lithology and stratigraphic position.

OLIGOCENE SERIES

CHADRON FORMATION

Character and thickness.—Little is known about the lower unit of the Chadron formation in Platte County because it is not exposed. However, if similar to the deposits in Goshen County, it consists of a series of lenses and beds of fluviatile deposits that range in grain size from clay to very coarse gravel. Its general color is red; the clay and silt beds are brick red, dark red, green to blue green, and buff; and the sandstone and conglomerate beds are brick red, maroon, purplish, and green. The coarser materials represent channel deposits. The thickness of the lower unit is unknown but may be as much as 100 feet.

The upper unit of the Chadron formation, the only part believed to crop out in Platte County, consists mainly of green, brown, red, or buff loosely to moderately cemented bentonitic clay and silt. It is sandy in places; the coarse-grained channel deposits that occur at several horizons in the unit are more concentrated in its upper part and are believed to mark the top of the formation in Platte County. The upper unit contains also a few lenticular beds of limestone and volcanic ash. The thickness of the upper unit ranges from 0 to about 100 feet, and the channel deposits are about 5 feet thick at several exposures. McGrew (1953, p. 19) reported that the total thickness of the buried Chadron in the Grayrocks area (fig. 3) in east-central Platte County ranges from about 100 to 700 feet, and that the formation is thickest in the southwestern part of the area. Consequently, the thicknesses of the upper and lower units may be somewhat different from those given above.

Distribution and surface form.—The Chadron formation underlies most of Platte County but is covered by younger sediments except along the eastern margin of the county in T. 23 N., Rs. 65 and 66 W., where an erosional lowland (Goshen Hole) extends into Platte County. Here, the upper unit is exposed below the Brule formation, which crops out along an escarpment to form the wall around the westernmost extension of Goshen Hole.

The upper unit, being soft and fine grained, weathers into a typical gently undulating topography characterized by small, well-rounded hills. The resistant channel deposits of sandstone form small mesa-like prominences in some places.

Age and correlation.—The Chadron formation is of early Oligocene age and lies unconformably on the older rocks. Correlation of the formation over any great distance is difficult, partly because of the pronounced relief upon which the Chadron sediments were deposited. This relief was much greater at the beginning of White River time than it is at the present time; the relief may have been more than 600 feet within a distance of a mile on the Permian and Triassic rocks in the vicinity of Glendo (Love, Denson, and Botinelly, 1949). In some places the lithologic similarity of Chadron to the Brule formation also makes correlation difficult.

Water supply.—There are no wells in the Chadron formation in Platte County, but the channel sandstone in the formation yields small quantities of water to many domestic and stock wells in Goshen County. Thus the formation might yield comparable amounts of water to wells in Platte County. However, the channel deposits usually are deep and discontinuous under Platte County and, therefore, probably would not be a good source of water for domestic and stock supplies. The water probably would be under artesian pressure.

BRULE FORMATION

Character and thickness.—The Brule formation in Platte County consists of white to buff or buff-orange moderately hard, brittle argillaceous bentonitic blocky siltstone or silty claystone. Locally, the formation contains channel deposits of sand and sandstone, resistant beds of limy siltstone, and a few beds of volcanic ash. In the Platte County area, the sandier materials usually occur in the lower and upper parts of the formation. Laterally, the sand or sandstone channels grade into sandy siltstone, which in turn grades into massive siltstone or silty claystone. In western Platte County, close to the Laramie Range, the upper part of the Brule formation is much sandier than its lower part and contains many channels and lenses of loosely cemented conglomerate, which locally are as much as 20 feet thick and interfinger laterally with sandy siltstone. These channel deposits are very coarse in places and are similar to and difficult to distinguish from the basal conglomerate generally found in the overlying Arikaree formation. In the eastern part of the county, the formation is typically a white to buff fairly homogeneous blocky siltstone. Particle-size analyses were not made of this material, but megascopically it resembles that in the Scotts Bluff area, Nebraska (Wenzel, Cady, and Waite, 1946, p. 66–70), and in Goshen County, Wyo. (Rapp, Visher, and Littleton, 1957).

Weathered exposures of the Brule formation show that it contains many individual fractures and zones of fractures, fissures, and faults. Many of the fractures or small fissures caused by weathering are filled with clastic materials, calcium carbonate, or barium sulfate. Other fractures resulting possibly from regional or local warping probably penetrate the entire thickness of the formation. The rocks so broken consist of loosely assembled siltstone blocks spaced as much as half an inch apart and the larger fissures range in width from 1 inch to as much as $2\frac{1}{2}$ feet. Many of these fractured zones and fissures are open but some are filled with eolian and fluviatile materials. The Brule formation is as much as 420 feet thick in the county.

Distribution and surface form.—The Brule formation is exposed principally in the southern part of the county. It is exposed also in northwestern Platte County, but there it has not been differentiated from other Tertiary rocks because of the similarity of the Oligocene and the Miocene sediments. Lenticular coarse to very coarse sandstone and conglomerate believed to be the upper Brule are exposed along Elkhorn Creek in the northern part of the area and in an area south and west of Chugwater.

The Brule formation in the county has been eroded to form a gently rolling upland surface. This surface has been deeply incised to form areas of considerable relief in the western part of the county. West of Chugwater, only a few remnants of the old surface remain, and here badland topography has been developed extensively in the formation.

Age and correlation.—The Brule formation is of middle and late Oligocene age. In places it overlies the Chadron formation nonconformably but elsewhere the formations are conformable. The Brule formation is correlative with the upper unit of the White River group (Wood, 1941, p. 1) in South Dakota, Nebraska, and northeastern Colorado.

Water supply.—The Brule formation in Platte County does not yield water abundantly to wells because it consists mainly of a relatively impermeable argillaceous siltstone. However, most wells in the formation produce sufficient water for domestic and stock use from fracture zones, fissures, or saturated lenses of sandstone and conglomerate. Although the formation yields moderate to relatively large quantities of water to irrigation and municipal wells in counties east and south of Platte County, no well in Platte County is known to obtain a large quantity of water from the Brule.

MIOCENE SERIES

ARIKAREE FORMATION

Character and thickness.—The Arikaree formation consists primarily of loosely to moderately cemented very fine to fine white to gray sand and silt. These are interbedded with lenses of loosely cemented to moderately consolidated fine-grained crossbedded sandstone and gravel, and layers or concretions of very hard, tough fine-grained brownish-gray to dark-gray sandstone. A few beds of white volcanic ash are present in the upper part of the formation. A basal conglomerate lies unconformably upon the Brule in many places throughout Platte County (fig. 5). The thickness of the formation

FIGURE 5.—Outcrop of basal conglomerate of Arikaree formation on Bear Creek in sec. 15, T. 28 N., R. 68 W. The weathered material below the shadows is the Brule formation.

ranges from 0 to about 1,200 feet (McGrew, 1953), app. A). Because the upper and lower part of the Arikaree formation differ in lithology, the formation is considered to consist of a lower unit and an upper unit.

The lower unit consists of lenses of loosely to well-cemented red to gray coarse to very coarse sandstone interbedded with lenses of well-cemented conglomerate containing fine to very coarse gravel and boulders. According to McGrew (1953, p. 28), the thickness of these materials ranges from 88 to 340 feet. They have been derived from the Laramie Range and other high structural areas and contain quartzite, granite, mafic rocks, sandstone, limestone, and chert.

The upper unit is principally a very fine grained soft to moderately hard generally massive sand and silt. An analysis of the grain size of these materials was not made; however, a microscopic study of the cuttings from test holes in the Wheatland Flats area indicates that the grain sizes of the materials in the upper unit are about the same as the grain sizes of material from the upper unit in Goshen County (Rapp, Visher, and Littleton, 1957). Pebbles and cobbles ranging from ¼ to 5 inches in diameter are scattered throughout the sand. Individual concretions as much as 7 inches in diameter and 10½ feet in length are numerous in places. Darton (1903a, p. 23–29) called these cylindrical masses pipes. These pipes generally trend northeastward. In some places the concretions are cemented into a mass that is as hard and tough as the concretions themselves. These relatively flat coalescing masses are as much as 3 feet thick and grade laterally into poorly consolidated sandstone. Wenzel, Cady, and Waite (1946, p. 72–75) believed that these concretions were formed by the deposition of calcium carbonate while ground water percolated through unconsolidated sediments. The thickness of the upper unit ranges from about 400 feet to 850 feet.

Distribution and surface form.—The Arikaree formation crops out along the eastern part of an extensive gently rolling upland area of moderate relief which extends eastward from the base of the Laramie Range across Platte County to Goshen Hole and to the Hartville Hills. In the southeastern part of the area the formation underlies an extensive tableland. The sandy mantle overlying this tableland accepts water readily and little surface runoff or soil erosion occurs. However, the upland area in central Platte County has been deeply incised by streams, which have developed a badland topography on the Arikaree formation. Along the sides of the Hartville uplift and related structures in Platte County, the Arikaree and other Tertiary rocks overlap the older rocks. Here, erosion has removed much of the Arikaree formation, but in general it is the principal formation exposed. In northwestern Platte County, where the rocks are mapped as Tertiary undivided, the Arikaree is present but its remnants are so thin or limited in areal extent that no attempt was made to distinguish it from the underlying Oligocene sediments.

In central Platte County the formation is cut by several faults of the Whalen and Wheatland fault systems. These faults are believed to have been formed by post-Miocene stresses along faults that were active during the Laramide orogeny, and by post-Miocene regional upwarping of the area. The two fault systems parallel each other 2 to 3 miles apart and extend northeastward about 70 miles. The Brule formation and the lower part of the Arikaree formation are upthrown against the upper part of the Arikaree along the northwest side of the Whalen fault system. Rocks of the upper part of the Arikaree formation are downdropped along the southeast side of the Wheatland fault system, and here they contact rocks of the Brule formation and the lower part of the Arikaree formation. The maximum displacement along the principal Whalen fault is about 300 feet and the minimum total throw from east to west across the system is estimated to be about 650 feet (McGrew, 1953, p. 40–45). Many fractures and fissures have been formed in the same general area. Many of these probably are open; however, some are filled, as is shown by the presence of clastic dikes in the area. In addition to the two main fault systems, several long lines of buttes of silicified sandstone (in sec. 31, 32, T. 30 N., R. 66 W.) west of Meadowdale suggest local faulting.

Age and correlation.—The Arikaree formation is considered to be Miocene in age. Generally, the deposits of Miocene age in Platte County constitute a fairly homogeneous mappable unit. However, detailed geologic and paleontologic dam work in western Nebraska and in the Grayrocks area, Platte County, has demonstrated that the Miocene deposits can be divided into smaller mappable units. The following tabulation of Miocene deposits in adjacent areas in western Nebraska was adapted from Lugn (1939, table 1):

	Feet
Unconformity.	
Hemingford group (250–400 ft. thick):	
Sheep Creek formation	140–300
Unconformity.	
Marsland formation (old "Upper Harrison")	125–200
Unconformity.	
Arikaree group (700–800 ft. thick):	
Harrison formation	200
Monroe Creek formation	375
Gering formation	100–200
Unconformity.	

McGrew (1953, p. 21) recognized and subdivided the Arikaree formation in the Grayrocks area; however, the scope of this report did not warrant subdividing the rocks of Miocene age. Except in the lower part of the formation, the materials are fairly homogeneous and probably have similar water-bearing properties. Of the above-mentioned formations, those of the Arikaree group and of the Marsland formation of the Hemingford group probably are present in Platte County. The complexities of the problem of subdividing the Miocene deposits is shown by the conflicting data presented by Schlaikjer (1935b, p. 111–120), Lugn (1939, p. 1251–1254, p. 1268–1269), and others. The basal conglomerate unit, which probably correlates with the Gering formation in Nebraska, disconformably overlies the Brule formation and forms a prominent escarpment along the east side of Chugwater Creek, along the west side of Goshen Hole, and along the lower part of North Bear Creek and the west side of U.S. Highway 87, 2 miles west of Cassa. Faulting in the vicinity of the Whalen and Wheatland fault zones also has exposed the basal unit. The unit is discontinuous; it varies in thickness from place to place, although it probably exists throughout most of the area. The unit is not readily mappable.

Water supply.—The Arikaree formation yields water to many domestic and stock wells in Platte County and to several municipal and industrial wells near Wheatland. Because of its relatively low permeability, a considerable saturated thickness of the formation normally must be penetrated to obtain moderate to large yields. For example, about 500 feet of saturated sandstone in the formation must be penetrated to obtain approximately 1,000 gpm from wells drilled in the vicinity of Wheatland. Large yields probably cannot be obtained from the formation at shallower depths unless open fractures are present. The formation in Platte County contains numerous fractures, but they are difficult to locate. The basal conglomerate is much coarser than the upper part of the formation; in places where the basal conglomerate contains a thick saturated section and where it is poorly cemented, it may yield large quantities of water to wells. However, the basal conglomerate is well cemented in most places, and it is doubtful that a much greater yield could be obtained from it than from the upper part of the formation.

PLIOCENE SERIES

CHANNEL DEPOSITS

The Pliocene deposits in Platte County are primarily complex channel deposits composed of loosely cemented sand, gravel, and pebbles. In places the channel deposits also contain boulders as much as 10 feet in diameter; their maximum thickness is 60 feet.

The deposits are exposed at a few places between Cottonwood and Horseshoe Creeks in the northwestern part of Platte County. There are some indications that these deposits once covered much of the county, but erosion has removed or obscured them so that only a few isolated remnants now cap a series of high hills.

Because the remnants that were examined overlie sandstone deposits of the Arikaree formation and because of their linear relationship to the Pliocene deposits, mapped by Rapp, Visher, and Littleton (1957) in adjacent Goshen County, the channel deposits also are believed to be Pliocene in age. However, adequate definition of the character and age of these deposits would require more detailed studies including paleontologic examination.

The Pliocene channel deposits in Platte County are very limited in areal extent, are topographically high, and are well drained; therefore, they are not a source of water for wells in the county.

TERTIARY(?) DEPOSITS (UNDIFFERENTIATED)

Character and thickness.—A variety of sedimentary rock types, which make up the Tertiary depositional record in Platte County, were discussed in the preceding section. In general, the age of the rocks was determined by means of fossils. However, adjacent to and on the east side of the Laramie Range a complex series of unfossiliferous sediments have been laid down which cannot be dated accurately. Consequently, they have been mapped as undifferentiated deposits and are not listed in table 1. These sediments consist primarily of gray to red loosely consolidated sand, gravel, and arkosic conglomerates containing particles of Precambrian rocks as much as 6 inches in diameter. The materials are interbedded or admixed with clayey sand or tuffaceous clay. The deposits generally consist of sand and gravel and range in thickness from 0 to about 200 feet. Some exposures near the mountains are predominantly conglomeratic. Beds of conglomerate as much as 300 feet thick are present west of Chugwater.

Distribution and surface form.—The deposits occur mainly in an irregular band adjacent to the east side of the Laramie Range in southwestern and west-central Platte County. They crop out principally between North Chugwater Creek and Cottonwood Creek, but outcrops of smaller areal extent lie outside these general limits. The band of undifferentiated deposits ranges in width from about 1 to 18 miles. The deposits were laid down as alluvial fans. As indicated by the form of the outcrops, the original fan deposits were deeply dissected by streams to form the series of parallel transverse ridges that now extend eastward from the Laramie Range.

Age and correlation.—Several studies of the geology of areas along both flanks of the Laramie Range in Laramie, Platte, and Albany Counties, contain maps that show undifferentiated nonfossiliferous deposits of sand, gravel, and conglomerate that are considered to be Tertiary in age. Lynn (1947, p. 28) described a conglomerate in the Richeau Hills area, in sec. 27, T. 22 N., R. 69 W., and named it the Sand Creek conglomerate. Because of its stratigraphic position, Lynn tentatively considered this conglomerate to be of Eocene age; however, he showed it on his geologic map as part of the Tertiary undifferentiated deposits. Tudor (1952, p. 36) tentatively identified as Tertiary a 96-foot section of very coarse conglomerate on the rim of an alluvial fan along the west-central flank of the Laramie Range. Because of their stratigraphic position, similar rocks in the Laramie Range have been considered by other investigators to be of Tertiary age. Jenkins (1938, p. 23) described a 303-foot section along the east side of the range as mainly arkosic conglomerate; he identified it as the Harrison or Arikaree formation of Miocene age.

The lithology and geologic age of the Tertiary(?) deposits (undifferentiated) of this report are probably similar to those of the rocks discussed in the preceding paragraph. However, because of the absence of fossils, the deposits are considered to be of unspecified Tertiary age for the purposes of this report.

Water supply.—The undifferentiated Tertiary(?) deposits in Platte County generally are topographically high, well drained, and of limited areal extent, and therefore they contain little or no water. In some places the lower part of the deposits are saturated and will yield small quantities of water to wells. Streams flowing eastward from the Laramie Range deeply dissected the deposits and left a series of relatively high, isolated parallel ridges, which are separated by valleys 100 to 200 feet deep. Springs emerge where some of the valleys are entrenched below the water table.

QUATERNARY SYSTEM

The Quaternary deposits in Platte County include terrace and flood-plain deposits, slope wash, dune sand, landslide material, and alluvial-fan deposits. As the slope wash, dune sand, landslide material, and alluvial-fan deposits are of very limited areal distribution and generally lie above the water table, the geology and water-bearing properties of only the terrace and flood-plain deposits are discussed in this report.

TERRACE DEPOSITS

Character and thickness.—The terrace deposits in Platte County are composed of subangular to rounded, unsorted, unconsolidated sand, gravel, cobbles, and boulders interbedded with lenses of clay and silt. The size of the material composing the terrace deposits varies with the location of the source rocks. Many of the finer rock fragments were transported from as far away as the Seminoe Mountains about 50 miles west of the Laramie Range. The coarser materials are derived primarily from igneous and metamorphic rocks of the Laramie Range. Some fragments of sandstone, siltstone, shale, and limestone are from local sources.

The oldest Quaternary deposits underlie the high-level surfaces along the Platte River, contain little locally derived material, are very coarse, and contain beds of boulders. These deposits are as much as 100 feet thick.

Younger deposits underlie the lower terraces along the Platte River and its tributaries, are finer than the older deposits, and range in thickness from about 5 to 50 feet. The thickness of the sand and gravel deposits underlying the third terrace along the Platte River and its tributaries ranges from 15 to 25 feet, whereas that underlying the lower terraces generally ranges from 5 to 15 feet.

Seven terraces have been mapped in the Wheatland Flats (pl. 2), where the thickness of the terrace deposits ranges from 5 to 85 feet and the average thickness is about 30 feet. The average thickness of the deposits underlying the 5 lower terraces ranges from 10 to 25 feet, whereas the average thickness of the deposits underlying the sixth and seventh terraces is about 50 and 40 feet, respectively. A summary of the pertinent data on the terrace deposits of the Wheatland Flats is given in table 3.

TABLE 3.—*Terrace deposits of Wheatland Flats*

Terrace	Approximate height above parent stream	Average thickness (feet)	Evaluation as source of irrigation water	Remarks
7	160	40	Good in N½ T. 23 N., R. 68 W.	Depth to water is more than 40 ft except in the approximate N½ T. 23 N., R. 68 W., where it is less.
6	140	50	Poor	Terrace is of small areal extent; depth to water generally is more than 40 ft.
5	120	25	Good	Depth to water under much of the terrace is less than 20 ft.
4	90	15	Fair to poor	Depth to water under much of the terrace is less than 10 ft.
3	70	25	Poor	Depth to water under most of the terrace is 20 ft or more.
2	40	20	do	Do.
1	25	10	do	Terrace is of very small areal extent.

Distribution and surface form.—A few isolated remnants of the high-level terraces are present in Platte County along the North Platte River just south and east of Glendo, and a larger remnant lies along the county line about 7 miles north of Glendo. These terraces overlie the high gently dipping limestone masses of the Hartville formation or the Tertiary rocks of the area; they probably were deposited before the Platte River cut its deep canyon through the Hartville formation.

The deposits underlying the lower terraces are related to the present erosional and depositional cycle of the North Platte River and its tributaries. The lower terraces range from 25 to 180 feet above present stream level and occur as relatively elongated remnants along the North Platte River just east of Guernsey and about 6 miles north and east of Glendo, along Fish Creek, along the North Laramie River, and along Chugwater Creek. The best developed terraces and the most continuous terrace deposits lie along the Laramie River near Wheatland. Seven distinct terraces have been formed near the confluence of the Laramie River and Sybille Creek. The terraces range from 25 to 160 feet above stream level. They form steps toward the south and east from the alluvial bottom lands of the Laramie River and Sybille Creek; in general they slope toward the north and west.

Water supply.—In Platte County terrace deposits constitute an important aquifer only in the Wheatland Flats because elsewhere they are of small areal extent or are well drained. Some of the terrace deposits under the Wheatland Flats are thick and extensive and receive sufficient recharge from surface-water sources and precipitation to be an important aquifer; they yield water to stock and domestic wells and also to many irrigation wells.

FLOOD-PLAIN DEPOSITS

Character and thickness.—The flood-plain deposits described and mapped in this report include those of the present flood plain and the lowest terrace because the boundary between the two is indistinct and because both are reported to be inundated during periods of extremely high floods.

The deposits that underlie the flood plains of the North Platte and Laramie Rivers and their major tributaries are principally fine to very coarse sand and gravel containing lenses and beds of fine sand, silt, and clay. The deposits also contain large chunks of limestone, sandstone, and siltstone, lenses of siltstone pebbles, and cobbles and boulders. Deposits underlying the flood plains of the smaller tributaries generally consists of sand and silt but contain both admixed clay and fine to very coarse sand and gravel.

The greatest thickness, 90 feet, of alluvium in the North Platte valley was reported in well 27–66–35bda at Guernsey. The thickness of alluvium in the valley decreases upstream; only about 65 feet of alluvium was reported in a well near the confluence of Horseshoe Creek and the North Platte River. The thickness of gravel and sand deposits underlying the valleys of Elkhorn, Horseshoe, Bear, and Cottonwood Creeks ranges from less than 15 feet in their upper reaches to as much as 50 feet in their lower reaches. The thickness of the alluvium along the Laramie River and its tributaries is probably less than 25 feet.

Distribution and surface form.—Alluvial flood-plain deposits underlie most of the stream valleys in Platte County, but they are shown on plate 1 only along the major valleys. The smaller streams have no well-developed flood plains and the alluvial deposits are narrow, thin, and discontinuous. The alluvial deposits along the North Platte River and its major tributaries are generally less than half a mile wide in Platte County; however, they are more than a mile wide in a few places along the river. The alluvial flood plain of the North Platte River is much narrower in most of Platte County than in adjacent counties. Little or no alluvium is present where the river has entrenched itself in rocks of the Hartville uplift.

Water supply.—The amount of ground water in the alluvium depends principally upon the areal extent and depth of the valley it occupies. The alluvium underlying the large valleys is thicker, coarser, and better sorted than is that under the small tributary valleys.

The alluvium under the larger valleys generally will yield adequate quantities of water for irrigation uses; the flood-plain deposits under most of the tributary valleys will yield water sufficient only for domestic and stock use.

The alluvium of the North Platte valley will yield moderate to large amounts of water in many places, and will yield large amounts of water near Guernsey. Small to moderate quantities of water can be obtained from the alluvium along the lower reaches of Elkhorn, Horseshoe, and Cottonwood Creeks, as well as from the alluvium underlying the valley of the Laramie River and the lower reaches of its major tributaries, Sybille and Chugwater Creeks and the North Laramie River.

GROUND WATER

PRINCIPLES OF OCCURRENCE

Because the fundamental principles governing the occurrence and movement of ground water have been set forth in detail by Meinzer and by many others, only a brief discussion of the subject will be made in this report; the reader is referred to Meinzer (1923a) for a more detailed discussion.

Ground water in Platte County is derived chiefly from the infiltration of precipitation that falls as rain or snow. However, in the irrigated areas along the stream valleys and in the Wheatland Flats, ground-water recharge is derived from precipitation and from irrigation water, the latter contributing the larger part. Of the water that falls on the land as precipitation or is applied for irrigation, a part runs off directly into streams, a part evaporates, a part is consumed by vegetation, and a part percolates through pore spaces in the soil and underlying rocks to the zone of saturation—the zone in which the rocks are saturated with water under hydrostatic pressure. Some of the water in the zone of saturation eventually returns to the land surface through seeps and springs or is discharged by wells and evapotranspiration. A large part of it, however, percolates into surface streams.

The porous rocks below the water table are saturated and will yield water to wells if the rocks are sufficiently permeable. In the more permeable rocks, such as the deposits of unconsolidated sand and gravel that underlie the stream flood plains and terraces, the individual pores are interconnected and are large enough so that water moves freely through them under the force of gravity. In less permeable rocks, such as the claystone, siltstone, and fine sandstone of some of the bedrock formations, the pores are so small that water moves through them but slowly. Where a saturated water-bearing rock is overlain by relatively impermeable rock the water is confined under artesian pressure and a piezometric (pressure-head-indicating) surface exists instead of a water table. In some areas a relatively impervious bed above the main water table, may hinder the downward percolation of water to such an extent that an upper zone of saturation, known as a perched water body, is formed. Generally, water in the rocks of Tertiary and Quaternary age is under water-table conditions. Water in sandstone beds in older rocks generally is under artesian conditions.

The water table is defined as the top of the zone of saturation. It is the surface at which the pressure is atmospheric and below which the pressure is greater than atmospheric; that is, hydrostatic pressure exists. Above the water table the pressure is less than atmospheric, and water is held up by capillary force, forming what is known as the capillary fringe. In the lower part of the capillary fringe the interstices may be full of water, but this is not a part of the zone of saturation as defined.

The water table is not a plane surface but has irregularities comparable with and related to those of the land surface, although it is much less uneven. It does not remain stationary but fluctuates up and down. Its differences in altitude from place to place are caused chiefly by local differences in gain or loss of water, and the fluctuations are caused by variations from time to time in gain or loss of water.

The piezometric surface is an imaginary surface that everywhere coincides with the static level of the water in the aquifer; therefore, it is the level to which the water from a given aquifer will rise under its full head. If the piezometric surface is above the land surface, water will flow from wells that penetrate the aquifer. The piezometric surface, like the water table, has irregularities; it fluctuates in response to the same forces that affect the water table.

HYDROLOGIC PROPERTIES OF THE PRINCIPAL WATER-BEARING FORMATIONS

The rate at which a rock formation will yield water to wells and the ability of the formation to transmit water depends upon the physical and hydrologic properties of its constituent materials. Detailed geologic descriptions of materials that are penetrated in drilling, such as those included in the well and test-hole logs tabulated at the end of this report, are useful in appraising the hydrologic properties of the rock formations; however, more accurate quantitative estimates require comprehensive analyses of the materials by laboratory and field tests.

The gross rate of ground-water movement is determined primarily by the quantity, size, shape, and degree of interconnection of the

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interstices in the formation, and by the hydraulic gradient. That property of a rock relating to transmission of water under a hydraulic gradient is termed permeability. The coefficient of permeability (in meinzers) may be defined as the rate of flow of water, in gallons per day, through a cross-sectional area of 1 square foot under a hydraulic gradient of 100 percent at a temperature of 60° F. A coefficient of permeability may be expressed as, say, 500 gpd per square foot, or as 500 meinzers. The field coefficient of permeability may be expressed as the number of gallons of water per day that percolates under prevailing conditions through each mile of water-bearing bed under investigation (measured at right angles to the direction of flow) for each foot of thickness of the bed and for each foot per mile of hydraulic gradient (Wenzel, 1942, p. 114). Thus, the principal difference between the two definitions is that the field coefficient is not corrected for temperature. In ground-water work, the coefficient is usually expressed in gallons per day per square foot.

The coefficient of transmissibility may be defined as the number of gallons of water per day, under prevailing conditions, that is transmitted through a mile-wide strip of the aquifer (having a height equal to its saturated thickness), under a hydraulic gradient of 1 foot per mile. It is the product of the average field coefficient of permeability and the saturated thickness of the aquifer in feet. The coefficient of transmissibility is expressed in gallons per day per foot.

The coefficient of storage of an aquifer is the volume of water it releases from or takes into storage per unit surface area of the aquifer per unit change in the component of head normal to that surface. Under water-table conditions, this quantity is approximately equal to the specific yield, which expresses the quantity of water that a given saturated volume of the aquifer will yield by gravity drainage. The specific yield is the ratio, expressed in percent, of the volume of this water to the total volume of the material that is drained.

A simple way of visualizing the concept of the coefficient of storage is to imagine an artesian aquifer which is uniform in thickness and which is assumed, for convenience, to be horizontal. If the head of water in that aquifer is decreased there will be released from storage some finite volume of water that is proportional to the change in head. Because the aquifer is horizontal, the full observed head change is effective perpendicular to the aquifer surface. Imagine further a representative prism extending vertically from the top to the bottom of this aquifer and extending laterally so that its cross-sectional area is coextensive with the aquifer-surface area over which the head change occurs. The volume of water released from storage in the prism, divided by the product of the prism's cross-sectional area and the change in head, results in a dimensionless number which is the coefficient of storage. If this example were revised slightly, it could be used to demonstrate the same concept of coefficient of storage for a horizontal water-table aquifer or for a situation in which the head of water in the aquifer is increased.

Aquifer tests were made at 14 well sites to determine the hydrologic properties of the principal water-bearing formations in the county. Tests were made on 1 well that penetrates the "Converse sand" of the Hartville formation, on 2 wells that penetrate the Brule formation, on 5 wells that penetrate the Arikaree formation, on 3 wells that penetrate the terrace deposits underlying the Wheatland Flats, and on 3 wells in the flood-plain deposits of the North Platte River and its tributaries. The results of these tests are shown in table 4 and are discussed in the following pages.

These tests of the "Converse sand" of the Hartville formation were made during an earlier investigation of part of Platte County, and the following discussion of the "Converse sand" is adapted largely from Rapp and Babcock (1953, p. 12). As these tests afforded an opportunity to utilize several methods to compute the coefficients, the methods are described in detail. The tests on the other formations employed one or more of the methods used in testing the "Converse sand."

"CONVERSE SAND" OF THE HARTVILLE FORMATION

The coefficients of transmissibility and storage of the "Converse sand" were determined at one locality by tests made on well 29–68–20abd, a flowing artesian well about 2 miles south of the town of Glendo. The coefficients of transmissibility and storage were determined by the constant drawdown-variable discharge method devised by Jacob and Lohman (1952), and by the constant discharge-variable drawdown method developed by Theis (1935). At the completion of each of these tests the coefficient of transmissibility also was determined by the Theis (1935) recovery method. The average value of the coefficient of transmissibility obtained by the 3 tests was 10,000 gpd per foot. In analyzing the two discharge tests the value of the coefficient of storage obtained by the Jacob-Lohman method was 3.1×10^{-7}, and the value obtained by the Theis method was 2.0×10^{-4}. The smaller value was considered unreliable because there was some doubt as to the diameter of the well through the aquifer and hence of the effective radius of the well; therefore, the larger value was used in subsequent computations of theoretical drawdown (fig. 10).

WELL METHODS

CONSTANT DRAWDOWN WITH VARIABLE DISCHARGE

Coefficients of transmissibility and storage may be determined by analyzing observed changes in rate of discharge of a flowing well from an aquifer that is extensive, homogeneous, and isotropic and of

TABLE 4.—*Results of aquifer tests at wells in Platte County, Wyo.*

Test data	"Converse sand" of the Hartville formation	Brule formation		Arikaree formation				
Well number	29-68-20abd	20-65-8abb	22-67-21aaa	24-66-20cbc	22-66-12ddd	24-68-12dbc	26-65-17bdd	30-66-24daa
Date of test	9-21-49	7-19-55	7-18-55	7-12-55	7-12-55	11-21-55	7-15-55	7-8-55
Duration of pumping ... hours	24	3	3	1	5	46	1.5	5
Well discharge ... gallons per minute	78	2.5	3.9	2.0	1.4	600	6.2	2.2
Drawdown at discharging well ... feet	30	3.6	5.0	.33	4.6	81.7	38	10.8
Specific capacity of discharging well gallons per minute per foot drawdown	2.6	.7	.8	6.0	.3	7.3	.2	.2
Saturated thickness of aquifer ... feet	120	30	25	40	85	486	45	37
Coefficient of transmissibility ... gallons per day per foot	[1] 10,000	480	900	15,000	110	[1] 9,400	140	61
Average field coefficient of permeability gallons per day per square foot	[1] 86	16	36	375	1.3	[1] 19	3.1	1.6
Storage coefficient of aquifer	.0002					.00075		

Test data	Terrace deposits			Flood-plain deposits		
				North Platte River	Bear Creek	Horseshoe Creek
Well number	24-68-16cdd	24-68-18acc	25-67-31ccc2	30-68-18aac	28-68-27abc	29-68-21bcc
Date of test	3-12-54	7-19-53	7-20-55	7-19-55	7-6-55	7-20-55
Duration of pumping ... hours	24	6	3	240	1	3
Well discharge ... gallons per minute	460	270	250	430	66	770
Drawdown at discharging well ... feet	14.5	9.1	5.2	17.5	5.3	5.3
Specific capacity of discharging well ... gallons per minute per foot drawdown	32	30	48	25	12.0	145
Saturated thickness of aquifer ... feet	25.0	33.0	23	30	6	25
Coefficient of transmissibility ... gallons per day per foot	67,000	87,000	120,000	90,000	6,500	240,000
Average field coefficient of permeability ... gallons per day per sqaure foot	2,700	2,600	5,100	3,000	1,100	9,600

[1] Average value.

uniform thickness. The formulas used in computing the values of transmissibility and storage are based on the assumption that the drawdown remains virtually constant during the test. The value determined for the storage coefficient will be accurate only to the extent that the assumed effective well radius is accurate. Precise measurements of the depth and diameter of a well are not always available. Moreover, even assuming that precise measurements are available, any caving of the walls of the uncased producing parts of the wells could mean that the true effective radius would be substantially different from the measured value.

The coefficient of transmissibility (T), in gallons per day per foot, and the coefficient of storage (S) are expressed by the formulae

$$T=\frac{229Q}{s_w[G(\alpha)]}$$

and

$$S=\frac{9.28\times10^{-5}Tt}{r_w^2\alpha}$$

where

Q = well discharge, in gallons per minute;
s_w = drawdown in the discharging well, in feet;
t = time, in minutes, since the well discharge began;
r_w = effective radius of the discharging well, in feet;
$G(\alpha)$ = well function of α, for the constant-drawdown situation.

The foregoing equations can be written also as

$$G(\alpha)=\frac{229}{s_wT}Q$$

$$\alpha=\frac{9.28\times10^{-5}T}{r_w^2S}t$$

The bracketed part of the equation above is the constant value for a given pumping test. Therefore, $G(\alpha)$ is related to α as Q is related to t, and a graphical solution is suggested wherein the curve obtained by plotting values of the discharge (Q) against values of time (t), on logarithmic tracing paper, is matched against a type curve obtained by plotting of values of $G(\alpha)$ against values of α. Values of α and $G(\alpha)$ needed for plotting the described type curve are given by Jacob and Lohman (1952, p. 561). In superposing the graph of the observed data on the type curve the coordinate axes of the two curves are alined and a position for which most of the plotted points fall on the type curve is found by trial. An arbitrary match point is chosen and its t and Q coordinates are obtained from the data plot, and the corresponding α and $G(\alpha)$ coordinates are obtained from the type curve. Appropriate substitution of these coordinate values in the cited formulas permits the straightforward computation of T and S values.

Preparatory to a discharge test on well 29–68–20abd, the static artesian head was measured with an ink-well mercury gage devised by Lohman (Jacob and Lohman, 1952) after the flow of the well had been stopped for several days. The valve then was opened and the

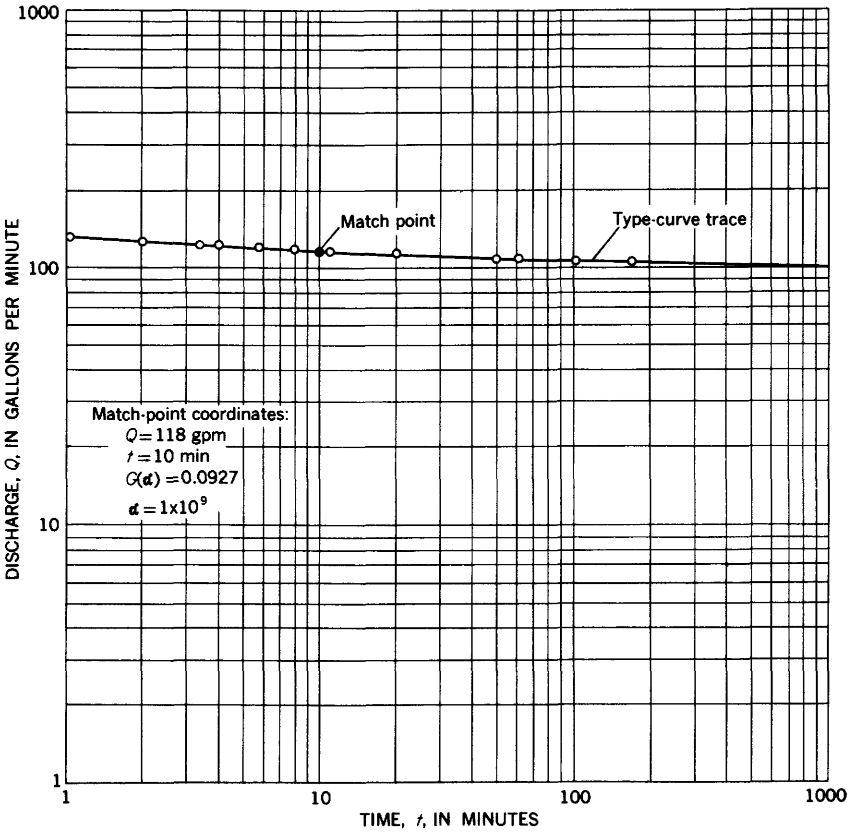

FIGURE 6.—Logarithmic graph of discharge-time relationship for well 29–68–20abd.

well allowed to discharge freely. The discharge was measured at gradually increasing intervals of time, ranging from 1 minute at the beginning to 30 minutes at the end of a 3-hour test period. The artesian head in the well also was measured at intervals during the test and at the end of the test before the well again was shut in. These data were used to develop the required logarithmic data plot (fig. 6) from which, after it was matched against the type curve, the values of T and S were computed as follows:

$$T=\frac{229\times118}{31.74\times0.0927}=9{,}200 \text{ gpd per ft}$$

$$S=\frac{9.28\times10^{-5}\times9{,}200\times10}{(0.167)^2\times1\times10^9}=3\times10^{-7}$$

The values of T and S were computed also by means of the straight-line graphic method described by Jacob and Lohman (1952, p. 566). Values of T and S computed by this method (8,800 and 3.5×10^{-7}, respectively) compare well with the values computed using the type curve plot.

CONSTANT DISCHARGE WITH VARIABLE DRAWDOWN

The Theis (1935, p. 520) nonequilibrium formula is based on the assumption that Darcy's law explaining the flow of water through a water-bearing material is analogous to the law of the flow of heat by conduction. It is assumed also, that the water-bearing formation is homogeneous, isotropic, and of infinite areal extent, the coefficient of transmissibility is constant at all places and all times, the water taken from storage is discharged instantaneously with decline in head, and the discharging well is of infinitesimal diameter. The following equation expresses the drawdown of the water level in the vicinity of a discharging well:

$$s=\frac{114.6Q}{T}\int_{\frac{1.87r^2S}{Tt}}^{\infty}\frac{e^{-u}}{u}\,du$$

in which

$$u=\frac{1.87r^2S}{Tt};$$

s =drawdown, in feet, at any point in the vicinity of a well discharging at a uniform rate;
Q=discharge, in gallons per minute;
T=coefficient of transmissibility, in gallons per day per foot;
r =distance, in feet, from discharging well to point of observation;
S=coefficient of storage, as a decimal fraction;
t =time, in days, that well has been discharging.

The exponential integral of the preceding equation may be replaced by the term "$W(u)$" and the equation may be rewritten as follows:

$$s=\frac{114.6Q}{T}W(u)$$

The values of $W(u)$ for corresponding values of u between 9.9 and 10^{-15} are given by Wenzel (1942, p. 88–89). The Theis equation shows that, if the rate of drawdown at a given distance from the well

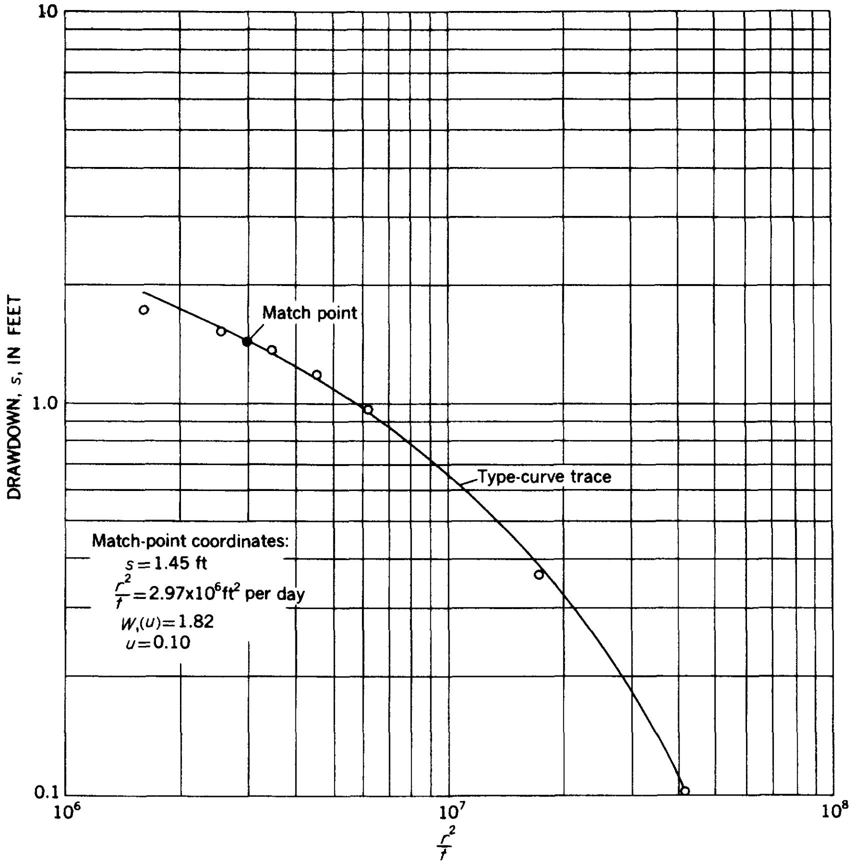

FIGURE 7.—Logarithmic graph of drawdown of water level in well 29-68-20abb, 1,073 feet from the flowing well.

under test is known, the coefficients of storage and transmissibility can be determined.

Again, a graphic method of superposition is suggested for solving the above equations. These equations can be written:

$$s=\left[\frac{114.6Q}{T}\right]W(u)$$

and

$$\frac{r^2}{t}=\left[\frac{T}{1.87S}\right]u$$

The bracketed terms are evidently constant for a given discharging-well test. Thus, s is related to $\frac{r^2}{t}$ as $W(u)$ is related to u. By plotting values of the drawdown (s) against values of $\frac{r^2}{t}$ on logarithmic tracing paper a curve is developed that is similar to the type curve obtained by plotting, on logarithmic paper of the same scale, values of $W(u)$ against values of u. The curve of the observed data is superposed on the type curve, the two sets of coordinate axes being kept parallel, and an arbitrary match point is chosen for which the coordinates $\frac{r^2}{t}$, s and u, $W(u)$ are obtained. Appropriate substitution of these coordinates and of the other known data in the Theis equation permits computation of T and S values.

After completion of the test described in the preceding section, the artesian head in well 29–68–20abd was allowed to recover until it had reached approximately its original static position. The static artesian head was then determined for this well and also for well 29–68–20abb, 1,073 feet northwest of the test well. The valve was opened on the test well and the discharge was held at a relatively constant rate of 78 gpm for 24 hours. The changes in artesian head were observed in well 29–68–20abb during the 24-hour discharge period. The data obtained from this test are shown in figure 7 and the coefficients of transmissibility and storage are computed as follows:

$$T=\frac{114.6\times78\times1.82}{1.45}=11{,}000 \text{ gpd per ft}$$

$$S=\frac{0.10\times11{,}200}{1.87\times2.97\times10^6}=2\times10^{-4}$$

RECOVERY FORMULA

From his nonequilibrium formula, which expresses the relation between the drawdown and the rate and duration of discharge from a well, Theis (1935, p. 522) developed the following recovery formula:

$$T=\frac{264Q}{s'}\log_{10}\frac{t}{t'}$$

in which

T = coefficient of transmissibility, in gallons per day per foot;
Q = discharge, in gallons per minute;
t = time since discharge began;
t' = time since discharge stopped;
s' = residual drawdown of the well, in feet, at time t'.

A semilogarithmic graph is prepared by plotting values of residual drawdown s' on the linear scale versus the corresponding values of the ratio $\frac{t}{t'}$ on the logarithmic scale. If the assumptions made in developing the formula are reasonably satisfied in the test conditions, a straight line may be drawn through the plotted points. The value

Δs for one log cycle of $\frac{t}{t'}$ (for which the change in the value of $\log_{10}\frac{t}{t'}$ is unity) is determined and T is computed from the simplified formula

$$T=\frac{264Q}{\Delta s'}$$

After shutdown of the discharging well in each of the two previouly described tests the inkwell mercury gage was used in measuring the recovery of the artesian head. Data for the recovery period after the constant-discharge test are shown in figure 8.

The value of T computed by the recovery method was 12,000 gpd per foot for the period after the constant-drawdown test and 9,000 gpd per foot for the period after the constant-discharge test.

BRULE FORMATION

Aquifer tests were made at two wells that penetrate the Brule formation. During each test a well was pumped at a constant rate for 3 hours and then shut off. The rate of recovery of the water level in the well was measured and the transmissibility of the formation was computed by the recovery method. The coefficients of transmissibility computed for the 2 tests were 480 and 900 gpd per foot, and the average coefficients of permeability were 16 and 36 gpd per square foot, respectively (table 4). These values are higher than the values obtained by laboratory tests of samples collected from the formation in Goshen County to the east.

Three samples of the formation from Goshen County (Rapp and others, 1957) were tested in the U.S. Geological Survey's hydrologic laboratory; the coefficients of permeability ranged from values too low to be measured accurately to 0.2 gpd per square foot. There is no apparent difference in the character and composition of the formation in Platte and Goshen Counties, and the higher permeability shown by the aquifer test must be due to the presence of the fractures and fissures in the formation. These openings greatly increase the permeability of the formation, the amount of increase depending on the number, size, and interconnection of the openings. Wells of large discharge have been developed in fracture zones of the Brule formation in areas adjacent to Platte County.

ARIKAREE FORMATION

Aquifer tests were made at five wells penetrating the Arikaree formation and the transmissibility was computed by the Theis recovery formula. For the test on well 24–68–12dbc the Theis nonequilibrium formula also was used, and the coefficients of transmissibility and storage were computed. The computed coefficients of

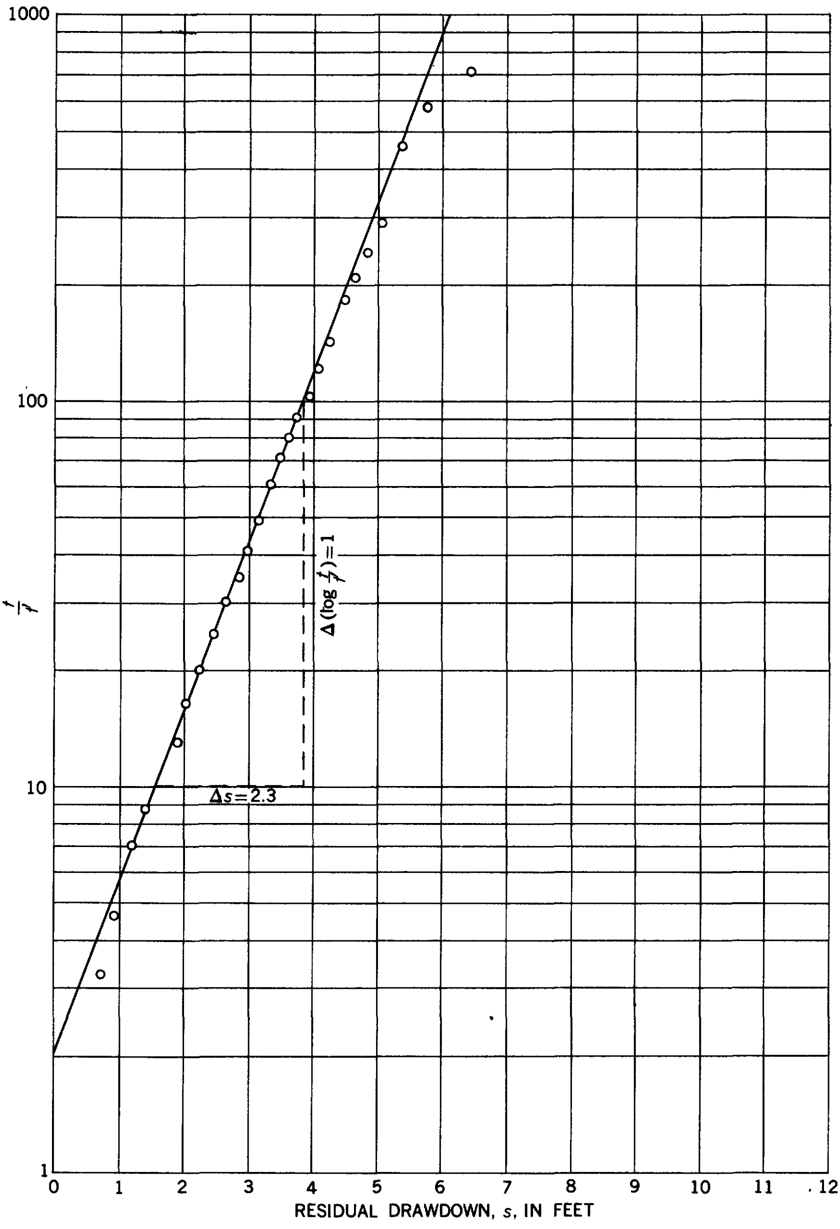

FIGURE 8.—Graph of recovery of water level in well 29–68–20abd after the well had flowed 24 hours at rate of 78 gpm.

transmissibility ranged from 61 to 15,000 gpd per foot, and the average coefficients of permeability ranged from 1.3 to 375 gpd per square foot. Well 24–66–20cbc, which had the highest values of transmissibility and permeability of the five wells in the Arikaree formation, is a relatively shallow well drilled into a faulted and consequently more permeable zone in the formation.

Well 24–68–20dbc, which penetrates a rather thick section of the formation including 486 feet of saturated material, was pumped at a rate of 600 gpm for 24 hours. This rate and pumping period afforded a much better opportunity to obtain reliable test data than was possible during the other four tests, when the wells were pumped at relatively small rates and for only short periods of time. Therefore, the test on this well is considered the most reliable of the five tests. The computed coefficients of transmissibility and storage were 9,400 gpd per foot and 7.5×10^{-4} respectively.

TERRACE AND FLOOD-PLAIN DEPOSITS

Three recovery tests were made to determine the coefficient of transmissibility of the terrace deposits underlying the Wheatland Flats. The coefficient of transmissibility ranged from 67,000 to 120,000 gpd per foot, and the coefficient of permeability ranged from 2,600 to 5,100 and averaged 3,500 gpd per square foot.

Recovery tests were made also to determine the transmissibility of the flood-plain deposits underlying the valleys of the North Platte River, Bear Creek, and Horseshoe Creek. The coefficient of transmissibility ranged from 6,500 gpd per foot for the alluvium of Bear Creek to 240,000 gpd per foot for the alluvium of Horseshoe Creek, and the coefficient of permeability ranged from 1,100 to 9,600 gpd per square foot.

INTERFERENCE BETWEEN WELLS

As soon as a pump begins discharging water from a well under water-table conditions, the water table in the vicinity of the well is lowered, and a hydraulic gradient toward the well is established. The water table assumes a form, called the cone of depression, that is comparable to that of an inverted cone, the well occupying the axis of the cone. At the beginning, most of the water pumped from the well is obtained by dewatering materials near the well. As pumping is continued, the material farther from the well is gradually dewatered; a hydraulic gradient is established that allows approximately the amount of water that is being pumped to be transmitted to the well; and the water is derived from ever-increasing distances from the well. Thus, the cone of depression continues to expand, and the water table within the cone continues to decline gradually. This continuous development may be altered if the expanding cone encounters less permeable rocks that form barriers to the movement of water, or if some of the natural discharge is intercepted.

After the pumping of a well is stopped, water continues to percolate toward the well because the hydraulic gradient is still in that direction, and gradually fills the well and the adjacent material that was dewatered by pumping. As the material near the well is refilled, the hydraulic gradient decreases, and the recovery of the water level in the well becomes progressively slower. A general equalization of water levels eventually takes place over the affected area, and the water table tends to assume its original form, although it may remain temporarily or permanently lower than before water was withdrawn, according to the amount and rate of recharge.

If wells having high rates of discharge are closely spaced, the cones of depression may overlap (interfere) sufficiently to cause a substantial increase in the pumping lift. The amount of interference depends upon the distance between wells, the rate and duration of pumping of the wells, and hydrologic properties of the aquifer.

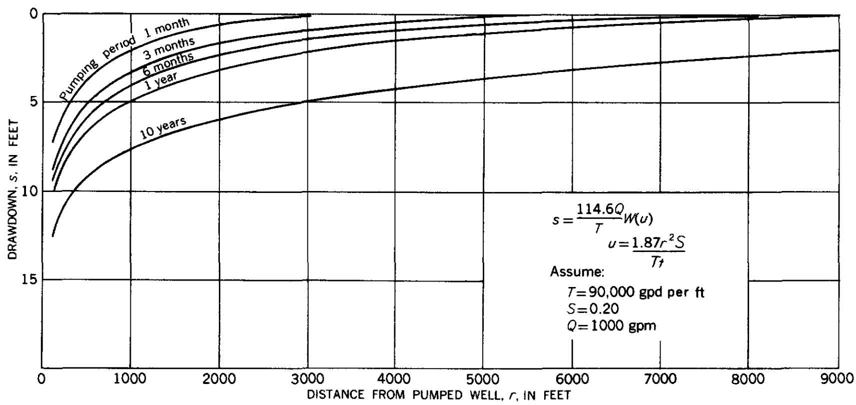

FIGURE 9.—Theoretical profiles of cone of depression for pumped well tapping terrace deposits.

In the terrace deposits underlying the Wheatland Flats, the theoretical shape and extent of the cone of depression, for selected pumping periods, around a well that is being pumped at a rate of 1,000 gpm are shown in figure 9. The theoretical drawdown curves were computed by using the relationships and assumed values indicated in figure 9 and by referring to the table of $W(u)$ values given by Wenzel (1942, p. 88–89).

A value of 90,000 gdp per foot for the coefficient of transmissibility agrees with the average of the 3 values obtained from the aquifer tests; the value of 0.20 for the storage coefficient is considered a reasonable estimate for the terrace deposits. The average coefficient of transmissibility determined by the aquifer tests, although probably representative, is not necessarily indicative of the value throughout the entire Wheatland Flats, as it varies with differences in composition and thickness of the aquifer. However, the computed theoretical

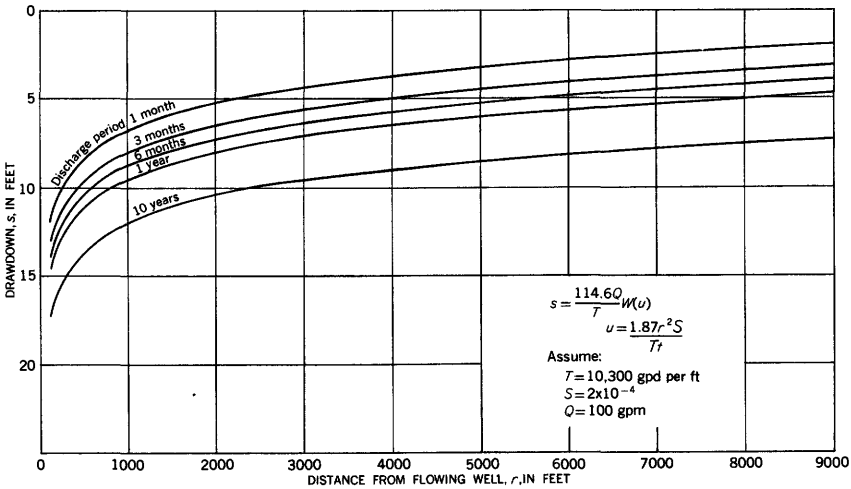

FIGURE 10.—Theoretical profiles of cone of depression for flowing well tapping the "Converse sand" of Hartville formation.

drawdown curves (fig. 9) are believed to show the right order of magnitude for the lowering of the water level that would occur near a well tapping the terrace deposits and discharging at a steady rate of 1,000 gpm. As the drawdown is directly proportional to the rate of discharge, the theoretical drawdown for various rates of discharge also can be determined from the curve. For example, a well pumping at a rate of 500 gpm would cause half the drawndown shown on the curve for a well pumping 1,000 gpm.

The theoretical shape and extent of the cone of depression around an artesian well tapping the "Converse sand" of the Hartsville formation that has been allowed to flow at the steady rate of 100 gpm for selected periods of time are shown on figure 10. When an artesian well is pumped or allowed to flow, the cone of depression developed in the piezometric surface expands much more rapidly than it does under water-table conditions. For example: the theoretical decline, postulated in figure 10, of the water level 9,000 feet from the artesian well would be approximately 2 feet after the well had been flowing for 1 month at a rate of 100 gpm; whereas under water-table conditions, with a much higher transmissibility and storage coefficient, the theoretical drawdown at a distance of 9,000 feet, while the well is discharging at the rate of 1,000 gpm, would be only a few hundredths of a foot, too small to measure with ordinary equipment.

SPECIFIC CAPACITY OF WELLS

The capacity of a well, or yield per unit of drawdown, is generally expressed as the number of gallons per minute that a well will yield for each foot the water in the well is drawn down. This relationship has been found experimentally to be approximately constant for only the first few feet of drawdown; it also varies from well to well because of differences in the construction and development of individual wells, and obviously it varies with time in the same well as the water level continues to draw down. A comparison of the specific capacities of wells is useful, however, to estimate the relative efficiency of the wells and the permeabilities of the aquifers. The discharge, drawdown, and specific capacity of wells in the principal water-bearing formations in Platte County are given in table 5.

Wells in the flood-plain and terrace deposits have the highest specific capacities of those tested. Data for 12 wells in the sand and gravel of the flood-plain deposits indicate specific capacities of 2.5 to 170 gpm per foot of drawdown. The 3 wells in T. 20 N., R. 67 W., and the 2 wells in T. 20 N., R. 68 W., are test wells drilled in the valley of Chugwater Creek. These wells were small in diameter and were pumped only to determine the feasibility of drilling irrigation wells in the area. Their casings were inadequately perforated and the wells were inadequately developed to obtain their maximum yield; consequently, the drawdown of the water level in the wells was great as compared to the amount of water produced. If these test wells had been better constructed and developed, their specific capacities undoubtedly would have been much greater. Thus, a more realistic estimate of the specific capacities that may be expected of wells in the flood-plain deposits is obtained from the other 7 wells. The specific capacities of these 7 wells range from 12 to 170 gpm per foot of drawdown and average about 80 gpm per foot of drawdown.

The specific capacities of 10 wells in the terrace deposits range from 7.2 to 150 and average about 40 gpm per foot of drawdown. All these wells penetrate the entire thickness of the terrace deposits; the difference in specific capacities is due to the difference in well construction and development and to the variation in the saturated thickness of the material.

Data for 11 wells in the Arikaree formation indicate specific capacities of 0.2 to 9.4 gpm per foot of drawdown. Wells 24–68–12dbb2, 12dbc, and 12dcb penetrate most of the saturated thickness of the formation. The specific capacities of these wells (5.6, 7.3, and 5.7 gpm per foot of drawdown, respectively) probably are the most indicative of the values that would be obtained from other deep wells drilled in the Wheatland Flats areas. Well 23–68–14ada, which has the highest specific capacity (9.4) of the 11 wells in the Arikaree formation, is a shallow well which apparently encountered either an unusually permeable bed of sandstone or fractures in the formation.

At the end of 30-minute flow periods the specific capacities of the two wells tested in the "Converse sand" were 3.1 gpm per foot of

TABLE 5.—*Discharge and specific capacity of wells tapping selected water-bearing formations in Platte County, Wyo.*

Well	Saturated thickness of material penetrated (feet)	Discharge (gallons per minute)	Drawdown (feet) after number of hours shown in parentheses	Specific capacity (gallons per minute per foot of drawdown)
"Converse sand" of the Hartville formation				
29-68-20abb	120	126	33(0.5)	4.8
-20abd	120	78	30(24)	2.6
Brule formation				
20-65-8abb	30	2.5	3.6(3)	0.7
22-67-21aaa	25	3.9	5.0(3)	.8
29-58-9bcd2	53	[1] 10	55	.2
Arikaree formation				
20-65-8abb	30	2.5	3.6	0.7
23-68-14ada	24	170	18	9.4
24-66-20cbc	40	2.0	.33(1)	6.0
-22ddd	85	1.4	4.6(5)	.3
24-67-4acc	23	90	21.7	4.1
24-68-12dbb1	270	[1] 220	100	2.2
-12dbb2	441	[1] 560	100	5.6
-12dbc	486	600	81.7(46)	7.3
-12dcb	497	1,030	180	5.7
26-65-17bdd	45	6.2	38(1.5)	.2
30-66-24daa	37	2.2	10.8(5)	.2
Arikaree formation and terrace deposits				
24-68-9ccc1	40	190	13.0	15
-21bdb	47	430	20.1	21
Terrace deposits				
23-68-1ccd	24	540	11.6	47
24-68-3bcb	19	130	18.1	7.2
-3bcc	16	200	10.7	19
-4cbc	14	230	18.0	13
-15acb	11	320	11.3	28
-16cdd	25	460	14.5(24)	32
-18acc	33	270	9.1(6)	30
-18acd	17	380	2.5(4)	150
25-67-31ccc2	23	250	5.2(3)	48
25-68-36ccc	11	160	14.7(1)	11
Flood-plain deposits				
20-67-3cbb	22	[1] 100	17	5.9
-9ccc	21	[1] 90	7.5	12
-19bbb	23	[1] 50	15	3.3
20-68-25bbb	26	[1] 40	16	2.5
-34baa	26	[1] 50	10	5.0
26-65-9acc	39	1,050	6.3(0.6)	170
27-66-35bda	47	330	6.0	55
-35dbd	43	[1] 500	7.0	71
28-68-27abc	6	66	5.3(1)	12
29-68-21bcc	25	770	5.3(3)	140
30-68-17cbb	28	940	12.2(0.5)	77
-18aac	30	430	17.5(240)	25

[1] Reported or estimated.

drawdown for well 29–68–20abd and 4.8 gpm per foot of drawdown for well 29–68–20abb. The specific capacity for well 29–68–20abd was 2.6 gpm per foot of drawdown after the well had been flowing for 24 hours.

The lowest specific-capacity determinations were for wells in the Brule formation. Of the 3 wells tested the highest specific capacity was only 0.8 gpm per foot of drawdown.

SHAPE AND SLOPE OF WATER TABLE

The configuration of the water table generally reflects, in a subdued manner, the configuration of the overlying land surface. The shape and slope of the water table and the rate and direction of ground-water movement are influenced by a number of factors, among which are: (a) configuration of the bedrock floor; (b) local differences in the thickness and permeability of the aquifer; (c) recharge of the ground-water reservoir by streams, and by irrigation water applied to the land; (d) unequal additions of water to the ground-water reservoir; (e) discharge of ground water into streams; and (f) discharge of water from wells, springs, or seeps. Ground water moves in the general direction indicated by the slope of the water table, and the gross rate of movement, assuming a uniform cross section, is proportional to the hydraulic gradient and to the permeability of the water-bearing material. The water table may be mapped and its configuration shown by contours, each one of which joins all points of a given altitude. As revealed on a water-table map the general directions of ground-water movement are at right angles to the contour lines.

In Platte County, the water in the Tertiary and Quaternary deposits generally is unconfined, and the statements on the following pages concerning the water table apply primarily to the water in those deposits.

Contour lines representing the position of the water table under most of the area in Platte County underlain by Tertiary or Quaternary rocks are shown by plate 1. The water-table contours in the Wheatland Flats area are based on measurements made during the summer of 1954. Water-level measurements used in constructing the contours in the rest of the county were made during the period 1952–55. As there was no appreciable change in the water levels in the county (except in the Wheatland Flats) during this period, it was not necessary to adjust these measurements to conform with the measurements made in the flats. The shape of the contour lines in the eastern part of the county is in part controlled by water-level measurements made in wells in Goshen County during previous studies. Ground water in the county generally moves in an easterly direction. The North Platte and Laramie Rivers, and their main tributaries, have cut their valleys to a level below that of the water table in the

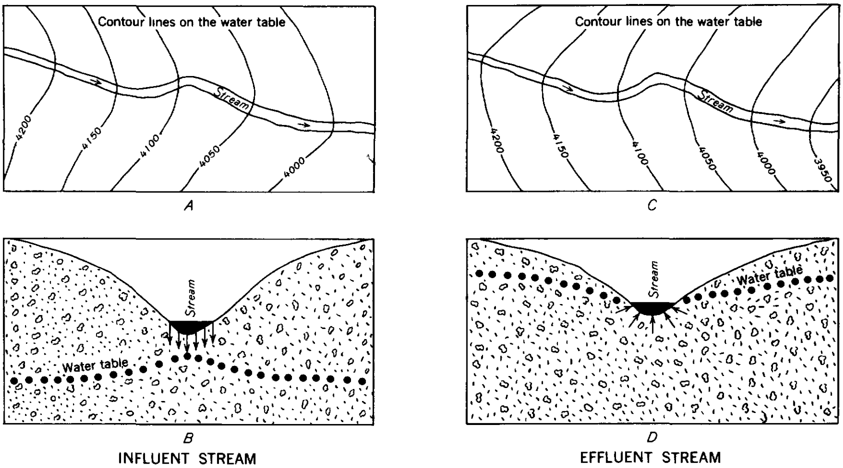

FIGURE 11.—Diagrams showing relation of a stream to the water table.

adjacent upland areas, causing the water table near the streams to slope toward them. Most of the small tributary streams in the county, however, lie above and lose water to the water table. The diagram in figure 11 shows the relations, with respect to recharge and discharge of ground water, between the water table and stream channels for both a gaining (effluent) stream and a losing (influent) stream.

The slope of the water table varies with the permeability and thickness of the water-bearing materials and the amount of water being transmitted; thus, the slope required to cause movement of a given amount of water through a given cross-sectional area differs from one formation to another. Although a relatively large amount of water is transmitted through the unconsolidated Quaternary terrace deposits underlying the Wheatland Flats, the deposits are so permeable that the water table is relatively flat. The slope of the water table in the less permeable Tertiary deposits generally is much greater. The water table is continuous throughout the Quaternary and Tertiary deposits, but its slope is greater in the Brule and Chadron formations than in the thicker and more permeable Arikaree formation. In some parts of the County the slope of the water table in the Arikaree formation is less than in the terrace deposits. The lesser slope of the water table in these areas indicates not that the Arikaree formation is more permeable than the terrace deposits, but that a much smaller quantity of water is moving through the Arikaree formation.

A detailed water-table contour map was prepared to show the slope and direction of movement of the ground water under the Wheatland Flats during the summer of 1954 (pl. 3). Here, the water level in deep wells penetrating the Arikaree formation stands at the same level as the water level in shallow wells drilled into the terrace deposits; thus, the water table is continuous from one formation to the other. Ground water in the area moves generally northward to the Laramie River and, to a lesser extent, toward Sybille and Chugwater Creeks.

The saturated thickness of the terrace deposits and the configuration of the surface of the underlying Arikaree formation influence considerably the shape and slope of the water table. The average slope of the water table is about 40 feet per mile.

The slope is less (the contours are spaced farther apart) where the maximum saturated thickness of terrace deposits occur, and the slope is greater where the terrace deposits are thinner, or where the water table lies in the underlying Arikaree formation. Adjacent to the Laramie River, Sybille Creek, and Chugwater Creek, the water table is in the Arikaree formation. The permeability of the Arikaree formation is much less than that of the terrace deposits; consequently, the slope of the water table in the Arikaree formation generally is much greater than that in the terrace deposits, and in places is as much as several hundred feet per mile.

DEPTH TO WATER

The depth to the water table in the county is determined largely by the configuration of the land surface. In general, the depth to water is least where the land surface is low, and greatest where the land surface is high.

Under the bottom land along the major streams and under parts of the Wheatland Flats, the water table is so shallow that the capillary fringe extends to the land surface or to within reach of plant roots. The depth to water in the stream valleys and in most of the Wheatland Flats generally is less than 60 feet. The greatest depths to water are found in the upland areas. Along the eastern margin of the county east of Wheatland, the depth to water is as much as 254 feet, and in the central part of the county in the vicinity of Dwyer it is as much as 240 feet.

Plate 4 shows by isobath lines the depth to water in the Wheatland Flats. Isobath lines, which connect points of equal depth to water, are shown at 20-foot intervals from 20 feet to 180 feet. Data for these lines were obtained by superimposing the topographic contour map over the groundwater contour map. The depth to water in the Wheatland Flats ranges from only a few feet to as much as 189 feet, the depth being least in the parts of the area that are supplied with surface water for irrigation. The depth is greatest along the eastern margin of the area where the terrace deposits are topographically high and where Chugwater Creek has cut its valley about 300 feet below the uppermost terrace level. Here, the terrace deposits are dry and the water table is in the underlying Arikaree formation.

PIEZOMETRIC SURFACES

Sufficient information could not be collected to determine the shape and slope of the piezometric surfaces of the several artesian aquifiers in Platte County. Although water occurs under artesian pressure in several of the bedrock formations in the county, the "Converse sand" of the Hartville formation is the only one into which wells have been drilled. All these wells are in the vicinity of Glendo. The piezometric surface in this aquifer along the lower reaches of Horseshoe Creek is as much as 40 feet above the land surface.

WATER-LEVEL FLUCTUATIONS

The water table and piezometric surfaces in an area are not stationary but fluctuate somewhat like the surface of the water in a reservoir. The rise and fall of the water table and piezometric surfaces depend upon the amount of recharge to the ground-water reservoir and the amount of discharge from it. If the inflow exceeds the outflow, the surfaces will rise; conversely, if the discharge exceeds the recharge, they will fall. The water level of a ground-water reservoir fluctuates more than the level of a surface reservoir in response to the addition or removal of a given quantity of water because water occupies only part of the gross volume of water-bearing material identified as the ground-water reservoir. If an unconfined aquifer of sand and gravel has an average specific yield of 25 percent, the addition of 1 foot of water to the aquifer will raise the water table about 4 feet. The storage coefficient of artesian aquifers generally is much smaller than the equivalent specific yield of unconfined aquifers; therefore, the fluctuations of the piezometric surface caused by water added to or discharged from artesian aquifers generally are greater than fluctuations of the water table caused by equal addition to or discharge from unconfined aquifers. Changes of water levels in wells reflects the fluctuations of the water table and the piezometric surfaces and, hence, reflect the recharge to and discharge from the ground-water reservoirs.

The principal factor that causes a rise of the ground-water levels in Platte County is the amount of precipitation and infiltration from irrigation canals and streams that either enters the outcrop of an artesian aquifer and percolates downward into it or descends to the water table in unconfined aquifers. The main factors that cause declines in the water table or piezometric surface are the movement of ground water to adjacent areas, discharge by springs and seeps, and discharge from wells. Evaporation and transpiration also discharge water from the unconfined aquifers and cause declines of the water table.

The fluctuations of the water table were determined by observing the water level in wells tapping the principal aquifers. Periodic measurements were begun in the fall of 1948. The water-level measurements through 1955 are published in annual reports of the U.S. Geological Survey. Very little information is available regarding the fluctuations of the piezometric surface in Platte County, and the following discussions of water-level fluctuations pertain only to the water-table aquifers.

The source of most of the water under the upland area is precipitation; here the recharge-discharge relationship is approximately in balance and the water table fluctuates within a very narrow range. The water level under the lowland areas along the streams is associated with the flow in the streams and fluctuates widely in response to that flow. Deep percolation of surface water applied for irrigation purposes supplies most of the water under the terrace deposits in the Wheatland Flats area, and the water table fluctuates widely with the periodic application of irrigation water.

RECHARGE

Recharge, the addition of water to a ground-water reservoir, may be accomplished in several ways. Once water becomes a part of the ground-water body it moves down gradient in the general direction indicated by the slope of the water table or piezometric surface, later to be discharged at some point farther down gradient. In nature, a ground-water reservoir is a hydraulic system in balance or equilibrium, and over a long period the recharge equals the discharge. However, pumping from wells superimposes an artificial discharge on this system and causes an unbalanced condition. Before a new equilibrium can be established, water levels throughout the aquifer must fall enough to increase the rate of natural recharge or decrease the rate of natural discharge, or both, by an amount equal to the rate at which water is being discharged by the wells. Until this new equilibrium is established, water must be withdrawn from storage in the aquifer. Conversely, the new position of equilibrium cannot be established until enough water is pumped from storage to depress the water table and establish the new rate of recharge or natural discharge, or both. These are the fundamental laws upon which must be based all investigations to determine the potential yield of aquifers. The average rate of water withdrawal from a ground-water reservoir, as from a surface-water reservoir, cannot exceed the average rate of replenishment without a progressive lowering of the water level.

As the Laramie Range along most of the western margin of Platte County is a natural barrier to underground movement of water from the west, the ground water in Platte County originates from the precipitation that falls within the county, from seepage from streams entering the area from the north, west, and south, and from irrigation seepage.

PRECIPITATION

According to data compiled by the U.S. Weather Bureau, the normal annual precipitation in Platte County ranges from 13.70 inches at Wheatland to 15.79 inches at Chugwater. Although the precipitation is greater in the mountainous areas of the Laramie Range, the average precipitation over the county is believed to be about 15 inches per year. A part of the precipitation runs off the land surface through streams, a part is dissipated by evaporation, a part is transpired by plants, and the small remaining part percolates downward to the zone of saturation. The amount that reaches the water table depends upon several factors, which include the amount, distribution, and intensity of the precipitation; the physical character and composition of the soil and subsoil; the proximity of the water table to the land surface; the condition of the soil before the precipitation falls (moisture content, cultivation); and the number, size, and depth of root holes, animal burrows, and other openings in the soil and underlying rocks.

The rocks and soil in Platte County are of many types. Some soil was derived from shale or siltstone; other, from sandstone or reworked sand, gravel, and conglomerate. Sandstone and other sandy rocks are the most prevalent types, and so the soil is largely sandy. Consequently, only a small part of the water that falls on the large upland areas in Platte County becomes surface runoff (water immediately carried away by streams), particularly in the Wheatland Flats area, underlain by terrace deposits, and in the upland area, underlain by the Arikaree formation. The material underlying these areas is very permeable and absorbs water readily. In contrast, very little water infiltrates the relatively impermeable rocks along the Laramie Range, the Richeau Hills, and the Hartville Hills; consequently, the greater runoff has created a well-defined drainage pattern on these areas. During this investigation, no attempt was made to determine the amount of recharge derived from precipitation. On the basis of studies made of adjacent areas that are similar in climate and terrane (Foley, 1943, p. 51; Rapp, Warner, and Morgan, 1953, p. 22), the annual recharge from precipitation in Platte County is believed to be about 5 percent of the normal annual precipitation. Assuming an average annual precipitation of 15 inches, the annual recharge from this source in Platte County (2,114 square miles) is about 85,000 acre-feet, of which about 3,800 acre-feet is recharged in the Wheatland Flats.

STREAMS

In Platte County the North Platte and Laramie Rivers and their larger tributaries are influent during periods of high water (fig. 11), at which times they contribute water to the adjacent ground-water reservoir. During these periods the streams may run bank-full or occupy the flood plains, and seepage causes the water table near the streams to rise. When the flow diminishes and the streams resume their normal stage, the water then stored temporarily in the flood-plain and adjacent deposits (bank storage) returns slowly to the stream and the ground-water levels again approach their normal stage.

Many small intermittent streams, such as South Bear and Fish Creeks, are influent. (An influent condition is indicated by the down-stream bow in the water-table contours on plate 1.) These small streams, which are principally in the upland areas, are important sources of ground-water recharge because their channels lie above the water table and, during their periods of flow, water is contributed to the sand and gravel of the stream bed; a part of this water eventually percolates to the water table in the alluvium or underlying rocks.

In places where streams flow across the outcrop of artesian aquifers or where saturated stream alluvium overlies the aquifers, much of the streamflow is absorbed by the aquifer.

The amount of annual recharge to the ground-water reservoir from streams in Platte County is not known but probably is appreciable.

IRRIGATION

Seepage from irrigation canals and irrigated lands recharges the ground-water reservoirs underlying the Wheatland Flats and other small irrigated areas along the main streams in Platte County. The large fluctuation of the water table caused by the application of irrigation water shows that this increment of recharge is large in those areas. Figure 12 shows hydrographs of the water levels in 3 representative wells penetrating the terrace deposits underlying the Wheatland Flats. These hydrographs show a general seasonal fluctuation of the water table. The water levels begin to rise in April or May of each year, and the rise continues until about the beginning of August; then the water levels decline until the next April or May.

The average rise in water levels was about 5 feet from May through July 1950, most of it being caused by seepage from canals and irrigated fields. Although, as in other years, considerable rain fell during this period, the amount of recharge from irrigation water, which is applied at a greater rate than the rainfall, is several times the recharge received from precipitation. The rise of the water table re-

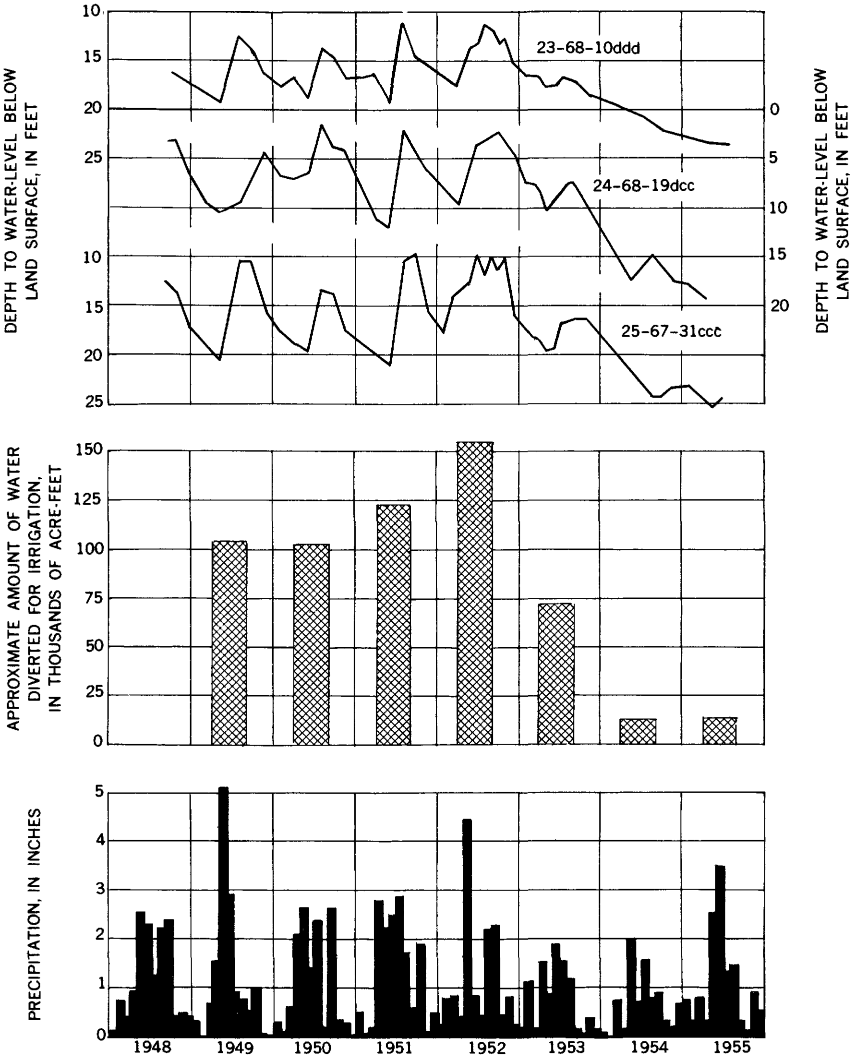

FIGURE 12.—Graph showing fluctuation of water levels in three wells in Wheatland Flats, monthly precipitation at Wheatland, and amount of surface water applied annually for irrigation.

flects only a part of the effects of irrigation seepage losses because discharge from the ground-water reservoir continues throughout the period of rising water levels; the rise indicates that the recharge exceeds the discharge.

The overall decline of the water levels during 1953, 1954, and 1955, a period when but little surface water was available for irrigation, also indicates the lack of irrigation recharge. The water table declined an average of about 6 feet throughout the Wheatland Flats during these years. Although seasonal pumping from the 60 irrigation wells in the Wheatland Flats lowers the water table, the amount of decline of the water table due to pumping is small as compared to the decline due to the lack of recharge from irrigation seepage, as indicated by the similarity of the fluctuations of the water levels in the three observation wells, which are located at varying distances from irrigation wells (fig. 12.) The hydrographs show comparable declines of water level in each of the wells, although well 23–68–10ddd is approximately 1 mile from the nearest irrigation well, well 24–68–19dcc is approximately half a mile from 3 irrigation wells, and well 25–67–31ccc is within 100 feet of an irrigation well.

DISCHARGE

Ground water is discharged from the zone of saturation in all parts of Platte County by the following methods, which operate either singly or simultaneously in one or more combinations: seepage into streams, evaporation and transpiration (evapotranspiration), ground-water underflow out of the area, discharge from springs, and pumping from wells. The rate at which ground water is discharged varies with many factors, such as the hydrologic properties of the water-bearing formations, the depth to and slope of the water table, the nature of the vegetative cover, and season of the year. Local differences in conditions cause more ground water to be discharged from some parts of the county than from other parts.

STREAMS

Most of the low flow (base flow) of the streams in Platte County is supplied by ground-water discharge. The water-table contours (pl. 1) show that the general direction of ground-water movement in the county is toward the North Platte or Laramie River. Much ground water is discharged directly into these rivers; however, a considerable amount is intercepted by tributaries and then carried into the main streams. The upstream bows of the water-table contour lines as they cross the stream valleys indicate the movement of ground water into the streams (fig. 11).

Much of the ground water discharged into streams adjacent to irrigated tracts (such as the Laramie River in the Wheatland Flats) is return flow from irrigation—that is, water has been added to the ground-water reservoir by seepage from irrigation canals and irrigated fields. However, the ground water discharged into the streams on the upland areas is water that was derived from the infiltration of precipitation. The annual ground-water discharge into streams could not be determined because sufficient streamflow records were not available and because the scope of this study did not provide for making the necessary measurements. However, the ground water discharged into the North Platte River along about a 40-mile stretch of the river, from near Douglas (about 18 miles northwest of the county line) to near Cassa, was estimated from available streamflow data. Here the average monthly gain in streamflow during November, December, January, and February (months when no diversions from the streams were being made and when the evaporation loss was negligible) was about 2,300 acre-feet from 1946 through 1951. Thus, the average annual ground-water discharge to this part of the North Platte River would be about 28,000 acre-feet. However, this at best is only an indication of the magnitude of the ground-water inflow to the river.

Similarly, the average annual ground-water inflow into Horseshoe Creek along about a 26-mile stretch of that stream, from Easterbrook (about 5 miles west of the Albany-Platte County line) to Cassa, was estimated to be about 3,800 acre-feet.

These gains in streamflow are derived principally from the Tertiary deposits within Platte County. The base flows of the other main tributaries to the North Platte and Laramie Rivers in Platte County are principally ground-water pickup and probably are comparable to that of Horseshoe Creek.

EVAPORATION AND TRANSPIRATION

Discharge of ground water by evaporation and transpiration (evapotranspiration) generally is restricted to areas where the depth to water is less than 20 feet. The principal areas in Platte County where ground water is so discharged are parts of the Wheatland Flats terraces (pl. 4), the flood plains of the North Platte and Laramie Rivers, and the flood plains adjacent to the effluent parts of their major tributaries.

Ground water is discharged by evaporation if the water table or capillary fringe is close to the land surface. The depth from which water may be brought to the surface by capillarity depends upon the texture of the material above the water table—the finer grained the material, the greater the distance the water will rise. Probably very little water is brought to the land surface by capillarity where the depth to water is more than 10 feet. Where ground water is discharged by evaporation, a residue of water-soluble salts generally is left at the land surface. The accumulation of sodium salts will eventually cause the soil structure to deteriorate so as to retard the movement of water through the soil. The poor drainage and the concentration of salts at the surface will gradually cause the land to become unfit for cultivation.

Ground water may be taken into the roots of plants directly from the zone of saturation or from the capillary fringe, and be discharged by evaporation from the leaves. This process is called transpiration. The depth from which plants will lift ground water varies with the species of plants and the type of soil. The roots of ordinary grasses and field crops will lift water only a few feet, but some desert plants may send their roots 60 feet or more to reach the water table (Meinzer, 1923a, p. 82).

Grasses and field crops are the principal users of ground water in most of the Wheatland Flats and the flood plains, except where cottonwood and willow trees grow along the major streams. The vegetation along the stream courses intercepts much of the ground water that otherwise would be discharged into the streams.

Evapotranspiration over the entire county consumes a large part of the precipitation before it can become ground water; as estimated previously (p. 64) only about 5 percent of the annual precipitation becomes ground-water recharge, and only a small part of this is later discharged by evapotranspiration, mostly from the water-table aquifers. The discharge of ground water from the artesian aquifers by evapotranspiration is negligible because these aquifers are overlain by other rocks throughout most of the county.

UNDERFLOW

Rapp, Visher, and Littleton (1957) computed the annual ground-water underflow through the alluvial deposits of the North Platte and Laramie River valleys to be about 6,000 acre-feet across the Platte-Goshen County line. The cited computations embody a field coefficient of permeability of 4,500 gpd per square foot, a cross-sectional area of the saturated part of the flood-plain deposits under the North Platte River valley of about 75 mile-feet, and a downvalley gradient of the water table of about 10 feet per mile; thus, nearly 4,000 acre-feet of water leaves Platte County each year as underflow through the flood-plain deposits of the North Platte River valley. The cross-sectional area of the saturated part of the flood-plain deposits of the Laramie River valley also is about 75 mile-feet, the downvalley gradient of the water table is about 6 feet per mile, and the permeability is estimated to be the same as above; thus, nearly 2,500 acre-feet of water leaves Platte County each year as underflow through the flood-plain deposits of the Laramie River valley.

A large but unknown amount of water moves eastward from Platte County by underflow through the bedrock formations. The amount of that discharge was not computed or estimated because the scope of this report did not permit determining the transmissibility of the bedrock formations and the slope of the piezometric surface of each.

SPRINGS

Ground water in Platte County is discharged through springs and seeps issuing from strata that range in age from Precambrian to Recent. Most of the springs are small and issue from Brule and post-Brule deposits in areas where the Tertiary rocks have been dissected deeply. Springs issue from the thin alluvial deposits formed in the small valleys developed in the Tertiary rocks, from beds of sandstone and conglomerate, and from fissures and fractures in the rocks. Although these springs generally yield less than 5 gpm each, a few yield 50 to 300 gpm.

A few springs occur in areas where older rocks are exposed. In some structural areas, such as the Laramie Range and the Hartville and the Richeau Hills, springs issue from weathered granite, from crevices in limestone, and from sandstone beds in the Casper, Hartville, and Cloverly formations. These springs also generally yield less than 5 gpm, but larger discharges have been reported from some places. Spring 30–68–16 dbb yields about 700 gpm from the Hartville formation.

Most of the springs are of the gravity type; that is, the water flows by gravity along outcrops of the formations where they have been dissected by streams. The water of a gravity spring percolates from permeable material or flows from large openings in a rock formation, under the action of gravity, as a surface stream flows down its channel (Meinzer, 1923b, p. 51). There are two types of gravity springs in Platte County: (a) depression springs, where water flows to the land surface because the land surface intersects the water table, and (b) contact springs, whose water issues from permeable material that overlies material of lower permeability which retards or prevents the downward percolation of the water. Most of the springs in Platte County are contact springs, although a few depression springs issue from the alluvium of stream valleys.

A few of the springs issuing from the Casper, Hartville, and Cloverly formations may be artesian; that is, the water may rise along crevices under artesian pressure. Spring 30–68–16dbb, mentioned above, is believed to be artesian.

The water discharged from springs is used primarily for stock watering but in some places the spring flow is large enough for domestic or irrigation use.

Water from springs used for domestic purposes generally is collected by perforated pipe laid in one or more trenches, which are dug into the deposits from which the springs issue. The water flows through pipes, either directly to the place of use or to a closed catchment basin or tank and then to the point of use.

Water from undeveloped springs used for stock water flows from the spring into open tanks, pits, or drainage courses. Some springs have been partly developed by digging a small pit or forcing a small pipe into the water-bearing deposits at the spring sites and collecting the water in a small open basin or tank. The development of springs, as practiced, generally does not make maximum use of the available water.

The total quantity of ground water discharged through springs in Platte County is not known because not all were inventoried. However, the total discharge of the springs inventoried was about 3,000 acre-feet a year; the discharge of all the springs in the county would be several times that amount.

WELLS

Most of the wells in Platte County are drilled and are cased with steel pipe. The diameters of the stock and domestic wells generally range from 4 to 6 inches; the diameters of the irrigation wells range from about 8 to about 16 inches. A few large-diameter shallow dug wells, cased with concrete, brick, or wood curbing, have been constructed in the area; these generally are in the stream valleys where the water table is near the land surface.

About 5,300 acre-feet of ground water is pumped annually in Platte County for irrigation, stock and domestic, and municipal uses; these uses are listed in what is believed to be the order of quantity pumped. Approximately half this water is withdrawn in the Wheatland Flats. The quantity of water pumped for each of the uses is discussed in a following section on utilization of ground water (p. 73).

WELL-DRILLING AND PUMPING METHODS

The drilled wells in Platte County were constructed by the cable-tool, the standard hydraulic-rotary, or the reverse-rotary drilling method. The cable-tool method is used to drill both small- and large-diameter wells and test holes; the standard hydraulic-rotary method generally is used to drill small-diameter wells and test holes; the reverse-rotary method is limited principally to drilling large-diameter wells for irrigation.

The cable-tool drilling method (sometimes referred to as the percussion or churn-drill method) utilizes a string of solid drill tools having a cutting bit on the bottom end. The tools are suspended in the drill hole on the end of a cable, by which they are lifted and dropped regularly to produce a cutting or drilling action at the bottom of the hole. The pulverized or broken material is removed from the bottom of the hole by a bailer, or sand bucket, suspended on the end of a second cable. A casing usually is forced into the hole as drilling proceeds, and the drill and bailer are lowered and withdrawn through the casing.

Many of the small-diameter (6 inches or less) wells have been drilled by the standard hydraulic-rotary method. Drilling is accomplished by rotating the drill tools which are at the bottom of a string of drilling pipe. During the drilling process, water is circulated downward through the revolving drill stem and bit into the bottom of the hole, and thence up the hole to the land surface into a sump pit, where the water is taken up by the pump and recirculated. Materials cut from the bottom of the hole by the drilling bit are carried to the surface by the water. Mud, clay, or some manufactured product is often added to the water to increase its viscosity and material-lifting capacity and also to seal the hole and prevent caving and the loss of drilling water by seepage into permeable material.

In Platte County the standard hydraulic-rotary method of drilling generally is limited to holes of small diameter, owing to the difficulty of providing enough water in the drill hole to maintain sufficient velocity to carry the cuttings to the surface. This disadvantage has been overcome in the reverse-rotary method of drilling by reversing the direction of the circulating water. By this method the water is pumped up the large-diameter hollow drill stem and discharged into a settling pit where the drill cuttings remain. The water runs back to the drill hole by gravity. Enough water is provided to keep the drill hole full at all times, so that the hydrostatic pressure will prevent caving. A revolving bit at the lower end of the drill stem cuts the material loose from the bottom of the hole, and the circulating water carries it through the pump to the settling pit. Generally a hole about 48 inches in diameter is drilled, a perforated casing of smaller size is placed in the hole, and the annular space around the casing is packed with sorted gravel.

Most domestic and stock wells in Platte County are equipped with lift or force pumps in which the cylinders are placed below the water table. These pumps generally are operated by windmills or by electric motors. A few wells are equipped with jet pumps. These pumps generally are operated where the depth to water is not great. Where electric power is available, the domestic wells are usually equipped with electric-powered pumps that force the water into pressure systems. In parts of the county where the depth to water is generally less than 15 feet, a few wells are equipped with hand-operated pitcher pumps.

Most of the municipal, industrial, and irrigation wells are equipped with turbine pumps operated by electric motors or gasoline engines. A few irrigation wells, in areas where the water is within suction lift, are equipped with horizontal centrifugal pumps.

UTILIZATION OF GROUND WATER

Specific data for 491 wells and 41 springs in Platte County were obtained during the investigation (table 10). Of these wells, 334 were used for domestic and stock, 75 for irrigation, 6 for industrial, and 16 for public water supplies. The remainder either were unused or their use was undetermined. All known irrigation, public-supply, and industrial wells were inventoried, and all available data concerning them were compiled. No attempt was made to inventory all the domestic and stock wells, and data concerning them were collected only in areas where information was needed to complete the study. Only a few of the springs in the county were inventoried.

DOMESTIC AND STOCK SUPPLIES

Most residents of the rural areas of Platte County obtain their domestic and stock water from small-diameter drilled wells, most of which penetrate rocks of Tertiary or Quaternary age. These wells generally penetrate the water-bearing formations only deep enough to obtain an adequate supply of water of satisfactory quality.

About 1,000 acre-feet of ground water is estimated to be used annually in the county for domestic and stock supplies. The chemical character of the ground water in the area varies greatly but generally is satisfactory for most domestic and stock uses. (See also section on "Quality of water," p. 87.)

PUBLIC SUPPLIES

All the five municipalities in the county that have public water systems obtain their water from wells. The average daily consumption of these municipalities aggregates about 650,000 gallons, or about 700 acre-feet a year. The municipal water-supply systems are described in the following paragraphs, in decreasing order of town size. The population figures given are according to the 1950 census.

Wheatland, population 2,286, is supplied by 6 drilled wells. The wells penetrate the Arikaree formation and are 355 to 560 feet deep. The static water level in the wells ranges from about 10 to about 85 feet below the land surface. Of the four wells equipped with electrically driven turbine pumps, one was not in use at the time this investigation was made. The remaining two are pumped by air lift and are used only occasionally when the demand for water is great. Water from the wells is pumped into a 150,000-gallon elevated storage tank. The annual consumption of water is about 180 million gallons, which is equivalent to an average rate of consumption of about 500,000 gpd or 340 gpm. The results of analysis of water from wells 24–68–12dbc and 24–68–13cddl indicate that the water is hard but is suitable for most domestic uses.

Guernsey, population 721, is supplied by 2 wells drilled into the flood-plain deposits of the North Platte River, 90 and 91 feet deep, respectively. The static water level at the 2 sites was reported to be 43 and 30 feet below the land surface, respectively. The combined discharge of the 2 wells, which are equipped with electrically driven turbine pumps, is approximately 1,000 gpm. Water from the wells is pumped into a concrete reservoir and a steel tank having a combined capacity of approximately 250,000 gallons. The town's annual consumption of water is about 33 million gallons, which is equivalent to an average rate of about 90,000 gpd, or 63 gpm. A chemical analysis was not made of the water from these wells, but the water should be comparable to other water sampled from the flood-plain deposits of the North Platte River, which is hard but is suitable for most domestic uses.

Chugwater, population 283, is supplied by 3 wells drilled into the Brule formation which are 62, 85, and 86 feet deep, respectively. The static water level in these wells is about 30 feet below the land surface. Each well is equipped with an electrically driven turbine pump and yields about 80 gpm. Water from the wells is pumped through a 6-inch pipe to a covered concrete reservoir which has a storage capacity of 100,000 gallons. The annual consumption of water is about 7 million gallons, which is equivalent to an average rate of about 20,000 gpd or 14 gpm. The maximum daily consumption is about 50,000 gallons. Water from well 21–66–30cca2 is moderately hard but is suitable for most domestic purposes.

Hartville, population 229, is supplied by 2 wells, which were dug to depths of 12 and 14 feet into the flood-plain deposits of a small creek tributary to the North Platte River. One well is equipped with a centrifugal pump and the other with a turbine pump. Both pumps are powered by electric motors; their combined discharge is about 300 gpm. In addition to small storage tanks at the well sites, the town has a 42,500-gallon elevated steel storage tank. The average daily consumption is not known but probably is about 20,000 gallons. Water from the wells was not analyzed during the investigation; however, it is reported to be satisfactory for domestic use after chlorination.

Glendo, population 215, is supplied by 2 wells. One well is 145 feet deep and penetrates the Brule formation; the other is 793 feet deep and obtains water from the "Converse sand" of the Hartville formation. The wells are equipped with electrically driven turbine pumps having a combined discharge of 80 to 90 gpm. Water is pumped from the wells into 2 steel tanks which have a combined storage capacity of about 50,000 gallons. A third well, drilled into the Brule formation, is equipped with a pump and motor but was not being used at the time this investigation was made. The annual consumption of water is about 7.6 million gallons, which is equivalent to an average rate of 21,000 gpd or about 15 gpm. The water is hard but is satisfactory for most domestic uses.

IRRIGATION

History of development.—Seventy-five irrigation wells in Platte County were inventoried during the study. Fifty-three, or more than two-thirds, of these wells are in the Wheatland Flats. All irrigation wells constructed by the end of 1955 are thought to have been inventoried. The locations of the wells are shown on plate 1, and pertinent data regarding them are given in table 10.

There was very little interest in the development of irrigation wells in the county between 1919, when the first irrigation well was drilled, and 1953. Starting in 1953, farmers, particularly in the Wheatland Flats, began to construct irrigation wells to supplement the continually decreasing supply of surface irrigation water. During the 3-year period 1953–55, 50 irrigation wells, or two-thirds of all the irrigation wells drilled through 1955, were constructed.

Quantity of water pumped.—Fifty-six of the 75 irrigation wells in the county were pumped during 1955. These wells pumped a total of about 3,500 acre-feet of water, of which 1,900 acre-feet was pumped within the Wheatland Flats. The determination of the amount of water pumped was based on the assumption that the average amount pumped per well was equivalent to the average amount pumped from wells for which measurements were made — that is, from wells equipped with electrically powered pumps. The quantity of water pumped for irrigation by electrically powered pumps in the area was calculated from records of power consumption supplied by the power company and from measurements of the rate of power input and the rate of discharge that were made during the investigation. The rate of power input to the motors was determined by clocking the electric watt-hour meters with a stopwatch. The duration of pumping during the year was determined by dividing the total amount of power consumed during the year by the rate of power input. The following table gives the quantity of water pumped in the county during the 3 years for which data were available:

Year	Wheatland Flats		Platte County	
	Wells in use	Water pumped (acre-feet)	Wells in use	Water pumped (acre-feet)
1955	42	1, 900	56	3, 500
1954	31	2, 300	39	3, 700
1953	21	700	27	1, 800

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There is a rather large seasonal fluctuation of water levels in the Wheatland Flats area. The aquifer that supplies most of the irrigation wells is thin, and consequently the saturated thickness is markedly affected by the seasonal fluctuation of the water table. The largest yields generally are obtained during the late summer when the water table is highest and the saturated thickness of the aquifer is greatest. However, during 1953, 1954, and 1955 there was a general lowering of the water table in the Wheatland Flats, and a corresponding decline in yield of irrigation wells. The lowering of water levels is due largely to a substantial decrease in recharge to the aquifer rather than dewatering of the aquifer by pumping from wells: the water table declined similarly in areas remote from irrigation wells.

Most irrigation wells in the Wheatland Flats yielded water at a considerably lower rate during 1955 than when they were first drilled. For example, the yield of well 24–68–16cdd decreased from a reported 750 gpm when the well was drilled in September 1950 to a measured 460 gpm in March 1954, 370 gpm in June 1954, 250 gpm in September 1954, and 130 gpm in August 1955. A small part of this decrease may be due to lessened pump efficiency, but the greater part is attributed to lower water levels. It is reasonable to expect the yields to increase during periods when the ground-water levels rise owing to an increase in the amount of water available for recharge.

Power required for pumping water.—The cost of pumping water from a well depends upon the cost of drilling the well and installing the pump, the cost of the fuel or power, and the cost of maintenance and operation. The only cost that could be determined with reasonable accuracy was the cost of the electric power for the electrically powered units. These data are given in kilowatt-hours rather than in dollars and cents because a rather complicated sliding scale is used in charging for the use of electric power. The average amount of electric power required to pump an acre-foot of water, for the 13 wells tested, was computed to be 2.6 kilowatt-hours per foot of lift. With an average pumping lift of approximately 30 feet, about 78 kilowatt-hours would be required to pump 1 acre-foot of water. The overall efficiencies of the electrically powered units ranged from 21 to 70 percent and averaged about 40 percent. The average overall efficiency of 40 percent is considerably less than would normally be expected for the relatively new pumping equipment in use in the county. Most of the pumping plants were installed when the water table was higher and larger yields were obtained from the wells. With the decreased yield, the electric motors are operating with a much reduced load, and thus at a lower efficiency, than when they were installed. For example, the overall efficiency of one well was 69 percent when pumping was at a rate of 460 gpm, but was only 28 percent when pumping was at a rate of 130 gpm.

POSSIBILITIES OF ADDITIONAL DEVELOPMENT OF GROUND WATER

Adequate quantities of ground water for domestic and stock use probably can be obtained from the Casper, Hartville, Cloverly, Brule, and Arikaree formations and the terrace and flood-plain deposits. Some of the other formations also may yield small quantities of water. Larger quantities of water are available at many places from the "Converse sand" of the Hartville formation, from the Arikaree formation, and from the terrace and flood-plain deposits; only these deposits will be discussed in detail in this section.

The feasibility of developing large amounts of ground water for irrigation, public supply, or industrial use depends upon many factors: the ability of the ground-water reservoirs to yield water over long periods; the costs of well construction, pumping equipment, power, and maintenance; and the chemical quality of the water. Irrigation-water development depends also on the type of soil, the crops raised, the length of the growing reason, and the market price of commodities and crops.

The ability of a ground-water reservoir to yield water over a long period of time is limited and is dependent upon the amount of water that is added annually to the reservoir by recharge. If water is withdrawn from a ground-water reservoir faster than the reservoir is recharged, the water levels will decline and the supply ultimately will be depleted. The long-term yield depends also upon the storage capacity of the aquifer. If an aquifer is thick, small seasonal fluctuations of water levels due to variations in the rate of recharge and discharge will have very little effect on the discharge of wells that penetrate a thick section of the materials. If the aquifer is thin, relatively small fluctuations of the water table will have a large effect on the rate of yield of wells even though they penetrate the entire aquifer.

The cost of well construction and pumping equipment is determined in part by the depth to the aquifer and the depth to water level. In areas where the water table or piezometric surface is relatively deep, the wells must be deep and the pumping lift is great. The cost of a well is determined also by the permeability and thickness of the water-bearing materials. Wells may penetrate relatively fine-grained materials that cause the yield of the well to be small in relation to the drawdown of the water in the well. Gravel packing may increase the yield of a well, but it also adds to the cost.

The character of the soil and contour of the land surface also are important factors in the use of ground water for irrigation. Very sandy soil may cause excessive loss of water in ditches or require the use of sprinkler system. The land may be poorly drained, or it may not have the proper slope and may require large expenditures for leveling.

Ground water may be so highly mineralized or may contain such great amounts of certain minerals that it is undersirable for public or industrial use, or is injurious to crops or soils and thus unsatisfactory for irrigation use. The feasibility of ground-water use depends on how well the chemical quality of the water is suited to its proposed use. The chemical quality of ground water in relation to its use is discussed on p. 102.

The crops raised, the length of the growing season, and the market price obtained also need consideration. If the crops raised are those having low cash value, or if the growing season of the crop is normally too short to allow maturing of the crop before frost, or if the market conditions are poor, it may not be economically feasible to pump ground water for irrigation use.

The following discussion will consider only the geologic and hydrologic factors that may make feasible the development of ground water from several aquifers.

"Converse sand" of the Hartville formation.—The areas of outcrop of the Hartville formation are shown on plate 1, and the formation is described in the section on geologic formations and their water-bearing properties (p. 28).

The feasibility of obtaining ground water from the "Converse sand" at any particular location is determined largely by the formation's thickness, permeability, and depth below land surface and by the pressure head. Little is known of the hydrologic properties of this sand in Platte County except in the Hartville Hills area. In this area the thickness of the "Converse sand" is fairly uniform (100 to 120 feet), and its grain size, which ranges from very fine to medium, generally is uniform. However, its degree of cementation and its porosity, and hence its permeability, differ from place to place. The depth to the aquifer and the pressure head of the water in the aquifer likewise vary from place to place.

Where the sand crops out, it generally is drained and will yield little or no water to wells. Where the sand occurs at depth near the outcrops, the artesian pressure within the aquifer may raise the water only a few feet above the top of the aquifer and the pumping lift may be great. Therefore, only one area in Platte County, in the vicinity of Glendo, seem favorable for development of water from the "Converse sand." Small to moderate quantities of water are obtained from four flowing irrigation wells drilled into the "Converse sand" in the valley of Horseshoe Creek, south of Glendo. Two of these wells, 410 and 442 feet deep, flow at the rate of 160 and 78 gpm, respectively. Comparable yields probably could be obtained from wells drilled into the "Converse sand" to depths not exceeding about 700 feet below the land surface along the southeast flank of the Elkhorn anticline in the vicinity of Glendo. This area is believed to be the most promising for exploration of the "Converse sand," although the area along the axis of the Broom Creek syncline also should be considered. Considerable test drilling would be necessary to determine the depth and thickness of the "Converse sand" in the areas cited above.

Arikaree formation.—The distribution of the Arikaree formation, the general shape and slope of the water table in it, and the depth to water for individual wells are shown on plate 1; a geologic description of the formation is given in the section on geologic formations and their water-bearing properties (p. 33). These data, together with the well logs, make possible the determination of the most favorable areas for ground-water development from the Arikaree formation. The feasibility of developing water from the formation is governed largely by the character and thickness of the water-bearing materials and by the depth to the water level below the land surface.

The materials composing the Arikaree formation range from loosely to well-cemented fine-grained sandstone in the upper part to well-cemented channel conglomerate in the lower part. The upper part contains also many concretionary layers of hard, tough sandstone. Where the materials lie below the water table and are loosely cemented, coarse, and porous, they will yield small to moderate quantities of water to wells; where the materials are well cemented and dense, they will yield only very small quantities of water. For the purpose of this discussion, the Arikaree formation is considered a single, relatively homogeneous hydrologic unit.

Wells of moderate to large capacity can be developed in the Arikaree formation only where there is an adequate thickness of saturated materials. Because the average permeability of the formation is low, several hundred feet of saturated materials must be penetrated to obtain large quantities of water from wells. The saturated zone in the Arikaree formation in most of Platte County is fairly thin. However, several hundred feet of saturated materials probably underlie the area in and adjacent to the Wheatland Flats and the area north and east of Wheatland in east-central Platte County.

In all but the east-central part of Wheatland Flats the depth to water is less than 100 feet, and in all but a few small areas it is less than 40 feet (pl. 4). Although the maximum thickness of the Arikaree formation underlying the area is not known, the saturated thickness of the formation is known to be at least 500 feet and probably is greater.

The Wheatland Flats is believed to be the best area in Platte County in which to develop wells of moderate to large capacity in the Arikaree formation. The combination of shallow depths to water, low pumping lifts, and thick sections of saturated materials is favorable for additional development of ground water. Similar conditions may be present along a few stream courses or in local areas outside the Wheatland Flats, but in most other parts of the county the formation is probably too thin or the depth to water is too great to warrant large-scale development. In the area north and east of Wheatland Flats the Arikaree formation probably has a thick section of saturated materials, but the pumping lifts may be too great for economical development at the present time.

It probably would not be practical to attempt construction of large-capacity wells into the Arikaree without first drilling test holes to determine the character and saturated thickness of the water-bearing materials. The low permeability of the Arikaree formation makes it imperative that the wells be as widely spaced as is economically and physically feasible, to minimize interference. Care should be exercised to obtain the proper type of well construction, the proper size of gravel if gravel packing is used, and the proper development of the well. Bennison (1947) describes several methods of well construction and development.

Terrace deposits.—Most terrace deposits in Platte County are probably not favorable for ground-water development because they are either small in areal extent, or are high, isolated, and well drained. However, all or parts of two terraces in the Wheatland Flats should provide opportunity for limited development when there is adequate surface water available for recharge. On terrace 5 and in the N½ T. 23 N., R. 68 W., on terrace 7 (pl. 2), the depth to water is less than 20 feet and the saturated thickness of the terrace deposits ranges from about 15 to about 25 feet (pl. 4). Small to moderate irrigation water supplies have been developed in these areas and a few additional properly spaced irrigation wells probably could be drilled. The yield of these wells will fluctuate with the amount of recharge to the terrace deposits.

Wells penetrating both the water-bearing terrace deposits and the underlying Arikaree formation probably would obtain moderate amounts of water for irrigation, and in places where a thick saturated section of terrace deposits is penetrated, large amounts of water may be available.

Flood-plain deposits.—The flood plains of the North Platte River, and those of its major tributaries near their confluence with the river, are well developed and are underlain by moderate thicknesses of highly permeable materials. Where these materials are saturated, moderate to large quantities of water (500 to 1,000 gpm) can be obtained from properly constructed wells. Wells that yield as much as 1,500 gpm probably could be constructed in the flood plains in the vicinity of Guernsey where the deposits are the thickest and the water table is shallow.

Generally, a buried channel that contains the thickest and most permeable water-bearing materials underlies the flood plains of the larger valleys. The buried channel lies between the valley walls and generally is much straighter than the present meandering streams. The position of the buried channel is not marked by the position of the present channel; it can be located most easily by test drilling or, in some cases, by geophysical surveys. In many valleys the only places where large-capacity wells can be developed are along the buried channels where the saturated materials are thickest and most permeable. Therefore, careful prospecting must be done in order to locate the buried channel at minimum cost. Unfortunately, many unsuccessful large-diameter wells have been drilled without the benefit of previous test drilling, or the test drilling was poorly planned. Systematic test drilling aids in selecting the most favorable well sites, and knowledge of the materials in the aquifer also permits the selection of the best type of well construction. It is generally advisable to drill several test holes, in order to locate the thickest and most permeable water-bearing materials, before drilling a large-diameter well.

Figure 13 shows schematically the correct and incorrect methods of selecting sites for test drilling. The upper part of the figure is a

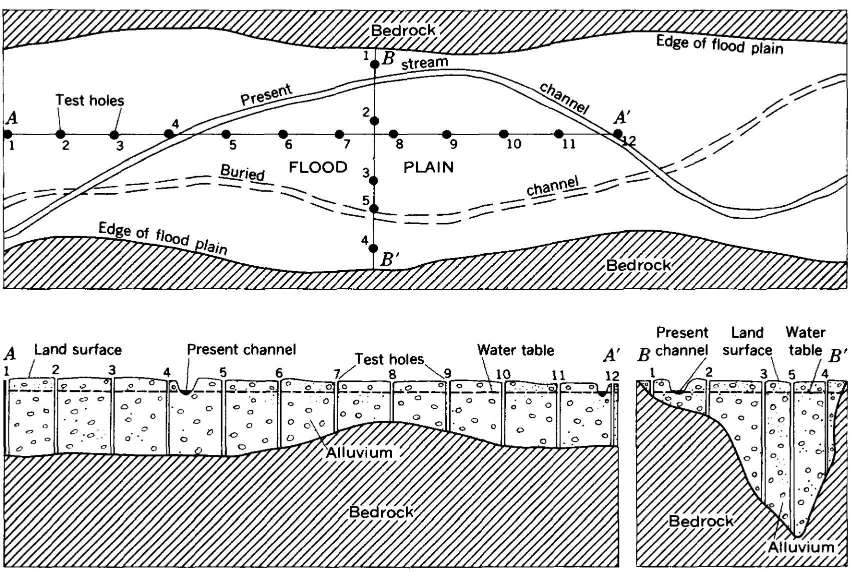

FIGURE 13.—Sketch showing method of locating a buried channel in a stream valley by test drilling.

plan view of a stream valley showing the flood plain, the bedrock walls of the valley, the buried channel, the present channel, and two lines of test holes (*A–A′* and *B–B′*)—one parallel to the trend of the valley and one across the valley. Line *A–A′* was drilled parallel to the valley and, although 12 test holes were drilled, the buried channel was not located. The alluvium was generally of about the same thickness except in test holes 7, 8, and 9. If additional similarly spaced test holes had been drilled beyond point *A′*, the buried channel would have been located in the 14th test hole. If the buried channel is narrow, as it is in some valleys, and if the test holes are widely spaced, the channel may be missed even by many more test holes.

The lines of test holes should be drilled across the flood plain of a valley in order to locate the buried channel with a minimum of test drilling. Line *B–B′* was drilled across the flood plain at right angles to the trend of the valley. The number and the spacing of test holes will depend upon the width of the valley. Four holes were drilled along line *B–B′* and a cross section of the valley was plotted. The thickest water-bearing materials were encountered in test holes 3 and 4, so test hole 5 was drilled between test holes 3 and 4 and located one of the deepest parts of the buried channel. The channel could be outlined more accurately, if necessary, by drilling additional closely spaced tests between test holes 3 and 5 and between 5 and 4.

The alluvium along the upper reaches of the major tributaries of the North Platte River and along the smaller streams may be dry or may be very thin, and only small to moderate quantities of water may be available. The presence of water in the alluvium along these valleys depends to a large extent upon the geologic setting. Figure 4 illustrates 4 geologic settings in which the alluvium of stream valleys in Platte County contains water and 2 in which the alluvium is dry.

In figure 14 *A* and *B*, the alluvium overlies the relatively impermeable Brule or Hartville formations. Water cannot move downward easily, and a perched water table exists; hence, wells *a* and *b* obtain water from the alluvium.

Where the alluvium overlies a permeable bedrock formation, as in figure 14*C* and *D*, the alluvium may be either dry or saturated. In figure 14*C*, the Arikaree formation is nearly drained, only its lower part being saturated. Water entering the alluvium moves downward through the permeable sandstone to the water table. Well *c* is a dry hole but would produce water if deepened into the saturated part of the Arikaree formation as is well *c′*. The Arikaree formation in figure 14*D* is more completely saturated and the water table slopes toward the valley from both sides. The water, therefore, moves from the Arikaree into the alluvium and well *d* obtains water from the saturated alluvium. If drilled into the Arikaree formation, so

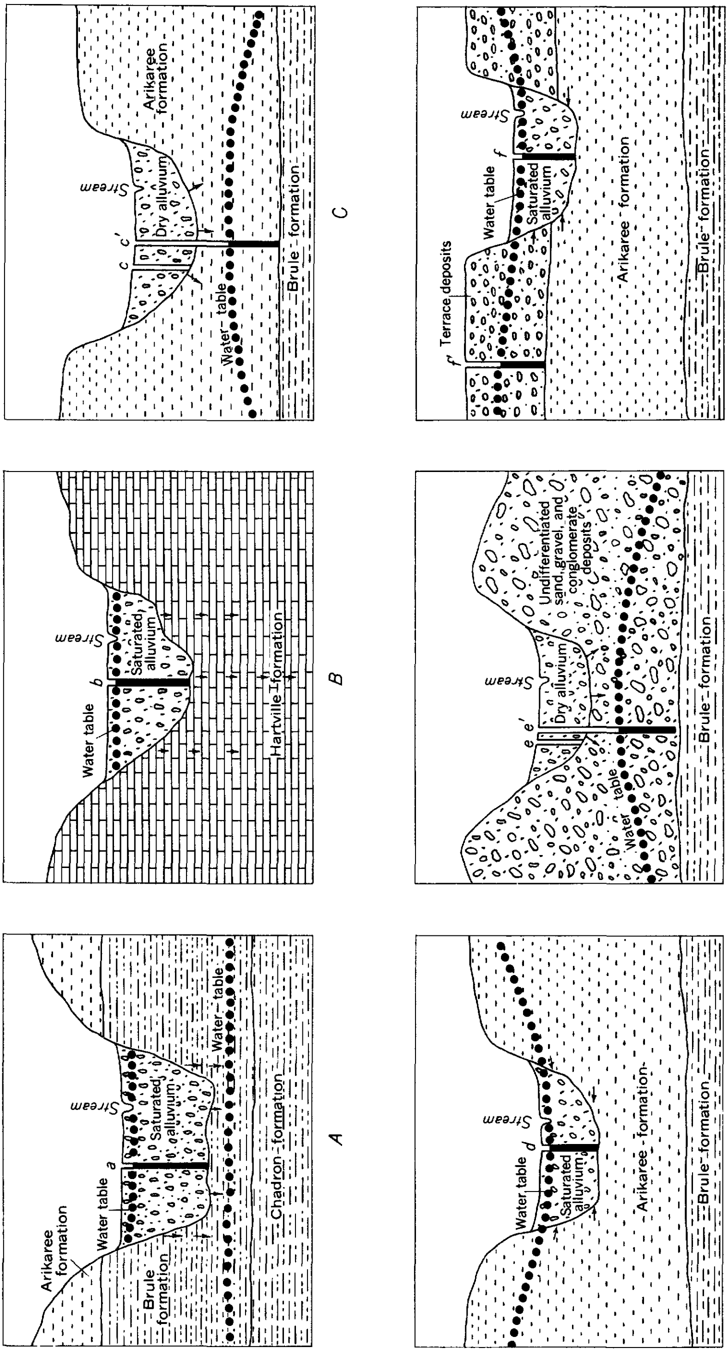

FIGURE 14.—Sketch showing occurrence of ground water in stream valley alluvium of Platte County.

that water could enter from both aquifers, the well would produce more water.

Where alluvium overlies surficial deposits, such as undifferentiated sand, gravel, and conglomerate deposits of Tertiary age or terrace deposits, it may be either dry or saturated (fig. 14*E*, *F*). In figure 22*E* the undifferentiated sand, gravel, and conglomerate deposits are nearly drained. Thus, well *e* is dry because the alluvium overlies unsaturated permeable materials in the undifferentiated surficial deposits. In this case, water moves downward from the alluvium to the water table in the lower part of the surficial deposits and a well drilled deeper, as is well *e′*, would obtain some water. In some places, beds of relatively impermeable silt and clay are present in the rocks underlying the alluvial fill of small valleys; thus, the downward movement of water is prevented or retarded and a perched or local water table develops. The terrace deposits shown in figure 14*F* are largely saturated by seepage from applied irrigation water and water from irrigation canals and laterals. Well *f* obtains water from the alluvium, and well *f′* obtains water from the terrace deposits.

CHEMICAL QUALITY OF THE WATER

By Russell H. Langford

Natural water is never pure. It contains dissolved inorganic and organic substances, dissolved gases, colloids, sediments, and bacteria and other organisms. The way in which water is used and the manner in which it is treated before use often depend on the amount and character of the materials dissolved in, or associated with, the water. The chemical quality of water depends principally on the amount and character of the dissolved materials. Many factors, such as the chemical composition of the rocks through or over which the water moves, the length of time the water has been in contact with the rocks, evaporation, precipitation, transpiration, and use by man, affect the chemical quality of water.

As part of the investigation of the ground-water resources of Platte County, studies were made to determine the chemical quality of the water and to evaluate the suitability of the water for irrigation, domestic, and industrial uses.

Some chemical-quality data were available from previous investigations of the Glendo-Wendover area (Rapp and Babcock, 1953) and of the North Platte River near Cassa and below Guernsey Reservoir (in a series of annual U.S. Geol. Survey water-supply papers entitled

"Quality of Surface Waters of the United States"). Therefore, in August 1953, studies were conducted principally in the Wheatland Flats and in the northeastern and southeastern parts of the county to augment the available information on the quality of the water resources. These studies included field measurements of the specific conductance of irrigation and drainage water in the Wheatland Flats and vicinity and the collection and laboratory analysis of representative samples of ground and surface waters.

The sampled sites are shown on figure 15, and the chemical analyses are given in tabular form in following sections in which the quality of the ground and surface waters is discussed. Chemical analyses were made by methods currently in use by the U.S. Geological Survey; the methods are similar to those generally used in the field of water chemistry (Am. Public Health Assoc., 1946).

Some of the terms used in this report are defined as follows:

Part per million (ppm) is a unit for expressing the concentration by weight of a chemical constituent, usually as milligrams of constituent per kilogram of solution or as grams of constituent per million grams of solution.

Equivalent per million (epm) is a unit for expressing the concentration of a chemical constituent in terms of the equivalent weight of the electrically charged particles (ions) in solution. One epm of a positively charged ion (cation) will react with 1 epm of a negatively charged ion (anion). Parts per million are converted to equivalents per million by multiplying by the reciprocal of the equivalent weight (combining weight) of the ion. The appropriate conversion factors are as follows:

Cation	*Factor*	*Anion*	*Factor*
Calcium (Ca^{++})	0.0499	Bicarbonate (HCO_3^-)	0.0164
Magnesium (Mg^{++})	.0822	Carbonate (CO_3^{--})	.0333
Sodium (Na^+)	.0435	Sulfate (SO_4^{--})	.0208
Potassium (K^+)	.0256	Chloride (Cl^-)	.0282
		Fluoride (F^-)	.0526
		Nitrate (NO_3^{--})	.0161

Specific conductance is a measure of the ability of water to conduct an electrical current and is expressed in micromhos per centimeter at 25° C. Specific conductance can be used to estimate the total mineralization of water. The following equations are generally applicable to the water in Platte County, Wyo.:

$$\text{Specific conductance} \times (0.6 \pm 0.15) = \text{ppm dissolved solids}$$

$$\frac{\text{Specific conductance}}{100} \times (1.1 \pm 0.1) = \text{epm total anions or cations}$$

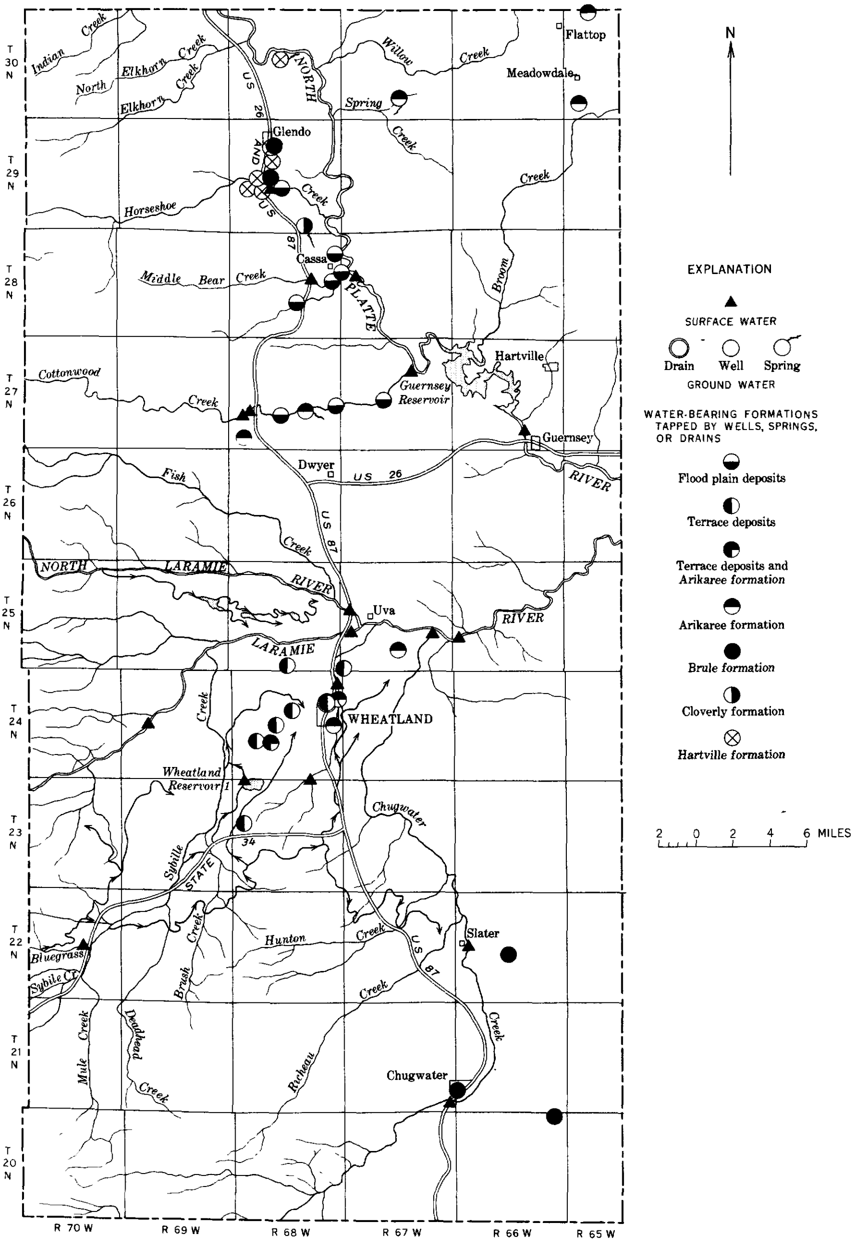

FIGURE 15.—Map showing sampled localities in Platte County.

Percent sodium is the ratio, expressed as a percentage, of sodium to the sum of the principal cations (calcium, magnesium, sodium, and potassium)—all ions being expressed in equivalents per million.

Sodium-adsorption-ratio (SAR) (U. S. Salinity Lab. Staff, 1954) is related to the adsorption of sodium by the soil and is an index of the sodium, or alkali, hazard of irrigation water. It is calculated from concentrations in equivalents per million of sodium, calcium, and magnesium as follows:

$$SAR=\frac{Na}{\sqrt{\frac{Ca+Mg}{2}}}$$

Residual sodium carbonate (Eaton, 1950) is the amount, expressed in equivalents per million, of carbonate plus bicarbonate that would remain in solution if all the calcium and magnesium were precipitated as calcium and magnesium carbonates.

Residual sodium carbonate $=(CO_3+HCO_3)-(Ca+Mg)$

GROUND WATER

Generally, water in the flood-plain and terrace deposits and the Arikaree, Brule, Cloverly, and Hartville formations in Platte County is moderately mineralized, very hard, and of the calcium bicarbonate or calcium sulfate type. Concentrations of dissolved solids ranged from about 200 to about 800 ppm (table 6). The variations in chemical quality of water from the different water-bearing formations are illustrated in figure 16 and are discussed in following sections. The examples used for figure 16 probably are typical of water from these water-bearing formations in Platte County.

The predominance of calcium and magnesium salts dissolved in the water attests to the calcareous nature and relatively uniform chemical composition of the rocks that underlie the surface in Platte County. Figure 17 indicates that more calcium and magnesium salts than sodium and potassium salts are dissolved by the ground water.

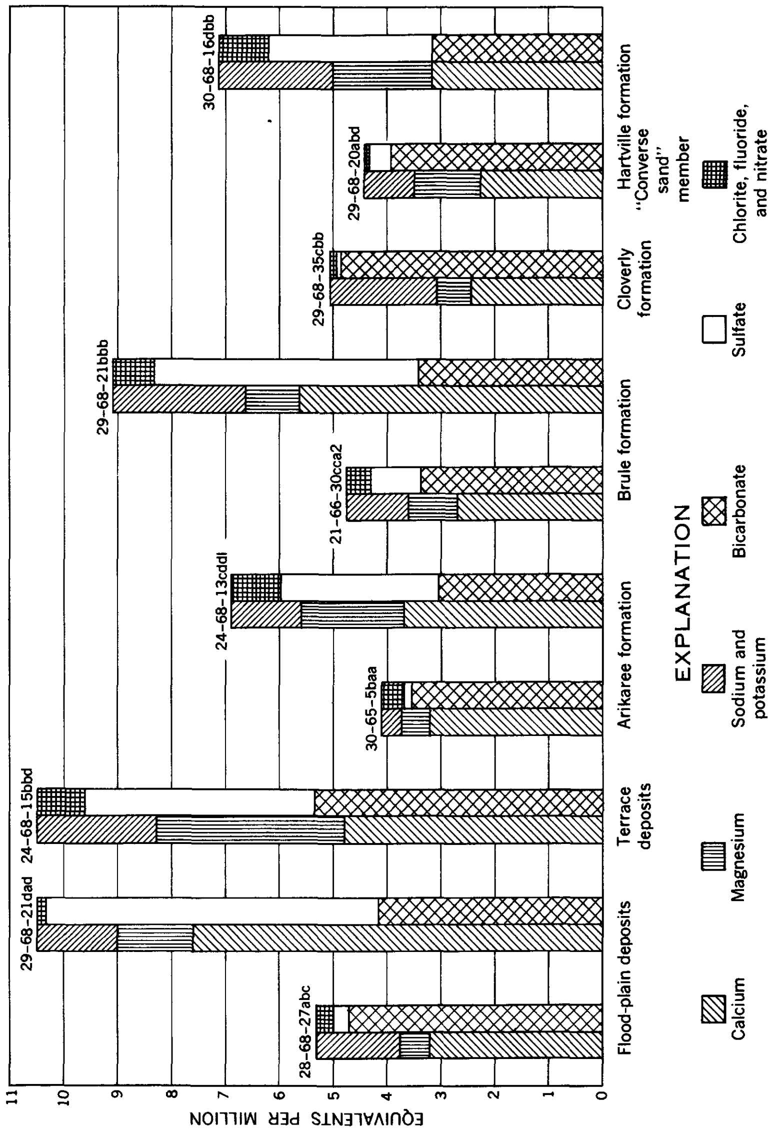

FIGURE 16.—Chart showing principal mineral constituents of ground water, Platte County.

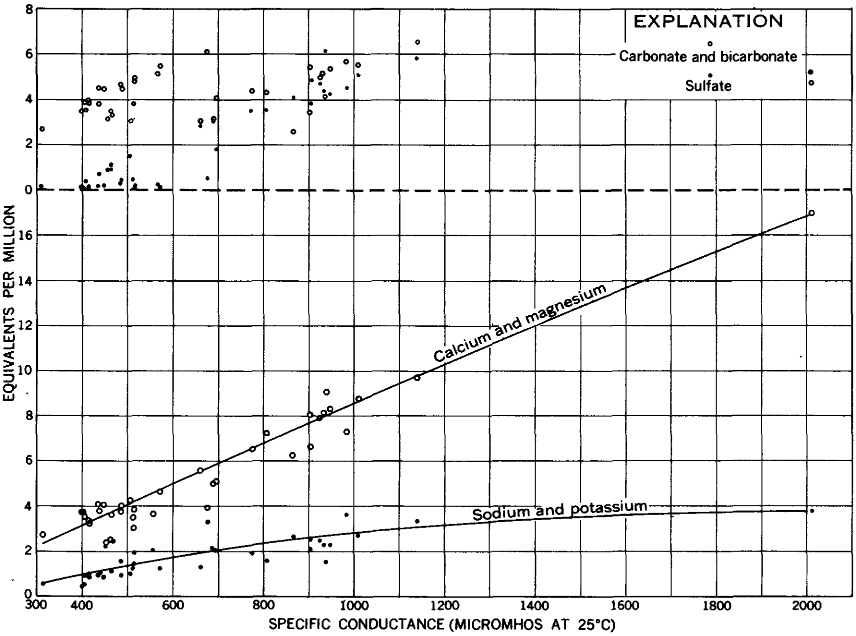

FIGURE 17.—Graph showing relation of concentration of major ions to total concentration of dissolved salts in ground water.

TABLE 6.—*Chemical analyses of*

[Results in parts

Well	Depth of well (feet)	Date of collection	Temperature (°F)	Silica (SiO_2)	Total iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)
Flood-plain										
27-67-21bda	19	*1949* Sept. 14	56	47	0.42	63	4.5	24	8.8	232
27-68-24dab	16	Sept. 15	56	31	.20	61	7.7	45	3.2	316
27-68-28aac	34	do	50	27	.20	68	7.5	20	3.2	274
28-67-18bcc	64	Sept. 24	52	39	.05	70	6.7	15	7.2	276
28-68-12adc	28	Sept. 15	53	19	2.8	259	49	84	5.6	286
28-68-13dcb	23	July 20	54	19	.08	67	8.7	19	6.0	[2] 277
28-68-27abc	12	Sept. 13	57	44	.44	72	3.0	31	2.4	302
		1953 Aug. 20	61	44	.03	64	6.7	34	3.8	287
29-68-21dad	58	*1949* Sept. 14	52	38	1.2	153	17	34	2.4	252
Terrace										
23-68-18acc	24	*1953* Aug. 18	71	14	0.07	66	56	55	1.4	305
24-68-12ccb	Drain	Aug. 19	55	20	.16	81	40	82	1.8	347
24-68-15bbd	43	do	55	22	.05	96	42	52	.9	327
24-68-16cdd	52	Aug. 18	54	18	.03	89	44	48	.6	332
24-68-20ccd	27	do	54	19	.02	72	35	44	2.0	267
25-67-31cccl	28	Aug. 19	60	21	.15	100	46	62	1.2	340
25-68-34ccb	21	do	64	27	.11	98	58	75	4.8	401
Terrace deposits and										
24-68-21ccc	53	*1953* Aug. 18	54	19	0.04	98	39	52	2.1	315
Arikaree										
24-68-12dbc	507	*1955* Oct. 31		65	[3]	56	18	23		186
24-68-13cddl	560	*1953* Aug. 21		43	0.04	74	23	27	6.4	186
25-67-27ccc	150	Aug. 19	56	52	.27	91	33	32	6.7	263
27-68-23ccc	Spring	*1949* Sept. 25	54	27	.24	73	12	27	3.2	336
27-68-31adc	100	*1953* Aug. 20	55	17	.01	44	2.4	51	1.2	194
30-65-5baa	160	do	58	42	.02	65	6.1	6.4	6.8	216
30-65-31aaa		do	53	44	.09	60	9.6	7.8	5.6	217
30-67-27ccb	Spring	do	53	53	.25	61	11	67	16	376
Brule										
20-66-1bab	90	*1953* Aug. 21	56	49	0.22	39	9.1	11	2.8	165
21-66-30cca2	62	do	63	52	.03	54	11	25	5.5	203
22-66-21add	200	do	67	47	.01	82	26	56	7.4	157
29-68-9bcd2	145	*1946* Aug. 5	54	64	.03	89	8.1	46		246
29-68-21bbb	94	*1949* Sept. 14	52	29	.26	113	12	52	8.0	208

See footnotes at end of table.

ground water, Platte County, Wyo.

per million except as indicated]

Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue on evaporation at 180° C)	Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$	Percent Sodium	Sodium adsorption-ratio	Specific conductance (micromhos at 25° C)	pH
deposits											
22	7.6	0.2	10	0.4	332	176	0	22	0.8	511	7.5
12	5.0	.2	.8	.4	342	184	0	34	1.4	558	7.5
20	5.0	.2	1.9	.4	292	201	0	18	.6	486	7.6
9.6	3.0	.2	4.7	.2	302	202	0	13	.5	449	7.5
252	27	.2	622	.1	[1] 1,460	848	613	18	1.3	2,010	7.6
9.2	4.0	.4	1.8	.2	284	203	0	16	.6	434	8.6
2.4	4.8	.2	.8	.4	330	192	0	26	1.0	515	7.6
14	4.5	.4	.4	.03	326	187	0	28	1.1	486	7.3
296	3.0	.4	1.2	.1	692	452	245	14	.7	939	7.5
deposits											
228	15	0.7	7.9	0.16	622	395	145	23	1.2	927	7.9
216	16	.8	14	.14	650	366	81	33	1.9	983	7.8
204	14	.6	28	.20	668	414	146	21	1.1	948	7.7
189	12	.6	16	.14	606	402	130	21	1.0	902	7.5
167	13	.8	12	.09	506	325	106	23	1.1	774	7.8
245	16	.9	14	.13	698	438	159	23	1.3	1,010	7.6
280	19	1.2	1.9	.18	786	484	155	25	1.5	1,140	7.7
Arikaree formation											
212	14	1.2	16	0.12	640	406	148	22	1.1	933	7.5
formation											
73	16	0.6	13	--------	373	214	61	19	0.7	507	7.8
139	22	.6	12	.08	496	280	127	17	.7	660	7.7
172	16	1.4	19	.09	604	362	146	16	.7	807	7.7
8.0	4.0	.2	2.0	--------	334	232	0	20	.8	571	7.5
42	17	.3	6.3	.06	288	120	0	48	2.0	453	7.8
7.0	9.0	.3	4.6	.03	264	187	10	7	.2	397	7.7
6.0	5.0	.2	16	.04	278	189	11	8	.2	405	7.8
28	11	.5	6.4	.09	468	199	0	40	2.1	677	7.5
formation											
9.0	4.5	0.7	6.0	0.07	232	135	0	15	0.4	312	7.8
43	10	.5	8.0	.05	330	180	14	23	.8	464	7.7
197	52	1.4	28	.08	616	311	182	28	1.4	865	7.3
88	33	.4	19	.02	519	256	54	28	1.3	696	7.5
236	24	.2	5.9	.35	646	332	161	25	1.2	901	7.6

TABLE 6.—*Chemical analyses of*

[Results in parts

Well	Depth of well (feet)	Date of collection	Temperature (°F)	Silica (SiO_2)	Total iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)
Cloverly										
29-68-35cbb	Spring	*1949* Sept. 13	53	19	0.12	49	7.5	40	8.0	296
Hartville										
29-68-9bcd1[4]	793	*1949* Sept. 14	--------	28	0.12	43	20	21	5.6	234
29-68-9cbc[4]	700	*1946* Aug. 5	55	--------	--------	42	4.6	58		214
29-68-20abb[4]	410	*1949* Sept. 21	54	18	.12	46	11	21	3.2	244
29-69-20abd[4]	442	July 20	54	21	.08	45	15	18	4.8	240
29-68-20bac[4]	460	Sept. 22	54	15	.20	45	13	18	3.2	240
30-68-16dbb	Spring	*1953* Aug. 20	60	22	.12	63	22	45	7.2	192

[1] Sum of determined constituents. Concentrations of bicarbonate converted to carbonate (CO_3) before summation.
[2] Includes equivalent of 20 ppm of carbonate (CO_3).
[3] Total manganese (Mn) 0.06 ppm.
[4] "Converse sand" member.

HARTVILLE FORMATION

The quality of water from the "Converse sand" of the Hartville formation in the vicinity of Glendo is represented in table 6 by analyses of water from 5 wells. The spring at 30–68–16dbb probably derives water from other members of the Hartville as well as from the "Converse sand."

Water from the "Converse sand" contained 200 to 300 ppm of dissolved solids and was generally of the calcium bicarbonate type. Water from the deeper wells near Glendo was slightly more mineralized than that from the shallower wells south of Glendo. Water from the spring was even more highly mineralized (440 ppm dissolved solids) and contained larger amounts of sodium and sulfate than other water from the "Converse sand." The predominance of calcium bicarbonate in the dissolved salts is evidence of the presence of calcareous material in the Hartville formation.

CLOVERLY FORMATION

Only one sample, which was from a spring at 29–68–35cbb, was analyzed to determine the chemical quality of water in the Cloverly formation. The water contained 296 ppm of dissolved solids, most of which were calcium and sodium bicarbonate. The spring is near *ground water, Platte County, Wyo.*—Continued

per million except as indicated]

Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids (residue on evaporation at 180° C)	Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$	Percent Sodium	Sodium adsorption ratio	Specific conductance (micromhos at 25° C)	pH
formation											
4.0	3.6	0.2	1.7	0.35	296	154	0	35	1.4	515	7.7
formation											
33	4.0	1.2	1.1	0.2	[1] 274	190	0	19	0.7	439	7.8
53	9.0	.8	5.0	-------	---------	124	0	50	2.2	463	-----
1.6	2.6	.2	1.6	.35	[1] 227	161	0	22	.7	414	8.0
19	4.0	.4	.7	.13	[1] 248	174	0	18	.6	408	7.8
3.2	2.6	.2	1.5	.3	226	166	0	19	.6	416	7.8
146	29	1.0	3.8	.09	440	249	92	28	1.2	689	7.7

the recharge area of the Cloverly formation, and thus the water has moved only a relatively short distance in the formation. The water probably becomes progressively more mineralized as it moves away from the recharge area.

BRULE FORMATION

The chemical quality of water from the Brule formation is represented in table 6 by analyses of samples from 5 wells. Water from 2 of the wells is used for municipal supply in Chugwater and Glendo, and that from wells 20–66–1bab and 22–66–21add is used for domestic purposes and stock watering. Well 29–68–21bbb was not being used, but the sample of water from this well is considered to be representative of ground water in the Brule where the Brule is overlain by flood-plain deposits in the Horseshoe Creek valley. The quality of water from this well closely resembles that from nearby well 29–68–21dad, which taps only the overlying flood-plain deposits.

Water in the Brule is of the calcium bicarbonate or calcium sulfate type. In the southeastern part of the county, water in the Brule formation is similar in quality to that in the overlying Arikaree formation; water from well 20–66–1bab, which taps the Brule, is similar in chemical composition to water from well 20–65–34daa (in Goshen County), which taps the overlying Arikaree formation.

Data	*Well* 20-66-1bab	20-65-34daa
Depth ---feet--	90	---
Dissolved solids---parts per million--	232	252
Hardness as $CaCO_3$---parts per million--	135	154
Bicarbonate (HCO_3)---parts per million--	165	198
Sulfate (SO_4)---parts per million--	9. 0	1. 0
Specific conductance---micromhos--	312	340

Well 22–66–21add also taps the Brule where the Brule is overlain by the Arikaree, but the water from this well differs in quality from that from wells tapping the overlying Arikaree (table 6.) Perhaps local differences in the lithologic and water-transmitting properties of the Brule cause the higher mineralization of the water from this well.

ARIKAREE FORMATION

The chemical quality of water from the Arikaree formation is represented in table 6 by analyses of water from 9 wells and springs, the water from most of which is used for domestic purposes and stock watering. Deep wells (24–68–12dbc, –13cddl) are used for municipal supply in Wheatland, and well 24–68–21ccc, which taps both the Arikaree formation and the overlying terrace deposits, is used for irrigation.

In the northeastern corner of the county, water from the Arikaree contains relatively small amounts of dissolved salts (264 to 278 ppm), most of which are calcium bicarbonate. Farther west in T. 30 N., R. 67 W., and southwest in T. 27 N., R. 68 W., water from this formation contains more dissolved salts (288 to 468 ppm) and is of the calcium sodium bicarbonate type; in these areas, the formation may be receiving water from nearby flood-plain deposits. The chemical composition of water in the Arikaree near Wheatland resembles that in the overlying terrace deposits; here, the water from the Arikaree contains appreciable concentrations of dissolved salts (373 to 604 ppm), and magnesium and sulfate as well as calcium and bicarbonate are major constituents. Well 24–68–21ccc probably derives most of its water from the overlying terrace deposits; water from this well is of the calcium bicarbonate sulfate type and contains 640 ppm of dissolved solids.

TERRACE DEPOSITS

The quality of water from terrace deposits in the Wheatland Flats and vicinity was studied in more detail than that from other aquifers. Because of drainage problems and the large increase since 1948, in the use of ground water for irrigation, samples of both irrigation and drainage water were collected from chemical analysis to determine the relationship, if any, between the quality of irrigation water and the quality of ground water and to determine, if possible, the degree of leaching now occurring. Field measurements of specific conductance of irrigation water and drainage water were made to aid in selecting wells, seeps, drains, reservoirs, and streams to be sampled for more complete chemical analysis. Sixteen field determinations of specific conductance were made. Water samples for chemical analysis then were collected from 6 wells tapping terrace deposits; from 1 well tapping both the terrace deposits and the Arikaree formation; from 1 drain, which receives water from irrigated terrace 6; from Bluegrass Creek and Wheatland Reservoir 1, which receive irrigation water from Wheatland Reservoir 2 (in Albany County); and from the Laramie River and Chugwater, Rock, and Wheatland Creeks, which drain a large part of the Wheatland Flats (fig. 15). Analyses of water from the wells and the drain are given in table 6; those of the river, creeks, and of Wheatland Reservoir 1 are given in the section on quality of surface water (p. 100).

Although field determinations of specific conductance are not as accurate as laboratory determinations, they are sufficiently accurate to indicate significant differences in total concentrations of dissolved salts. Comparison of field and laboratory determinations for each site on Wheatland Flats where both determinations were made shows reasonably good correlation.

Because water samples for laboratory analysis were not collected at all field sites where specific conductance was determined in the field, the sites where only field determinations were made and the results of the tests are given below:

Description	*Location*	*Specific conductance (micromhos at 25° C)*
Irrigation water:		
In lateral from Bluegrass and Sybille Creeks via No. 1 Canal.	23–68–14aab	730
Drainage water:		
Upper Rock Creek (water from terrace 7)	23–68–8cdd	1, 120
Ground-water seep (water from terrace 7)	23–68–9cdc	900
Festo Lake (water from terrace 5)	24–68–3cac	1, 080

Because the terrace deposits contained little water prior to irrigation with water from Wheatland Reservoir 1, the chemical composition of ground water in the terrace deposits generally resembles that of the surface water used for irrigation; calcium and magnesium bicarbonates and sulfates are the major salts in solution. The chemical composition of surface, ground, and drainage water is illustrated in figure 18 by patterns (Stiff, 1951).

Ordinarily, the analysis of any one sample of water from Bluegrass Creek or Wheatland Reservoir 1 would not represent the long-term chemical quality of the surface water used for irrigation. However, the quality of the surface water used in 1953 for irrigation was

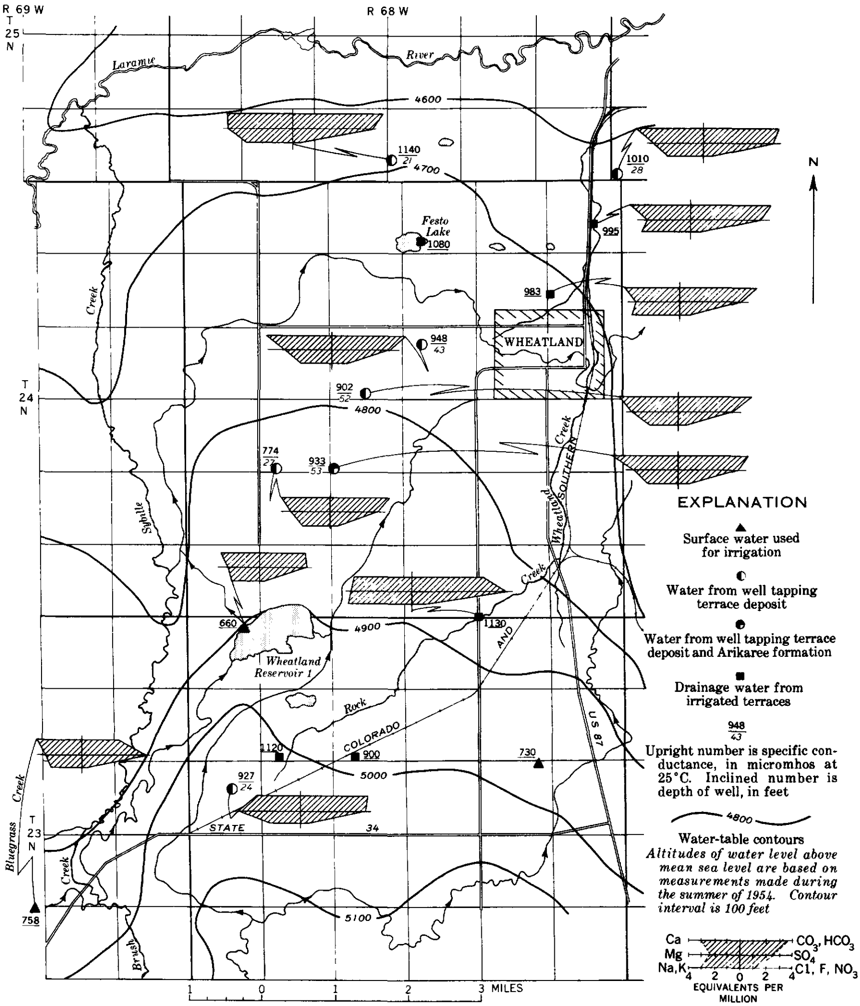

FIGURE 18.—Map of part of Wheatland Flats and vicinity showing chemical quality of irrigation and drainage water and water-table contours.

not appreciably different from that of the water used in the late 1800's. Concentrations of dissolved mineral constituents in water in the Laramie River 50 miles below Laramie were given by Clarke (1924) in percentage of dissolved solids. The sampled site was close to the site of Wheatland Reservoir 2, which stores water used for irrigation on Wheatland Flats. Comparison of the analysis for 1895 with the analysis of water from Wheatland Reservoir 1 for 1953 indicates that the composition and concentration of dissolved salts in the surface water used for irrigation have not changed appreciably in past years.

Analyses in percentage, by weight, of dissolved solids

Constituent	Source of sample	
	Laramie River, 50 miles below Laramie, Wyo.[1] (1895)	Wheatland Reservoir 1, near Wheatland, Wyo. (1953)
Silica (SiO_2)	4.54	2.56
Iron and aluminum oxides ($Fe_2O_3+Al_2O_3$)	1.12	------
Calcium (Ca)	15.07	13.48
Magnesium (Mg)	5.10	6.51
Sodium (Na)	8.82	11.38
Potassium (K)	1.96	
Carbonate (CO_3)	19.59	23.47
Sulfate (SO_4)	37.48	39.03
Chloride (Cl)	6.32	3.25
Fluoride (F)	------	.14
Nitrate (NO_3)	------	.19
Total	100.00	100.01
Dissolved solids ppm	429	430

[1] Clarke (1924, p. 84).

Concentrations of dissolved salts in ground water and drainage water are somewhat higher than in surface water used for irrigation. For example, specific conductance of water from Bluegrass Creek, Wheatland Reservoir 1, and the lateral at 23–68–14aab ranged from 660 to 758 micromhos, whereas that of ground water from shallow wells and drainage water from the irrigated terraces ranged from 774 to 1,140 micromhos (fig. 18). Because the concentration of dissolved salts in ground water and drainage water is only slightly higher than that in surface water, the ratio of the amount of irrigation water that is drained through the root zone to the amount entering the soil (leaching percentage) probably is relatively large.

Contours on the water table show that the general direction of ground-water movement in the terrace deposits is northward and northeastward (pl. 1, fig. 18). The concentration of dissolved salts in ground water increases with distance down gradient from the source of recharge. For example, water from well 24–68–16cdd, which taps terrace deposit 5, had a specific conductance of 902 micromhos, whereas water from wells and drains in the same terrace to the northeast had specific conductances ranging from 983 to 1,140 micromhos (fig. 18).

FLOOD-PLAIN DEPOSITS

The chemical quality of water from flood-plain deposits in Horseshoe, Bear, and Cottonwood Creek valleys is represented in table 6 by analyses of water from 8 shallow wells. Generally, water in these flood-plain deposits is of the calcium bicarbonate type, moderately mineralized, and hard. However, water from well 29–68–21dad in the Horseshoe Creek valley was of the calcium sulfate type and was more mineralized than water from wells in the Bear and Cottonwood Creek valleys. Durum (Rapp and Babcock, 1953) stated that the source of this calcium sulfate is probably the "gypsum and red shale sequence," which underlies the Chugwater formation. The Chugwater formation crops out on the south side of the Horseshoe Creek valley in T. 29 N., R. 69 W. (pl. 1). Water from Horseshoe Creek at site 29–68–20ada downstream from the outcrop also was of the calcium sulfate type.

Water from well 28–68–12adc at Cassa contained an extremely high concentration nitrate (622 ppm). High concentrations of nitrate in ground water usually are rare unless the water is from wells down gradient from sources of nitrate, such as barnyards or sewers. Because the water sample from well 28–68–12adc contained roots and had a high iron concentration (2.8 ppm), the well casing may have been deteriorated and surface drainage may have seeped into the well (Rapp and Babcock, 1953).

SURFACE WATER

The chemical quality of surface water also was studied because of the close relationships between ground and surface waters in Platte County. Sites where surface-water samples were obtained are shown in figure 15, and chemical analyses of the water are given in table 7. Most of these analyses represent the quality of water during periods when ground-water inflow made up a large part of the streamflow; therefore, the analyses probably are fairly representative of the quality of the ground water discharged into the streams. However, Chugwater Creek, when sampled in August 1953, was very turbid, and its rate of discharge was relatively high because of recent rains in its headwater areas. Bluegrass Creek, through which irrigation water from Wheatland Reservoir 2 is diverted, was flowing at a rate estimated to be 150 cfs (cubic feet per second) when sampled.

The data given in table 7 for the North Platte River near Cassa and below Guernsey Reservoir represent only a small part of the available data for these sites. However, they do indicate the variation in chemical quality of water in the North Platte River above Guernsey Reservoir and the average quality of the water in the river below Guernsey Reservoir. Figure 19 shows by means of patterns (Stiff, 1951) the chemical quality of surface water in Platte County and the variations in quality resulting from such factors as ground-water inflow, drainage from irrigated land, storage, and regulation.

Water in Bear Creek, Cottonwood Creek, the North Laramie River, and the Laramie River upstream from Wheatland Flats in Platte County is of the calcium bicarbonate type and contains less than 400 ppm of dissolved solids. The areas drained by these streams are

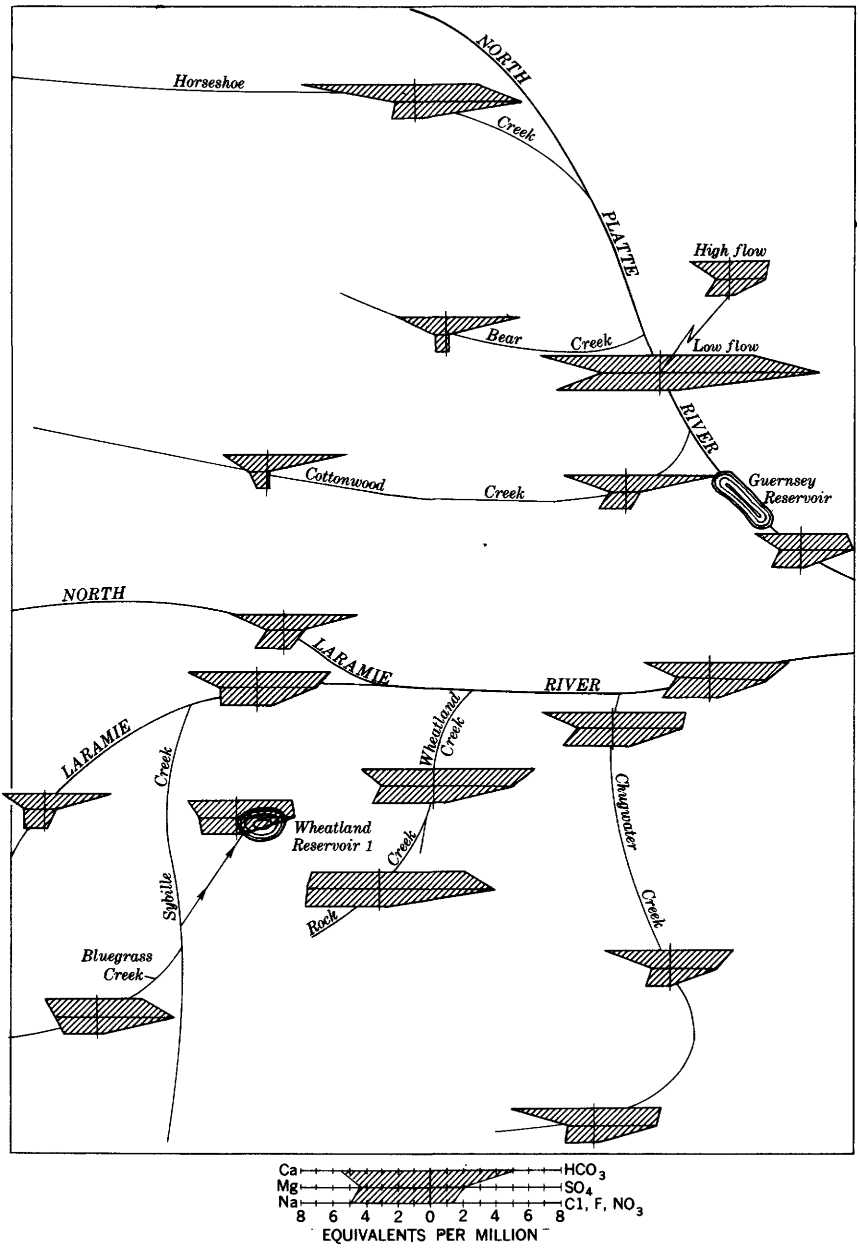

FIGURE 19.—Chart showing chemical quality of surface water, Platte County.

TABLE 7.—*Chemical analyses of*

[Results in parts per

Location [1]	Date of collection	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)
Horseshoe											
29-68-20ada	[2] 9-25-49	38	0.04	141	16	29	13	214	0	296	3.0
Bear											
28-68-14ccc	[2] 9-25-49	37	0.04	57	10	17	6.4	242	14	2.4	1.0
North Platte											
28-67-18d	[2] 12-7-50	20	0.04	146	41	130	8.6	342	0	473	37
28-67-18d	[3] 6-4-52	15	.04	49	11	31		141	0	103	7.5
Cottonwood											
27-68-30aca	[2] 8-20-53	18	-------	56	9.8	12		236	0	7.0	2.0
27-68-29bbc	[2] 9-25-49	31	0.04	56	14	14	5.6	288	0	4.0	1.4
27-67-10dbc	[2] 9-25-49	39	.04	67	12	39	4.0	324	0	34	5.0
North Platte River											
27-66-27dd	[4] 10-1-51–9-30-52	-------	-------	52	17	40	-------	[5] 154	-------	142	11
27-66-27dd	[4] 10-1-50–9-30-53	17	0.02	56	17	41	3.7	[5] 162	-------	150	11
Laramie											
24-69-17dcc	[2] 8-19-53	17	-------	54	16	27		246	4	41	5.5
25-67-19dcc	[2] 8-20-53	38	-------	86	28	51		273	0	178	21
25-66-30bbc	[2] 8-19-53	35	-------	82	25	65		282	0	182	19
Bluegrass											
22-70-22aaa	8-18-53	6.3	0.01	66	32	49	4.0	171	0	231	15
Wheatland Reservoir											
23-68-6a	8-18-53	11	-------	58	28	49		206	0	168	14
North Laramie											
25-67-18cda	[2] 8-20-53	29	-------	64	13	40		275	0	57	10
Rock											
23-68-2bbb	8-18-53	13	-------	82	54	106		325	0	338	23
Wheatland											
24-68-1dba	8-19-53	15	-------	90	40	86		359	0	239	19
Chugwater											
21-67-36ada	8-21-53	22	-------	103	19	39		262	0	183	11
22-66-18ddc	8-21-53	18	-------	82	15	35		235	0	130	8.0
25-67-23ddd	8-19-53	35	-------	87	26	68		276	0	204	19

[1] See well-numbering system, p. 6.
[2] Represents low flow.
[3] Represents high flow.
[4] Discharge-weighted average. Represents 100 percent of runoff for water-year.
[5] Includes carbonate as bicarbonate.

surface water, Platte County, Wyo.

million except as indicated]

Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids: Calculated	Dissolved solids: Residue on evaporation at 180° C	Dissolved solids: Tons per acre-foot	Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$	Percent sodium	Specific conductance (micromhos at 25° C)	pH	SAR
Creek											
0.8	0.7	0.1	....	650	0.88	418	243	13	875	7.7	0.6
Creek											
0.4	0.8	0.1	....	266	0.36	183	0	16	427	8.2	0.5
River near Cassa											
0.4	4.2	0.0	1,030	....	1.48	534	254	34	1,450	7.9	2.4
.3	1.4	.07	....	312	.42	168	52	29	460	7.7	1.0
Creek											
0.4	0.0	....	221	....	0.30	180	0	12	380	7.5	0.4
.4	2.0	.1	....	280	.38	197	0	13	434	7.9	.4
.4	1.6	.2	....	364	.50	217	0	28	569	7.9	1.2
below Guernsey Reservoir											
....	1.0	0.05	....	363	0.49	200	74	30	548	....	1.2
0.4	1.0	.08	....	383	.52	210	77	29	570	....	1.2
River											
0.4	0.1	....	286	....	0.39	200	0	23	457	8.3	0.8
.8	2.4	....	539	....	.73	331	107	25	794	7.8	1.2
.4	3.0	....	550	....	.75	309	78	31	805	8.0	1.6
Creek											
0.4	0.3	0.10	....	516	0.70	297	157	26	758	8.0	1.2
1											
0.6	0.8	....	430	....	0.58	260	91	29	660	7.6	1.3
River											
0.4	0.2	....	349	....	0.47	214	0	29	537	7.8	1.2
Creek											
1.0	4.6	....	782	....	1.06	426	159	35	1,130	7.9	2.2
Creek											
0.8	5.4	....	672	....	0.91	390	96	32	995	8.2	1.9
Creek											
0.4	0.0	....	506	....	0.69	336	121	20	763	7.6	0.9
.6	.1	....	405	....	.55	265	72	22	628	7.6	.9
.6	4.2	....	580	....	.79	323	97	31	841	7.9	1.6

underlain principally by rocks of Precambrian and Tertiary age and are not irrigated extensively. On the other hand, water in the North Platte River, by the time it enters Platte County, is of the calcium and sodium sulfate type and is relatively highly mineralized; it contains as much as 1,030 ppm of dissolved solids during low-flow periods. The North Platte River drains large areas underlain by clay, shale, and other fine-grained sedimentary deposits and receives return flow from irrigated land upstream from Platte County.

The effect on the quality of water in Horseshoe Creek of the "gypsum and red shale sequence" beneath the Chugwater formation is illustrated in figure 19. Most of the rock mantle of the Horseshoe Creek drainage basin is similar to that of the drainage basins of Bear and Cottonwood Creeks, except for the outcrop of the Chugwater formation in T 29 N., R. 69 W. Therefore, the water in Horseshoe Creek probably would be similar in quality to that in Bear and Cottonwood Creeks if it were not for drainage from the Chugwater and other gypsiferous rocks of Permian, Triassic and Jurassic age. The water in Horseshoe Creek is of the calcium sulfate type and had a dissolved solids concentration of 650 ppm.

The Chugwater formation crops out also in the upper reaches of Chugwater Creek in T. 20 N., R. 69 W. (pl. 1). Drainage from this and other gypsiferous rocks probably partly explains the presence of calcium sulfate in the water of Chugwater Creek. Farther downstream the creek also receives drainage from irrigated land in Chugwater Creek valley and in the Wheatland Flats area. This drainage also contributes sulfate salts to the creek (fig. 19).

The effect of drainage from irrigated lands in the Wheatland Flats area on the quality of Laramie River water also is illustrated in figure 19. Comparison of the pattern for the upstream sampling site with those for the two downstream sites shows the increase in sulfate concentration as a result of both direct ground-water inflow and inflow via the North Laramie River and Wheatland and Chugwater Creeks. Inflow via Sybille Creek was low at the time of sampling; the mean daily discharge of Sybille Creek was less than 3 cfs at the gaging station at 24–69–25b during the latter part of August 1953.

The chemical quality of irrigation and drainage water in Wheatland Flats and vicinity (Bluegrass Creek, Wheatland Reservoir 1, Rock Creek, and Wheatland Creek) is discussed in the section on quality of ground water from terrace deposits (p. 94).

SUITABILITY OF THE WATER

IRRIGATION

Characteristics that determine the suitability of water for irrigation are (a) the total dissolved-salt content and the amount of boron,

(b) the relative amounts of some dissolved constituents, and (c) the chemical changes that may take place after the water has been applied and subjected to evaporation and transpiration.

High concentrations of dissolved salts in irrigation water may adversely affect plant growth. Plants absorb water and essential minerals and nutrients by the process of osmosis; when the concentration of salts in the soil solution becomes too high, the osmotic pressure balance between the soil solution and the plant root is upset and growth is retarded.

Boron in minute quantities is an essential plant nutrient. However, boron in concentrations as low as 1 ppm in irrigation water is toxic to many plants. Wilcox (1948, table 8) recommended the following limits:

Permissible limits of boron, in parts per million, for several classes of irrigation water

Classes of water: Rating	Classes of water: Grade	Sensitive crops	Semitolerant crops	Tolerant crops
1	Excellent	<0.33	<0.67	<1.00
2	Good	0.33 to 0.67	0.67 to 1.33	1.00 to 2.00
3	Permissible	.67 to 1.00	1.33 to 2.00	2.00 to 3.00
4	Doubtful	1.00 to 1.25	2.00 to 2.50	3.00 to 3.75
5	Unsuitable	>1.25	>2.50	>3.75

Sensitive crops include nut, citrus, and stone-fruit trees; semitolerant crops include cereals, potatoes, and cotton; tolerant crops include sugar beets, alfalfa, and garden crops such as onions, lettuce, and carrots.

The amount of sodium in relation to the amount of calcium and magnesium in irrigation water is an important factor in the classification of an irrigation supply. Sodium, when present in water in relatively higher concentrations than calcium and magnesium, may replace calcium and magnesium ions adsorbed on the soil colloids. Calcium and magnesium when adsorbed on soil particles tend to flocculate the colloids; flocculation results in soil of good tilth and permeability. However, if adsorbed calcium and magnesium are replaced by sodium, the colloids disperse and a puddled, structureless soil of poor tilth and permeability results. The sodium-adsorption-ratio of a water is directly related to the adsorption of sodium by soil and thus is a valuable criterion for determining the suitability of an irrigation supply.

The classification of irrigation water by the method of the U.S. Salinity Laboratory Staff (1954) is based on the salinity and the sodium (alkali) hazards of the water (fig. 20). The salinity hazard is

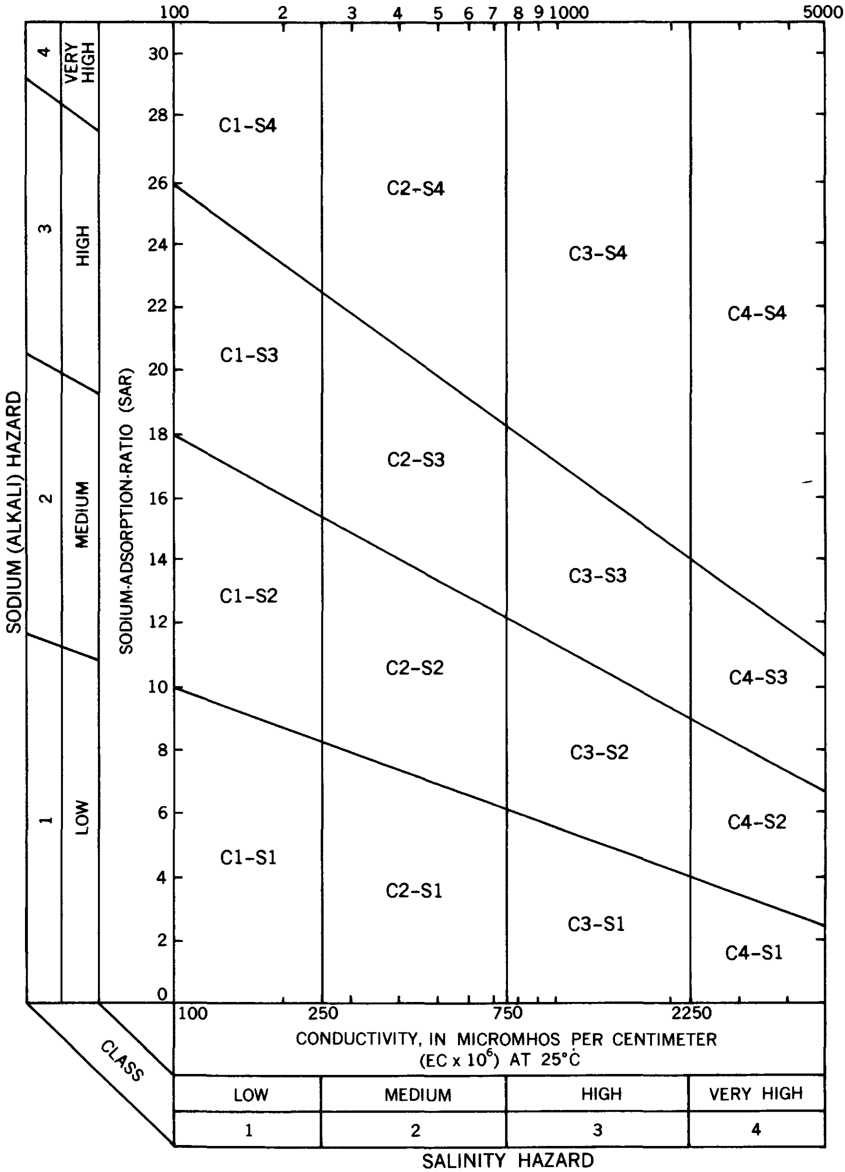

FIGURE 20.—Diagram for classifying irrigation water.

related directly to the specific conductance, and the sodium (alkali) hazard is related directly to the sodium-adsorption-ratio. The classification is based on the assumption that the water will be used under average conditions of soil texture, drainage, infiltration rate, quantity of water used, salt tolerance of crops, and climate. Large deviations from any of the average conditions may change the classification. The interpretation of the diagram by the U.S. Salinity Laboratory Staff is as follows:

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

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

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

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

The classification of irrigation waters with respect to SAR is based primarily on the effect of exchangeable sodium on the physical condition of the soil. Sodium-sensitive plants may, however, suffer injury as a result of sodium accumulation in plant tissues when exchangeable sodium values are lower than those effective in causing deterioration of the physical condition of the soil.

Low-sodium water (S1) can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops such as stone-fruit trees and avocados may accumulate injurious concentrations of sodium.

Medium-sodium water (S2) will present an appreciable sodium hazard in fine-textured soils having high cation-exchange capacity, especially under low-leaching conditions, unless gypsum is present in the soil. This water may be used on coarse-textured or organic soils with good permeability.

High-sodium water (S3) may produce harmful levels of exchangeable sodium in most soils and will require special soil management—good drainage, high leaching, and organic matter additions. Gypsiferous soils may not develop harmful levels of exchangeable sodium from such waters. Chemical amendments may be required for replacement of exchangeable sodium, except that amendments may not be feasible with waters of very high salinity.

Very high-sodium water (S4) is generally unsatisfactory for irrigation purposes except at low and perhaps medium salinity, where the solution of calcium from the soil or use of gypsum or other amendments may make the use of these waters feasible.

The chemical changes that take place in water as the result of evapotranspiration and selective plant uptake also are important. Evaporation of water from the soil and transpiration of water by plants increase the concentration of salts in the soil solution. Because alkaline-earth carbonates are among the least soluble salts in natural water, they tend to precipitate as the volume of water is reduced. Precipitation of alkaline earths will cause an increase in the sodium-adsorption-ratio of the water; and if the concentration of carbonate plus bicarbonate in the applied water is greater than the concentration of the alkaline earths, precipitation of all the alkaline earths will cause residual sodium carbonate to be present. Residual sodium carbonate has strong alkaline properties and tends to make the soil alkaline and to dissolve organic matter; the soil becomes blackish gray and is referred to as "black alkali." Wilcox, Blair, and Bower (1954) found by experimentation that irrigation water containing more than about 2.5 epm of residual sodium carbonate is unsuitable for irrigation over a long period without use of amendments, that water containing between 1.25 and 2.5 epm is marginal, and that water containing less than 1.25 epm probably is safe.

The suitability of the water in Platte County for irrigation is summarized in table 8. Concentrations of sodium, boron, and residual sodium carbonate are low enough that the water is excellent for irrigation. However, the water has a medium to high salinity hazard and thus should be used only on soils having good drainage and on plants having moderate to good salt tolerance.

TABLE 8.—*Classification of water in Platte County, Wyo., for irrigation*

Source	Specific conductance (micromhos at 25° C.)	Sodium-adsorption-ratio	Classification [1]	Boron (ppm)	Residual sodium carbonate (epm)
Ground water					
Flood-plain deposits [2]	434–939	0.5–1.4	C_2S_1–C_3S_1	0.03–0.4	0–1.51
Terrace deposits	774–1,140	1.0–1.9	C_3S_1	.09–.20	0
Arikaree formation [3]	397–933	.2–2.1	C_2S_1–C_3S_1	.03–.12	0–2.18
Brule formation	312–901	.4–1.4	C_2S_1–C_3S_1	.02–.35	0
Cloverly formation	515	1.4	C_2S_1	.35	1.78
Hartville formation	689	1.2	C_2S_1	.09	0
"Converse sand" member	408–463	.6–2.2	C_2S_1	.13–.35	.03–1.03
Surface water					
Horseshoe Creek	875	0.6	C_3S_1	0.1	0
Bear Creek	427	.5	C_2S_1	.1	.78
North Platte River near Cassa	460–1,450	1.0–2.4	C_2S_1–C_3S_1	.0–.07	0
Cottonwood Creek	380–569	.4–1.2	C_2S_1	.1–.2	.27–.98
North Platte River below Guernsey Reservoir [4]	429–1,280	1.0–2.4	C_2S_1–C_3S_1	.03–.19	0
Laramie River	457–805	.8–1.6	C_2S_1–C_3S_1		0–.16
Bluegrass Creek	758	1.2	C_3S_1	.10	0
Wheatland Reservoir 1	660	1.3	C_2S_1		0
North Laramie River	537	1.2	C_2S_1		.23
Rock Creek	1,130	2.2	C_3S_1		0
Wheatland Creek	995	1.9	C_3S_1		0
Chugwater Creek	628–841	.9–1.6	C_2S_1–C_3S_1		0

[1] After U.S. Salinity Lab. Staff, 1954.
[2] Water from well 28–68–12adc not included because of contamination.
[3] Includes water from well 24–68–21ccc which also taps terrace deposits.
[4] For period October 1951 to September 1953.

Relatively saline water, in excess of normal requirements, has been used successfully in many parts of the world for irrigation of permeable, well-drained soil. Soils of the Fort Collins series, principally the Fort Collins loam, mantle most of the irrigated land in the Wheatland Flats area. Carpenter and others (1926) stated that "Fort Collins loam is probably the most desirable soil for irrigation farming in the Wheatland area, because it is not too heavy for easy cultivation, has good water-holding capacity and a good store of plant food, and does not require so much water and so frequent irrigation as the more sandy soils."

Most of the crops, such as grains, sugar beets, and alfalfa, now being irrigated in the Wheatland Flats area have a medium to high salt tolerance.

DOMESTIC USE

The U.S. Public Health Service Drinking Water Standards (1946) established sanitary, bacteriological, and chemical requirements for water used for drinking and culinary purposes on interstate common carriers. They have been accepted by the American Water Works Association as criteria of quality for all public water supplies. Although the standards are not compulsory for water that is used locally, they are measures of the suitability of water for domestic use. The standards for some of the chemical constituents are:

Constituent	*Concentration (ppm)*
Iron and manganese (Fe+Mn)	3.0
Magnesium (Mg)	125
Sulfate (SO_4)	250
Chloride (Cl)	250
Fluoride (F)	[1] 1.5
Dissolved solids	[2] 500

[1] Mandatory limit.
[2] 1,000 ppm permitted if water of better quality is not available.

Most ground water in Platte County conforms to the standards and thus is suitable for domestic use. However, water from several wells tapping flood-plain deposits near Horseshoe, Bear, and Cottonwood Creeks and at Cassa in the North Platte River valley contained iron in excess of the recommended limit of 0.3 ppm. Iron and manganese in water stain fixtures, utensils, and fabrics and, when present in concentrations greater than about 1 ppm, can be tasted. The growth of "iron bacteria" is sometimes associated with iron-bearing waters.

Sulfate in excess of the recommended limit of 250 ppm was present in water from wells that tap terrace deposits north of Wheatland and flood-plain deposits in the Horseshoe Creek and the North Platte River valleys at Cassa. The maximum sulfate concentration, however, was only 296 ppm.

Dissolved-solids concentrations exceeded the recommended limit of 500 ppm in water from 14 wells. Most of these wells tapped terrace

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deposits near Wheatland. Water from only 1 well (28–68–12adc) contained dissolved solids in excess of 1,000 ppm; this high concentration is due mainly to the high concentration of nitrate. Nitrate is the end product of oxidation of nitrogenous organic matter, and the presence of significant amounts of nitrate may indicate contamination of the water by sewage or other organic matter. Cyanosis in infants, caused by methemoglobinemia, has resulted from high concentrations of nitrate in water used for drinking and for preparing formulas (Maxcy, 1950).

None of the wells sampled yielded water containing more than the recommended limits for magnesium and fluoride.

Although specific limits of hardness cannot be set, the following are general criteria:

Hardness as $CaCO_3$ *(ppm)*	*Rating*	*Usability*
<60	Soft	Suitable for most uses without further softening.
60–120	Moderately hard	Suitable for many uses except in some industrial applications.
120–200	Hard	Softening required for laundries and some other industries.
>200	Very hard	Softening required for most uses

Ground water in Platte County is moderately hard to very hard. Generally, the hardest water is obtained from rocks of Tertiary and Quaternary age, whereas moderately hard water is obtained from the Cloverly formation and the "Converse sand" of the Hartville formation.

Water from most streams draining Platte County is chemically suitable for domestic use; obviously, its sanitary potability cannot be taken for granted. However, during periods of low flow the water from many of the streams is very hard and contains dissolved solids in excess of the recommended limit of 500 ppm. Water from Horseshoe Creek, Rock Creek, and the North Platte River near Cassa also contains sulfate in excess of the recommended limit of 250 ppm.

INDUSTRIAL USE

Industrial water-quality criteria vary widely. Table 9 is a compilation of water-quality tolerances for 17 industrial applications. The suitability of an individual water for industrial use can be evaluated by comparing data given in tables 6 and 7 with the tolerance data given in table 9.

Because ground water in Platte County generally is hard and alkaline and locally may contain iron in excess of the usual requirements, it is unsuitable for many industrial uses unless treated. However, the ground water is clear, is generally colorless and odorless, and has a virtually unvarying temperature of about 55° F.

TABLE 9.—*Water-quality tolerances for industrial applications*

[From California Institute of Technology (1952). Recommended maximum or range of maximum concentrations in parts per million except as indicated]

Industry	Turbidity (as SiO_2)	Color (units)	Taste	Odor	Oxygen consumed	Dissolved oxygen	Hydrogen sulfide (H_2S)	Total solids
Baking	10	10	None	Low	-	-	0.2	-
Boiler feed water:								
Pressure:								
0–150 psi	20	80	-	-	15	1.4	5	[3] 3,000–500
150–250 psi	10	40	-	-	10	.14	3	[3] 2,500–500
250–400 psi	5	5	-	-	4	.00	0	[3] 1,500–100
Over 400 psi	1	2	-	-	3	.00	0	[3] 50
Brewing:								
Light beer	0–10	0–10	None	Low	-	-	.2	500–1,000
Dark beer	0–10	0–10	None	Low	-	-	.2	500–1,000
Carbonated beverages	1–2	5–10	None	Low	1.5	-	0–.2	850–855
Confectionary	-	-	Low	Low	-	-	.2	50–100
Cooling water	50	-	-	-	-	-	-	-
Food:								
Canning and freezing	1–10	-	None	Low	-	-	1.0	-
Equipment washing	1	5–20	None	None	-	-	-	850
Processing—general	1–10	5–10	Low	Low	-	-	-	850
Ice manufacturing	1–5	5	None	Low	3	-	-	170–1,300
Laundering	-	-	-	-	-	-	-	-
Photographic processes	-	-	-	-	-	-	-	-
Plastics, clear, uncolored	2	2	-	-	-	-	-	200
Pulp and paper:								
Ground-wood paper	50	30	-	-	-	-	-	500
Soda and Sulfate pulps	25	5	-	-	-	-	-	250
Kraft paper (bleached)	40	25	-	-	-	-	-	300
Kraft paper (unbleached)	100	100	-	-	-	-	-	500
Fine paper	10	5	-	-	-	-	-	200
Rayon (viscose):								
Pulp	5	5	-	-	-	-	-	100
Manufacture	.3	-	-	-	-	-	-	-
Steel manufacture	-	-	-	-	-	-	-	-
Sugar manufacture	-	-	-	-	-	-	-	-
Tanning operations	20	10–100	-	-	-	-	-	-
Textile manufacture	.3–25	5–70	-	-	-	-	-	-

Industry	Hardness (as $CaCO_3$)	Alkalinity (as $CaCO_3$)	Iron (Fe)	Manganese (Mn)	Fe+Mn	Aluminum (as Al_2O_3)	Silica (SiO_2)	Calcium (Ca)
Baking	[2]	-	0.2	0.2	0.2	-	-	-
Boiler feed water:								
Pressure:								
0–150 psi	80	-	-	-	-	5	40	-
150–250 psi	40	-	-	-	-	.5	20	-
250–400 psi	10	-	-	-	-	.05	5	-
Over 400 psi	2	-	-	-	-	.01	1	-
Brewing:								
Light beer	-	75–80	.1–1.0	.1	.1	-	50	100–200
Dark beer	-	80–150	.1–1.0	.1	.1	-	50	200–500
Carbonated beverages	200–250	50–128	.1–.2	.2	.1–1.5	-	-	-
Confectionary	-	-	.2	.2	.2	-	-	-
Cooling water	50	-	.5	.5	.5	-	-	-
Food:								
Canning and freezing	50–85	-	.2	.2	.2	-	-	-
Equipment washing	10	-	-	-	.2	-	-	-
Processing—general	10–250	30–250	.2	.2	.2–.3	-	-	-
Ice manufacturing	70–72	30–50	.03–.2	.2	.2	-	10	-
Laundering	0–50	60	.2–.0	.2	.2	-	-	-
Photographic processes	100–200	-	-	-	-	-	-	-
Plastics, clear, uncolored	-	-	.02	.02	.02	-	-	-
Pulp and paper:								
Ground-wood paper	200	150	.3	.1	-	-	50	-
Soda and sulfate pulps	100	75	.1	.05	-	-	20	-
Kraft paper (bleached)	100	75	.2	.1	-	-	50	-
Kraft paper (unbleached)	200	150	1.0	.5	-	-	100	-
Fine paper	100	75	.1	.05	-	-	20	-
Rayon (viscose):								
Pulp	8	50	.05	.03	.05	8	25	-
Manufacture	55	-	.0	.0	.0	-	-	-
Steel manufacture	50	-	-	-	-	-	-	-
Sugar manufacture	-	-	.1	-	-	-	-	20
Tanning operations	50–513	128–135	.1–2.0	.1–.2	.2	-	-	-
Textile manufacture	0–50	-	.1–1.0	.05–1.0	.2–1.0	-	-	10

See footnotes at end of table.

TABLE 9.—*Water-quality tolerances for industrial applications*—Continued

Industry	Bicarbonate (HCO_3)	Carbonate (CO_3)	Hydroxide (OH)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	pH [1]	Other
Baking	--	--	--	--	--	--	--	--
Boiler feed water:								
Pressure:								
0–150 psi	50	200	50	--	--	--	>8.0	
150–250 psi	30	100	40	--	--	--	>8.4	
250–400 psi	5	40	30	--	--	--	>9.0	
Over 400 psi	0	20	15	--	--	--	>9.6	
Brewing:								
Light beer	--	50–68	--	(4)	--	1.0	6.5–7.0	NO_3, 30.
Dark beer	--	50–68	--	(4)	--	1.0	6.5–7.0	NO_3, 30.
Carbonated beverages	--	--	--	250	250	.2–1.0	--	
Confectionary	--	--	--	--	--	--	>7.0	
Cooling water	--	--	--	--	--	--	--	
Food:								
Canning and freezing	--	--	--	--	(5)	1.0	>7.5	
Equipment washing	--	--	--	--	250	1.0	--	
Processing—general	--	--	--	--	--	1.0	--	
Ice manufacturing	--	--	--	--	--	1.0	--	
Laundering	--	--	--	--	--	--	6.0–6.8	
Photographic processes	--	--	--	--	--	--	--	(6).
Plastics, clear, uncolored	--	--	--	--	--	--	--	
Pulp and paper:								
Ground-wood paper	--	--	--	--	75	--	--	CO_2, 10.
Soda and sulfate pulps	--	--	--	--	75	--	--	CO_2, 10.
Kraft paper (bleached)	--	--	--	--	200	--	--	CO_2, 10.
Kraft paper (unbleached)	--	--	--	--	200	--	--	CO_2, 10.
Fine paper	--	--	--	--	--	--	--	CO_2, 10.
Rayon (viscose):								
Pulp	--	--	--	--	--	--	--	Cu, 5.
Manufacture	--	--	--	--	--	--	7.8–8.3	
Steel manufacture	--	--	--	--	175	--	6.8–7.0	(7).
Sugar manufacture	100	--	--	20	20	--	--	Mg, 10.
Tanning operations	--	--	--	--	--	--	6.0–8.0	
Textile manufacture	200	--	--	100	100	--	--	Mg, 5; heavy metals, none.

[1] Values preceded by ">" are recommended minimums; when a range is shown, pH should be within that range.
[2] Some hardness desirable.
[3] Depends on design of boiler.
[4] Presence of $CaSO_4$ advantageous.
[5] Sodium chloride (NaCl) 1,000–1,500.
[6] Presence of sulfides, colloidal sulfur, and calcium sulfate in water used to mix developer solution can cause chemical fog. Iron, manganese, suspended solids, turbidity, and color in solution and wash waters can cause stains.
[7] Temperature, 75° F.

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RECORDS OF WELLS AND SPRINGS AND LOGS OF TEST HOLES AND WELLS

Records of 532 wells and springs in Platte County were obtained during the investigation. Their locations are shown on plate 1, and pertinent data are given in table 10. Measurements of the depth of the well or of the depth to water could not be made in many wells, and the data given for such wells are as reported by the owner or driller.

The logs of 187 test holes and wells in Platte County, including 73 test holes drilled for the U. S. Geological Survey are given in table 11. The logs entitled "sample log" are those for which the well cuttings were collected and studied by personnel of the U. S. Geological Survey. Logs not designated as "sample logs" are written logs of wells that were obtained from drillers' records or other sources, and their terminology is virtually unchanged. These test holes are not tabulated in table 10. The test hole and well logs are numbered according to the well-numbering system previously described.

The altitudes given in tables 10 and 11 are those of the land surface at the well or test-hole site, and are in feet above mean sea level; they were determined by interpolation between contours on topographic quadrangle map.

Table 10.—*Records of wells and springs in Platte County, Wyo.*

Well number: See text for description of well-numbering system.
Type of supply: B, bored well; Dn, driven well; Dr, drilled well; Du, dug well; Sp, spring.
Depth of well: Measured depths are given in feet and tenths below measuring point; reported depths are given in feet below land-surface datum.
Type of casing: C, concrete, brick or tile pipe; N, none; P, iron or steel pipe; R, rock; W, wood.
Character of material: Congl, conglomerate; G, gravel; Gr, weathered granite; Ls, limestone; S, sand; Sch, schist; Sls, siltstone; Ss sandstone.
Type of pump: A, airlift; C, cylinder; Cf, centrifugal; F, flows; J, jet; N, none; P, pitcher pump; T, turbine.
Type of power: E, electric; G, gasoline or diesel engine; H, hand operated; N, none; W, windmill.
Use of water: D, domestic; I, irrigation; In, industrial or railroad; N, none; O, observation; P, public; S, stock.
Description of measuring point: Bp, bottom of discharge pipe; Bpb, bottom of pump base; Hc, hole in casing; Hpb, hole in pump base; Hph, hole in pump housing; Ls, land surface; Tc, top of casing; Tpc, top of pipe clamp; Twc, top of well cover.
Height of measuring point above mean sea level: Altitudes were interpolated from topographic maps.
Depth to water: Measured depths to water level are given in feet, tenths and hundredths; reported depths are given in feet.
Remarks: Bw, battery of wells; Ca, sample collected for chemical analysis; D, discharge in gallons per minute (B, bailed; E, estimated; M, measured; R, reported); DD, drawdown in feet while discharging at the preceding rate; L, log of well given in table of well logs; T, temperature in degrees Fahrenheit; Tw, test well.

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet), (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
20-65- 8abb	Ernest Lutzke......	......	Dr	126.0	5	P	Ss	Arikaree formation.	C, W	S	Tc	+1.7	....	97.27	10-27-53	D2.5M, DD3.6.
9daa	Arthur J. Eastwood	......	Dr	156.0	5	P	Ss	.....do...........	C, W	N	Tc	+2.5	5,423	123.65	10-27-53	
18dad	L. S. Fyler..........	......	Dr	115.0	5	P	Ss	.....do...........	C, N	N	Tc	+.4	....	61.91	11- 3-53	

30abb	C. J. Stafford	......	Dr	116.0	5	P	Ss	.....do..........	C,W	S	Tc	+1.5	....	74.85	10-27-53	
32cbc	.....do........	......	Dr	113.5	5	P	Ss	.....do..........	C,W	S	Tc	+1.1	....	72.63	10-27-53	
33ddd	.....do........	......	Dr	114.5	5	P	Ss	.....do..........	C,W	S	Tc	+.7	....	97.27	10-27-53	
66- 1bab	Fred Steinacker ...	1912	Dr	90	......	P	Sls	Brule formation.	C,W	D	Ls	....	....	48	....	T56,Ca.
3dda	E. Rhoades.........	1912	Dr	110	6	P	Sls	.....do..........	C,E	D,S	Ls	....	....	90	....	
5bcb	Thomas and Fred Kane.	......	Dr	97.0	5	P	Sls	.....do..........	C,H	N	Tc	+1.0	....	79.37	11- 6-53	
8aaa	R. Bostwick........	......	Dr	200.0	5	P	Sls	.....do..........	C,W	S	Twc	+1.0	....	105.70	10-27-53	
11aad	E. Rhoades	1912	Dr	100	6	P	Sls	.....do..........	C,W	S	Ls	....	....	70	....	
15bbb	A. V. Tyrrell........	......	Dr	122.0	5	P	Sls	.....do..........	C,W	S	Tc	+.5	....	56.30	11- 3-53	
18daa	.....do........	......	Dr	121.5	5	P	Sls	.....do..........	N	N	Tc	+.2	....	82.27	10-27-53	
23dbb	E. W. Harding........	......	Dr	121.0	5	P	Ss	Arikaree formation.	C,W	S	Tc	+1.3	....	94.55	10-27-53	
29ada	A. V. Tyrrell........	......	Dr	177.5	5	P	Sls	Brule formation.	C,W	S	Tc	+.5	....	131.92	10-27-53	
31ddd	Max Pensold	......	Dr	153.0	5	P	Sls	.....do..........	N	N	Tc	+.6	....	98.53	10-27-53	
67- 1aba	A. R. Bastion........	......	Dr	160.0	5	P	Sls	.....do..........	C,W	S	Tc	+.3	....	84.50	11- 6-53	
2add	F. H. Cushatt	1912	Dr	160	6	P	Sls	.....do..........	C,E	D,S	Ls	....	....	125	....	
3cbb	Mrs. H. McDonald	1951	Dr	26.0	6	....	S,G	Flood-plain deposits.	....	......	Ls	....	....	4	....	D100R, DD17,L, Tw.
5aaa	Curtis Templin	......	Dr	100	5	P	Sls	Brule formation.	C,W	D,S	Tc	0	5,500	46.68	11-17-53	
6bca	A. L. Voight	......	Dr	87.0	5	P	Sls	.....do..........	C,E	D,S	Ls	....	....	50	....	
8dcc	Mrs. H. McDonald	1951	Dr	32.0	6	....	S,G	Flood-plain deposits.	....	......	Ls	....	....	....	....	D20R,L,Tw.
8ddc	H. McDonald........	......	Dr	68.8	5	P	S,G,Sls	Flood-plain deposits, Brule formation.	J,E	D	Tc	+.2	....	3.44	11-17-53	
9ccc	Mrs. H. McDonald	1951	Dr	26.0	6	...	S,G	Flood-plain deposits.	....	.....	Ls	....	....	....	....	D90R,DD7.5, L,Tw.
11bbd	F. H. Cushatt.......	......	Dr	105.0	4	P	Sls	Brule formation	N	N	Tc	+1.0	....	57.67	11- 6-53	
11cbb	.....do........	1912	Dr	110.0	5	P	Sls	.....do..........	N	N	Tc	0	....	59.63	11- 6-53	
19bbb	Mrs. H. McDonald	1951	Dr	29.0	6	...	S,G	Flood-plain deposits.	....	.....	Ls	....	....	6	....	D50R,DD15, L,Tw.

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring Point: Description	Measuring Point: Distance above (+) or below (-) land surface (feet)	Measuring Point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
20-67-23bba	Stanley Meeker.....	....	Dr	129.4	5	P	Sls	Brule formation.	C,W	S	Tc	+0.5	....	99.80	11- 5-53	
33abd	C. K. Long..........	....	Dr	169.0	5	P	Sls	.....do..........	N	N	Tc	+1.0	....	102.55	11- 5-53	
34ddd	Harry Ewart	....	Dr	179.0	5	P	Sls	.....do..........	C,W	S	Tc	+.3	....	105.94	11- 5-53	
68- 1dbd	Earl Morrison......	1933	Dr	80	5	P	Sls	.....do..........	C,W	S	Ls	....	....	30	....	
3cdd	T. R. Oberman	....	Dr	49.0	5	P	S,G, Congl	Tertiary(?) deposits.	C,W	S	Tc	+1.7	....	44.61	11-10-53	
25bbb	Mrs. H. McDonald.	1951	Dr	30.0	6	....	S,G	Flood-plain deposits.	....	......	Ls	....	....	4	....	D40R,DD16, L, Tw.
27ccc	Ned Foss............	1915	Dr	162	6	P	Sls	Brule formation.	C,E	D,S	Ls	....	....	22	....	
34baa	Mrs. H. McDonald.	1951	Dr	29.0	6	....	S,G	Flood-plain deposits.	....	......	Ls	....	....	8	....	D50R,DD10, L,Tw.
34bbb	Hugh McDonald.....	1952	Dr	11.0	10	N	S,G	.....do..........	N	N	Ls	0	....	8.03	11-17-53	
69- 23dbc	D. Piper.............	....	Dr	56.0	5	P	S,G,Ss	Flood-plain deposits, Chugwater(?) formation.	C,W	D,S	....	....	....	....	....	
26cdb	.....do................	1952	Dr	162.9	6	P	Ss	Morrison(?) formation.	C,W	S	Tc	+2.0	....	122.47	11-17-53	
70- 3aad	G. S. Martin.........	....	Sp	....	....	....	Gr	Precambrian rocks.	F	D,S	....	....	....	....	....	

	13bcd	Mrs. D.M.Oberman		Du	19.0	36	C	S,G	Flood-plain deposits.	C,H	S	Twc	+2.0		14.35	11-12-53	
	26aaa	Gus Miller		Du	8.6	6	C	S,G	do	C,H	D,S	Tc	+.2		6.80	11- 9-53	
	26aba	do		Sp				Gr	Precambrian rocks.	F	D,S						
21-65-	4acc	W. Karlson	1915	Dr	100	6	P	Ss	Arikaree formation.	C,W	D,S	Ls			70		
	4bcc	do	1915	Dr	110	6	P	Ss	do	C,W	S	Ls			80		
	6add	G. Rhoads	1912	Dr	170	6	P	Ss	do	C,W	N	Ls			95		
	7aaa	Mr. Hellbaum		Dr	130	6	P	Ss	do	C,W	D,S	Ls			110		
	9bdb	do		Dr	135	6	P	Ss	do	C,W	S	Ls			80		
	16cab	do		Dr	180	6	P	Ss	do	C,W	S	Ls			120		
	17bab	do		Dr	180	6	P	Ss	do	C,W	S	Ls			135		
	17dcc	do		Dr	165	6	P	Ss	do	N	N	Ls	0		118.00	9- 5-52	
	19bad	do		Dr	190	6	P	Ss	do	C,W	S	Ls			140		
	21bac	do		Dr	165	6	P	Ss	do	C,W	S	Ls			120		
	30add	Harry Goertz		Dr	156.0	5	P	Ss	do	C,W	S	Tc	+1.0		137.28	11- 3-53	
	33add	D. I. Young		Dr	157.1	5	P	Ss	do	N	N	Tc	+.7		117.90	11- 3-53	
66-	3dcc	R. Marke	1915	Dr	200	6	P	Sls	Brule formation.	J,E	D	Ls	0	5,335	83.80	7-13-55	D4R.
	6aba	W. J. Brown		Dr	45.0	6	P	Sls	do	C,W	S	Tc	+1.0	5,121	36.60	11-24-53	
	12ddd	Mr. Hellbaum		Dr	165	6	P	Sls	do	C,W	S	Ls			130		
	14bcc	do		Dr	180	6	P	Sls	do	C,E	D,S	Ls		5,440	140		
	15ddd	do		Dr	165	6	P	Sls	do	C,E	D,S	Ls		5,450	115		
	18bcc	Mr. Abel		Dr	66.0	5	P	Sls	do	C,H	N	Tc	+.5	5,271	43.90	11-24-53	
	26ddd	R. J. Honey		Dr	119.3	5	P	Ss	Arikaree formation.	N	N	Tc	0		93.37	11- 3-53	
	29ccb	W. J. Brown	1953	Dr	20	5	P	S,G	Flood-plain deposits.	Cf,E	D,S	Ls		5,255	6		
	30cca1	City of Chugwater	1938	Dr	85	6	P	Sls	Brule formation.	T,E	P	Ls		5,300	20		
	30cca2	do	1948	Dr	62.0	6	P	S,Sls	do	T,E	P	Tc	-5.0	5,295	27.14	11-19-53	T63,Ca.
	30cca3	do	1953	Dr	86	6	P	S,Sls	do	T,E	D,P	Ls		5,300	20		
	33bba	N. Goertz		Dr	248.0	5	P	Sls	do	C,W	N	Tc	+2.5	5,492	100.90	11- 3-53	
67-	1aca	W. J. Brown		Dr	63.8			Sls	do	N	N	Hph	+.4	5,220	42.30	11-24-53	
	3abb	Claude Lewis		Dr	86.0	5	P	Sls	do	C,W	S	Tc	+2.5	5,312	53.70	11-25-53	
	4ddd	D. P. Grant	1952	Dr	134.0	6	P	Sls	do	C,W	S	Tc	+.5	5,350	62.07	11-25-53	L.
	10dbc	A. L. Voight		Dr	102.0	5	P	Sls	do	C,W	S	Tc	+.7	5,576	52.91	11-23-53	

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well		Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring Point: Description	Measuring Point: Distance above (+) or below (-) land surface (feet)	Measuring Point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet) (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
21-67-	13bbb	W. A. Latham.......	1913	Dr	81.8	5	P	Sls	Brule formation.	C,H	N	Tc	+0.9	5,291	53.70	11.24-53	
	22ccd	Harold Piper........	....	Dr	88.0	5	P	Sls	.....do..........	C,W	N	Tc	+2.5	5,600	68.35	11-10-53	
	26ada	Phillip Ash..........	....	Dr	111.5	5	P	Sls	.....do..........	C,W	S	Hpb	+.5	5,472	69.90	11-12-53	
	30cac	A. L. Voight.........	....	Dr	27.0	5	P	S	Flood-plain deposits.	C,H	N	Tc	+.7	5,571	19.90	11-27-53	
	31bbd	L. A. Voight.........	....	Dr	122.3	5	P	Sls	Brule formation.	N	N	Tc	+.6	5,611	71.20	11-23-53	
	34daa	E. Gustafson........	1947	Dr	182.0	6	P	Sls	.....do..........	N	N	Tc	+1.3	5,501	75.40	11-23-53	
68-	31cda	D. M. Oberman.....	....	Sp	....	....	...	Ls	Converse sand	F	D,S	....	....	....	....	....	
70-	2abd	G. W. Small.........	....	Sp	....	....	...	S	Flood-plain deposits.	F	D,S	....	....	....	....	....	
	4ccc	W. E. Dover.........	1943	Dr	40	4	P	S,G	.....do..........	J,E	D,S	Ls	....	....	10	....	
22-65-	6ddc	J. R. Prickett.......	....	Dr	268	6	P	Sls	Brule formation.	C,W	D,S	Ls	....	....	72	....	
	7ccd	M. Goertz...........	1912	Dr	160	6	P	Sls	.....do..........	C,W	D	Ls	....	....	90	....	
	16cdc	W. Swan.............	1940	Dr	245	6	P	Sls	.....do..........	C,W	S	Ls	....	....	100	....	
	18cdd	K. Artery...........	1912	Dr	150	6	P	Sls	.....do..........	C,W	D,S	Ls	....	....	90	....	
	29bcc	Mr. Hitt.............	1912	Dr	150	6	P	Sls	.....do..........	C,W	N	Tc	+.4	....	85.50	8-27-52	
	33bbb	F. Wilson...........	1912	Dr	160	6	P	Sls	.....do..........	C,W	D	Ls	....	....	90	....	

66-	1bab	W. Baker	1915	Dr	150	6	P	Sls	Brule(?) formation.	C,E	D,S	Ls	....	....	90	....	
	3ddd	Marion Fuller	1912	Dr	280	6	P	Sls	Brule formation.	C,W	D	Ls	....	5,200	90	....	
	4aaa	J. Michaelis	1952	Dr	230	6	P	Sls	Brule(?) formation.	C,W	S	Ls	....	5,190	90	....	
	6cba	F. Prewitt	1950	Dr	30	6	P	S,G	Flood-plain deposits.	C,W	S	Ls	....	4,930	18	....	
	10cdd	R. Wilson	1912	Dr	135	6	P	Sls	Brule formation.	C,W	D	Ls	....	5,164	90	....	
	15cbc	P. Scranton	1940	Dr	160	6	P	Sls	.....do	C,W	D,S	Bpb	+.3	5,205	104.50	8-22-52	
	17ddd	J. Goertz	1950	Dr	80	6	P	Sls	.....do	C,W	S	Ls	....	5,055	40	....	
	18cdc	J. J. Olnstead	1949	Dr	27	5	P	S,G	Flood-plain deposits.	C,E	D	Ls	....	4,990	3	....	
	21add	J. Goertz	1950	Dr	200	6	P	Sls	Brule formation.	C,E	.....	Ls	....	5,265	60	....	T67,Ca.
	24ddd	Edward Hitt	1915	Dr	160	6	P	Sls	.....do	C,W	N	Ls	....	....	85	....	
	27daa	W. E. Hitt	1952	Dr	130	6	P	Sls	.....do	C,H	N	Tc	0	5,310	108.50	9- 3-52	
	28dad	R. George	1912	Dr	320	6	P	Sls	.....do	C,W	D	Ls	....	5,325	90	....	
	36abb	Herbert Havely	....	Dr	267	6	P	G,Sls	.....do	C,W	D,S	Twc	+.7	....	91.97	10-18-50	L.
67-	3dbd	H. H. Settell	1915	Du	30	6	P	S,G	Flood-plain deposits.	C,W	D,S	Tc	+.6	4,987	6.10	8-25-52	
	4ada	O.Gudahl	1915	Dr	120	6	P	Sls	Brule formation.	C,W	D,S	Ls	....	5,120	35	....	
	14bbc	R. H. Baker	1952	Dr	118	6	P	Sls	.....do	N	N	Tc	+.2	5,130	61.20	8-25-52	
	15ddc	R. Baker	....	Dr	....	6	P	Sls	.....do	C,W	N	Tc	+.5	5,154	61.40	8-25-52	
	21aaa	Claude Lewis	....	Dr	93.0	5	P	Sls	.....do	C,W	S	Tpc	+.5	5,200	68.00	11-24-53	D3.9M, DD5.0.
	30cbc	D. P. Grant	1952	Dr	60	6	P	S,G,Sls	Flood-plain deposits. Brule formation.	J,E	D,S	Tc	-1.5	5,368	3.50	11-25-53	
	36aba	W. J. Brown	....	Dr	48.0	4	P	Sls	Brule formation.	C,W	S	Tc	+2.5	5,074	8.00	11-24-53	
68-	3cac	Ralph Allison	1952	Dr	103.7	5	P	S,G, Congl	Tertiary(?) deposits.	C,W	S	Tc	+.9	5,496	72.65	11-25-53	D6R,L.

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring Point: Description	Measuring Point: Distance above (+) or below (-) land surface (feet)	Measuring Point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
22-68- 12aad	H. E. Graves........	....	Du	6.8	48	C	S,G	Flood-plain deposits.	C,W	D,S	Ls	0	5,150	4.58	11-13-53	
14caa	J. E. Irvine..........	1952	Dr	162	6	C	S,Sls	Brule formation.	T,E	S	Tc	+1.3	5,381	27.97	7-14-55	D5.1M,L.
29cad	D. P. Grant..........	....	Dr	42.8	5	P	S,G, Congl	Tertiary(?) deposits.	C,W	S	Tc	+2.5	5,756	9.98	11-24-53	
36dab	.....do..................	1952	Dr	79.0	6	P	G,Sls	Brule formation.	N	S	Tc	+.5	5,488	46.98	11-25-53	L.
69- 3bcb	R. P. Rogers	....	Du	27.8	36	C	S,G	Terrace deposits.	C,H	N	Twc	+.2	5,090	21.35	11-11-53	
8bca	Lence Guthrie.......	1950	Dr	42	5	P	S,G	Flood-plain deposits.	J,E	D	Ls	....	4,505	25	....	
9dcd	R. P. Rogers	1949	Dr	41.0	6	P	S,G	.....do..........	J,E	D,S	Tc	-5.5	5,160	9.45	11-11-53	
15add	.....do..................	....	Dr	125.0	4	P	S,G, Congl	Tertiary(?)deposits.	N	N	Tc	+.8	5,333	99.40	11-11-53	
27adb	D. M. Oberman	....	Du	16.4	6	P	S,G	Flood-plain deposits.	N	N	Tc	+.5	5,460	15.30	11-12-53	
30adb	C. L. King............	1900	Du	18.8	36	C	S,G	.....do..........	C,H	D	Twc	+.3	5,400	10.66	11-12-53	
34caa	Mr. Ames	....	Dn	14.7	2	P	S,G	.....do..........	P,H	N	Hph	+4.0	5,589	8.98	11-12-53	

70-	9cad	H. H. Hall	1940	Dr	49.0	4	P	S,G	do	C,W	D,S	Tc	+.7	5,581	22.10	11-11 53	
	14caa	L. Seidel	...	Du	26	48	C	S,G	do	C,E	D,S	Tc	-5.5	5,240	22.00	11- 9-53	L
	22bbb	John Wickam	1942	Dr	21.9	4	P	S,G	do	C,E	D	Tc	+.7	5,311	13.40	11-11-53	
	33ddd	C. H. Walters	...	Du	18.1	4	P	S,G	do	C,E	D	Tc	-6.0	5,404	4.85	11- 9-53	
23-65-	9dad	...	...	Du	33.5	48	R	Sls	Brule formation.	N	N	Twc	+.3	4,473	31.85	3-19-43	
66-	1bcb	R. Carey	1917	Dr	99	6	P	Sls	Brule(?) formation.	C,W	D,S	Ls	...	...	81	...	
	3bcc	M. Goertz	...	Dr	70	6	P	Ss	Arikaree (?) formation.	C,W	S	Ls	...	5,084	40	...	
	5ddd	W. Hobson	1915	Dr	110	6	P	Ss	do	C,W	S	Ls	...	5,130	60	...	
	9cdb	Mrs. A. Swan	1915	Dr	100	6	P	Ss	do	C,W	D,S	Tc	+.3	5,145	78.40	8-14-52	
	10ccb	F. C. Kenny	1914	Dr	260	6	P	Ss	do	C,W	D,S	Tc	+.5	5,166	122.53	5-28-53	
	13bcc	J. Phillippi	...	Sp	...	...	...	Sls	Brule formation.	F	S	...	...	...	...	...	D1E.
	15ddd	do	...	Sp	...	...	...	Sls	do	F	S	...	...	4,880	...	...	D2E.
	17cdd	C. C. Huston	...	Dr	200	6	P	Sls	do	C,W	S	Ls	...	5,185	90	...	
	27ccd	L. H. Michaelis	1948	Dr	230	6	P	Sls	do	C,W	S	Ls	...	5,175	90	...	
	28caa	M. Goertz	...	Sp	...	...	...	Sls	do	F	S	...	...	...	...	...	D1E.
	29dbb	R. Wilson	...	Dr	90	6	P	Sls	do	C,W	S	Ls	...	5,134	80	...	
	32bab	do	1950	Dr	262	6	P	Sls	do	C,E	D,S	Ls	...	5,195	150	...	
	33bcb	M. Goertz	1915	Dr	200	6	P	Sls	do	C,W	D,S	Tc	+.4	5,183	79.00	8-25-52	
67-	1acd	J. W. Johnson	...	Sp	...	...	...	S,G	Flood-plain deposits.	F	S	...	...	4,915	...	...	D1E,T64.
	11adb	do	...	Sp	...	...	...	S,G	do	F	S	...	...	4,850	...	...	D5E,T66.
	12dbd	J. Phillippi	...	Sp	...	...	...	Sls	Brule formation.	F	S	...	...	4,940	...	...	D1E,T69.
	21dbd	M. Thomas	1950	Dr	60	6	P	Sls	do	J,E	D	Ls	...	4,880	17	...	
	22cdd	J. S. Kinnamon	1946	Dr	213	6	P	Sls	do	C,E	D,S	Ls	...	4,985	45	...	
	25abc	F. Prewitt	1950	Dr	30	6	P	S,G	Flood-plain deposits.	C,W	S	Ls	...	4,862	18	...	T48.
	26daa	Mrs. J. Phillippi	1915	Du	...	6	P	S,G	do	C,W	D,S	Ls	...	4,870	30	...	
	35cab	C. L. Hoffman	...	Sp	...	...	...	Sls	Brule formation.	F	S	...	...	4,995	...	...	D50E,T66.
	35ccc	do	...	Dr	90	...	...	Sls	do	C,E	D,S	Ls	...	5,065	30	...	
	36abb	F. Prewitt	1949	Dr	25	...	...	S,G	Flood-plain deposits.	J,E	D	Ls	0	4,885	18	...	

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring Point: Description	Measuring Point: Distance above (+) or below (-) land surface (feet)	Measuring Point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
23-68-1ccc	R. S. Willson........	1953	Dr	43	16	P	S,G	Terrace deposits.	T,E	I	Bp	+2.0	4,924	6.10	6- 4-54	D420M,L.
1ccd	.....do..................	1955	Dr	32	24	C	S,G	.....do..........	T,E	I	Tc	+2.3	4,922	10.38	8-30-55	D540M, DD11.6.
2ccb	Mr. Baker............	1954	Dr	22	24	C	S,G	.....do..........	T,G	I	Tc	0	4,916	7.09	6-15-54	L.
3ddd	Marlin Baker........	1943	Dr	110	4	P	S,G,Ss	Terrace deposits, Arikaree formation.	J,E	D,S	Tc	-4.0	4,928	15.43	6-15-54	
7bcc	G. H. Rhoads	....	Du	11	48	W	S,G	Terrace deposits.	C,H	O	Twc	0	4,930	7.56	6-14-54	
8add	C. Nickel	1918	Dr	28	6	P	Ss	Arikaree formation.	C,E	D,S	Tc	0	4,975	3.05	6-14-54	
8ddd	Fred Ryff............	1908	Du	28	....	C	S,G	Terrace deposits.	C,W,H	D,S	Tc	+.4	5,014	18.95	6-14-54	
9bbc	G. E. Graefe........	....	Du	....	48	.....	Ss	Arikaree formation.	N	N	Twc	0	4,972	10.35	6-14-54	
10daa	....	....	Du	....	....	.....	S,G	Terrace deposits.	N	N	Twc	+.9	4,966	8.30	6-14-54	

10ddd	School District.....	......	Dr	31	5	P	S,G	Terrace deposits.	C,H	O	Tc	+2.2	5,007	22.60	6-14-54	
11daa	Richard Timms....	......	Du	25	....	....	S,G	.....do..........	C,E	D,S	Tc	0	4,970	8.40	6-14-54	
14ada	J.R. and J.L. Turner	1953	Dr	75	7	P	Ss	Arikaree formation.	T,E	I	Tc	+1.0	5,036	51.90	7-15-54	D170M, DD18,L.
15ccc	Bertha Kenty........	....	Du, Dr	47	....	....	S,G	Terrace deposits.	C,H	D	Tc	+.7	5,063	6.33	6-11-54	L.
16abb	A. A. Juschka.......	....	Dr	53	4	P	S,G	.....do..........	J,E	D,S	Tc	0	4,990	9.90	6-14-54	
18aaa	G. Bower............	1949	Dr	57	4	P	Ss	Arikaree formation.	J,E	D,S	Tc	0	5,035	19.70	6-14-54	
18acc	.....do................	1953	Du	24.0	48	C	S,G	Terrace deposits.	T,G	I	Tc	0	5,058	10.90	3-10-54	T71,Ca.
18bab	C. Wilson............	....	Dr	29.7	6	P	S,G	.....do..........	C,E	D	Tc	+2.0	5,043	13.93	3-10-54	
18ccc	K. V. Howe..........	....	Du	40	48	C	S,G	.....do..........	N	N	Ls	0	5,088	17.72	6-20-54	
19aba	L. L. Bowen.........	......	Du, Dn	15	48	C	S,G	.....do..........	N	O	Twc	+.1	5,069	11.57	6-11-54	
19dcd	R. Chase.............	....	Dr	42.8	4	P	S,G	.....do..........	J,E	D	Tc	+1.2	5,136	19.10	6-11-54	
21bcb	M. Echelberger.....	1915	Dr	62	6	P	S,G	.....do..........	J,E	D	Tc	0	5,116	44.60	6-11-54	
22bcc	J. A. Corman........	1954	Dr	28	12	P	S,G	.....do..........	T,E	I	Ls	....	5,098	7	....	D500R,L.
29bba	R. Wallesen.........	....	Dr	71	6	P	Ss	Arikaree deposits.	N	N	Ls	0	5,150	25.10	6-11-54	D5R,L.
69- 23ddc	L. C. Johnson.......	....	Du	13.0	12	C	S,G	Flood-plain deposits.	P,H	N	Twc	+3.0	4,968	8.91	11-12-53	
24-65- 4cdb	Mrs. E. M. Kershner.	1915	Dr	270	6	P	Sls	Brule formation.	C,W	S	Hc	+1.4	5,036	255.00	8- 4-52	
5bcb	.....do................	1915	Dr	260	6	P	Sls	.....do..........	N	N	Tc	0	5,010	240.20	8- 4-52	
7abc	R. Romig............	1950	Dr	327	6	P	Sls	Brule(?) formation.	C,E	D,S	Ls	....	5,120	280	....	
9aaa	Mr. E.M. Kershner	1915	Dr	128	6	P	Ss	Arikaree(?) formation.	C,W	S	Tc	+.4	4,890	81.00	8- 4-52	
17bcc	E. H. Hudson........	1915	Dr	337	6	P	Sls	Brule(?) formation.	C,E	D,S	Ls	....	5,190	300	....	
20bdd	.....do................	1950	Dr	322	6	P	Sls	.....do..........	C,N	N	Ls	....	5,250	280	....	
30ccd	J. Weber.............	......	Dr	215	6	P	Sls	.....do..........	C,W	S	Ls	....	5,165	200	....	
66- 2bdb	O. F. Throckmorton	1915	Dr	280	6	P	Ss	Arikaree formation.	C,W	N	Ls	....	5,080	260	....	

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
24-66- 4bab	Mr. Phifer..........	......	Sp	....	......	....	S,G	Flood-plain deposits.	F	S	.....	....	4,670	....	....	D1E,T68.
9cab	.....do................	......	Sp	....	......	....	S,G	.....do..........	F	S	.....	....	4,810	....	....	D4E,T68.
12dbb	Lee Marr...........	1914	Dr	284	6	P	Ss	Arikaree formation.	C,W	D,S	Hpb	0	5,050	220.70	8- 6-52	
17cbc	Mr. Phifer..........	1938	Dr	3,800	10-8	P	....	....	C,W	S	Ls	....	4,930	60	....	T56.
20cbc	A. Weber............	1952	Dr	100	6	P	Ss	Arikaree formation.	C,W	S	Tc	+1.1	5,001	66.49	8-12-52	D2.0M, DD0.33.
21ada	.....do................	......	Dr	240	6	P	Ss	.....do..........	C,W,E	D,S	Tc	+.4	5,100	220.90	8-12-52	
21cbd	.....do................	......	Dr	250	6	P	Ss	.....do..........	C,W	S	Bpb	0	5,110	212.50	8-12-52	
21dcd	H. Curtis, Jr	1915	Dr	145	6	P	Ss	.....do..........	C,W	N	Tc	0	5,020	97.50	8- 7-52	
22ccc	A. Weber............	1950	Dr	124	6	P	Ss	.....do..........	C,W	S	Tc	0	5,035	123.45	8-12-52	
22ddd	.....do................	......	Dr	240	6	P	Ss	.....do..........	C,W	S	Tc	+.3	5,060	182.00	8-12-52	D1.4M, DD4.6.
28ddd	H. Curtis, Jr........	1915	Dr	145	6	P	Ss	.....do..........	C,W	S	Ls	....	5,050	105	....	
29cbb	I. E. Johnson........	1915	Dr	85	6	P	Ss	.....do..........	C,W	D	Ls	0	4,995	79.08	8- 8-52	
31bdc	J. W. Johnson.......	1951	Dr	107	8	P	Ss	.....do..........	J,E	D,S	Ls	....	4,970	52	....	
33dbb	I. E. Johnson........	1947	Dr	152.0	6	P	Ss	.....do..........	C,W	S	Ls	....	5,057	112	....	L.
35ada	J. Valentine..........	1915	Dr	300	6	P	Ss	.....do..........	C,E	D,S	Ls	....	5,090	113	....	

67-	4acc	Tom Bennett........	1953	Dr	72	18	P	Ss	Arikaree formation.	T,E	I	Tc	0	4,645	48.62	5- 6-54	D90M, DD21.7,L.
	5ccc	B. E. McCartney....	....	Dr	301	.....	P	Ss	.....do..........	J,E	D	Ls	....	4,712	50	1949	L.
	5dcd	Grace Tolman........	....	Dr	136	4	P	Ss	.....do..........	C,E	D,S	Tc	+.7	4,681	59.92	6-20-54	
	6bdc	Henry Funk..........	1953	Dr	43	24	P	S,G	Terrace deposits.	T,E	I	Ls	....	4,670	15	1954	D220M, L,T54.
	6dcd	W. Rains............	....	Dr	300	6	P	Ss	Arikaree formation.	N	N	Twc	+.2	4,705	60.35	6-20-54	
	8ccc	....	....	Dr	147.0	6	P	Ss	.....do..........	N	N	Ls	0	4,765	113.16	6-20-54	
	17bba	A. Marshall..........	....	Dr	315	4	P	Ss	.....do..........	J,E	D,S	Tc	+2.7	4,764	126.31	6-20-54	L.
	18cdd	W. W. Wolfe..........	....	Dr	174.0	6	P	Ss	.....do..........	N	N	Tc	+.7	4,821	144.10	6-20-54	
	18dab	Lambert Ryff.........	....	Dr	309	6	P	Ss	.....do..........	N	N	Twc	+.5	4,800	144.20	6-20-54	
	26aad	J. W. Johnson........	....	Dr	165	6	P	Ss	.....do..........	C,W	S	Ls	....	4,940	130	1952	
68-	2dcc	John Whalen..........	1954	Dr	15	12	....	S,G	Terrace deposits.	T,E	I	Ls	....	4,715	7	....	D800R,L.
	3aad	C. R. Pool............	....	Du	....	36	C	S,G	.....do..........	C,H	N	Twc	+.7	4,709	7.05	6-17-54	
	3bcb	J. W. Lawyer........	1953	Dr	40	24	P	S,G	.....do..........	T,E	I	Tc	0	4,733	15.12	4- 6-54	D130M, DD18.1,L.
	3bcc	.....do.................	1954	Dr	33.5	12	P	S,G	.....do..........	T,E	I	Tc	+2.3	4,738	18.99	6- 4-54	D200M, DD10.7,L.
	4bdc	Leo Norris...........	1953	Dr	38	18	P	S,G	.....do..........	T,E	I	Tc	+.6	4,743	16.20	6- 7-54	D210M, T54,L.
	4cbc	A. C. Johnson.......	1953	Dr	42	18	P	S,G	.....do..........	T,E	I	Tc	0	4,753	18.91	6-22-54	D230M, DD18.0, T54,L.
	5add	Fred Martinez......	1953	Dr	40	24	P	S,G	.....do..........	T,E	I	Tc	+1.0	4,746	16.10	6- 7-54	D100E,L.
	5baa	Guy Holmes..........	1914	Du	18	36	C	S,G	.....do..........	C,H	N	Tc	+.3	4,711	17.21	6-17-54	
	5cbb	U. S. Geol. Survey.	1953	Dr	10.0	1	P	S,G	.....do..........	N	O	Tc	+4.3	4,730	7.08	7- 3-54	
	5ddd	Daniel Jensen.......	1941	Du	47	48	C	S,G	.....do..........	T,E	I	Twc	0	4,764	22.70	6- 8-54	D600R.
	6abb	Verne Cook..........	....	Du	8.5	36	P	S,G	.....do..........	N	O	Twc	+.6	4,706	7.52	6-16-54	
	7caa	J. E. Utter..........	1955	Dr	44	12	P	S,G	.....do..........	T,E	I	Hpb	+.9	4,760	17.85	9- 1-55	D100E.
	7cdd	.....do.................	1954	Dr	33.2	16	P	S,G	.....do..........	T,E	I	Tc	+.7	4,771	9.80	6-10-54	
	8adc	Floyd Andrews......	1953	Dr	42	24	P	S,G	.....do..........	T,G	I	Tc	+1.0	4,776	23.06	6- 8-54	
	8bbb	G. W. Goodrich.....	....	Dr	....	......	P	S,G	.....do..........	J,E	D,S	Twc	+.5	4,740	3.91	6-17-54	
	8bdd	.....do.................	1931	Dr	225	15	P	Ss	Arikaree formation.	T,E	I	Ls	0	4,754	6.50	6- 8-54	D160M.

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

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24-68- 8ccd1	Doval Johnson......	1955	Dr	25	12	P	S,G	Terrace deposits.	T,E	I	Ls	....	4,771	10	1955	
8ccd2	.....do................	1955	Dr	25	12	P	S,G	.....do...........	T,E	I	Ls	....	4,771	10	1955	Bw3,D300E.
8ccd3	.....do................	1955	Dr	25	8	P	S,G	.....do...........	T,E	I	Ls	....	4,771	10	1955	
8cdc	.....do................	1954	Dr	....	10	P	S,G	.....do...........	T,E	I	Tc	+1.0	4,775	4.98	7-15-54	
8ddc	Floyd Andrews.....	1953	Dr	40	24	P	S,G	.....do...........	T,E	I	Tc	+1.0	4,786	25.87	6- 8-54	L.
9baa	A. J. Deines	....	Du	35	....	....	S,G	.....do...........	C,G	D	Tc	+.8	4,760	6.32	6- 8-54	
9ccc1	Doval Johnson	1953	Dr	60	18	P	S,G,Ss	Terrace deposits, Arikaree formation.	T,E	I	Hpb	+1.7	4,791	22.04	6- 8-54	D190M, DD13.0,L.
9ccc2	.....do................	1953	Dr	....	18	P	S,G	Terrace deposits.	T,E	I	Tc	+1.1	4,790	20.70	6- 8-54	
10bab	G. C. Lawrence....	....	Du	....	48	P	S,G	.....do...........	C,H	D	Twc	+1.0	4,743	14.52	6-16-54	
10cdc	Fred Hanes	1953	Dr	37	12	P	S,G,Ss	Terrace deposits, Arikaree formation.	T,E	I	Ls	....	4,777	12	1954	D200E,L.
11cdc	A. F. Bowen........	1954	Dr	37	16	P	S,G	Terrace deposits	T,E	I	Hpb	+.9	4,739	8.85	6-17-54	L.
11cdd	.....do................	1953	Du	25	48	C	S,G	.....do...........	T,E	I	.....	....	....	....	....	L.

12dbb1	Great Western Sugar Co.	1933	Dr	281.5	16	P	Ss	Arikaree formation.	T,E	In	Hpb	+.5	4,700	14.15	1954	D220R, DD100.
12dbb2	.....do................	1933	Dr	453	15	P	Ss	.....do...........	T,E	In	Ls	....	4,702	12	1954	D560R, DD100,L.
12dbc	Town of Wheatland	1933	Dr	507	15	P	Ss	.....do...........	T,E	P	Hpb	+.5	4,700	15.62	11- 4-55	D600M, DD81.7, Ca,L.
12dcb	.....do................	1936	Dr	508	20	P	Ss	.....do...........	T,E	P	Ls	....	4,708	12	....	D1,030M, DD180,L.
13cdc	.....do................	1946	Dr	355	12	P	Ss	.....do...........	T,E	P	Tc	-4.5	4,798	84.45	6-18-54	D500R,L.
13cdd1	.....do................	1934	Dr	560	12	P	Ss	.....do...........	T,E	P	Ls	....	4,760	....	....	D600R,Ca,L.
13cdd2	.....do................	1910	Dr	400	4	P	Ss	.....do...........	A,E	P	Ls	....	....	30	1910	
13cdd3	.....do................	1910	Dr	450	4	P	Ss	.....do...........	A,E	P	Ls	....	....	30	1910	
15aba	S. R. Mills	....	Du	....	36	P	S,G	Terrace deposits.	C,H	N	Twc	+.9	4,773	13.72	6-17-54	
15acb	.....do................	1953	Dr	25	48	C	S,G	.....do...........	T,E	I	Hpb	0	4,782	13.84	6- 8-54	D320M, DD11.3,L.
15bbd	R. A. Brashear	1953	Dr	43	36	P	S,G	.....do...........	T,E	I	Tc	0	4,785	11.35	6- 8-54	D760R,T55, Ca,L.
15dbc	Clarence Stumpff..	1946	Dr	90	4	P	S,G,Ss	Terrace deposits, Arikaree formation.	C,E	D,S	Tc	-3.4	4,816	28.15	6-20-54	
16adc	U. V. Combs........	1940	Dr	37	10	P	S,G	Terrace deposits.	T,E	I	Ls	....	4,797	23	1951	D300M.
16cdd	J. Zwetzig...........	1950	Dr	52.0	18	P	S,G	.....do...........	T,E	I	Tc	0	4,818	18.83	3-11-54	D460M, DD14.5, T54,Ca,L.
17bba	Herman Hellbaum.	1955	Dr	27	12	P	S,G	.....do...........	T,E	I	Ls	....	4,771	10	1955	Bw2,D380R.
18acc	R. M. Straw.........	1938	Dr	36	10	P	S,G	.....do...........	T,E	I	Tc	0	4,788	9.96	6-25-53	D270M, DD9.1,L.
18acd	.....do................	1954	Dr	32	8	P	S,G	.....do...........	T,E	I	Tc	0	4,786	10.10	6-17-54	D380M, DD2.5,L.
18add	.....do................	1954	Dr	28	10	P	S,G	.....do...........	T,E	I	Tc	+1.0	4,785	12.55	7-15-54	D290M,L.
19dcc	Homer Cochran....	....	Dr	19.7	6	P	S,G	.....do...........	C,H	S,O	Hpb	+2.1	4,829	12.80	6-16-54	
20acc	O. S. Preuit.........	1954	Du, B	25	24	C	S,G	.....do...........	T,E	I	Ls	....	4,818	21	....	

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
24-68- 20bcc	R. A. Brown.........	....	Dr	60	12	P	S,G	Terrace deposits	T,E	I	Tc	0	4,822	16.92	6-8-54	D260M.
20bcd	.....do.................	1938	Dr	75	22	P	S,G,Ss	Terrace deposits, Arikaree formation.	T,G	I	Tc	+.3	4,822	14.78	6- 8-54	L.
20ccd	Louis Lauck.........	1934	Du	27	30	P	S,G	Terrace deposits.	T,E	I	Tc	+0.4	4,836	15.13	6- 8-54	D420M, T54,Ca.
21abc	E. A. and F. R. Miller.	1953	Dr	41	20	P	S,G	.....do..........	T,E	I	Ls	0	4,822	13	1954	D270M, T54,L.
21bdb	John L. Schluter....	1951	Dr	70	18	P	S,G,Ss	Terrace deposits, Arikaree formation.	T,E	I	Hpb	+.4	4,831	23.88	6- 8-54	D430M, DD20.1,L.
21ccc	C. Franzen..........	1953	Dr	53	18	P	S,G,Ss	.....do...........	T,E	I	Ls	....	4,849	13	1954	D130M,T54, Ca,L.
25ada	T. Thor................	....	Dr	244	6	P	Ss	Arikaree formation.	C,W	D,S	Tc	+.6	4,885	189.10	6-20-54	
26ccc	Rachel Gearhart ...	....	Dr	120	6	P	S,G,Ss	Terrace deposits.	C,W	D,S	Tc	+2.0	4.886	58.90	6-15-54	
27aaa	Don Hunton	....	Dr	140	6	P	S,G,Ss	Arikaree formation.	C,E	D,S	Tc	0	4,960	57.10	6-16-54	

32bab	Walter Norvel	...	Dr	60	10	P	S,G	Terrace deposits.	C,W	D,S	Tc	+1.4	4,883	38.10	6-15-54	
35ddd	W. A. Beran	1923	Dr	265	...	P	Ss	Arikaree formation.	J,E	N	Tc	0	4,879	54.19	6-15-54	
69- 1abd	...	...	Dr	...	6	P	S,G	Terrace deposits.	N	N	Tc	+1.9	4,691	24.50	6-16-54	
10cad	Dean Prosser	1955	Du	15.0	42	P	S,G	Flood-plain deposits.	Cf,E	I	Tc	+2.5	4,658	9.78	9- 1-55	D500E.
12dcd	James Maguire	...	Dr	...	6	P	S,G	Terrace deposits.	C,G	D,S	Tc	+.5	4,745	4.21	6-16-54	
24aab	G. J. Ryan	...	Du	...	6	P	S,G	.....do	C,H	D	Twc	+.6	4,770	5.30	6-16-54	
25-65- 8aca	J. W. Blevins	...	Sp	...	...	...	Ss	Arikaree formation.	F	S	...	...	4,520	...	...	D1E.
8cad	.....do	...	Sp	...	...	...	Congl	.....do	F	S	...	...	4,540	...	...	D1E.
17aaa	Lee Blevins	1920	Dr	200	6	P	Ss	.....do	N	N	Ls	...	4,650	187	...	
17bac	J. W. Blevins	...	Sp	...	...	...	Congl	.....do	F	S	...	...	4,590	...	...	D1E.
18cab	M. Kershner	...	Sp	...	...	...	Congl	.....do	F	S	...	...	4,520	...	...	D5E,T60.
20aaa	E. Larson	1915	Dr	...	6	P	Ss	Arikaree(?) formation.	N	N	Tc	0	4,825	196.50	7-29-52	
20acc	.....do	...	Dr	1,629	8	P	...	...	N	N	Tc	+1.0	4,861	195.00	7-29-52	Oil test.
30aad	R. D. Anderson	1900	Dr	230	6	P	Ss	Arikaree formation.	C,N	N	Tc	0	4,940	220.60	7-30-52	
31aaa	J. Weber	1915	Dr	280	6	P	Ss	.....do	C,W	S	Tc	0	4,975	254.40	8- 4-52	
31daa	.....do	1915	Dr	280	6	P	Ss	.....do	C,W	N	Tc	+.4	4,980	240.20	8- 4-52	
32bcc	Mrs. E. M. Kershner.	1915	Dr	257	6	P	Ss	.....do	C,W	D,S	Tc	+.7	4,966	229.80	8- 4-52	
33baa	.....do	1915	Dr	...	6	P	Ss	.....do	C,W	N	Tc	0	4,920	213.00	8- 4-52	
66- 13bab	H. Turner	...	Du	25	...	...	S,G	Flood-plain deposits.	C,E	D	Ls	...	4,360	10	...	
18bcc	Mrs. Myrtle Criss.	1940	Dr	171	6	P	Ss	Arikaree formation.	C,W	S	Ls	...	4,570	106	...	
21cab	Mrs. H. F. Blake	1950	Dr	55	6	P	S,G	Flood-plain deposits.	C,W	D,S	Tc	+.4	4,405	16.00	7-27-52	
23abb	Mr. Phifer	...	Dr	45	6	P	Sls	Brule formation.	C,E	S	Ls	...	4,422	20	...	T56.
24aaa	M. Kershner	...	Sp	...	...	...	Ss, Congl	Arikaree formation.	F	S	...	...	4,590	...	...	D5E,T60.

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
25-66-24abd	M. Kershner		Sp				Ss, Congl	Arikaree formation.	F	S			4,590			D8E, T60.
25cbb	Cottonwood Falls Spring.		Sp				Ss, Congl	do	F	S			4,720			D60E, T63.
28cab	Mr. Phifer		Dr	240	6	P	Ss	do	C,E	S	Ls		4,580	200		T56.
35bdb			Sp				Ss, Congl	do	F	S			4,720			D50E, T65.
67- 6bcc	P. Cundall	1915	Dr	80	6	P	Ss	do	C,W,E	S	Ls		4,585	65	1952	
20baa	Colorado and Southern R. R.	1908	Du	19	120	C	S,G	Flood-plain deposits.	C,G	In	Ls		4,464	13	1954	D300R.
27ccc	Lester Cobb		Dr	150	6	P	Ss	Arikaree formation.	C,W	S,O	Tc	+.5	4,598	84.15	6-22-54	T56,Ca.
31ccc1	E. T. Hall	1908	Du, Dr	28	36	C	S,G	Terrace deposits.	J,E	D,O	Tc	+.4	4,650	24.63	8- 6-54	T60,Ca.
31ccc2	do	1953	Dr	40	12	P	S,G	do	T,E	I	Hpb	+1.0	4,648	21.92	5- 6-54	D250M, DD5.2,L.
31cdc	Edward Preuitt	1955	Dr	43	16	P	S,G	do	T,E	I						D140M,L.
33dcc	John Geringer		Du	21	24	P	S,G	do	T,E	D,S	Twc	+.7	4,631	13.10	7-12-54	

68-31bcd1	Eldon Johnston......	1954	Dr	68	8	P	S,G,Ss	Terrace deposits, Arikaree formation.	T,E	I	Hpb	+.5	4,668	22.60	6- 9-54	D100R,L.
31bcd2	.....do................	1954	Dr	36	8	P	S,G	Terrace deposits.	T,E	I	.....	....	....	....	....	L.
31bda	.....do................	1954	Dr	58	6	P	S,G,Ss	Terrace deposits, Arikaree formation.	....	I	Tc	+.3	4,650	17.11	9-15-54	L.
31cba	.....do................	1954	Dr	52	12	P	S,G,Ss	.....do..........	T,E	I	Ls	....	....	20	1954	D125R,L.
32aab	F. A. Beard	.....	Du	10	16	P	S,G	Terrace deposits.	C,H	N	Tc	+.4	4,628	5.70	6-18-54	
33dcd	Lester Pitts	.....	Du	8	24	C	S,G	.....do..........	C,H	O	Twc	+.7	4,720	7.35	6-17-54	
34ccb	John Suntych	1953	Du	21	48	C	S,G	.....do..........	N	N	Twc	0	4,688	8.96	6-17-54	T64,Ca,L.
35dad	J. Foos...............	.....	Du	....	24	C	S,G	.....do..........	C,H	D	Twc	+.2	4,650	8.80	6-17-54	
35dbb	.....do................	1953	Dr	85	16	P	S,G,Ss	Terrace deposits, Arikaree formation.	T,G	I	Tc	+1.1	4,656	9.01	6- 9-54	L.
36ccc	Henry Geringer.....	1953	Dr	32	12	P	S,G	Terrace deposits.	T,E	I	Hpb	+.9	4,655	5.46	6- 7-54	D160M, DD14.7,L.
36cdb	.....do................	1940	Dr	50	8	P	S,G	.....do...	C,E	D,S	Tc	-4.4	4,646	10.90	6- 7-54	
69- 6bcd	J. A. Weaver........	.....	Du	15	......	C	S,G, Congl	Tertiary(?) deposits.	C,H	D	Ls	....	4,800	10	1952	
6dac	D. E. Tatman........	......	Du	18	......	C	S,G	Flood-plain deposits.	C,H	D	Ls	....	4,775	13	1952	
26-65- 9aaa	Charles Frederick.	1935	Du	25	......	C	S,G	.....do..........	C,W	D,S	Tc	0	4,290	19.40	10- 1-48	T56.
9acc	.....do................	1953	Dr	51	18	P	S,G	.....do..........	T,E	I	Hpb	+.5	4,272	12.02	7-15-55	D1,050M, DD6.3,L.
17bdd	Platte Valley Pipe Line Co.	1951	Dr	157	6	P	Ss	Arikaree formation.	C,E	D	Tc	-5.0	4,460	125.12	7-24-53	D6.2M, DD38,L.
19abb	C. Stoneking.........	1915	Dr	185	6	P	Ss	.....do..........	C,W	D,S	Ls	0	4,453	120.00	7-28-52	
19caa	A. Bomgardner......	1947	Dr	265	6	P	Ss	.....do..........	N	N	Tc	+.2	4,450	59.30	7-29-52	
66- 6aaa	....	......	Dr	....	6	P	Ss	.....do..........	C,W	S	Tc	0	4,620	107.80	7-23-52	

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-Bearing bed: Character of material	Principal water-Bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet).(+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
26-66- 12aac	C. Frederick	1949	Dr	35	6	P	S,G	Flood-plain deposits.	C,H	D	Ls	...	4,320	24	...	
15dab	D. G. Anderson	...	Dr	...	6	P	Ss	Arikaree formation.	C,W	N	Hph	+1.4	4,481	121.10	7-25-52	
17ccc	Paul Cundall	...	Sp	...	...	...	Ss	...do	F	S	...	...	4,780	...	...	D1E.
18cbb	...do	1915	Dr	240	6	P	Ss	...do	C,E	D,S	Ls	...	4,755	225	...	
23ada	G. D. Anderson	1905	Dr	44	6	P	Ss	...do	C,W	S	Tc	+2.0	4,417	29.50	7-25-52	
23daa	J. W. Weber	1910	Dr	45	6	P	Ss	...do	C,H	N	Tc	+2.5	4,428	31.50	7-25-52	
24dab	Mrs. Jake Daly	...	Dr	...	6	P	Ss	...do	C,W	N	Tc	0	4,430	43.20	7-25-52	
67- 5dbd	J. Miller	...	Dr	120	6	P	Ss	...do	C,W	S	Tc	+.8	4,701	112.30	7-23-52	T59.
6cbb	C. Rutherford	1910	Dr	216	6	P	Ss	...do	C,G	D,S	Ls	...	4,800	208	...	
14cca	O. G. Thompson	1920	Dr	320	6	P	Ss	...do	C,W	S	Ls	...	4,830	300	...	
17bca	Paul Cundall	...	Sp	...	...	...	Ss	...do	F	S	...	...	4,800	...	...	D1E.
17cda	...do	1915	Dr	250	6	P	Ss	...do	C,E	...	Ls	...	4,775	230	...	
20ccb	...do	1915	Dr	400	6	P	Ss	...do	C,E	S	Ls	...	4,810	280	...	
25dcd	C. H. Milton	1940	Dr	510	4	P	Ss	...do	C,E	D,S	Ls	...	5,024	480	...	
31bcc	P. Cundall	1915	Dr	80	6	P	Ss	...do	C,W	S	Ls	...	4,590	60	...	
33baa	...do	...	Dr	219	6	P	Ss	...do	C,W	S	Ls	...	4,796	165	11- 4-47	L.
68- 4bbb	Mrs. E. B. Bowman	1949	Dr	70	6	P	Ss	...do	C,H	N	Tc	+1.0	4,886	47.10	7-17-52	
5abb	...do	...	Dr	...	6	P	Ss	...do	N	N	Tc	0	4,880	41.90	7-17-52	

68- 12bdd	Colorado and Southern R. R.	....	Dr	278	6	P	Ss	Arikaree formation.	....	D	Ls	....	4,830	245	7-22-47 L
16cac	J. Johnson	....	Dr	....	6	P	Ss	.....do	C,W	N	Tc	+1.8	4,860	242.10	7-18-52
19cbb	N. Patterson	1940	Dr	30	12	P	S,G	Flood-plain deposits.	Cf,G	I	Tc	0	4,815	9.50	7-12-52
23ddb	C. Chambers	....	Dr	180	6	P	Ss	Arikaree formation.	N	N	Tc	0	4,715	166.30	7-23-52
34add	J. Johnson	....	Dr	....	6	P	Ss	.....do	C,N	N	Tc	+.4	4,665	107.40	7-17-52
69- 2add	Mrs. E. B. Bowman	1949	Dr	65	6	P	S,G,Ss	Flood-plain deposits, Arikaree formation.	C,W	S	Tc	+.8	4,991	39.10	7-17-52
11cdc	O. E. Lewis	1946	Dr	64	6	P	Ss	Arikaree formation.	C,W	S	Tc	+.4	4,970	30.70	7-16-52
15cab	....	....	Dr	....	6	P	Ss	.....do	C,W	S	Tc	+2.1	4,992	20.50	7-16-52
20ccc	D. E. Tatman	1952	Dr	126	4	P	S,G, Congl	Tertiary(?) deposits.	C,W	S	Tc	+2.1	5,022	11.30	7-15-52
25bca	O. E. Lewis	1946	Dr	80	6	P	Ss	Arikaree formation.	C,W	S	Tc	+.7	4,813	22.80	7-17-52
30add	D. E. Tatman	....	Dr	80	4	P	S,G, Congl	Tertiary(?) deposits.	N	N	Tc	+1.0	5,041	45.40	7-15-52
70- 1bbc	W. H. Clark	1940	Du, Dr	25	6	P	S,G	Flood-plain deposits.	C,W	S	Tc	+1.0	5,261	5.30	7-16-52
3adb	F. Henderson	....	.....	12	....	R	S,G	.....do	C,H	D	Tc	0	5,350	6.30	7-16-52
9cab	Jim Pulver	1915	Du	12	....	R	S,G	.....do	C,H	D,S	Tc	0	....	7.70	7-15-52
11abb	R. Butner	....	Sp	....	....	.....	S,G	.....do	F	.....	.....	....	5,295	....	.... D20E.
11abc	.....do	1946	Du	12	36	P	S,G	.....do	N	N	Twc	0	5,305	9.40	7-16-52
11bbd	.....do	1951	Dr	58	6	P	S,G, Congl	Tertiary(?) deposits.	N	N	Tc	+1.6	5,337	18.50	7-16-52
17bab	Edward Clark	....	Du	....	....	R	S,G, Congl	.....do	C,H	N	Tc	0	....	7.85	7-17-52

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-Bearing bed: Character of material	Principal water-Bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
27-65- 17abb	Fred Dupra........	1953	Dr	250	......	....	Sch(?)	Precambrian(?)rocks	C,.	S	Ls	....	4,670	30	....	L.
66- 12caa	Town of Hartville..	......	Du	14	72	C	S,G	Flood-plain deposits.	C,E	P	......	....	....	....	....	
12cbd	.....do............	1954	Du	12	216	C	S,G	.....do..........	T,E	P	......	....	....	....	....	
35bda	Town of Guernsey..	1944	Dr	90	12	P	S,G	.....do..........	T,E	P	Ls	....	4,360	43	1944	D330M, DD6,L.
35bdd	.....do............	......	Dr	91	10	P	S,G	.....do..........	T,E	P	Ls	....	4,355	30	1954	D550R.
35dbd	State of Wyoming..	1941	Dr	60	10	P	S,G	.....do..........	T,E	P	Ls	....	4,366	17	1941	D500R,DD7.
67- 10bda	E. E. Ragan........	1940	Du, Dn	8	......	P	S,G	.....do..........	C,W	N	Twc	0	4,442	5.91	11- 2-48	
10dbd	Chicago Burlington and Quincy R. R.	......	Du	....	120	C	S,G	.....do..........	Cf,E	In	Ls	....	....	11	1945	D300R.
11dcb	H. L. Boner........	......	Du	15	......	C	S,G	.....do..........	Cf,G	I	Ls	....	4,440	6	1949	D1,000R,L.
15bbd	Otto Herman.......	......	Sp	....	......	....	S,G	.....do..........	F	....	......	....	4,453	....	....	D75R,T60.
21bbb	F. T. Stanfield.....	1940	Du, Dn	10	36	C	S,G	.....do..........	C,W	D,S	Bpb	0	4,520	7.82	11- 4-48	
21bda	W. A. Herman......	1946	Du	19	36	C	S,G	.....do..........	C,W	S	Tc	+.5	4,510	7.35	9-14-49	T56,Ca.
23dcb	Otto Herman.......	1952	Dr	240	6	P	Ss	Arikaree formation.	C,W	S	Twc	+1.0	4,707	163.69	7-24-53	L.

68- 1dab	.....do........	1948	Dr	800	6	P	Ss	Arikaree(?) formation.	N	N	Tc	0	4,660	57.58	10-26-53	
6bbb	W. H. Johnson......	....	Dr	....	4	P	Sls	Brule(?) formation.	N	N	Tc	+.9	5,051	28.99	10-15-53	
17bcd	Coleman Bros......	1952	Dr	130	6	P	Ss	Arikaree formation.	C,W	S	Ls	....	4,920	60	....	D5B,L.
18aaa	.....do........	....	Dr	133.5	5	P	Ss	.....do..........	C,W	S	Tc	+1.0	4,951	52.00	10-15-53	
20cdc1	Steven Willadsen..	....	Dr	18	10	P	S,G	Flood-plain deposits.	Cf,G	I	......	....	4,780	....	....	
20cdc2	.....do........	....	Dr	22	10	P	S,G	.....do..........	Cf,G	I	......	....	....	....	....	
20cdc3	.....do........	....	Dr	18	10	P	S,G	.....do..........	Cf,G	I	......	....	....	....	....	
20dcb	.....do........	....	Dr	....	6	P	S,G	.....do..........	N	O	Tc	+2.5	4,782	18.22	11- 2-48	
23ccc	Bob Russell.........	....	Sp	....	....	.....	S	Arikaree(?) formation.	F	S	......	....	4,660	....	....	D275E, T54,Ca.
24ccc	.....do........	....	Du	7	72	C	S,G	Flood-plain deposits.	N	N	Tc	+.8	4,611	6.01	11- 2-48	
24dab	W. A. Herman......	....	Du	16	72	C	S,G	.....do..........	J,E	D,S	Twc	+.3	4,580	13.38	10-19-48	T56,Ca.
28aac	Claude Adams......	1903	Du	34	36	P	S,G	.....do..........	J,E	D	Bpb	0	4,710	30.66	9-15-49	T50,Ca.
28abc	.....do........	....	Du	14	72	C	S,G	.....do..........	N	N	Tc	+2.8	4,713	11.30	11- 4-48	
30acc	M. L. Coleman.....	....	Dr	22	4	P	S,G	.....do..........	C,G	D,O	Tc	+2.8	4,798	13.19	8- 6-54	
31adc	Arthur Seaton......	1950	Dr	100	6	P	Ss	Arikaree formation.	....	D	Ls	....	4,875	36	1950	D4B,T55, Ca,L.
69-11dcc	Coleman Bros......	....	Dr	76	6	P	Sls	Brule formation.	C,W	S	Ls	....	5,157	70	....	
25abb	Fred Fletcher......	1947	Dr	73	4	P	Congl	Arikaree formation.	C,W	S	Ls	....	4,880	54	1947	L.
28bba	Coleman Bros......	1950	Dr	105	4	P	S,G,Ss	Flood-plain deposits, Arikaree(?) formation.	C,W	S	Ls	....	4,995	80	1950	D8B.
70-16cab	J. E. Ferguson......	....	Du	14	....	R	S,G	Flood-plain deposits.	C,E	D	Twc	+.3	5,540	10.47	10-21-48	
28-65- 4dcc	Mr. Fredrickson...	....	Dr	....	6	P	Ss	Arikaree formation.	C,W	S	Tc	+.4	5,290	47.80	7- 9-52	
6ccd	A. Schamel.........	....	Dr	70	6	P	Ss	.....do..........	C,W	S	Bpb	+.4	5,155	65.10	7- 9-52	
6ddb	W. R. Johnson.......	1915	Dr	160	6	P	Ss	.....do..........	C,W	D,S	Tc	-1.6	5,168	100.30	7- 9-52	
7bcd	D. L. Anderson....	....	Dr	65	6	P	Ss	.....do..........	C,W	S	Tc	+1.2	5,126	51.10	7- 9-52	

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
28-65- 8adb	W. R. Johnson......	1952	Dr	86	6	P	Ss	Arikaree formation.	C,W	S	Tc	+1.0	5,356	63.30	7- 9-52	
17dba	Ruth Fredrickson.	....	Dr	....	6	P	Ss	.....do.........	C,W	S	Tc	+1.4	5,111	21.80	7-12-52	
20ccd	A. J. Muttart.......	1952	Dr	52	6	P	S,G,Ss	Flood-plain deposits, Arikaree formation.	C,W	D,S	Tc	0	5,140	16.30	1-19-53	
29aac	R. C. Lauck.........	....	Sp	....	....	....	....	Hartville(?) formation.	F	D,S, I	.....	....	5,300	....	....	
30caa	Ruth Fredrickson.	1915	Dr	80	6	P	Ss	Arikaree formation.	C,W	D,S	Tc	+.7	5,131	27.80	7-12-52	
66- 2bdd	J. Sudsbury..........	1952	Dr	65	6	P	Ss	.....do.........	N	N	Tc	+.6	4,921	24.06	7- 8-52	
8cda	Housher Bros	....	Sp	....	....	....	Ls(?)	Hartville formation.	F	D,S	.....	....	4,925	....	....	D1E.
9bad	John Housher.......	....	Sp	....	....	....	Ls(?)	.....do.........	F	S	.....	....	4,875	....	....	D15E.
12dcc	D. L. Anderson	1915	Du	26	36	P	S,G	Flood-plain deposits.	C,W	S	Tc	+2.2	5,072	22.20	7- 9-52	
17dab	J. Housher..........	....	Sp	....	....	....	Ls(?)	Hartville formation.	F	S	.....	....	4,855	....	....	D2E.

19acc	.....do................	1951	Dr	60	6	P	Ss	Arikaree formation.	C,W	S	Ls	....	4,790	50	....	
21adc	Helen Brooks	1915	Dr	35	6	P	....	Hartville(?) formation.	C,G	S	Tc	+.8	4,701	28.30	7-11-52	
24aac	R. Fredrick.........	1915	Dr	60	6	P	Ss	Arikaree formation.	C,W,G	S	Ls	....	5,090	15	....	
26caa	C. Hazelwood.......	1951	Dr	81	6	P	Ss	.....do.........	C,W	S	Ls	....	4,900	20	....	
28baa	Helen Brooks.......	1925	Dr	65	6	P	Ss	.....do.........	C,W	S	Tc	+1.7	4,677	26.50	7-11-52	
67- 1cad	Les Osborn	1952	Dr	50	6	P	....	Hartville formation.	C,H	N	Tc	0	5,060	22.50	7-10-52	
6cca	Ivan Hooley	....	Dr	56	6	P	S,G	Flood-plain deposits.	J,E	D	Ls	....	4,495	19	1949	
18bcc	Harry Twiford	....	Dr	64	12	P	S,G	.....do.........	T,E	I	Ls	....	4,490	20	1949	T52,Ca,L.
19aaa	George Robb.......	....	Dn	24	2	P	S,G	.....do.........	C,W	D,S	Ls	....	4,470	20	1949	T54.
68- 2dcd	Ivan Hooley.........	....	Du	35	84	....	Ss	Brule formation.	N	N	Twc	0	4,570	29.93	8-24-49	
5ddd	J. Hughes...........	1951	Dr	74.0	5	P	Ss	Arikaree formation.	N	N	Tc	+.4	4,740	60.64	10-19-53	L.
7abc	W. H. Johnson......	....	Dr	58.0	6	P	Ss	.....do.........	C,N	N	Tc	+.2	4,866	53.17	10-19-53	
7ddb	J. L. Jones..........	....	Dr	37.0	4	P	Ss	.....do.........	N	N	Tc	+.8	4,871	7.95	10-19-53	
12aac	Chicago Burlington and Quincy R.R.	1942	Dr	42.0	12	P	S,G	Flood-plain deposits.	T,E	In	Ls	....	4,490	20	1942	D100R,L.
12adc	I. J. Hammer.......	....	Dr	28	6	P	S,G	.....do........	C,H	D	Ls	....	4,490	12	1949	T53,Ca.
13dcb	Mrs. B. A. Caster.	1925	Dn	23	6	P	S,G	.....do........	C,W,H	D	Ls	....	4,525	15	1948	T54,Ca.
15ddd1	W. H. Johnson......	1950	Dr	31.5	18	P	S,G	.....do........	T,E	I	Bpb	+3.0	....	5.37	10-24-53	D375E.
15ddd2	.....do................	1950	Dr	27.7	18	P	S,G	.....do........	T,E	I	Hpb	+3.0	....	9.98	10-24-53	
15ddd3	.....do................	1950	Dr	23.5	18	P	S,G	.....do........	T,E	I	Hpb	+3.0	....	9.74	10-24-53	
22baa	.....do................	....	Sp	....	....	....	S,G	.....do........	F	I	.....	....	4,665	....	....	D50E.
24bcb	Jack Jones	....	Dr	65(?)	6	P	S,G	.....do........	C,E	D,S	Ls	....	4,570	40	1949	T57,L.
27abb	D. W. Brown........	1947	Dr	58	6	P	Ss	Brule formation.	N	O	Tc	+.8	4,691	29.03	8- 6-54	T54.
27abc	.....do................	1919	Du	12	48	R	G	Flood-plain deposits.	Cf,G	D,I,O	Twc	0	4,668	3.50	5-18-54	D66M, DD5.3,T61 Ca.
34abd	Simon Katzman	....	Dr	127.0	6	P	Ss	Arikaree formation.	N	N	Tc	+1.0	4,881	90.52	10-19-53	
35dbc	Otto Herman........	1953	Dr	250.0	5	P	Ss	.....do.........	C,W	S	Ls	....	4,920	188	....	L.
36bac	.....do................	1951	Dr	273.0	4	P	Ss	.....do.........	N	N	Tc	+.2	4,820	117.55	10-26-53	L.

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
28-69- 11dba	Bess Panushka	......	Dr	98.0	5	P	Sls	Brule formation.	N	N	Tc	0	5,130	67.00	10-23-53	
12bcd	F.J. Jones	......	Dr	63.0	5	P	Sls	.....do	N	N	Tc	+.3	5,082	19.40	10-19-53	
20add	Donald Gordon	1950	Dr	128	4	P	G	.....do	C,W	S	Ls	....	5,374	98	....	D8B,L.
21cdd	.....do	1950	Dr	155	6-4	P	G	Brule(?) formation.	C,W	S	Ls	....	5,370	130	....	D5B,L.
34bda	W. H. Johnson	......	Dr	....	4	P	Sls	Brule formation.	C,W	S	Tc	+1.0	5,344	71.90	10-14-53	
70- 2acc	Hans Christiansen	1946	Dr	54	6	P	S,G	Flood-plain deposits.	C,H	D,S	Tc	+.2	5,055	23.09	8-24-49	
11bbc	Mr. Jacobsen	......	Dr	15	6	P	S,G	.....do	N	N	Tc	+.3	5,065	8.87	8-25-49	T54.
29-65- 4bbb	Gene Bass	1914	Dr	180	6	P	Ss	Arikaree formation.	C,W	S	Tc	+.8	....	154.30	7- 2-52	T50.
6acc	G. Smith	......	Dr	100	6	P	Ss	.....do	C,W	S	Tc	0	....	75.20	7- 1-52	
7dbc	.....do	1949	Dr	66	6	P	Ss	.....do	C,W	S	Tc	+.6	5,161	29.50	7- 1-52	
8cbc	Edward Furhman	1908	Dr	90	6	P	Ss	.....do	C,W	D,S	Tc	0	4,190	71.30	7- 2-52	
17cab	.....do	1948	Dr	80	6	P	Ss	.....do	C,W	S	Tc	+.2	5,160	45.69	7- 2-52	T52.
18dba	G. Smith	......	Dr	70	6	P	Ss	.....do	C,W	S	Tc	+.6	5,138	30.00	7- 1-52	
32bbc	Bill Brownrigg	1951	Dr	60	6	P	Ss	.....do	C,W	S	Tc	+.4	5,150	29.20	7- 8-52	

32cca	Mr. Johnson	......	Dr	....	6	P	Ss	.....do	C,W	S	Tc	+2.7	5,163	50.97	7- 8-52	T50.
33cbd	B. Brownrigg	1951	Dr	48	6	P	Ss	.....do	C,W	S	Ls	....	5,180	20	1952	
66- 4ccd	M. Hammer	1915	Dr	125	6	P	Ss	.....do	C,W,G	D,S	Tc	0	5,145	101.40	7- 3-52	
8acd	.....do	......	Dr	....	6	P	Ss	.....do	C,N	N	Tc	0	5,155	174.50	7- 3-52	
9dba	....	......	Dr	....	6	P	Ss	.....do	C,W	S	Tc	+1.2	5,106	54.50	7- 3-52	
18ddb	A. R. Adair	1951	Dr	243	6	P	Ss	.....do	C,W	S	Tc	+1.2	5,051	210.00	6-25-52	
20cad	A. B. Ferguson	......	Dr	....	6	P	Ss	.....do	C,W	S	Tc	0	5,056	68.43	6-25-52	T52.
23caa	Edward Orr	1900	Du	32	36	P	S,G	Flood-plain deposits.	C,H	D,S	Tc	+.4	5,050	20.00	6-25-52	
27bbb	A. B. Ferguson	......	Dr	....	6	P	....	Hartville formation.	C,W	S	Tc	0	4,980	40.25	6-25-52	T45.
28baa	.....do	......	Dr	45	6	P	....	Hartville(?) formation.	C,W	S	Tc	0	4,975	28.50	6-25-52	
30cac	Les Osborn	......	Dr	70	6	P	Ss	Arikaree formation.	C,W	S	Tc	+1.3	5,096	58.50	7-10-52	
31bdc	.....do	......	Dr	90	6	P	Ss	.....do	C,W	S	Tc	0	5,125	58.50	7-10-52	
33dac	F. V. Smith	......	Sp	....	......	....	S,G	Flood-plain deposits.	F	S,I	......	....	4,920	....	....	
35aaa	Edward Orr	......	Dr	....	6	P	Ss	Arikaree formation.	N	......	Tc	+.3	5,025	52.09	7- 1-52	
36aaa	School District	......	Dr	....	6	P	Ss	.....do	C,H	D	Tc	+.2	5,067	46.48	7- 1-52	
67- 2ccc	.....do	......	Dr	....	6	P	Ss	.....do	C,H	S	Tc	0	4,926	107.90	6-25-52	
2dcc	H. H. Brecht	1930	Dr	120	6	P	Ss	.....do	N	N	Twc	0	4,940	90.40	6-30-52	
4aac	....	......	Dr	113.0	6	P	Ss	.....do	C,W	N	Tc	+.6	4,791	75.70	7- 8-52	
10bac	William Hytrek	1951	Dr	50	6	P	Sls	Brule formation.	C,W,H	S	Tc	+.8	4,796	20.10	6-25-52	T51.
11aac	Bud Jones	......	Dr	....	6	P	Ss	Arikaree formation.	C,W	S	Tc	+.4	4,980	96.90	6-30-52	
14baa	O. R. McNutt	1932	Dr	40	6	P	Sls	Brule formation.	C,W,G	D	Hpb	+1.4	4,856	18.50	6-30-52	
23cbc	.....do	1925	Dr	66	6	P	Ss	Arikaree formation.	C,W	S	Tc	+.3	5,100	43.49	7- 1-52	
24acc	Les Osborn	......	Dr	165	6	P	Ss	.....do	C,W	S	Ls	0	4,975	78.80	7-10-52	
25abc	Frank Brooks	......	Dr	....	6	P	Ss	.....do	C,W	......	Tc	+1.8	5,062	83.00	7-10-52	
27aad	O. R. McNutt	1948	Dr	40	6	P	Ss	.....do	C,H	......	Tc	+.2	5,040	24.40	7- 1-52	

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
29-68- 9bcd1	City of Glendo......	1947	Dr	793	....	P	Ss	Converse sand of the Hartville formation.	T,E	P	Ls	....	4,720	....	1954	D84R,Ca,L.
9bcd2	.....do...............	1933	Dr	145	8	....	Sls	Brule formation.	T,E	P	Ls	....	4,720	92	....	D10E,DD55, T54,Ca.
9bdc	.....do...............	1940	Dr	225	6	P	Sls	.....do..........	C,E	N	Ls	....	4,750	90	1954	D8R.
9cbc	Chicago Burlington and Quincy R. R.	1895	Du, Dr	700*	....	....	Ss	Converse sand of the Hartville formation.	C,E	D	Twc	....	....	....	....	Ca,T55.
20abb	A. M. Downey.......	1941	Dr	410	6	P	Ss	.....do..........	F	S,I	Tc	+0.8	4,639	+32.46	9-21-49	D160M, DD33,T54, Ca,L.
20abd	.....do...............	1941	Dr	442	4	P	Ss	.....do..........	F	D,S,I	Tc	+.7	4,626	+40.40	9-21-49	D78M,DD30, T54,Ca,L.
20acc	.....do...............	1954	Du	41	50	C	S,G	Flood-plain deposits.	T,E	I	Ls	....	4,643	24	1954	L.

	20acd	.....do..........	1952	Dr	435	6	P	Ss	Converse sand of the Hartville formation.	F	N	.....	....	4,640	....	....	D55E.
	20bac	W. E. Hughes	1924	Dr	[1]1,296	4	P	Ss	.....do..........	F	I,D	.....	....	4,644	....	....	D150R,T54, Ca,L.
	21bbb	Clark Coleman	1939	Dr	94	6	P	Ss	Brule formation.	C,H	D,O	Twc	+1.0	4,646	36.35	8- 6-54	T52,Ca,L.
	21bcc	J. R. Lancaster	1954	Dr	40.5	16	P	S,G	Flood-plain deposits.	T,E	I	Ls	....	4,625	17	....	D770M, DD5.3, T52,L.
	21dad	Hauf Bros...........	1907	Dr	58	6	P	S,G	.....do..........	C,H	D,O	Tc	+.1	4,585	9.18	8- 6-54	D10E,T52, Ca.
	26adc	Mr. Thompson......	1904	Dr	65	......	P	S,G	.....do..........	J,E	D,S	Ls	....	4,520	14	1948	
	27cca	Don Sommers.......	1948	Dr	75	6	P	Ss	Brule formation.	J,E	D	Ls	....	4,626	57	....	
	35cbb	Ivan Hooley.........	......	Sp	....	......	....	Ss	Cloverly formation.	F	S	.....	....	4,655	....	9-20-49	D33M,T53, Ca.
69-	28ccd	J. A. Moran	1939	Dr	72	4	P	S,G	Flood-plain deposits.	J,E	D	Ls	....	4,850	22	1948	
	31cad	W. L. Schmidt	1941	Dr	16	......	....	S,G	.....do..........	C,E	S	Twc	+.2	4,945	10.15	11- 4-48	
	36bdc	Emmett Robb	1941	Dr	46	6	P	Sls	Brule formation.	C,W	S	Ls	....	4,819	18	....	
70-	14aab	J. A. Moran	1943	Dr	150	6	P	S,G, Congl	Tertiary(?) deposits.	C,W	S	Ls	....	5,481	138	1943	
	35aab	C. B. Harmon.......	......	Dr	48	......	....	Sls	Brule formation.	C,H	D	Hph	+3.0	5,137	33.97	8-24-49	T54.
30-65-	5baa	E. S. Starrett	1915	Dr	160	6	P	Ss	Arikaree formation.	C,W	D,S	Twc	+1.5	....	109.87	6-11-52	T58,Ca.
	19add	Elmer Johnson	......	Dr	165	6	P	Ss	.....do..........	C,W	D,S	Bpb	0	....	92.00	6-16-52	
	20bcd	Mrs. H. L. Kidder..	......	Dr	79.1	6	P	Ss	.....do..........	C,W	S	Twc	+.5	....	65.27	6-11-52	T51.
	30caa	Mr. Martin..........	......	Dr	....	6	P	Ss	.....do..........	C,W	S	Tc	0	....	66.50	7- 2-52	T52.
	31aaa	.....do...............	......	Dr	....	6	P	Ss	.....do..........	C,W	S	Tc	0	....	86.40	7- 2-52	D2E,T53,Ca.
66-	10dad	....	......	Dr	....	6	P	Ss	.....do..........	C,W	S	Bpb	+.4	5,185	20.00	6-18-52	T54.
	13ddd	G. G. Hughes	......	Dr	....	6	P	Ss	.....do..........	C,W	D,S	Hph	+1.2	....	216.50	6-16-52	
	17bad	J. A. Payne..........	1913	Dr	106	......	N	Ss	.....do..........	N	....	Twc	0	5,030	51.70	6-16-52	
	17dda	.....do...............	1915	Dr	104	6	P	Ss	.....do..........	C,W	S	Twc	+.6	5,031	70.68	6-17-52	

See footnotes at end of table.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
30-66- 18acb	J. A. Payne..........	....	Sp	....	......	....	Ss	Cloverly formation.	F	S	......	....	5,120	....	....	D1E,T56.
23aac	H. M. Mowrey	....	Dr	....	6	P	Ss	Arikaree formation.	C,W,G	D,S	Bpb	0	....	180.19	6-18-52	
24daa	.....do..................	....	Dr	200	6	P	Ss	.....do..........	C,E	D,S	Bpb	0	....	179.88	6-18-52	D2.2M, DD10.8.
25add	G. G. Hughes	1950	Dr	180.0	6	P	Ss	.....do..........	C,W	N	Bpb	0	....	101.58	6-16-52	
30aaa	....	....	Dr	....	6	P	Ss	.....do..........	C,W	N	Hph	0	5,013	106.18	6-19-52	
34bcd	....	....	Dr	....	6	P	Ss	.....do..........	C,W	S	Tc	+.6	5,181	58.22	7- 3-52	
34cdd	....	....	Dr	....	6	P	Ss	.....do..........	C,W	S	Tc	+.3	5,155	73.95	7- 3-52	
67- 5cdc	Harley Martin.......	1950	Dr	....	6	P	Sls	Brule(?) formation.	C,W	S	Tc	+1.2	4,681	18.50	6-23-52	T50.
6caa	Mr. Reese...........	....	Sp	....	......	....	Ss	Arikaree formation.	F	S	......	....	4,660	....	....	D300E,T52.
8cbd	Harley Martin.......	1947	Dr	80	6	P	Sls	Brule formation.	C,H	D	Tc	+.8	4,666	20.50	6-23-52	
10bcb	George McCormick	....	Dr	110	6	P	Ss	Arikaree formation.	C,W	S	Hpb	+2.6	4,798	69.02	6-20-52	
12cca	D. Lay..................	....	Dr	....	6	P	Ss	.....do..........	C,W	D,S	Bpb	+.9	4,990	82.25	6-19-52	

	14baa	.....do	1949	Dr	....	6	P	Ss	Arikaree formation.	C,G	S	Bpb	0	4,915	41.28	6-19-52	
	14dbb	.....do	1949	Dr	....	6	P	Ss	.....do	N	.....	Tc	0	4,935	44.80	6-19-52	
	15aca	.....do	......	Dr	....	6	P	Ss	.....do	C,W	S	Tc	+1.1	4,798	40.30	6-19-52	T52.
	18dad	L. J. Millikan	1947	Dr	120	......	....	Sls	Brule formation.	N	.....	Ls	0	4,690	79.90	6-24-52	
	19bdc	F. S. Schumer	1941	Du	64	288	R	Sls	.....do	T,E	I	Ls	....	4,660	49	....	T54.
	20bac	Thomas Berry	1945	Dr	[2]1,775	8	P	....	....	....	S	Tc	+.8	4,721	89.60	6-21-52	L.
	22cca	Roy McCormick	......	Dr	....	6	P	Ss	Arikaree formation.	N	.....	Tc	+2.4	4,832	98.87	6-21-52	
	26bad	....	......	Dr	....	6	P	Ss	.....do	C,W	S	Hph	+1.4	4,831	33.58	6-19-52	T52.
	27ccb	Glen Cundall	......	Sp	....	......	....	Ss	.....do	F	S	.....	....	4,744	....	....	D50E,T53, Ca.
	28bad	Roy McCormick	......	Dr	....	6	P	Ss	.....do	C,H	N	Tc	+.4	4,755	61.10	6-21-52	
	30aac	L. Hytrek	1915	Dr	70	6	P	Sls	Brule formation.	C,G	S	Tc	+.8	4,661	47.50	6-23-52	
	30cdc	....	......	Dr	....	6	P	Sls	.....do	C,W	N	Bpb	0	4,670	66.05	6-23-52	
	33acc	Glen Cundall	......	Sp	....	......	....	Congl	Arikaree formation.	F	D,S	.....	....	4,720	....	....	D30E,T50.
	33dbb	Roy McCormick	......	Dr	....	6	P	Ss	.....do	C,W	N	Tc	+3.3	4,728	12.75	6-21-52	
68-	16dbb	Oliver Wormwood	......	Sp	....	......	....	....	Hartville formation.	F	D,S	.....	....	4,585	....	....	D700E,T60, Ca.
	17cbb	.....do	1947	Dr	34	18	P	S,G	Flood-plain deposits.	T,E	I	Ls	....	4,600	6	1947	D940M, DD12.2.
	18aac	.....do	1939	Dr	36	24	P	S,G	.....do	T,E	I	Ls	....	4,610	9	1952	D430M, DD17.5.
	31ba	Dick Cundall	......	Sp	....	......	....	S,G	Terrace deposits.	F	S	.....	....	4,779	....	....	D2R.
	33ccd	Mr. Hershberger	1955	Dr	78	6	P	Sls	Brule formation.	J,E	D	Ls	....	4,660	67	1955	L.
69-	2bab	Chicago Burlington and Quincy R.R.	1919	Dr	61	......	....	Sls	.....do	....	In	Ls	....	4,675	40	....	L.
	2ccb	Hugh Stemler	......	Dr	....	6	P	Sls	.....do	C,W,G	D,S	Hph	+1.3	4,731	84.50	6-12-52	T54.
	4cdd	.....do	......	Dr	....	6	P	Sls	.....do	C,W	S	Tpc	+.7	4,896	46.00	6-12-52	T53.
	14bdb	....	......	Du	....	72	....	S,G	Flood-plain deposits.	N	N	Twc	0	4,740	8.09	6-10-52	
	17adc	Earl Stephenson	1945	Dr	85	6	P	Sls	Brule formation.	C,W	S	Hph	+3.3	5,003	28.73	6-10-52	T52.

Table 10.—*Records of wells and springs in Platte County, Wyo.*—Continued

Well	Owner or tenant	Year drilled	Type of supply	Depth of well (feet)	Diameter of well (inches)	Type of casing	Principal water-bearing bed: Character of material	Principal water-bearing bed: Geologic source	Type of pump and power	Use of water	Measuring point: Description	Measuring point: Distance above (+) or below (-) land surface (feet)	Measuring point: Height above mean sea level (feet)	Distance to water level above or below measuring point (feet). (+ indicates water level is above measuring point)	Date of measurment	Remarks (yield in gallons per minutes, drawdown in feet)
30-69-18cdb	....	....	Dr	....	6	P	Sls	Brule formation.	C,W	S	Bpb	+0.5	5,096	41.27	6-12-52	
21bbd	Don Cundall	....	Dr	51	.....	.....	S,G	Flood-plain deposits.	C,W	N	Hph	+1.6	4,902	24.71	6-10-52	
23baa	Victor Black	....	Dr	....	6	P	S,G	.....do	C,W	N	Tc	+.4	4,771	24.90	7-14-52	
27ada1	Dick Cundall	1940	Dr	50	6	P	Sls	Brule formation.	C,W	D,S	Tc	0	4,860	9.90	7-14-52	
27ada2	Jack Cundall	....	Sp	....	.....	.....	Ss	Arikaree(?) formation.	F	S	.....	....	4,830	....	....	D2E.
32cab	Mr. Foy	....	Dr	60	6	P	S,G,Sls	Flood-plain deposits, Brule formation.	C,H	D	Hph	+1.2	5,026	9.50	7-14-52	
36bdb	Jack Cundall	....	Sp	....	.....	.....	....	Hartville formation(?).	E	S	.....	....	4,940	....	....	D1E.
70-24baa	....	....	Dr	54.0	6	P	Sls	Brule formation.	N	N	Tc	0	5,130	53.90	6-12-52	

[1]Well plugged back to 460 ft.
[2]Well plugged back to 600 ft.

*Well buried but connected to cistern 43.0 ft deep.

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*

	Thickness (feet)	Depth (feet)
20-67-3cbb		
[Test well drilled for Mrs. H. McDonald, 1951]		
Alluvium:		
Soil	6	6
Gravel	16	22
Gravel and boulders	2	24
Brule formation:		
Clay	2	26
20-67-8dcc		
[Test well drilled for Mrs. H. McDonald, 1951]		
Alluvium:		
Soil	12	12
Sand and quicksand	8	20
Gravel	3	23
Quicksand and boulders	8	31
Brule formation:		
Clay	1	32
20-67-9ccc		
[Test well drilled for Mrs. H. McDonald, 1951]		
Alluvium:		
Soil	2	2
Sand, fine	3	5
Sand	20	25
Brule formation:		
Clay	1	26
20-67-19bbb		
[Test well drilled for Mrs. H. McDonald, 1951]		
Alluvium:		
Soil	10	10
Sand	12	22
Brule formation:		
Clay	7	29
20-68-25bbb		
[Test well drilled for Mrs. H. McDonald, 1951]		
Alluvium:		
Soil	8	8
Quicksand and sand	5	13
Sand and gravel	11	24
Brule formation:		
Clay	6	30

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
20-68-34baa		
[Test well drilled for Mrs. H. McDonald, 1951]		
Alluvium:		
Soil	1	1
Gravel	6	7
Clay	9	16
Sand and gravel	13	29
21-67-4ddd		
[Stock well drilled for D. P. Grant, 1952. Altitude, 5,349 ft]		
Brule formation:		
Clay and rocks	20	20
Clay and limerock	140	[1]160

[1]Measured depth of well 134.0 ft.

	Thickness (feet)	Depth (feet)
22-66-36abb		
[Domestic and stock well drilled for Herbert Havely]		
Soil	8	8
Brule formation:		
Rock, gravel (cemented)	84	92
Clay	108	200
Limerock, gravel and clay	8	208
Gravel (water)	42	250
Clay	17	267
22-68-3cac		
[Stock well drilled for Ralph Allison, 1952. Altitude, 5,495 ft]		
Soil, black	5	5
Brule formation:		
Gravel	3	8
Rock, cement	27	35
Clay (water)	36	71
Sand, black (water)	5	76
Shale, blue	21	97
Clay, yellow	5	102
Gravel (water)	1	103
22-68-14caa		
[Stock well drilled for J. E. Irvine, 1952. Altitude 5,381 ft]		
Soil	6	6
Brule formation:		
Clay and gravel	5	11
Clay	47	58
Clay, sandy	18	76
Clay, hard and soft	40	116
Limerock	2	118
Clay, soft, and sand	6	124
Clay, hard and soft	36	160
Rock	1	161
Sand (water)	1	162

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
22-68-36ab		
[Stock well drilled for D. P. Grant, 1952. Altitude, 5,488 ft]		
Brule formation:		
Clay	9	9
Clay and boulders	26	35
Clay, white	83	[1]118

[1]Measured depth of well 79.0 ft.

	Thickness (feet)	Depth (feet)
22-70-14caa		
[Domestic and stock well drilled for L. Seidel. Altitude, 5,240 ft]		
Alluvium:		
Soil	25	25
Gravel	1	26
23-67-3aba		
[Abandoned oil test well drilled for G. E. Hall, 1950. Altitude, 4,849 ft]		
Base of White River group	....	1,200
Top of Chugwater formation	....	1,300
23-68-1ccc		
[Irrigation well drilled for R. S. Wilson, 1953. Altitude, 4,922 ft]		
Soil	7	7
Terrace deposits:		
Gravel	16	23
Arikaree formation:		
Sandstone, soft	20	43
23-68-2ccb		
[Irrigation well drilled for Mr. Baker, 1954. Altitude, 4,916 ft]		
Soil	5	5
Terrace deposits:		
Gravel, coarse, clean	16	21
Arikaree formation:		
Sand	1	22
23-68-3bba		
[Sample log of test hole, 1953. Altitude, 4,935]		
Soil	2	2
Terrace deposits:		
Sand and gravel; contains clay	8	10
Gravel, fine, and sand	12	22
Sand, fine, and gravel	12	34
Clay	3	37
Sand, fine	7	44
Clay; contains sand and gravel	3	47
Sand, medium; contains medium gravel	3	50
Sand, medium to coarse	12	62

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
23-68-3bba—Continued		
Terrace deposits:—Continued		
Clay, sandy	6	68
Arikaree formation:		
Sandstone, soft, fine to medium	4	72
23-68-6cbb		
[Sample log of test hole, 1953. Altitude, 4,903 ft]		
Soil	2	2
Terrace deposits:		
Sand and gravel; contains clay and boulders	11	13
Gravel, fine to medium	4	17
Arikaree formation:		
Sand, fine to medium	5	22
23-68-8dcc		
[Sample log of test hole, 1953. Altitude, 5,020 ft]		
Soil	2	2
Terrace deposits:		
Gravel, coarse; contains sand and a few thin lenses of clay	26	28
Arikaree formation:		
Sandstone, fine-grained, yellow	4	32
23-68-10baa		
[Sample log of test hole, 1953. Altitude, 4,941 ft]		
Clay, brownish	2	2
Terrace deposits:		
Gravel, medium	4	6
Clay; contains gravel	6	12
Clay, sandy	5	17
Gravel, medium, and sand	4.5	21.5
Arikaree formation:		
Sandstone, fine-grained, yellow	10.5	32
23-68-10cdc		
[Sample log of test hole, 1953. Altitude 5,005 ft]		
Clay, sandy	6	6
Terrace deposits:		
Sand, and gravel, up to coarse	12	18
Boulder	1	19
Gravel, medium, and sand	13	32
Arikaree formation:		
Sandstone, fine-grained, moderately hard, yellow; contains beds of white, lime-cemented sandstone	10	42

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
23-68-14aab		
[Sample log of test hole, 1953 Altitude, 5,010 ft]		
Terrace deposits:		
Clay; contains sand and coarse gravel	3	3
Clay; contains silt and sand	3	6
Gravel, coarse	8	14
Clay, brownish	8	22
Clay, sandy, brownish	16	38
Clay; contains lenses of sand	9	47
Sand, medium; contains lenses of clay	9	56
Arikaree formation:		
Sandstone, fine to medium, gray	6	62
23-68-14ada		
[Irrigation well drilled for J. R. and J. L. Turner, 1953. Altitude, 5,035 ft]		
Soil	10	10
Terrace deposits:		
Sand and gravel	30	40
Arikaree formation:		
Sandstone, soft	35	75
23-68-15ccc		
[Domestic well drilled for Bertha Kenty. Altitude, 5,062 ft]		
Soil and clay	10	10
Terrace deposits:		
Gravel	30	40
Arikaree formation:		
Clay, white	7	47
23-68-15dcd		
[Sample log of test hole, 1953. Altitude, 5,081 ft]		
Soil	1	1
Terrace deposits:		
Clay, sandy, brown	8	9
Gravel, coarse;contains lenses of sandy clay	20	29
Gravel, coarse, and sand; contains boulders	8	37
Gravel, coarse; contains cobbles	7	44
Arikaree formation:		
Sand, fine	8	52
23-68-16dcc		
[Sample log of test hole, 1953. Altitude, 5,082 ft]		
Soil	2	2
Terrace deposits:		
Gravel, coarse; contains sand and clay lenses	14	16
Clay, sandy, brownish	11	27
Gravel, fine; contains sand	9	36
Boulder	1.5	37.5
Sand, fine to medium	10.5	48

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
23-68-16dcc—Continued		
Terrace deposits:—Continued		
Gravel, fine; contains sand and clay lenses	3	51
Boulder	1	52
Gravel, fine; contains sand and clay lenses	8.5	60.5
Clay, sandy, buff	1.5	62
Arikaree formation:		
Sand, very fine; contains considerable buff clay	10	72
23-68-17ccc		
[Sample log of test hole, 1953. Altitude, 5,074 ft]		
Soil	0.5	0.5
Terrace deposits:		
Sand and gravel	3.5	4
Clay, sandy	5	9
Gravel, coarse	4	13
Sand, coarse, and very fine gravel	.5	13.5
Clay, sandy	4.5	18
Sand, very coarse; contains very fine gravel	9	27
Arikaree formation:		
Sand, fine to medium	15	42
23-68-18abb		
[Sample log of test hole, 1953. Altitude, 5,037 ft]		
Soil	2	2
Terrace deposits:		
Gravel, coarse, and sand	8	10
Gravel and sand; contains boulders	4	14
Arikaree formation:		
Clay, sandy	12	26
Sandstone, sand, and greenish clay layers, interbedded	26	52
23-68-18ccd		
[Sample log of test hole, 1953. Altitude, 5,083 ft]		
Soil	0.5	0.5
Terrace deposits:		
Sand and gravel, up to very coarse; contains boulders	10	10.5
Sand, coarse; contains medium gravel	1.5	12
Sand; contains fine gravel	7	19
Sand; contains medium gravel	18.5	37.5
Sand, coarse	2.5	40
Arikaree formation:		
Sand, fine	6	46
23-68-20abb		
[Sample log of test hole, 1953. Altitude, 5,083 ft]		
Clay, sandy	10	10
Terrace deposits:		
Gravel, coarse	2.5	12.5
Clay, sandy, brown	12.5	25

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
23-68-20abb—Continued		
Terrace deposits:—Continued		
Gravel and sand	10	35
Clay, sandy, brown	9	44
Gravel, up to coarse	10	54
Arikaree formation:		
Sandstone, fine-grained, greenish	8	62
23-68-22bcc		
[Irrigation well drilled for J. A. Corman, 1954. Altitude, 5,098 ft]		
Soil	4	4
Terrace deposits:		
Clay	5	9
Sand and gravel	14	23
Gravel, cemented	2	25
Clay	3	28
23-68-23bcc		
[Sample log of test hole, 1953. Altitude, 5,138 ft]		
Terrace deposits:		
Clay, sandy	5	5
Gravel, medium to coarse, and sand	11	16
Arikaree formation:		
Sandstone, fine, brownish	3	19
Lime	1	20
Sand, fine to medium	22	42
23-68-29bba		
[Unused well drilled for R. Wallesen. Altitude, 5,150 ft]		
Terrace deposits:		
Gravel	15	15
Arikaree formation:		
Clay, soft, and sand	15	30
Sand (water)	2	32
Clay, white	18	50
Chalk rock (water)	18	68
Sand, loose	3	71
23-68-31cda		
[Abandoned oil test well drilled for A. A. Potter, 1949. Altitude 5,165 ft]		
Soil and gravel	12	12
Arikaree formation:		
Clay, pink	4	16
Clay	44	60
Sandstone, very fine grained, pink	10	70
Sandstone, very fine grained, clayey, pink	10	80
Clay, pink	5	85
Clay, sandy	10	95
Clay, sandy, buff	38	133
Gravel, medium	3	136

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
23-68-31cda—Continued		
Arikaree formation:—Continued		
Clay, silty, and clayey silt	29	165
Siltstone, sandy	25	190
Siltstone, clayey	5	195
Clay, silty, buff	5	200
Sand, pink	5	205
Clay, silty, buff	35	240
Sand, very fine-grained, pink	5	245
Clay, silty, buff	23	268
Silt, clayey	4	272

24-66-2add

[Abandoned oil test well drilled by General Petroleum Corporation, 1949. Altitude 5,100 ft]

	Thickness (feet)	Depth (feet)
Schlumberger tops:		
Benton shale	......	1,235
Cloverly formation	......	1,875
Morrison formation	......	1,961
Sundance formation	......	2,133

24-66-15bdc

[Abandoned oil test well drilled by General Petroleum Corporation, 1942. Altitude 5,140 ft]

	Thickness (feet)	Depth (feet)
Soil	12	12
Arikaree and Brule formations:		
Lime	38	50
Sand, fine, dark-gray	250	300
Gravel coarse, and clay	340	640
Clay, buff, and sand	400	1,040
Sand, fine, gray	60	1,100
Clay, buff to light-gray	240	1,340
Sand, very fine, buff	20	1,360
Pierre shale:		
Shale, dark-gray	160	1,520
Niobrara formation:		
Shale, light-gray	287	1,807
Benton shale:	1,121	2,928
Cloverly formation	168	3,096
Morrison formation	237	3,333
Sundance formation	88	3,421
Jelm formation	78	3,499
Chugwater formation	722	4,221
Minnekahta limestone	21	4,242
Opeche shale	60	4,302
Hartville formation	882	5,184
Guernsey formation	157	5,342
Precambrian	......	......

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-66-33dbb		
[Stock well drilled for I. E. Johnson, 1947. Altitude, 5,057 ft]		
Soil	8	8
Arikaree formation:		
Limerock, hard	4	12
Chalk rock	18	30
Limestone, soft	24	54
Chalk rock	36	90
Limestone, hard	15	105
Limerock	10	115
Chalk rock	7	122
Limestone, hard	4	126
Chalk rock (water)	23	149
Limerock	3	152
24-67-4acc		
[Test hole drilled for Tom Bennett, at site of irrigation well, 1953. Altitude 4,645 ft]		
Soil	6	6
Terrace deposits:		
Gravel, coarse, clean	19	25
Gravel, very fine	11	36
Arikaree formation:		
Sand	4	40
24-67-4bbb		
[Sample log of test hole, 1953. Altitude, 4,628 ft]		
Soil	1.5	1.5
Terrace deposits:		
Gravel, up to coarse; contains fine to medium sand	10.5	12
Gravel, up to coarse	2.5	14.5
Sand, medium	1.5	16
Arikaree formation:		
Sand, fine to medium	42	58
Sandstone, fine to medium, moderately well cemented	8	66
24-67-4bcc		
[Test hole drilled for M. Bennett, 1953. Altitude, 4,655 ft]		
Soil	7	7
Terrace deposits:		
Gravel	13	20
Arikaree formation:		
Sand, loose	20	40
Sand	3	43
Sandstone, hard	1	44
Sandstone	16	60
Sandstone; contains thin hard streaks	15	75
Sandstone; contains thin layers of clay	16	91
Sand, soft	9	100
Sandstone	26	126

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-67-5ccc		
[Domestic well drilled for B. E. McCartney. Altitude, 4,712 ft]		
Terrace deposits:		
Gravel (dry)	50	50
Arikaree formation:		
Sand, fine; contains thin layer of gravel at 75 ft	150	200
Sand and clay	94	294
Sandstone, hard, brown	1	295
Sand, fine (water)	6	301
24-67-5dcc		
[Sample log of test hole, 1953. Altitude, 4,694 ft]		
Clay, sandy	5	5
Terrace deposits:		
Clay, cobbles, and gravel	3	8
Gravel and sand	6	14
Sand, coarse	7	21
Sand, medium	5	26
Sand, fine to coarse	12	38
Arikaree formation:		
Sand, fine to medium	8	46
Sandstone, medium to coarse, hard	4	50
Sand, fine	8	58
Sandstone, medium, moderately hard, lime cemented	2	60
Sandstone, medium-grained, soft	6	66
24-67-6aac		
[Test hole drilled for N. F. Hester, 1953. Altitude, 4,641]		
Soil and sand	10	10
Terrace deposits:		
Gravel, clean	5	15
Sand, with a streak of clay at 17 ft	10	25
Clay, sandy	5	30
Sand, fine, and boulders	6	36
Arikaree formation:		
Sand, white	6	42
24-67-6aad		
[Sample log of test hole, 1953. Altitude, 4,638 ft]		
Soil	2	2
Terrace deposits:		
Gravel, up to very coarse; contains sand	8	10
Sand, medium	3	13
Arikaree formation:		
Sand, fine to medium	3	16
Sandstone, fine- to medium-grained, soft, cemented with clay	10	26
Sand, fine; contains thin lime cemented sandstone layers at 31 and 33 ft	10	36
Sand, fine to medium	10	46

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-67-6bdc		
[Test hole drilled for Henry Funk, at site of irrigation well, 1953. Altitude 4,670 ft]		
Soil	10	10
Terrace deposits:		
Gravel	9	19
Sand, soft; contains clay streaks	5	24
Sand and gravel	6	30
Gravel	6	36
Sand, fine	4	40
Sand and coarse gravel	5	45
Arikaree formation:		
Sand	10	55
24-67-6dab		
[Test hole drilled for N. F. Hester, 1953. Altitude, 4,662 ft]		
Soil	5	5
Terrace deposits:		
Gravel and boulders	7	12
Sand, fine; contains some boulders	6	18
Arikaree formation:		
Sand, fine	24	42
24-67-7daa		
[Sample log of test hole, 1953. Altitude, 4,749 ft]		
Sand, fine, silty	5	5
Terrace deposits:		
Gravel, coarse, and sand	5	10
Clay, buff to brown	1	11
Gravel, and sand, coarse	13	24
Sand, fine to medium	6	30
Sand, fine to medium; contains clay	3	33
Sand, medium	6	39
Gravel, fine, and sand	9	48
Sand, fine to medium, tannish	8	56
Sand, medium, clayey, tannish	4	60
Sand, fine to medium, tannish	10	70
Gravel, up to very coarse; contains coarse sand, a 3-inch clay lens at 72 ft, and cobbles	13	83
Arikaree formation:		
Sand, fine to medium	13	96
24-67-17bba		
[Domestic well drilled for A. Marshall. Altitude, 4,762 ft]		
Terrace deposits:		
Gravel	75	75
Arikaree formation:		
Sand, fine	165	240
Limestone	4	244
Sand, fine	41	285
Sandstone, hard	2	287
Sand and clay	28	315

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Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-67-18bdc		
[Sample log of test hole, 1953. Altitude, 4,786 ft]		
Soil	4	4
Terrace deposits:		
Gravel, limey crust	.5	4.5
Gravel, up to very coarse	5.5	10
Gravel, up to very coarse; contains boulders	1	11
Sand, medium	5	16
Arikaree formation:		
Sand, fine; contains granules of clay	5	21
Sand, fine to medium	15	36
Sand, medium	60	96
Sand, fine to medium; contains 2- to 5-in. beds hard sandstone at 98, 101, 103 and 113 ft.	27.5	123.5
Sandstone, medium, moderately hard	2.5	126
Sand, fine to medium; contains 0.5-ft bed of hard sandstone at 143 feet	124	250
Sand, fine; contains 1.5-foot bed of hard, lime-cemented sandstone at 254 ft	6	256
Sandstone, fine to coarse, lime cemented	2	258
Sand, fine to medium	44	302
24-68-1cdc		
[Sample log of test hole, 1953. Altitude, 4,699 ft]		
Soil	2	2
Terrace deposits:		
Clay, white; contains sand and coarse gravel	3	5
Clay, pinkish and some green	2	7
Gravel, up to coarse, and coarse to very coarse sand	4	11
Gravel, very fine, and very coarse sand	5	16
Sand, coarse to very coarse, and very fine gravel	9	25
Arikaree formation:		
Sand, fine to medium	3	28
Sand, fine to medium; contains 3- to 6-in. beds of hard, lime-cemented sandstone at 29, 34, 37.5 and 42 ft	18	46
24-68-1ddd		
[Sample log of test hole, 1953. Altitude, 4,688 ft]		
Soil	3	3
Terrace deposits:		
Clay, sandy, cream-colored; contains coarse gravel	5	8
Gravel, coarse; contains sand	11	19
Sand, very coarse, and very fine gravel	12	31
Sand, fine to medium	4	35
Gravel, up to very coarse; contains sand and boulders	10	45
Arikaree formation:		
Sand, fine to medium	11	56

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-2dcc		
[Irrigation well drilled for John Whalen, 1954. Altitude, 4,715 ft]		
Soil	6	6
Terrace deposits:		
Gravel	9	15
24-68-3bcb		
[Test hole drilled for J. W. Lawyer, at site of irrigation well, 1953. Altitude, 4,733 ft]		
Soil and rocks	10	10
Terrace deposits:		
Gravel, coarse	18	28
Gravel, fine	6	34
Arikaree formation:		
Sand	6	40
24-68-3bcc1		
[Irrigation well drilled for J. W. Lawyer, 1954. Altitude, 4,736 ft]		
Soil	3	3
Terrace deposits:		
Boulders	4	7
Gravel; contains streaks of clay	7	14
Sand and gravel	6	20
Gravel, coarse	7	27
Gravel, hard, cemented	1	28
Gravel (water)	5	33
Arikaree formation:		
Sand, loose	.5	33.5
24-68-3bcc2		
[Test hole drilled for J. W. Lawyer, 1953. Altitude, 4,739 ft]		
Soil	5	5
Terrace deposits:		
Gravel	15	20
Arikaree formation:		
Sand, very fine	4	24
Sand, fine (water)	6	30
Sandstone, hard	2	32
Sand, fine	2	34
Sandstone; contains thin hard streaks	29	63
24-68-3bcc3		
[Test hole drilled for J. W. Lawyer, 1953. Altitude, 4,736 ft]		
Soil	5	5
Terrace deposits:		
Gravel	19	24
Clay, hard	1	25
Gravel, medium	2	27
Arikaree formation:		
Sandstone, fine	3	30

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-3bcc3—Continued		
Arikaree formation:—Continued		
Sandstone	12	42

24-68-4bdc

[Irrigation well drilled for Leo Norris, 1953. Altitude, 4,743 ft]

Soil	5	5
Terrace deposits:		
Gravel and boulders	27	32
Arikaree formation:		
Sandstone, soft	6	38

24-68-4cbc

[Irrigation well drilled for A. C. Johnson, 1953. Altitude, 4,753 ft]

Soil	5	5
Terrace deposits:		
Gravel and boulders	15	20
Gravel, medium	13	33
Arikaree formation:		
Sand	9	42

24-68-4cbd

[Test hole drilled for A. Johnson, 1953. Altitude, 4,754 ft]

Soil	5	5
Terrace deposits:		
Gravel	22	27
Arikaree formation:		
Sand, soft	3	30
Sand, hard	10	40

24-68-5add

[Sample log of test hole, 1953. Altitude, 4,745 ft.. Irrigation well 24-68-5add drilled at this site]

Soil	1	1
Terrace deposits:		
Clay, sandy, calcareous, buff; contains gravel	3	4
Gravel, up to very coarse, and sand; contains cobbles from 5 to 8 ft	7	11
Gravel, medium; contains boulders	13	24
Sand, up to very coarse	2	26
Gravel, medium; contains sand	6	32
Arikaree formation:		
Sandstone, fine, hard	2	34
Sand, fine to medium; contains beds of lime about 1 in. thick at 37 and 44 ft	12	46

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-5cbb		
[Sample log of test hole, 1953. Altitude, 4,725 ft]		
Soil	1	1
Terrace deposits:		
Gravel, medium to coarse; contains sand	9	10
Sand, very coarse	2	12
Arikaree formation:		
Sand, very fine to fine	24	36
24-68-7cdc		
[Test hole drilled for J. E. Utter, 1953. Altitude, 4,767 ft]		
Soil	3	3
Terrace deposits:		
Gravel and boulders	9	12
Boulders	4	16
Arikaree formation:		
Sand	6	22
Sand, very fine	18	40
24-68-7ddd		
[Sample log of test hole, 1953. Altitude, 4,774 ft]		
Soil	2	2
Terrace deposits:		
Gravel, medium; contains sand	8	10
Arikaree formation:		
Sand, fine to coarse	16	26
24-68-8add		
[Sample log of test hole, 1953. Altitude, 4,775 ft. Test hole cased to 10.0 ft and converted into an observation well]		
Soil	2	2
Terrace deposits:		
Clay, sandy, and coarse gravel; contains boulders	3	5
Gravel; contains sand and cobbles	32	37
Sand, coarse	2	39
Arikaree formation:		
Sand, fine	2	41
24-68-8ddc		
[Irrigation well drilled for Floyd Andrews, 1953. Altitude, 4,785 ft]		
Soil	5	5
Terrace deposits:		
Gravel, coarse	7	12
Chalk rock	1	13
Gravel, coarse, and boulders	14	27
Chalk rock	1	28
Gravel, coarse, and boulders	7	35
Arikaree formation:		
Sand, fine	5	40

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-9baa		
[Sample log of test hole, 1953. Altitude, 4,760 ft]		
Soil	0.5	0.5
Terrace deposits:		
Clay, sandy; contains gravel and cobbles	5.5	6
Gravel, coarse; contains sand	5	11
Arikaree formation:		
Sand, fine to coarse	25	36
24-68-9ccc1		
[Irrigation well drilled for Doval Johnston, 1953. Altitude, 4,789 ft]		
Soil and gravel	5	5
Terrace deposits:		
Gravel and boulders	25	30
Arikaree formation:		
Sand, very soft	15	45
Sandstone, soft	15	60
24-68-10ada		
[Sample log of test hole, 1953. Altitude, 4,751 ft]		
Soil	1	1
Terrace deposits:		
Sand, gravel and clay; contains cobbles	5	6
Gravel, medium; contains sand	8	14
Sand, up to very coarse; contains very fine gravel	15	29
Arikaree formation:		
Sand, fine to coarse	17	46
24-68-10cbc		
[Sample log of test hole, 1953. Altitude, 4,771 ft]		
Soil	2	2
Terrace deposits:		
Clay, sandy; contains gravel and cobbles with limey surfaces	3	5
Gravel and sand	5	10
Sand, up to very coarse; contains very fine to fine gravel	6	16
Sand, up to coarse	8	24
Arikaree formation:		
Sand, medium to coarse; contains thin beds of lime-cemented sandstone at 24, 30, 32 and 34 feet	13	37
Sand, fine to medium	19	56

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-10cdc		
[Irrigation well drilled for Fred Hanes, 1953. Altitude, 4,777 ft]		
Soil	5	5
Terrace deposits:		
Sand and gravel	7	12
Gravel	10	22
Arikaree formation:		
Sandstone, cemented	6	28
Sand	9	37
24-68-11cdc		
[Irrigation well drilled for A. F. Bowen, 1954. Altitude, 4,752 ft]		
Soil	2	2
Terrace deposits:		
Sand and gravel	28	30
Arikaree formation:		
Sand	7	37
24-68-11cdd		
[Irrigation well dug for A. F. Bowen, 1953. Altitude, 4,738 ft]		
Soil	5	5
Terrace deposits:		
Clay and gravel	3	8
Sand and gravel	12	20
Arikaree formation:		
Sand	5	25
24-68-12abb		
[Sample log of test hole, 1953. Altitude, 4,679 ft]		
Soil	2	2
Terrace deposits:		
Gravel; contains sand and cobbles	14	16
Arikaree formation:		
Sand, fine to medium	20	36
24-68-12add		
[Sample log of test hole, 1953. Altitude, 4,716 ft]		
Soil	4	4
Clay, sandy, cream-colored	2	6
Terrace deposits:		
Gravel, coarse; contains clay and sand	4	10
Gravel, coarse; contains sand and cobbles	6	16
Gravel, medium; contains sand	8	24
Gravel, fine to coarse; contains sand and cobbles	10	34
Arikaree formation:		
Sand, fine to coarse	22	56

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-12bcb		
[Sample log of test hole, 1953. Altitude, 4,722 ft]		
Soil	2	2
Terrace deposits:		
Clay, cream-colored; contains sand and gravel	3	5
Gravel, up to coarse; contains coarse sand	18	23
Arikaree formation:		
Sand, fine to medium	23	46
24-68-12dbb2		
[Industrial well drilled for the Great Western Sugar Co., 1933. Altitude, 4,702 ft]		
Soil	16	16
Arikaree formation:		
Sand, fine	132	148
Sandstone, gray	2	150
Sand, coarse	29	179
Sandstone	5	184
Sand and gravel, cemented	66	250
Sandstone	1	251
Sand, coarse	10	261
Sandstone, hard	2	263
Sandstone, soft	60	323
Clay, yellow	5	328
Sandstone, brown	10	338
Sand	22	360
Sandstone, white	4	364
Sand	11	375
Sandstone, brown	5	380
Sand and clay	20	400
Clay, white	5	405
Sandstone, brown	5	410
Sand, white	25	435
Sandstone, gray	2	437
Sand, coarse	9	446
Sand, fine, brown	7	453
24-68-12dbc		
[Industrial well drilled for the Great Western Sugar Co., 1933, and purchased by town of Wheatland in 1955 for municipal use. Altitude, 4,700 ft]		
Soil	8	8
Terrace deposits:		
Sand and gravel	22	30
Arikaree formation:		
Quicksand	130	160
Clay	2	162
Sand	8	170
Sandstone	2	172
Sand	11	183
Sandstone	2	185
Sand	40	225
Lime rock	3	228
Sand	52	280
Lime rock	5	285

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (f et)	Depth (feet)
24-68-12dbc—Continued		
Arikaree formation:—Continued		
Sand (water)	39	324
Lime rock	3	327
Sand (water)	89	416
Clay, sandy	5	421
Sand, (water)	31	452
Clay, white	6	458
Lime rock	2	460
Sand (water)	35	495
Clay, white	12	507
24-68-12dcb		
[Industrial well drilled for the Great Western Sugar Co., 1936, and purchased by town of Wheatland in 1955 for municipal use. Altitude, 4,708 ft]		
Soil	8	8
Terrace deposits:		
Gravel	22	30
Arikaree formation:		
Sand	130	160
Clay, sandy	20	180
Shell, hard	3	183
Lime and sand	20	203
Shell, hard	3	206
Lime and sand	25	231
Shell, lime	3	234
Lime and sand	36	270
Shell, lime	3	273
Lime and sand	10	283
Shell, lime	3	286
Lime and sand	10	296
Shell, lime	3	299
Lime, sandy	30	329
Limestone	3	332
Lime, sandy	13	345
Shell, lime	4	349
Lime and sand	50	399
Limestone	4	403
Lime and sand	40	443
Shell, lime	3	446
Lime and sand	59	505
Shell, lime	3	508
24-68-13cdc		
[Public supply well drilled for town of Wheatland, 1946. Altitude, 4,803 ft]		
Arikaree formation:		
Sand and gravel(?)	158	158
Sandstone, cemented, white	6	164
Sand, soft	56	220
Sandstone, soft	12	232
Sand	123	355

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-13cdd1		
[Public supply well drilled for town of Wheatland, 1934. Altitude, 4,760 ft]		
Soil and gravel	18	18
Arikaree formation:		
Sand, light-colored	32	50
Sand, brown (water)	23	73
Sand	151	224
Sand and sandstone	143	367
Clay and dark sand	133	500
Clay, sandy, blue	60	560
24-68-14ccc		
[Sample log of test hole, 1953. Altitude, 4,847 ft]		
Soil	3	3
Terrace deposits:		
Clay, sandy, tannish	3	6
Gravel, up to very coarse; contains very coarse sand	35	41
Gravel, up to very coarse, and cobbles	5	46
Sand, medium	3	49
Arikaree formation:		
Sand, fine to medium	3	52
24-68-15acb		
[Irrigation well drilled for S. R. Mills, 1953. Altitude, 4,782 ft]		
Soil	5	5
Terrace deposits:		
Sand and gravel	20	25
24-68-15baa		
[Sample log of test hole, 1953. Altitude, 4,777 ft]		
Soil	0.5	0.5
Terrace deposits:		
Sand and gravel; contains cobbles (lime crust at 3 ft)	7.5	8
Gravel, coarse, and sand	11	19
Gravel, medium, and sand	9	28
Arikaree formation:		
Sandstone, fine to medium, hard	1	29
Sand, fine to medium	7	36
24-68-15bbd		
[Irrigation well drilled for R. A. Brashear, 1953. Altitude, 4,785 ft]		
Soil	2	2
Terrace deposits:		
Sand; contains gravel and boulders	10	12
Gravel, coarse	15	27
Gravel, coarse, and boulders	4	31
Boulders, small	5	36
Arikaree formation:		
Sandstone, fine, soft	7	43

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-16abb		
[Sample log of test hole, 1953. Altitude, 4,785 ft]		
Soil; contains 5-in. layer of white gypsum at 2.5 ft	3	3
Terrace deposits:		
Sand, medium	8	11
Gravel, coarse, and sand	10	21
Arikaree formation:		
Sand, fine to medium	15	36
24-68-16cbb		
[Sample log of test hole, 1953. Altitude, 4,803 ft]		
Soil	1	1
Terrace deposits:		
Sand; contains clay, gravel and cobbles	4	5
Arikaree formation:		
Sand, medium	16	21
Sand, fine	5	26
Sandstone, limey, fine to medium, soft	5	31
Sand, fine to medium	15	46
24-68-16cdd		
[Irrigation well drilled for J. Zwetzig, 1950. Altitude, 4,818 ft]		
Soil	6	6
Terrace deposits:		
Gravel and boulders	27	33
Gravel and sand	11	44
Arikaree formation:		
Sandstone, soft	8	52
24-68-17cdd		
[Sample log of test hole, 1953. Altitude, 4,801 ft]		
Soil	4	4
Terrace deposits:		
Gravel, medium; contains sand	7	11
Arikaree formation:		
Sand, fine to coarse	15	26
24-68-18acc		
[Irrigation well drilled for R. M. Straw, 1938. Altitude, 4,788 ft]		
Soil	8	8
Terrace deposits:		
Sand and gravel	16	24
Gravel, coarse	12	36

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-18acd		
[Irrigation well drilled for R. M. Straw, 1954. Altitude, 4,786 ft]		
Soil	2	2
Terrace deposits:		
Boulders and gravel	8	10
Gravel	8	18
Boulders	2	20
Gravel	5	25
Boulders	2	27
Arikaree formation:		
Sand	5	32
24-68-18add		
[Irrigation well drilled for R. M. Straw, 1954. Altitude, 4,785 ft]		
Soil	2	2
Terrace deposits:		
Gravel, cemented	9	11
Boulders	2	13
Gravel	8	21
Sand and gravel	7	28
24-68-18dbb1		
[Sample log of test hole, 1953. Altitude, 4,789 ft]		
Soil	2	2
Terrace deposits:		
Sand, contains silt	4	6
Gravel, coarse, and sand	14	20
Arikaree formation:		
Sand, fine to coarse	19.5	39.5
Sandstone, fine- to coarse-grained, hard	.5	40
24-68-18dbb2		
[Sample log of test hole, 1953. Altitude, 4,789 ft]		
Soil	2	2
Terrace deposits:		
Sand, fine; contains medium gravel	2	4
Gravel, coarse; contains sand and boulders	9	13
Gravel, medium; contains medium to coarse sand	4	17
Arikaree formation:		
Sand, fine to coarse	14	31
24-68-18dbb3		
[Sample log of test hole, 1953. Altitude, 4,789 ft]		
Soil	2	2
Terrace deposits:		
Sand, medium	2	4
Gravel, medium; contains sand	8.5	12.5
Arikaree formation:		
Sand, fine to medium	13.5	26

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

24-68-20bcd

[Irrigation well drilled for R. A. Brown, 1938. Altitude, 4,821 ft]

	Thickness (feet)	Depth (feet)
Soil	6	6
Terrace deposits:		
Gravel	15	21
Arikaree formation:		
Sand, very fine	54	75

24-68-21abc

[Irrigation well drilled for E. A. and F. R. Miller, 1953. Altitude, 4,822 ft]

	Thickness (feet)	Depth (feet)
Soil	6	6
Terrace deposits:		
Gravel and boulders	25	31
Arikaree formation:		
Sand	10	41

24-68-21baa1

[Sample log of test hole, 1953. Altitude, 4,818 ft]

	Thickness (feet)	Depth (feet)
Soil	3	3
Terrace deposits:		
Sand, medium; contains gravel	10	13
Gravel, coarse; contains very coarse sand	20	33
Arikaree formation:		
Sand, fine to medium	13	46

24-68-21baa2

[Sample log of test hole, 1953. Altitude, 4,818 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Terrace deposits:		
Clay, sandy	3	5
Gravel, coarse; contains very coarse sand	25	30
Arikaree formation:		
Sand, fine to coarse	6	36

24-68-21baa3

[Sample log of test hole, 1953. Altitude, 4,819 ft]

	Thickness (feet)	Depth (feet)
Soil	2	2
Terrace deposits:		
Clay, sandy	2	4
Gravel; contains lenses of clay and cobbles	4	8
Gravel, up to coarse; contains sand	18	26

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-21bcb		
[Test hole drilled for O. S. Preuitt, 1953. Altitude, 4,828 ft]		
Soil	5	5
Terrace deposits:		
Gravel	14	19
Arikaree formation:		
Sandstone; contains hard streaks	21	40
24-68-21bcc1		
[Test hole drilled for O. S. Preuitt, 1953. Altitude, 4,835 ft]		
Soil	5	5
Terrace deposits:		
Gravel, coarse	16	21
Arikaree formation:		
Sandstone, soft	39	60
24-68-21bcc2		
[Test hole drilled for O. S. Preuitt, 1953. Altitude, 4,834 ft]		
Soil	5	5
Terrace deposits:		
Gravel	16	21
Arikaree formation:		
Sandstone	9	30
24-68-21bdb		
[Irrigation well drilled for John L. Schluter, 1951. Altitude, 4,830 ft]		
Soil	3	3
Terrace deposits:		
Gravel, coarse; contains clay	2	5
Boulders (water)	23	28
Arikaree formation:		
Sandstone, soft	7	35
Sand, coarse (water)	8	43
Sandstone, soft	16	59
Sand, fine (water)	6	65
Sandstone, soft	5	70
24-68-21ccc		
[Irrigation well drilled for C. Franzen, 1953. Altitude, 4,849 ft]		
Soil	5	5
Terrace deposits:		
Boulders and coarse gravel	11	16
Gravel, coarse	2	18
Arikaree formation:		
Sandstone, soft	35	53

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-22abb		
[Sample log of test hole, 1953. Altitude, 4,837 ft]		
Soil	1	1
Terrace deposits:		
Clay, sandy	9	10
Clay	3	13
Gravel, coarse; contains sand	14.5	27.5
Sand, very coarse, and very fine gravel	1.5	29
Gravel and sand; contains cobbles	8	35
Arikaree formation:		
Sand, fine to coarse	7	42
24-68-26baa		
[Sample log of test hole, 1953, Altitude, 4,850 ft]		
Clay, sandy	5	5
Terrace deposits:		
Gravel, up to coarse; contains fine sand	9	14
Silt, clayey	9	23
Sand, medium	10	33
Sand, coarse to very coarse	1	34
Arikaree formation:		
Sand, fine to coarse; contains thin layers of sandstone	8	42
24-68-26ccc		
[Sample log of test hole, 1953. Altitude, 4,882 ft]		
Soil	3	3
Terrace deposits:		
Clay, contains sand and gravel	7	10
Gravel; contains beds of coarse sand	23	33
Clay, brown	5	38
Arikaree formation:		
Sand, fine to coarse	24	62
24-68-27aba		
[Sample log of test hole, 1953. Altitude, 4,878 ft]		
Clay	3	3
Terrace deposits:		
Clay, light-gray; contains gravel and sand	4	7
Clay, light-gray	10	17
Sand; contains gravel and clay lens at 18 to 18.5 ft	3	20
Sand; contains gravel and thin clay lenses	7	27
Sand, fine	9	36
Gravel, coarse	3.5	39.5
Clay	1.5	41
Arikaree formation:		
Sand, fine to medium; contains 0.5-ft lens of gray sandy clay at 60 ft	21	62

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-27cdd		
[Sample log of test hole, 1953. Altitude, 4,900 ft]		
Soil	1	1
Terrace deposits:		
Clay, sandy	10	11
Gravel and sand	5	16
Clay	3	19
Gravel and sand	9	28
Sand, coarse, and fine gravel	3	31
Gravel (claystone(?) fragments)	2	33
Clay, brown	11	44
Gravel (claystone and limestone fragments)	4	48
Arikaree formation:		
Sand, fine to medium	14	62
24-68-29aab		
[Sample log of test hole, 1953. Altitude, 4,845 ft]		
Soil	2	2
Terrace deposits:		
Gravel, sand, cobbles and clay	3	5
Gravel; contains coarse sand	18	23
Arikaree formation:		
Sand, medium to coarse	5	28
Sand, fine to medium	4	32
24-68-29ccc		
[Test hole drilled for D. O'Bannon, 1953. Altitude, 4,863 ft]		
Soil	5	5
Terrace deposits:		
Gravel	19	24
Arikaree formation:		
Sandstone, cemented	1	25
Sand	5	30
Sandstone	10	40
24-68-29ccd		
[Test hole drilled for D. O'Bannon, 1953. Altitude, 4,864 ft]		
Soil	5	5
Terrace deposits:		
Gravel	14	19
Arikaree formation:		
Sandstone; contains hard streaks	11	30
24-68-29aaa		
[Sample log of test hole, 1953. Altitude, 4,863 ft]		
Soil	2	2
Terrace deposits:		
Sand, contains clay, gravel and cobbles	3	5
Sand, coarse to very coarse	4	9

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-29daa—Continued		
Arikaree formation:		
Sand, medium	7	16
Sand, fine	13	29
Clay, sandy, buff	2	31
Sandstone, soft, buff; contains clay	5	36
Sand, fine to medium	5	41
Sandstone, very soft, buff	25	66

24-68-30baa

[Sample log of test hole, 1953. Altitude, 4,822 ft]

Soil	3	3
Terrace deposits:		
Gravel, lime coated	2	5
Gravel, up to very coarse; contains boulders	7	12
Gravel, fine; contains sand and cobbles	7	19
Sand, coarse	8	27
Arikaree formation:		
Sandstone, fine to medium, soft; contains thin lenses of hard sandstone	9	36

24-68-30cdc

[Sample log of test hole, 1953. Altitude, 4,850 ft]

Soil	2	2
Terrace deposits:		
Gravel; contains cobbles, sand, and some clay near top	6	8
Gravel, very fine to fine; contains sand and boulders	10	18
Gravel; contains sand	6	24
Arikaree formation:		
Sand, fine to medium	12	36

24-68-32aba

[Sample log of test hole, 1953. Altitude, 4,881 ft]

Soil	2	2
Terrace deposits:		
Gravel, coarse; contains boulders and sand	14	16
Gravel, medium	9	25
Sand, fine	5	30
Clay, buff	4	34
Arikaree formation:		
Sand, fine to medium	8	42

24-68-32adc

[Test hole drilled for H. J. Dietrich, 1953. Altitude, 4,903 ft]

Soil	5	5
Arikaree formation:		
Sand, soft	37	42
Sandstone, soft	18	60

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Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-68-32add		
[Test hole drilled for H. J. Dietrich, 1953. Altitude, 4,896 ft]		
Soil	5	5
Arikaree formation:		
Sand	35	40
24-68-32ccc		
[Sample log of test hole, 1953. Altitude, 4,922 ft]		
Soil	0.5	0.5
Terrace deposits:		
Sand, and gravel; contains cobbles and limey coating	4.5	5
Sand and gravel, up to very coarse; contains pebbles of soft, white limestone	7	12
Sand, very coarse, and very fine gravel	3	15
Arikaree formation:		
Sandstone, fine- to medium-grained, buff	16	31
24-68-33aaa		
[Sample log of test hole, 1953. Altitude, 4,918 ft]		
Terrace deposits:		
Clay, sand, gravel, and cobbles	7	7
Sand, medium to coarse, and up to medium gravel	9	16
Gravel, up to medium, and coarse sand	5	21
Sand, very coarse; contains very fine gravel	6	27
Arikaree formation:		
Sand, fine to medium, yellowish	33	60
Sand, fine to coarse, brownish	36	96
24-68-33cdc		
[Sample log of test hole, 1953. Altitude, 4,945 ft]		
Terrace deposits:		
Sand and gravel; contains clay and cobbles	10	10
Sand and gravel	16	26
Sand, up to very coarse	7	33
Sand, coarse, and gravel	9	42
Arikaree formation:		
Sand, fine to medium	10	52
24-68-35ccc		
[Sample log of test hole, 1953. Altitude, 4,878 ft]		
Soil	2	2
Terrace deposits:		
Sand, and gravel, up to coarse	10	12
Sand and gravel (white claystone fragments)	13	25
Arikaree formation:		
Sand, very fine to fine	17	42

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
24-69-1aab		
[Sample log of test hole, 1953. Altitude, 4,680 ft]		
Soil	1	1
Terrace deposits:		
Sand and silt; contains gravel and cobbles	4	5
Gravel, up to coarse; contains sand and boulders	15	20
Arikaree formation:		
Sand, fine to coarse	4.5	24.5
Sandstone, fine	1	25.5
Sand, fine	5.5	31
Sandstone, fine	1	32
Sand, fine	4	36
24-69-13dcd		
[Sample log of test hole, 1953. Altitude, 4,768 ft]		
Soil	0.5	0.5
Terrace deposits:		
Gravel, sand, and boulders	5.5	6
Sand, medium	2	8
Gravel and sand	1	9
Sand, medium	1	10
Gravel, coarse, and sand	3.5	13.5
Sand, medium	2.5	16
Gravel, coarse, and sand	2	18
Arikaree formation:		
Sand, fine to coarse	18	36
25-66-13ba		
[Abandoned oil test well drilled for A. E. Jacobs, 1950]		
Soil	6	6
Conglomerate, coarse	103	109
Clay, sandy, calcareous, light-buff	46	155
Conglomerate, light-buff, and limey clay	7	162
Conglomerate, light-buff, and sandy, limey clay	54	216
Conglomerate, buff, and limey clay	9	225
Clay, limey, light-buff	75	300
Clay, brown	68	368
Clay, light-brown to gray	73	441
Shale, sandy, limey, dark-brown to red	10	451
Clay, sandy, limey, light-brown	20	471
Shale, sandy, limey, brown	10	481
Clay, limey, light-brown	44	525
Clay, sandy, light-brown	7	532
Clay, sandy, limey, brown	4	536
Sandstone, hard, limey, buff	1	537
Clay, sandy, limey, buff	23	560
Clay, sandy, limey, brown	5	565
Shale, gray	11	576
Clay, sandy, limey, brown to gray	15	591
Clay, sandy, gray	24	615
Shale, limey, light-gray	153	768
Sand, limey, brown	7	775
Shale, limey, gray	72	847

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
25-66-13ba—Continued		
Clay, sandy, limey, brown	53	900
Shale, limey, brown to red	89	989
Clay, brown to red	21	1,010
Shale, sandy, limey, brown to red	250	1,260
Shale, red, and hard shells	100	1,360
Stone, medium hard; contains some sand	12	1,372
Shale, red, and shells	8	1,380
Shale, red to gray	10	1,390
Shale, buff	32	1,422
Shale, brown to gray	68	1,490
Shale, black to gray	26	1,516
Shale, light-red	8	1,524
Shale, dark-red	12	1,536
Shale, blue to red	26	1,562
Clay, sandy, black	16	1,578
Shale, sandy, red to brown	39	1,617
Clay, soft, brown to red	8	1,625
Shale, sandy, hard, light-gray	5	1,630
Sand, limey, red	32	1,662
Shale, pink	18	1,680
Shale, sandy, red	12	1,692
Gypsum	25	1,717
Shale, sandy, red	17	1,734
Rock, red	6	1,740
Rock, red; contains gypsum	5	1,745
Shale, limey, pink	13	1,758
Shale, sandy, limey, pinkish-red	1	1,759
Limestone	191	1,950
25-67-20bcb1		
[Sample log of test hole, 1953. Altitude, 4,465 ft]		
Soil	2	2
Alluvium:		
Gravel, up to coarse; contains medium sand	14	16
Sand, coarse	12	28
Arikaree formation:		
Sandstone, fine- to medium-grained, moderately hard	1	29
Sand, medium	7	36
Sand, fine to medium; contains thin layers of hard sandstone	10	46
25-67-20bcb2		
[Sample log of test hole, 1953. Altitude, 4,465 ft]		
Soil	1	1
Alluvium:		
Sand, very coarse, and fine to very fine gravel	25.5	26.5
Arikaree formation:		
Sandstone, fine-grained, hard	.5	27
Sand, fine	2.5	29.5
Sandstone, fine- to medium-grained, hard	1.5	31

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
25-67-23ddb		
[Sample log of test hole, 1953. Altitude, 4,437 ft]		
Soil	2.5	2.5
Alluvium:		
Gravel, up to very coarse; contains cobbles	3.5	6
Sand, coarse, and fine to medium gravel	16	22
Sand, coarse to very coarse	4	26
Arikaree formation:		
Sand, fine to coarse	10	36
25-67-23ddd		
[Sample log of test hole, 1953. Altitude, 4,437 ft]		
Soil	2.5	2.5
Alluvium:		
Sand and gravel; contains boulders	2.5	5
Gravel, fine, and very coarse sand	13	18
Sand, very coarse, and very fine gravel	1	19
Sand, up to coarse	3	22
Arikaree formation:		
Sandstone, fine- to coarse-grained, hard	1	23
Sand, fine to medium; contains 4-in. layer of hard, fine-grained sandstone at 23.5 ft	3	26
25-67-30ccc		
[Sample log of test hole, 1953. Altitude, 4,585 ft]		
Soil	1	1
Alluvium:		
Sand, coarse to very coarse	8	9
Arikaree formation:		
Sand, medium to coarse	1	10
Sandstone, medium- to very coarse-grained, moderately hard; contains limey streaks	6	16
Sandstone, very coarse-grained, moderately hard; contains beds of fine sand	30	46
25-67-31ccb		
[Sample log of test hole, 1953. Altitude, 4,642 ft]		
Soil	2.5	2.5
Terrace deposits:		
Gravel; contains coarse sand	5.5	8
Sand, and coarse gravel	2	10
Clay, calcareous	4.5	14.5
Gravel, coarse; contains sand	3.5	18
Gravel and sand; contains thin clay lenses at 20 and 22 ft and cobbles	12	30
Sand, coarse, and gravel	5	35
Arikaree formation:		
Sand, fine to medium	31	66

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
25-67-31ccc2		
[Irrigation well drilled for E. T. Hall, 1953. Altitude, 4,648 ft]		
Soil	7	7
Terrace deposits:		
Clay and gravel	8	15
Gravel, coarse	25	40
25-67-31ccd		
[Test hole drilled for R. P. Hall, 1953. Altitude, 4,647 ft]		
Soil	8	8
Terrace deposits:		
Gravel	2	10
Clay	5	15
Sand	9	24
Gravel, fine to coarse; contains boulders	8	32
Gravel, coarse	5	37
Gravel, fine, and sand	3	40
Sand and gravel	8	48
Arikaree formation:		
Sand	2	50
Sandstone, hard	1	51
25-67-31cdc		
[Test hole drilled for Ed Preuitt, at site of irrigation well, 1953. Altitude, 4,650 ft]		
Soil	10	10
Terrace deposits:		
Gravel	9	19
Clay and sand	8	27
Gravel, coarse	13	41
Clay and sand	7	48
Arikaree formation:		
Sand, soft	6	54
Sandstone, hard	4	58
25-67-33add		
[Sample log of test hole, 1953. Altitude, 4,612 ft]		
Soil	5	5
Terrace deposits:		
Gravel, up to coarse; contains sand	19	24
Sand, up to very coarse	10	34
Sand, fine to coarse	2	36
Sand, up to very coarse	2.5	38.5
Arikaree formation:		
Sand, fine to coarse	7.5	46

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)

25-67-33dcc

[Test hole drilled for J. Geringer, 1953, at site of irrigation well. Altitude, 4,629 ft]

Soil	5	5
Terrace deposits:		
Gravel, clean	16	21
Arikaree formation:		
Sand, very soft	13	34
Sand	6	40

25-68-26bbb

[Sample log of test hole, 1953. Altitude, 4,508 ft]

Clay, sandy, grayish	3	3
Alluvium:		
Sand, coarse; contains streaks of gravel	17	20
Arikaree formation:		
Sandstone, very fine grained, hard	6	26

25-68-26bcb

[Sample log of test hole, 1953. Altitude, 4,503 ft]

Soil	2	2
Silt, sandy	4	6
Alluvium:		
Gravel, up to coarse; contains sand	11	17
Arikaree formation:		
Sand, fine to medium	19	36

25-68-27aad

[Sample log of test hole, 1953. Altitude, 4,504 ft]

Soil	2.5	2.5
Alluvium:		
Gravel; contains medium to coarse sand and cobbles	11.5	14
Sand, medium	5	19
Sand, very coarse; contains very fine gravel	2.5	21.5
Arikaree formation:		
Sand, fine to medium	7.5	29
Sandstone, soft to moderately hard	2	31
Sandstone, fine- to very coarse-grained, hard	5	36

25-68-28ccc

[Sample log of test hole, 1953. Altitude, 4,621 ft]

Soil	2	2
Terrace deposits:		
Sand, gravel, and cobbles	4	6
Sand and gravel	3	9
Sand, medium	2	11
Gravel; contains sand	1	12
Arikaree formation:		
Sand, fine to medium	9	21
Sandstone, fine-grained, hard	4	25

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
25-68-28ccc—Continued		
Arikaree formation:—Continued		
Sand, fine; contains thin sandstone lenses at 31 and 33 ft	8	33
Sand, fine	3	36
25-68-31bcd1		
[Irrigation well drilled for Eldon Johnston, 1954. Altitude, 4,668 ft]		
Soil	2	2
Terrace deposits:		
Gravel and boulders	14	16
Clay and gravel	4	20
Sand and gravel	8	28
Arikaree formation:		
Chalk rock, soft	14	42
Chalk rock	22	64
Chalk rock (water)	2	66
Chalk rock, soft	2	68
25-68-31bcd2		
[Irrigation well drilled for Eldon Johnston, 1954. Altitude, 4,668 ft]		
Soil	3	3
Terrace deposits:		
Clay and gravel	17	20
Sand and gravel	8	28
Arikaree formation:		
Chalk rock	8	36
25-68-31bda		
[Irrigation well drilled for Eldon Johnston, 1954. Altitude, 4,650 ft]		
Soil	3	3
Terrace deposits:		
Gravel	8	11
Boulders	3	14
Gravel, dirty	6	20
Arikaree formation:		
Chalk rock, soft	8	28
Chalk rock (water)	9	37
Sandstone, cemented	3	40
Chalk rock (water)	6	46
Sandstone, cemented	1	47
Chalk rock (water)	11	58
25-68-31cba		
[Irrigation well drilled for Eldon Johnston, 1954. Altitude, 4,668 ft]		
Soil	2	2
Terrace deposits:		
Clay, sand, and gravel	18	20
Arikaree formation:		
Chalk rock, soft	13	33
Chalk rock and gravel	19	52

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
25-68-32ddc		
[Sample log of test hole, 1953. Altitude, 4,711 ft]		
Soil	1	1
Terrace deposits:		
Sand and gravel; contains clay and cobbles	4	5
Sand and gravel; contains cobbles	4	9
Gravel, up to very coarse; contains very coarse sand and boulders	13	22
Sand, coarse	2	24
Arikaree formation:		
Sandstone, medium- to coarse-grained	2	26
25-68-33dad		
[Test hole drilled for John Suntych, 1953. Altitude, 4,690 ft]		
Soil	6	6
Terrace deposits:		
Gravel and boulders	14	20
Gravel, fine; contains some boulders	2	22
Arikaree formation:		
Sand	3	25
Sandstone	15	40
25-68-34abb		
[Sample log of test hole, 1953. Altitude, 4,657 ft]		
Soil	2	2
Terrace deposits:		
Sand, contains clay, gravel, and cobbles	5	7
Arikaree formation:		
Sand, fine to very fine	11	18
Sandstone, very fine- to coarse-grained, soft, light gray to buff	18	36
25-68-34bcc		
[Sample log of test hole, 1953. Altitude, 4,670 ft]		
Soil	2	2
Terrace deposits:		
Clay, sandy, light gray; contains gravel and cobbles	2	4
Gravel, up to very coarse, and cobbles	6	10
Sand, coarse	4	14
Arikaree formation:		
Sandstone, fine-grained, limey	7	21
Sandstone, fine-grained; cemented at 28 and 34 ft	15	36
25-68-34cbc		
[Test hole drilled for John Suntych, 1953. Altitude, 4,690 ft]		
Soil and sand	13	13
Terrace deposits:		
Gravel, fine, and small boulders	8	21
Gravel and sand	6	27
Arikaree formation:		
Sandstone, soft, limey	11	38

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
25-68-34ccb		
[Unused well dug for John Suntych, 1953. Altitude, 4,688 ft]		
Soil and sand	8	8
Terrace deposits:		
Sand and gravel	11	19
Arikaree formation:		
Sandstone	2	21
25-68-34ccd		
[Test hole drilled for John Suntych, 1953. Altitude, 4,710 ft]		
Soil and clay	5	5
Arikaree formation:		
Sand	5	10
Clay and white sandstone	3	13
Shale, very soft, brown	3	16
Sandstone, soft	20	36
Sandstone, hard	4	40
25-68-35baa		
[Sample log of test hole, 1953. Altitude, 4,642 ft]		
Soil	1	1
Terrace deposits:		
Gravel, up to coarse; contains clay, buff sand and cobbles	3	4
Gravel, coarse; contains cobbles and sand	3	7
Arikaree formation:		
Sandstone, fine, soft, buff	29	36
25-68-35dbb		
[Test hole drilled for J. Foos, at site of irrigation well, 1953. Altitude, 4,655 ft]		
Soil and sand	7	7
Terrace deposits:		
Gravel and boulders	13	20
Arikaree formation:		
Sandstone	7	27
Limestone	1	28
Sandstone	29	57
Limestone	1	58
Sandstone, soft	9	67
Sandstone	18	85
25-68-35dbc		
[Test hole drilled for J. Foos, 1953. Altitude, 4,668 ft]		
Soil	3	3
Terrace deposits:		
Gravel	7	10
Arikaree formation:		
Sandstone; contains soft layers	19	29
Sandstone, hard, fractured	3	32
Sandstone, hard	8	40

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
25-68-36bcc		
[Sample log of test hole, 1953. Altitude, 4,643 ft]		
Soil	4	4
Clay, calcareous, light-gray; contains sand and gravel	3	7
Terrace deposits:		
Gravel, fine to medium; contains fine sand and buff clay	4	11
Arikaree formation:		
Sandstone, fine- to medium-grained, brownish	15	26
25-66-36ccc		
[Irrigation well drilled for Henry Geringer, 1953. Altitude, 4,655 ft]		
Soil	4	4
Terrace deposits:		
Gravel	12	16
Arikaree formation:		
Sand	6	22
Sandstone	4	26
Sand, loose	6	32
25-69-25ccc		
[Test hole drilled for E. B. May, 1953. Altitude, 4,598 ft]		
Soil	4	4
Alluvium:		
Gravel	8	12
Arikaree formation:		
Sandstone	8	20
Clay, very soft	4	24
Sandstone	16	40
Sandstone, soft	10	50
Sandstone, hard	2	52
Sandstone, very hard	8	60
26-65-9acc		
[Irrigation well drilled for Charles Frederick, 1953. Altitude, 4,272 ft]		
Soil and clay	8	8
Alluvium:		
Sand, coarse, gravel and boulders	43	51
26-65-17bdd		
[Domestic well drilled for the Platte Valley Pipe Line Co., 1951. Altitude, 4,465 ft]		
Soil	10	10
Arikaree formation:		
Chalk rock	40	50
Sandstone	2	52
Chalk rock	8	60
Sandstone, hard	2	62
Chalk rock	21	83
Quartzite ledge, very hard, blue to gray	3	86
Chalk rock	20	106

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
26-65-17bdd—Continued		
Arikaree formation:—Continued		
Sandstone, hard	2	108
Chalk rock	3	111
Sandstone, hard	3	114
Chalk rock	23	137
Quartzite ledge, very hard, blue to gray	3	140
Chalk rock	7	147
Sandstone, hard	10	157
26-65-23aaa		
[Abandoned oil test well drilled by Gem Oil Co., 1955. Altitude, 4,525 ft. Well located in Goshen County		
Sample tops (in part):		
Niobrara formation		1,282
Frontier formation		1,592
Lakota sandstone		2,678
Hartville formation		3,700
26-67-33baa		
[Stock well drilled for P. Cundall. Altitude, 4,796 ft]		
Soil	2	2
Arikaree formation:		
Lime rock	6	8
Chalk rock	4	12
Lime rock	18	30
Chalk rock	5	35
Lime rock	45	80
Chalk rock, hard	65	145
Chalk rock, soft	35	180
Lime rock	10	190
Sand (water)	14	204
Lime rock	15	219
26-68-12bdd		
[Domestic well drilled for Colorado & Southern R. R. Altitude, 4,830 ft]		
Soil	20	20
Arikaree formation:		
Limestone	5	25
Chalk rock	5	30
Lime rock	30	60
Limestone	20	80
Chalk rock	70	150
Lime rock	6	156
Chalk rock	38	194
Lime rock, hard	3	197
Chalk rock	3	200
Lime rock, hard	2	202
Limestone	5	207
Chalk rock	27	234
Lime rock, hard	1	235
Chalk rock (water)	30	265
Quicksand	5	270
Lime rock	8	278

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
27-65-17abb		
[Stock well drilled for Fred Dupra, 1953. Altitude, 4,670 ft]		
Soil	10	10
Arikaree formation:		
Chalk rock	90	100
Conglomerate	90	190
Bentonite, sand, and gravel	40	230
Schist, red	20	250
Graphite(?)	...	...
27-66-35bda		
[Industrial well drilled for Chicago, Burlington & Quincy R. R., 1944, and purchased in 1955 by town of Guernsey for municipal use. Altitude, 4,360 ft]		
Soil, sandy, yellow	9	9
Alluvium:		
Sand and gravel, fine	18	27
Clay and sand rock	1	28
Sand and gravel, medium	27	55
Clay, sandy, hard	1	56
Sand and gravel, coarse	11	67
Clay, sandy, hard	1	68
Sand and gravel, coarse	2	70
Clay	2	72
Boulders, small	1	73
Sand and gravel, coarse	7	80
Clay, sandy	2	82
Gravel, coarse, sandy	8	90
27-67-11dcb		
[Irrigation well dug for H. L. Boner. Altitude, 4,440 ft]		
Soil	4.5	4.5
Alluvium:		
Sandstone and boulders	1	5.5
Gravel	3	8.5
Gravel and lime rock	3.5	12
Gravel and boulders	3	15
27-67-23dcb		
[Stock well drilled for Otto Herman, 1952. Altitude, 4,707 ft]		
Soil	10	10
Arikaree formation:		
Chalk rock	230	240
27-68-17bcd		
[Stock well drilled for Coleman Bros., 1952. Altitude, 4,920 ft]		
Soil	3	3
Arikaree formation:		
Chalk rock	16	19
Lime rock	2	21

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
27-68-17bcd—Continued		
Arikaree formation:—Continued		
Chalk rock	33	54
Lime rock	4	58
Sandstone, hard, white	32	90
Sand (water)	6	96
Rock, cement	20	116
Rock, cement (water)	14	130
27-68-31adc		
[Domestic well drilled for Arthur Seaton, 1950. Altitude, 4,875 ft]		
Soil	5	5
Arikaree formation:		
Lime rock, soft	10	15
Chalk rock	6	21
Lime rock	3	24
Chalk rock	12	36
Clay	12	48
Chalk rock	4	52
Sand (water)	12	64
Chalk rock and sand	8	72
Sand	8	80
Clay, white	6	86
Clay, pink	14	100
27-69-25abb		
[Stock well drilled for Fred Fletcher, 1947. Altitude, 4,880 ft]		
Soil and clay	20	20
Arikaree formation:		
Rock, cement	40	60
Rock, hard	2	62
Gravel(?) (water)	11	73
28-67-18bcc		
[Irrigation well drilled for Harry Twiford. Altitude, 4,490 ft]		
Soil	22	22
Sand and gravel	40	62
Arikaree formation:		
Chalk rock	2	64
28-68-5ddd		
[Unused well drilled for J. Hughes, 1951. Altitude, 4,740 ft]		
Arikaree formation:		
Sandstone (water at 70 ft)	70	70
Chalk rock (water)	10	[1]80

[1]Measured depth 74.0 ft.

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
28-68-12aac		
[Industrial well drilled for Chicago, Burlington & Quincy R. R., 1942. Altitude, 4,490 ft]		
Alluvium:		
Soil and sand	24	24
Gravel (water)	16	40
Sand, fine	2	42
28-68-24bcb		
[Domestic and stock well drilled for Jack Jones. Altitude, 4,570 ft]		
Alluvium:		
Soil	20	20
Sand and gravel	45(?)	65(?)
28-68-35dbc		
[Stock well drilled for Otto Herman, 1953. Altitude, 4,920 ft]		
Soil	10	10
Arikaree formation:		
Chalk rock	130	140
Clay	70	210
Chalk rock and sand (water at 230 ft)	40	250
28-68-36bac		
[Unused stock well drilled for Otto Herman, 1951. Altitude, 4,820 ft]		
Arikaree formation:		
Chalk rock	120	120
Clay	140	260
Chalk rock (water at 260 ft)	30	[1]290

[1]Measured depth 273.0 ft.

	Thickness (feet)	Depth (feet)
28-69-20add		
[Stock well drilled for Donald Gordon, 1950. Altitude, 5,374 ft]		
Soil	4	4
Brule formation:		
Rock, cement	85	89
Rock, cement (hard)	6	95
Gravel (water)	33	128
28-69-21cdd		
[Stock well drilled for Donald Gordon, 1950. Altitude, 5,370 ft]		
Soil	4	4
Gravel (dry)	31	35
Brule formation:		
Rock, cement (alternating hard and soft layers)	97	132
Gravel (water)	13	145
Rock, cement	10	155

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
29-68-9bcd1		
[Municipal well drilled for the town of Glendo, 1947. Altitude, 4,720 ft]		
Clay, bentonitic, brown, and coarse sand	80	80
Clay, brown and gray	110	190
Clay, brown, and sand	40	230
Clay, sandy, brown and gray	160	390
Clay, sandy, white, brown, and gray	15	405
Clay, sandy, white and brown	25	430
Clay, bentonitic, varicolored	90	520
Clay, brown and gray; contains some gypsum and sand	10	530
Clay, orange; contains some sand	15	545
Clay, chalky white, orange; contains fine sand	15	560
Clay, brown, orange; contains fine sand	15	575
Sand, fine, red; contains orange shale and anhydrite	40	615
Shale, red, and anhydrite	15	630
Lime, purple; contains fine sand	20	650
Sand, red, yellow; contains red and gray shale and anhydrite	25	675
Anhydrite, white	8	683
Sand, white (contains water)	7	690
Anhydrite, white	35	725
Lime, pink, and white anhydrite	5	730
Anhydrite, white	63	793
29-68-20abb		
[Stock and irrigation well drilled for A. M. Downey, 1941. Altitude, 4,638 ft]		
White River group, pink	225	225
"Red beds"	25	250
Ledge, hard, red	6	256
Shale, red	24	280
Ledge, red	2	282
Sand, red	28	310
Sand, yellow	4	314
Shale, red	42	356
Limestone, hard	2	358
Sandstone, ledgy, white	40	398
Sandstone, soft, white (contains water under artesian pressure)	10	408
Ledge, hard	2	410
29-68-20abd		
[Domestic, stock, and irrigation well drilled for A. M. Downey, 1941. Altitude, 4,625 ft]		
Gravel and sand	37	37
White river group	97	134
Lime shell	4	138
Shale, red	18	156
Lime shell	3	159
Shale, red	7	166
Lime shell	2	168
Shale, red	12	180
Lime shell, hard	4	184
Clay	7	191
Shale, red	18	209
Sbell, hard	6	215
Sandstone, hard, red (water)	35	250
Shale, tan	15	265

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
29-68-20abd—Continued		
Shale, red	25	290
Ledge, hard, red	5	295
Shale, red	9	304
Ledge, hard, red	2	306
Shale, red	52	358
Sand, red	8	366
Shale, ledgy, red	37	403
Limestone	2	405
Sandstone, white (water)	9	414
Sandstone, yellow	28	442
29-68-20acc		
[Irrigation well dug for A. M. Downey, 1954. Altitude, 4,643 ft]		
Alluvium:		
Soil and sand	17	17
Gravel, coarse	24	41
29-68-20bac		
[Domestic and irrigation well drilled for W. E. Hughes, 1924. Altitude, 4,644 ft]		
Soil and gravel (water)	36	36
Shale, gray	68	104
Limestone shells	61	165
Shale, sandy, gray and pink	45	210
Chugwater formation, pink	130	340
Sand, white (water under artesian pressure)	9	349
Limestone caprock, very hard; contains shells	1	350
Sand, light-brown	110	460
"Red bed," sandy, pink and red; contains lime shells	180	640
Sand, white (water and gas)	3	643
"Red bed," pink; contains lime shells	264	907
"Red bed," light-pink	136	1,043
Limestone shells, sandy; contains some water	13	1,056
"Red bed," very sticky, red and pink	74	1,130
"Red bed," sandy, red; contains lime shells	166	1,296
29-68-21bbb		
[Domestic well drilled for Clark Coleman, 1939. Altitude, 4,646 ft]		
Soil	20	20
Terrace deposits:		
Sand	25	45
Brule formation:		
Shale	49	94
29-68-21bcc		
[Test hole drilled for J. R. Lancaster, at site of irrigation well, 1954. Altitude, 4,625 ft]		
Alluvium:		
Sand	12	12
Gravel (very coarse at bottom)	30	42

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
30-66-7ada		
[Abandoned oil test well drilled for J. A. Payne, 1951. Altitude, 5,061]		
Schlumberger tops (in part):		
Base Tertiary	....	250
Upper basal Sundance formation	....	340
.Chugwater formation	....	450
Minnekahta limestone	....	1,070
Opeche shale	....	1,105
Minnelusa formation	....	1,190
First Converse sand	1,190	1,225
Second Converse sand	1,375	1,407
Guernsey formation	....	2,215
30-67-20bac		
[Oil test well drilled, plugged back to about 600 ft, and left as a stock well for Thomas Berry, 1945. Altitude, 4,721 ft]		
No log	107	107
Shell, flint	5	112
Sand (water)	15	127
Shell, hard	5	132
Clay, yellow	14	146
Shale, brown and green	246	392
Shale and clay, pink to green and brown with thin water sand at 498 ft	213	605
Shell, hard, brown	2	607
Sand, red and pink	23	630
Sand and clay, pink to red (water)	66	696
Sand, pink and white	5	701
Lime, white	89	790
Lime, sandy, gray	20	810
Clay, sticky, red	57	867
Shell	5	872
Formation, red	13	885
Lime, sandy, red	35	920
Lime, pink to white	110	1,030
Lime, hard, gray	25	1,055
Formation, white to chalky	5	1,060
Lime, sandy, gray and brown	10	1,070
Crevice	10	1,080
Lime, hard, gray	37	1,117
Lime, gray and shells, flint	11	1,128
Lime, sandy, fine (water)	2	1,130
Lime, hard, gray	12	1,142
Lime, hard, black	5	1,147
Lime, white	3	1,150
Lime, dark (gas)	3	1,153
Lime, sandy, hard, brown	10	1,163
Lime, sandy, hard, gray	7	1,170
Lime and shale, gray to brown	11	1,181
Lime, very hard, gray	10	1,191
Lime, hard, light-gray	9	1,200
Lime, brown and gray	8	1,208
Lime, gray	32	1,240
Shale, sticky, red	10	1,250
Shells, white and brown	4	1,254
Shale, sticky, red	11	1,265

Table 11.—*Logs of test holes and wells, Platte County, Wyo.*—Continued

	Thickness (feet)	Depth (feet)
30-67-20bac—Continued		
Clay, sticky, red	45	1,310
Lime, hard, pink	8	1,318
Clay and shale, sticky, red	30	1,348
Shale, varigated red, green and purple, and shells	37	1,385
Shale, red	73	1,458
Sand, fine, red (water)	10	1,468
Shale, red with hard white and green shells	10	1,478
Lime, hard, pink	48	1,526
Lime, brown	4	1,530
Lime, sandy, gray (water at 1,533 ft)	3	1,533
Lime, hard, gray	34	1,567
Lime, very hard, gray to white	20	1,587
Lime, hard, white	21	1,608
Lime, white to pink	22	1,630
Lime and shale, pink, bentonitic	27	1,657
Limestone, pink to buff	10	1,667
Limestone, white, pink and buff	28	1,695
Limestone, pink, buff and brown	20	1,715
Sand, brown with streaks of red shale or clay	7	1,722
Sand, hard, light-colored	13	1,735
Formation, hard, red to black	16	1,751
Sand, hard, black or basalt	4	1,755
Sand, hard, black	10	1,765
Granite, dark-gray with some red and black	10	1,775
30-68-33ccd		
[Domestic well drilled for Mr. Hershberger, 1955. Altitude, 4,660 ft]		
Soil	28	28
Brule formation:		
Siltstone, buff	50	78
30-69-2bab		
[Industrial well drilled for Chicago, Burlington & Quincy R. R., 1919. Altitude, 4,675 ft]		
Alluvium:		
Soil	25.5	25.5
Gravel	4.0	29.5
Sand, fine	8.0	37.5
Sand and gravel (water)	23.5	61.0

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