WATER RESOURCES OF THE BIG WOOD RIVER– SILVER CREEK AREA, BLAINE COUNTY, IDAHO

IDAHO DEPARTMENT OF WATER ADMINISTRATION
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WATER RESOURCES OF THE BIG WOOD RIVER-SILVER CREEK AREA, BLAINE COUNTY, IDAHO

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INTRODUCTION

PURPOSE

The purpose of this report is to provide more detailed information on the water resources in the Big Wood River-Silver Creek area of Blaine County.

The specific objectives of the study were as follows:

1. Identify the general relationships between the water table and artesian aquifer systems in the area.

2. Develop a water budget for the area.

3. Identify the hydrologic relationship between the ground water in the study area and the Snake Plain aquifer.

4. Determine the reaches of gain and loss in Silver Creek.

5. Determine the present and predicted future effect of ground-water development on the flow of Silver and Spring creeks and the Big Wood River.

6. Update the information presented in previous studies

LOCATION AND EXTENT OF STUDY AREA

The study area is located in central Blaine County and includes portions of the drainage areas of the Big Wood River and Silver Creek (fig. 1). The area is roughly triangular in shape with the base to the south and Hailey at the apex. It is bounded on the north by Hailey, on the east by the Pioneer Mountains, on the south by the Picabo and Timmerman Hills and on the west by an unnamed range of mountains. The area of primary interest is the lowland area in the valley bottom, the approximate limit of which is the boundary between the bedrock of the mountains and the valley fill. The area thus described covers approximately 84 square miles.

The Big Wood River enters the study area at Hailey and flows along the western boundary, leaving at Stanton Crossing. Silver Creek rises from springs within the area and flows southeastward through a gap between the Pioneer Mountains and the Timmerman Hills, leaving the study area near Priest (fig. 1).

PREVIOUS INVESTIGATIONS

The most detailed previous investigation of the water resources of the Big Wood River-Silver Creek area was conducted by Rex O. Smith (1954). Other studies include a report by H. T. Stearns, Lynn Crandall, and W. G. Steward (1938), which was concerned primarily with the Snake River Plain, but contained some information on the Big Wood River Basin; a watermaster report by S. H. Chapman (1921); a geohydrological evaluation of

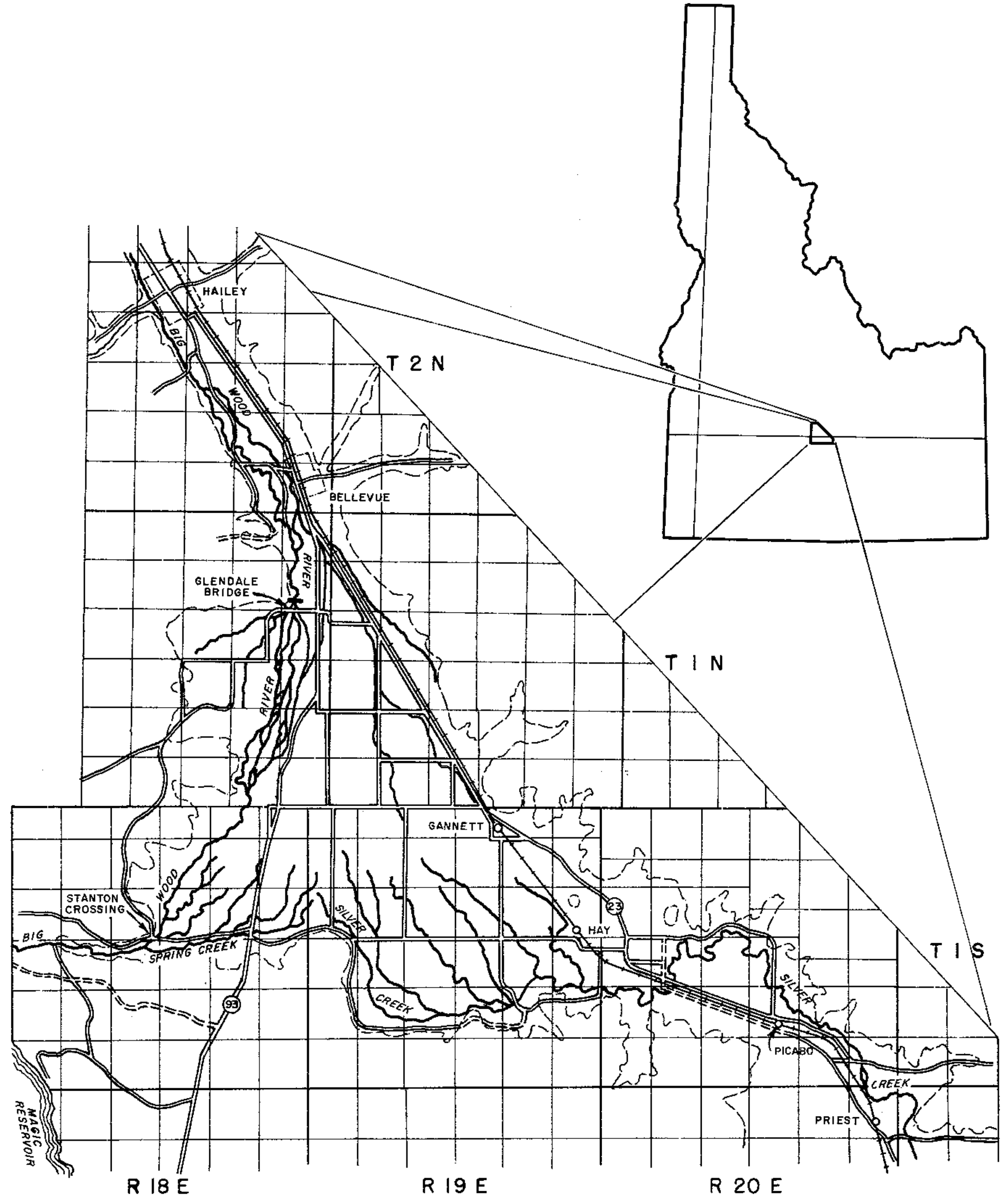


FIGURE 1. **Location and extent of Big Wood River-Silver Creek study area.**

streamflow records in the Big Wood River Basin by Smith (1960); a report on the geology and ore deposits of the area by Umpleby, Westgate, and Ross (1930) and by Anderson, Kiilsgaard, and Fryklund (1950); a report on the effects of surface-water diversions on streamflow records for the Big Wood River by Jones (1952); and a portion of U. S. Geological Survey (USGS) Water Supply Paper 1654 by Mundorff, Crosthwaite, and Kilburn (1964) which was concerned with ground water for irrigation in the Snake River Basin.

Keith E. Anderson (P.E.), prepared a report on possible well interference in the area for Parry, Robertson and Daly, Attorneys, Twin Falls, Idaho, in May of 1961.

On June 21, 1961, George N. Carter, then State Reclamation Engineer for Idaho, declared a portion of the study area a critical ground-water area. Horton G. Haight (P.E.), prepared a report in May 1963, for the State Reclamation Engineer, with his recommendation that the critical ground-water area designation be modified.

Dwight L. Schmidt, in USGS open-file report 625 (1961), discussed in considerable detail the late geologic history of the area. Further study of the geology of the area was in progress during the summer of 1970 by Wayne E. Hall of the USGS Branch of Field Geochemistry and Petrology.

ACKNOWLEDGEMENTS

The department and the authors wish to acknowledge the assistance and cooperation of the U. S. Geological Survey, Boise, Idaho; Reid Newby and Les Bushby, Watermaster and Deputy Watermaster, respectively, for the Big Wood River-Silver Creek area; Rex Braithwaite of the Agricultural Stabilization and Conservation Service (ASCS), Hailey; and especially the farmers and ranchers in the area for their friendly cooperation in supplying needed information and access to their land and wells.

WELL NUMBERING SYSTEM

The well numbering system used in this study is the same as that used by the USGS in Idaho. This system indicates the locations of wells within the official rectangular subdivisions of the public lands, with reference to the Boise Baseline and Meridian. The first two segments of a number designate the township and range. The third segment gives the section number, followed by two letters and a numeral, which indicate, respectively, the quarter section, the forty-acre tract, and the serial number of the well within the tract. If a well has been more accurately located than the nearest forty-acre tract, there will be three letters and a numeral following the section number (fig. 2).

Quarter sections are lettered a, b, c, and d in counterclockwise order from the northeast quarter of each section. Within the quarter sections, forty-acre and ten-acre tracts are lettered in the same manner. In the above example, well 1S 19E 18cab1 is in the NW¼ of the NE¼ of the SW¼ of Section 18, Township 1 South, Range 19 East, and is the first well designated in that tract.

In the event that a spring is located by this method, a capital "S" is inserted between the third letter and the numeral, as follows: 1S 19E 18cabS1.

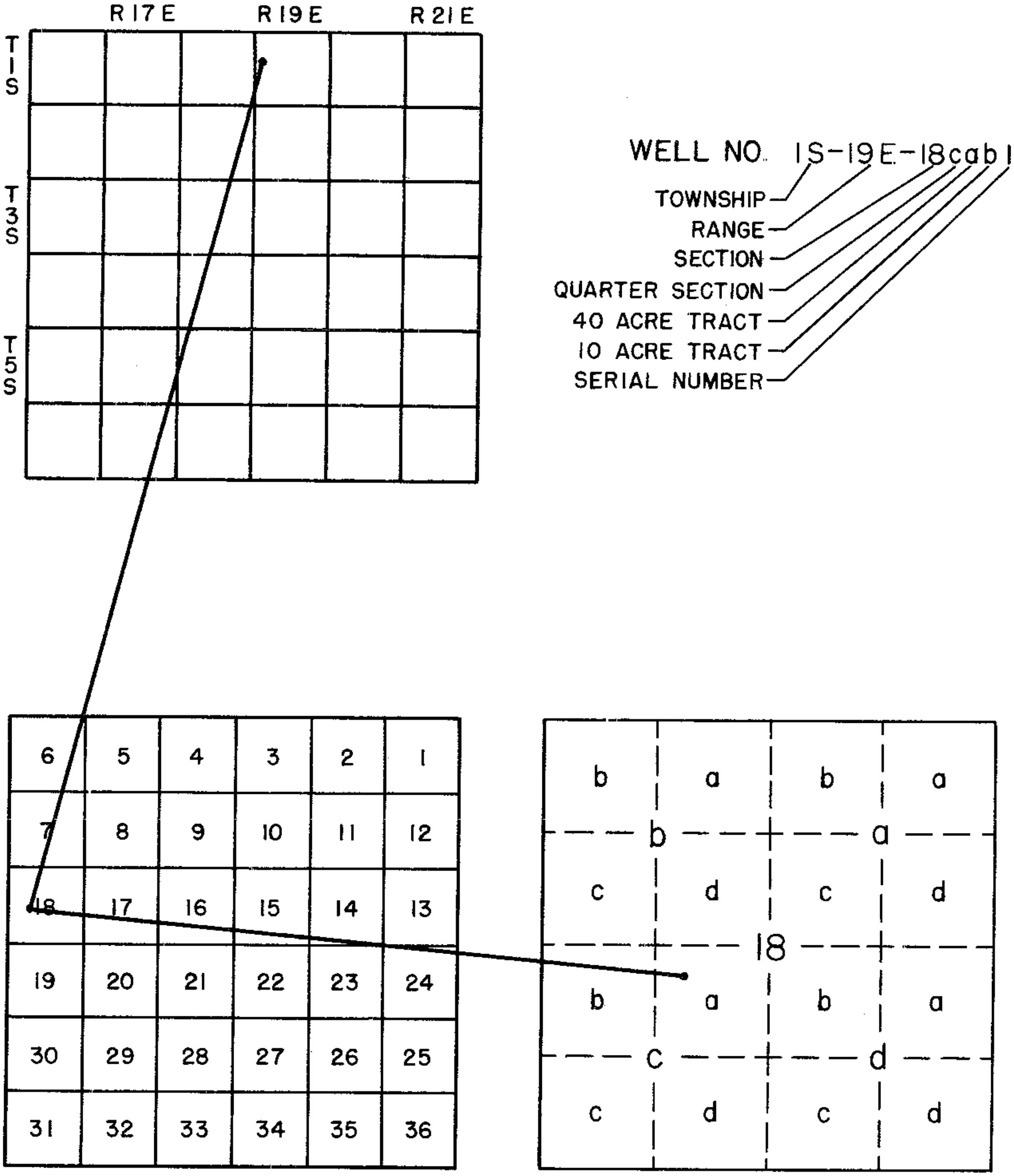


FIGURE 2. Well numbering system.

GEOGRAPHY AND ECONOMY

GEOGRAPHIC SETTING

Physiographically, the study area is one of contrasts. Steep mountains flank the relatively narrow, flat, alluvium-filled valley on three sides. Extensive basalt flows are present at both the southeast and southwest corners of the area, which are correlative with the Snake River basalts that form the Snake River Plain to the south.

The elevation of the valley floor ranges from approximately 4,750 feet above mean sea level in the southeast outlet of Silver Creek, about three miles southeast of Picabo, to 4,800 feet at Stanton Crossing, to 5,300 feet at Hailey. The Pioneer Mountains, which bound the valley on the east, reach an elevation of about 8,200 feet near Hailey, but decrease in height toward the south. The unnamed range of mountains bounding the west side of the valley reaches elevations in excess of 7,000 feet, but decreases in elevation to the south where it eventually merges with the basalt plain near Magic Reservoir.

Native vegetation in the area consists of sagebrush and grasses in the hills; willows, cottonwoods, marsh and other grasses on the lowland areas.

The valley averages about 1¼ miles in width from Hailey south to a point approximately 2½ miles south of Bellevue, where it widens abruptly to the west, forming an area with prominent river terraces known as Poverty Flats.

The Big Wood River and Silver Creek are the two major streams draining the area. Both are perennial but are fed during periods of high runoff by numerous intermittent streams. The Big Wood River enters the area at Hailey, flows along the west side of the valley and exits the area at the southwest corner at Stanton Crossing. Silver Creek rises within the study area from an area of springs located approximately one mile south of Baseline Road. It flows southeastward toward Picabo and exits the area to the south, eventually joining the Little Wood River near Tikura.

Hailey, the largest town in the area, with a population of 1,425 (1970 census), is also the county seat of Blaine County. Other villages in the area include Bellevue, Gannett, and Picabo. Idaho State Highway 23 and U. S. Highway 93 presently serve the area. A branch line of the Union Pacific Railroad also serves Picabo, Gannett, Bellevue, and Hailey.

CLIMATE

Climate in the study area is characterized by moderately cold winters and warm summers. The valley area is protected from high winds by the mountain ranges on either side which also manage to intercept much of the moisture that may be carried by the winds. The average monthly minimum temperature of 18.7° Fahrenheit (F) occurs in January, with the average monthly maximum temperature of 67° F occurring in July (fig. 3). The average frost-free growing season of 131 days at Hailey begins in mid-May and ends in late September (Stevlingson and Everson, 1968). These figures are based on the 50% probability of a killing (28° F) freeze occurring on or after a particular date in the spring or on or before a particular date in the fall.

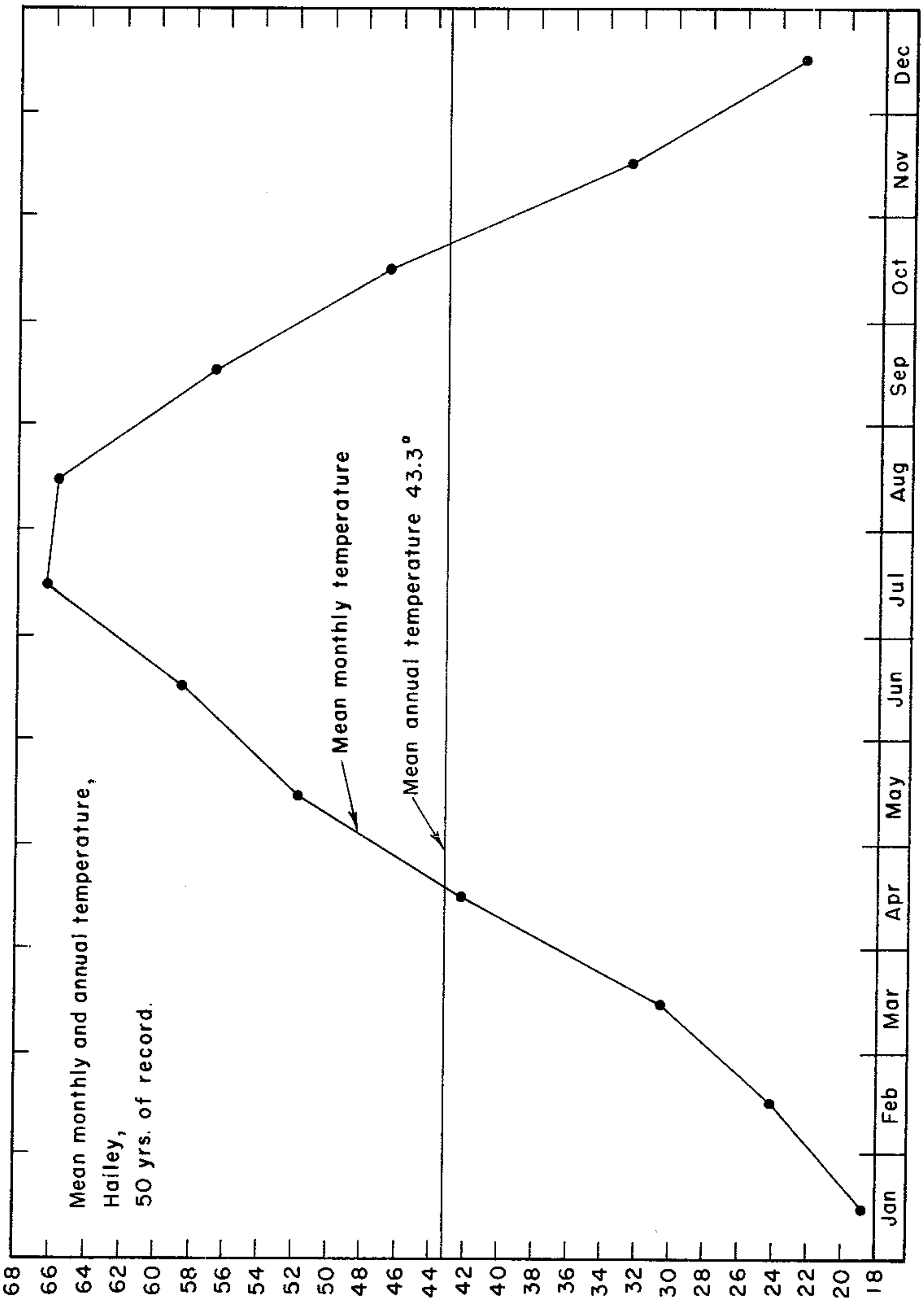


FIGURE 3. **Mean monthly and annual temperature at Hailey station.**

Precipitation at Hailey (fig. 4) averages 15.38 inches annually (61 year average), 42% (6.43 inches) of it during the months of December, January, and February, and only 11% (1.67 inches) during the months of July, August, and September. Approximately 23% (3.52 inches) falls during the 131 day frost-free or irrigation season. During the period 1961 to present, except for 1966, annual amounts of precipitation have been consistently above normal, reversing a 33-year decline. The average annual precipitation for the 10-year period 1961 to present is 18.31 inches. Average annual precipitation at Picabo for the 1960-1969 period averages 13.74 inches.

ECONOMY

The economy of the area depends on agriculture and cattle raising as the primary sources of income. The principal crops include alfalfa, wheat, barley, clover, oats, and potatoes. Wheat is the primary cash crop, with the hay, alfalfa, and other grains being used for cattle feed. It is estimated that between 60-65% of the irrigated acreage consists of alfalfa and pasture, with the remainder consisting of grain crops. Approximately 22,968 acres of land are irrigated with another 5,247 acres being devoted to dry land farming. Most of the irrigated land is irrigated by sub-irrigation methods with sprinkler irrigation techniques being applied by some farmers to increase efficiency of application and to reduce transmission losses in canals and ditches. Because of the increase in the number of wells in the area, much of the area which was once difficult to irrigate has now been developed.

OTHER NATURAL RESOURCES

Other natural resources contributing to the economy of the area include mining and recreation. Mining activity has decreased during recent years, but recreational pursuits have increased dramatically. The area's proximity to Sun Valley, an internationally known ski resort, has caused much of it to be developed for seasonal occupancy. As a result many recreational homes and cabins have been constructed along the Big Wood River and Silver Creek.

GEOLOGIC FRAMEWORK

GEOLOGIC HISTORY

The geologic history of the region is complex with several geologic environments being represented (Schmidt, 1961).

During the early Paleozoic Era, the region was covered by a succession of seas in which many thousands of feet of sediments accumulated. These sediments, lime, silt and sand, were compressed by the weight of overlying material until they were lithified, forming limestone, siltstone and sandstone. These sediments compose most of the basement rock forming the walls of the valley and underlie the valley fill. After these sediments were consolidated, faulting occurred, resulting in a structural depression or trough. This depression, now called the Big Wood River Valley, has been slowly filling with sediments since its formation.

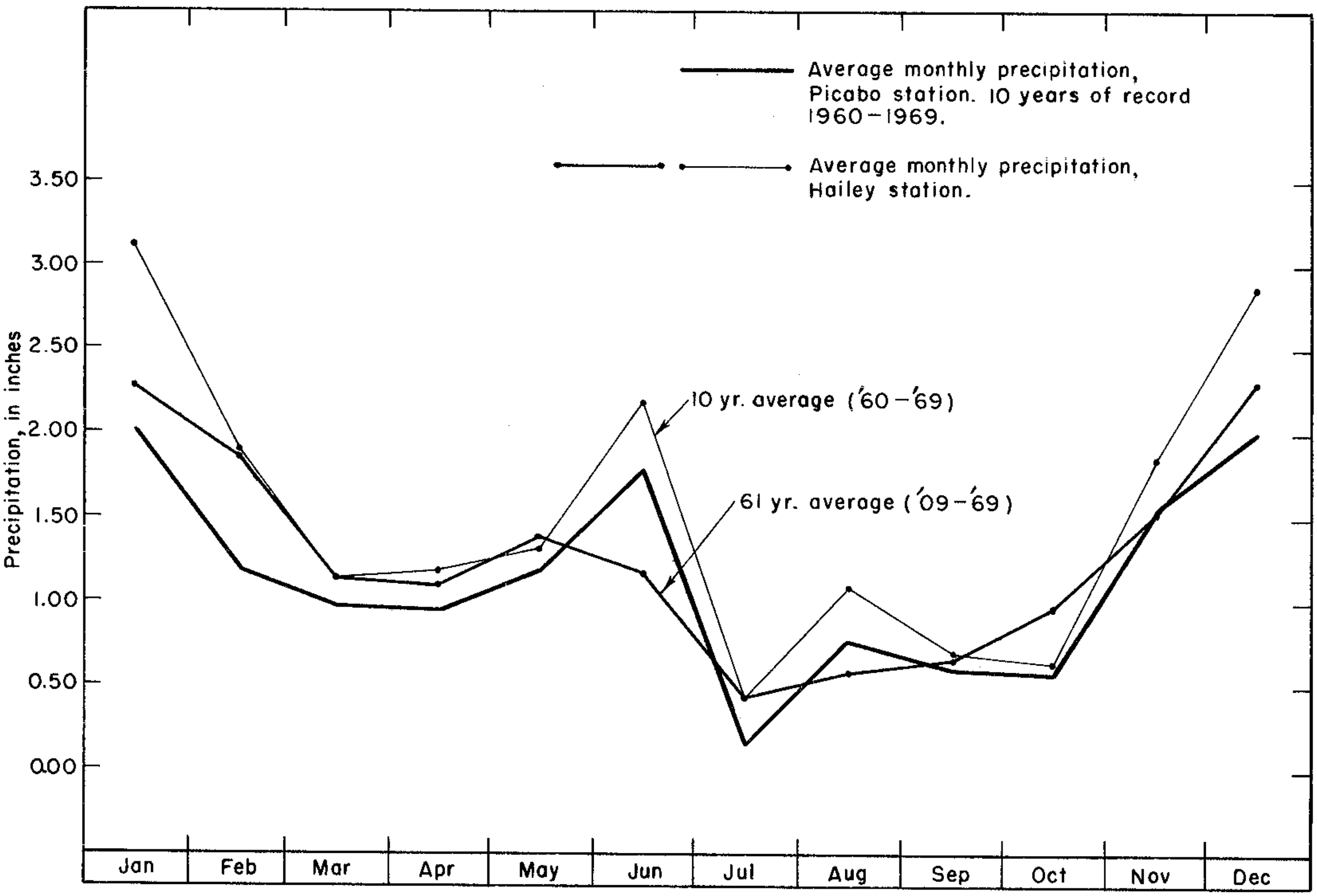


FIGURE 4. Average monthly precipitation at Picabo and Hailey stations.

The next event to modify the area, the extrusion of the Challis Volcanics, occurred during the Tertiary Period. Large volumes of siliceous lava were extruded from vents in a series of flows whose aggregate thickness exceeds several thousand feet. These flows have been extensively eroded, and are now exposed primarily in the Timmerman Hills and in the Pioneer Mountains from Priest to a point approximately three miles northwest of Picabo.

Perhaps the most important geologic events pertinent to the hydrology of the area occurred during the Quaternary period. These were a succession of basalt flows in the valley followed by alpine glaciation in the headwaters region of the Big Wood River

The modern Big Wood River presently occupies a channel on the west side of the valley, but such has not always been the case. During the Quaternary period the Big Wood River flowed in what is now the Silver Creek drainage. Basalt then flowed from a vent located approximately in Section 24, Township 1 South, Range 19 East, Boise Meridian, blocking the southeastern portion of the valley. The flow impounded the waters of the river, forming a lake, which eventually spilled through the southwest outlet. Sediments consisting of sand and silt were deposited in the lake. Later, another lava flow, the Lower Wind Ridge flow, issued from a vent on the south side of the southwest outlet, again blocking the Big Wood River. The lake formed behind this dam, filled with fine-grained sediments. As the sediments accumulated, the river became braided, uniformly depositing the sediments throughout the valley. Then, from probably the same source as the Lower Wind Ridge flow, the Upper Wind Ridge flow erupted depositing an additional 60 feet of lava. Fine-grained sediments accumulated in the lake formed behind the flow, adding to an already substantial sequence of alternating layers of sands, silts, and clays (Schmidt and Mackin, 1962).

The river later breached the lava dam in the southeast part of the valley, and had established a temporary base level by the time the Priest lava flow occurred. The Priest vent was located on the east side of the Timmerman Hills and extruded enough basalt to form a dam approximately 110 feet high, the top of which was below the elevation of the southwest spillway. For this reason the Big Wood River was not diverted back to the southwest outlet at this time.

Later in the Quaternary period alpine glaciers in the headwaters of the Big Wood River began to recede, their meltwaters increasing the flow of river substantially. Much of the rock material that they scoured from the mountains was deposited in the lake formed behind the lava dams. These sediments were deposited according to the load-carrying capacity of the river; clay, silt, and sand during low flow conditions, fine to coarse gravel during periods of greater flow. This variation in flow led to a succession of alternating layers of clay, sand, silt, and gravel. Further deposition of sediments during the next glacial stage added materially to the thickness of the unit. During this period, the river eventually established its course once again on the west side of the valley. The surface of the valley floor is presently convex upward and affords only a shallow surface-water divide between the Big Wood River and Silver Creek drainages.

GEOLOGIC UNITS

Basic to any study involving ground water is a description of the primary geologic formations in the area and a discussion of their water-bearing properties (table 1). A

TABLE 1

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING CHARACTERISTICS

Modified from Smith [1959] and Malde & Powers [1962]

PERIOD	EPOCH	FORMATION AND MAP SYMBOL	THICKNESS (feet)	PHYSICAL CHARACTER AND AREAL DISTRIBUTION	WATER-BEARING CHARACTERISTICS
Quaternary	Recent	Alluvium Qal	0-10±	Silt, sand, and gravel underlying the channel and flood plain of the Big Wood River; chiefly of reworked fluvioglacial sediments derived from the headwater area of the Big Wood River.	Very permeable; yields large quantities of water to numerous shallow wells.
		Terrace gravel Qt	Undetermined	Sand, gravel cobbles, and boulders in thin deposits on stream terraces. Consists chiefly of reworked older fluvioglacial material; poorly sorted to moderately well sorted.	Generally very permeable; yields water readily but is thin and limited in areal extent.
		Slope wash and gravel undifferentiated Qsw	Undetermined	Silt, sand, and gravel, poorly sorted, with angular fragments; at some places interfingers with stream gravel; elsewhere overlies old pediment slopes; occurs along border of basin and along Rock Creek.	Yields some water to domestic and stock wells in small recharge areas; limited in area extent.
	Pleistocene	Fluvioglacial sediments Qgf	300±	Clay, silt, sand, and pebble- to cobble-sized gravel deposited by streams and lakes; underlies most of the basin floor. Grades from poorly sorted coarse material on the north to interbedded clay and well-sorted sand and gravel south of the Boise baseline. Mantled at some places by topsoil.	Deepest, most extensive, and productive aquifer in the area; forms recharge area in northern portion of area, forms confining beds of artesian system in southern portion.
		Snake River Basalt Qsr	50-250±	Olivine basalt, light-gray to black, fine-grained, drusy to vesicular, jointed; contains zones of broken basalt, cinders, and interflow sediments; crops out between Gannett and Picabo and at the southeastern and southwestern outlets from the basin.	A productive aquifer prominent in the southeastern portion of the area. Yields substantial amounts of water; forms ground-water outflow section in southeast portion of basin.
Tertiary	Miocene	Volcanic rocks Tv	Undetermined	Extrusive rocks ranging in composition from rhyolite to basalt; unconformably overlie older rocks; considerably jointed. In some places individual flows are separated by thin sedimentary beds; crop out in Picabo Hills and along northwestern border of basin.	Aquifer of low permeability yields little water to wells.
Pre-Tertiary		Sedimentary and granitic rocks pre-T	Undetermined	Sedimentary rocks, well indurated, folded and faulted; intruded by stocks of granodiorite and quartz monzonite; crop out in mountains that border the basin and extend beneath it at unknown depth.	Extremely low in permeability, yields very little water to wells, generally poor aquifer; forms basement rock in most of the area.

generalized geologic map appears in figure 5.

The most important aquifer in the area is the thick sequence of fluvioglacial sediments which constitute most of the valley fill. Another important, less widespread aquifer in the study area, is the Snake River basalt, which comprises most of the southeast outlet section between Gannett and Priest.

HYDROLOGY

The hydrology of the Big Wood River-Silver Creek basin consists of a complexly interconnected surface-water - ground-water system. Streamflow entering the basin near Hailey becomes connected with the ground-water system and contributes to Silver Creek in the lower end of the valley.

To facilitate discussion for this report, the area was divided into three subareas: the Bellevue subarea, the Gannett subarea, and the Picabo subarea (fig. 6). The Bellevue subarea includes the region from Hailey to Baseline Road, the Gannett subarea includes most of Township 1 South, ranges 18 and 19 East, and the Picabo subarea includes the portion of the study area in townships 1 and 2 South, ranges 20 and 21 East. Plates 1, 2 and 3 in the back pocket of the report are comprehensive maps of the subareas.

SURFACE WATER

Surface drainage in the study area is accomplished by two major streams, the Big Wood River and Silver Creek.

Two USGS stream gages in the study reach of the Big Wood River, are located at Hailey and below Stanton Crossing, have been operated since 1947. The low flow of the river generally occurs from December through February each year and averages approximately 90 cubic feet per second (cfs) at the gage near Stanton Crossing (fig. 7). The high flows occur from April through July with the peak usually in June. This pattern is primarily the result of the rapid runoff of snowmelt from higher elevations during this period. This gage near Stanton Crossing exhibits a similar fluctuation although of a much smaller magnitude. This lower flow is primarily the result of two factors: diversions for irrigation, and loss to the ground-water system between the gages. During the summer months, with the exception of May, irrigation diversions between Hailey and Stanton Crossing usually equal the flow of the river at Hailey. The primary diversion, the Bypass Canal, and subsequent diversions leave the river bed dry from Glendale bridge downstream to the Black 61 diversion (plates 1 & 2) during the irrigation season. Below this diversion approximately 15 cfs returns to the river by way of surface-water return flow and ground-water inflow. The rest of the flow shown by the record of the gage near Stanton Crossing is contributed by three creeks: Timmerman, Spring and Crystal creeks, which rise in the southern portion of the Silver Creek Basin (plate 2).

Silver Creek, the other major stream, rises from a series of springs in the Gannett subarea and flows eastward out of the basin (plates 2 & 3). These springs are formed by application of irrigation water in amounts in excess of consumptive use requirements of crops and upward leakage from the underlying artesian aquifer system. The artesian

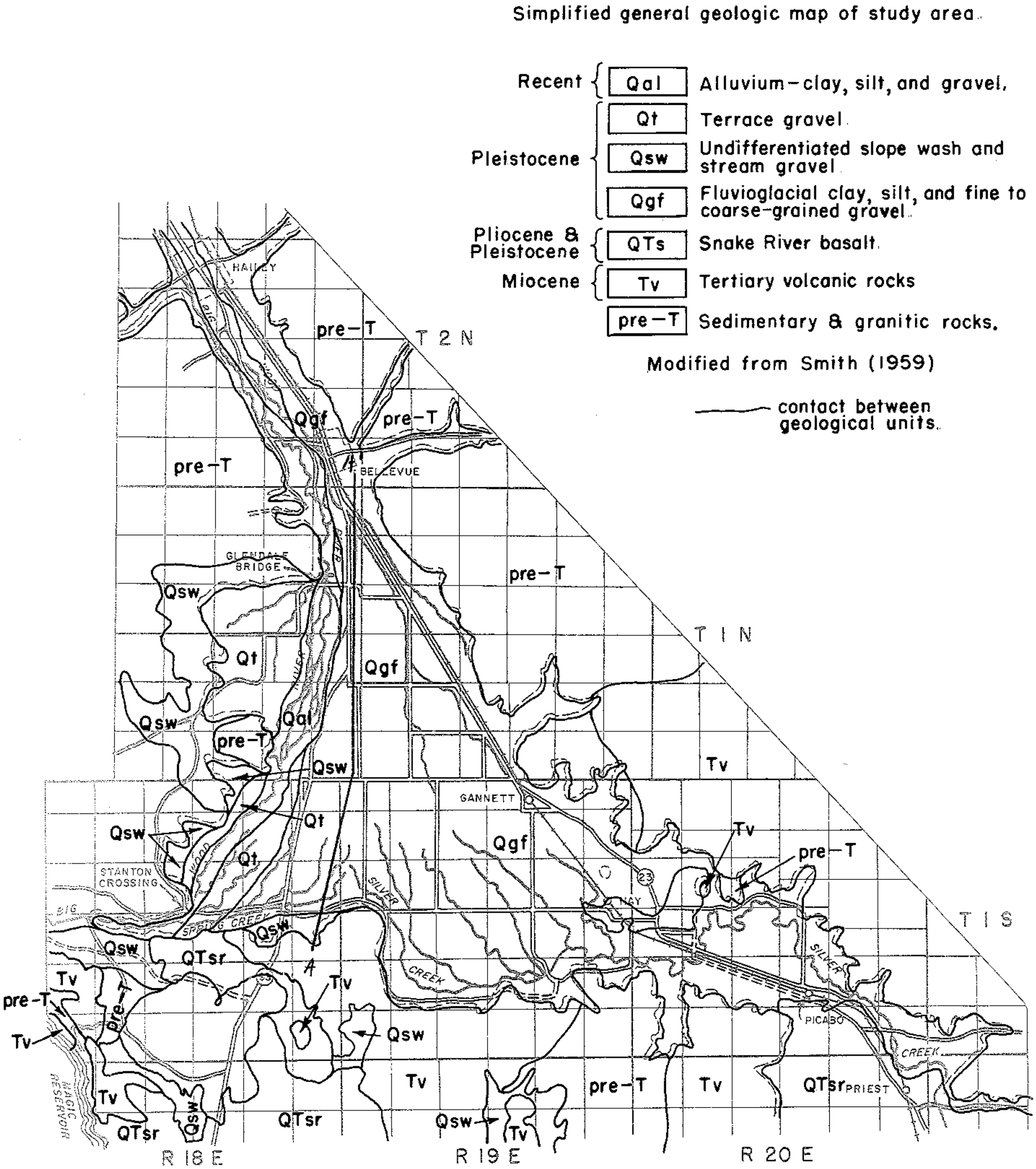


FIGURE 5. Simplified general geologic map of study area.

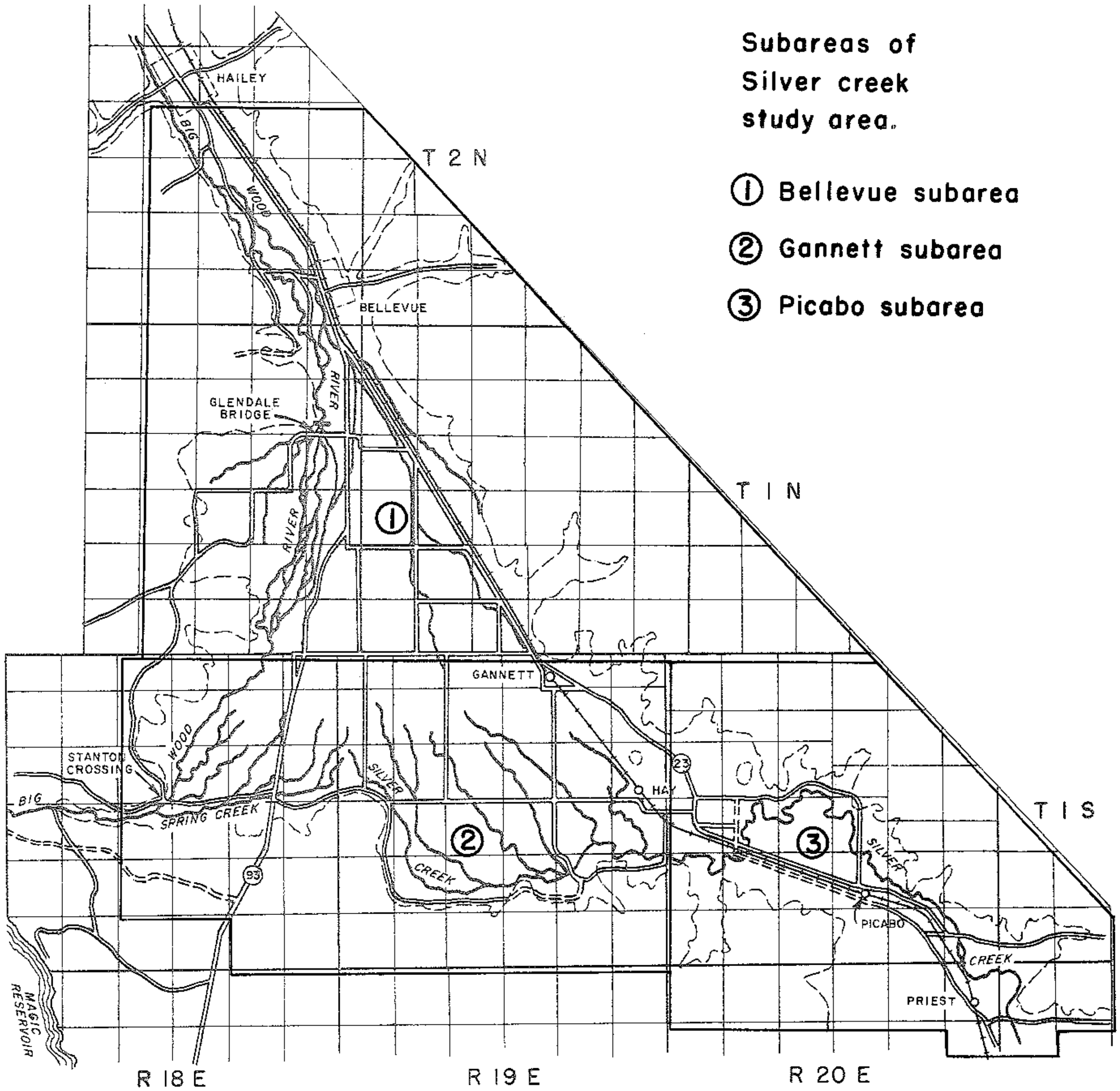


FIGURE 6. Subareas of Silver Creek study area.

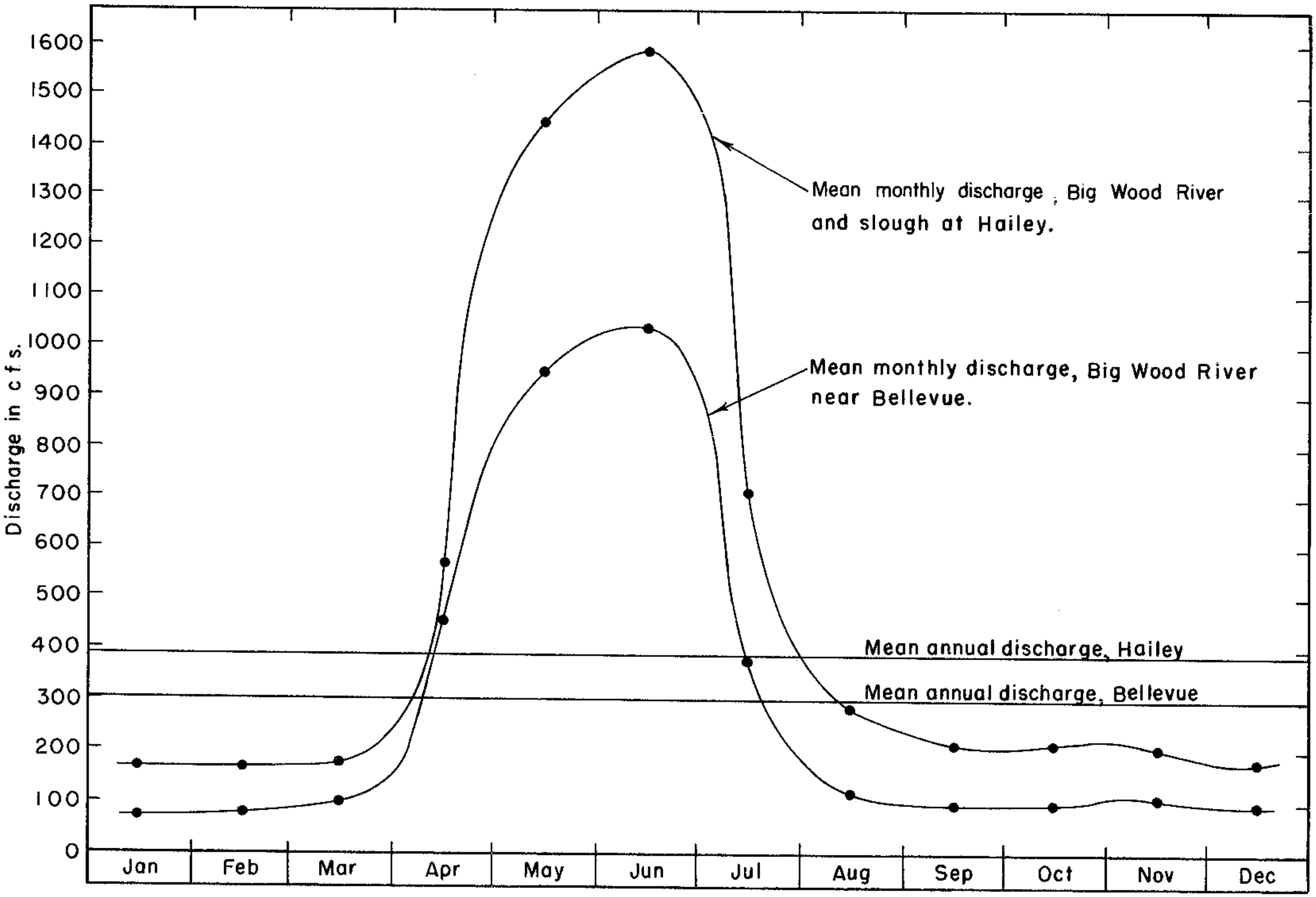


FIGURE 7. Mean monthly discharge at Big Wood River and slough at Hailey and Big Wood River near Bellevue and mean annual discharge at Hailey and Bellevue.

ground-water system contributes to the spring flow by means of upward leakage through the overlying sediments to the surface as evidenced by the close correlation of fluctuations in Silver Creek with those of wells in the area, both in the artesian and water table systems The recharge effect of amounts of water in excess of consumptive use requirements reaching the ground-water system is also shown by the hydrograph of well 1N 18E 1daa1 (fig. 8). The abrupt rise in water level in May with the peak usually in June coincides with the application of surface water for irrigation. Well 1S 19E 22aaa1 (fig. 9), has a water level peak later in the summer, usually August or September, which indicates a two to three month time of travel for the effect of the recharge through the aquifer system to this point.

Fluctuations in the flow of Silver Creek are shown by the hydrograph of the discharge at the gaging station near Picabo for the years 1958-1962 (fig. 13). The hydrograph shows a pattern of low flows from about June through July or August. Discharge begins to increase in the latter part of August or September and increases to a peak during the period from November to February. Peak flows shown by the hydrograph also occur during the months of March and April for the period of record. These peaks occur abruptly and are of short duration. These high flows are the result of surface runoff caused by snowmelt in the lower basin. The low flows in June and July are believed to result from the lack of recharge from the ground-water system. This is due to the time lag involved for the effect of recharge to travel through the aquifer system to the springs that supply the creek. The increase in flow from August to mid-winter is the result of the recharge effect reaching the springs after approximately 3-4 months of travel time through the aquifer system.

Other surface drainage in the basin includes many small drains and creeks, nearly all of which flow into Silver Creek. In general, these creeks and drains are fed by springs resulting from the summer rise in the "sub" level or shallow ground-water system. High flows occur in June or July and low flows in the winter and early spring months. Flows vary in quantity from less than 1 cfs to more than 50 cfs.

GROUND WATER

Well Development - Approximately 283 wells have been drilled in the study area since 1940 (fig. 14). These include 124 irrigation wells, 110 domestic wells and 49 stock, industrial or observation wells. Depths of the wells range from 11 to 520 feet with most being less than 200 feet.

Irrigation well development was most intensive during the period 1947 to 1963, with the greatest increase from 1958 to 1961 (fig. 14). This is believed to be the result of a period of several extremely dry years in the basin. Domestic well development has increased steadily for the period of record. The number of stock, industrial and observation wells increased slowly from 1940 to 1970 with the exception of 1953, at which time a large increase was noted. This was due to a USGS study conducted at that time, which resulted in many observation wells being drilled.

One industrial well, 2N 18E 35bb, is presently used for processing mine products in the basin.

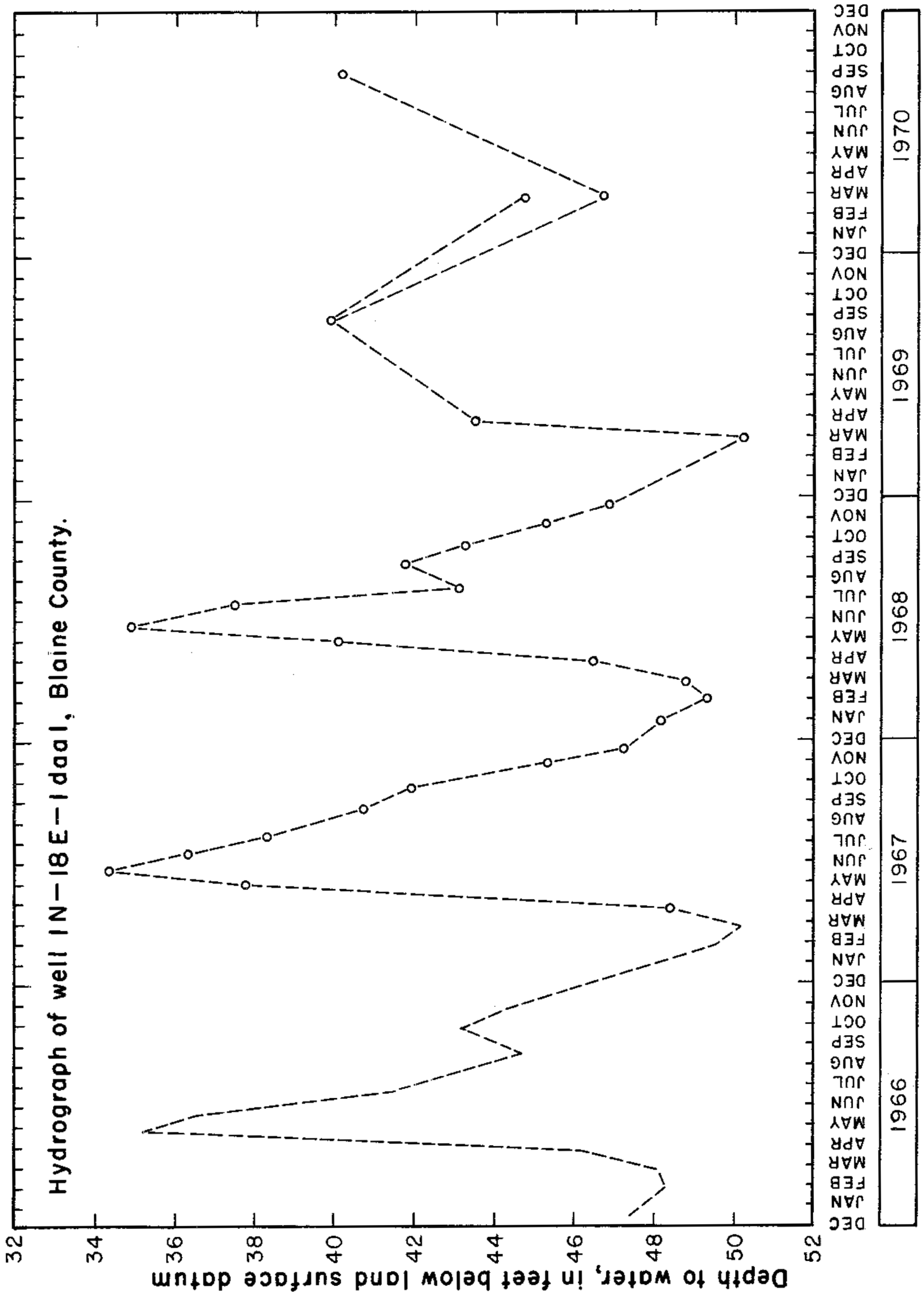


FIGURE 8. Hydrograph of well 1N 18E 1daa1, Blaine County.

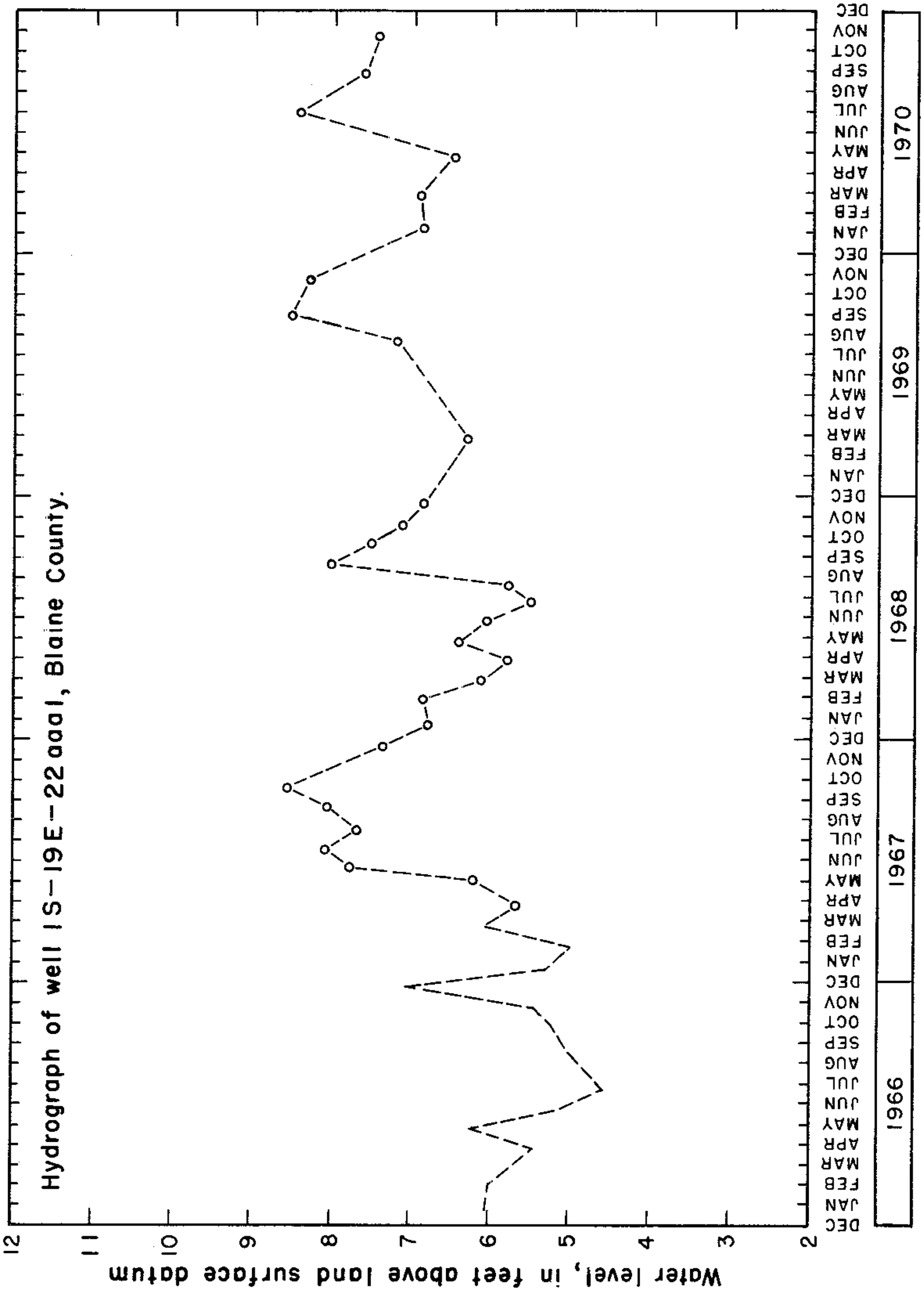


FIGURE 9. Hydrograph of well 1S 19E 22aa1, Blaine County.

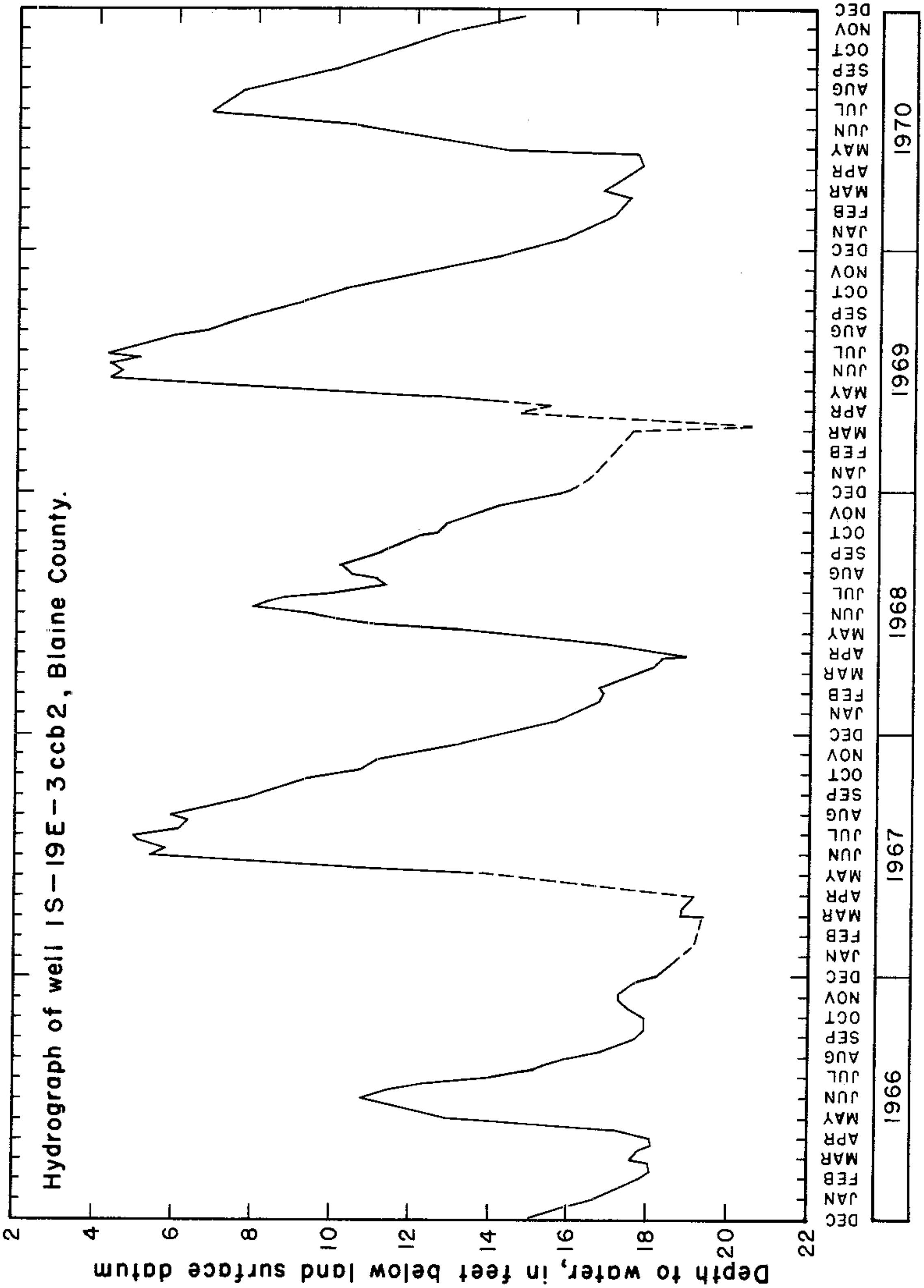


FIGURE 10. Hydrograph of well 1S 19E 3ccb2, Blaine County.

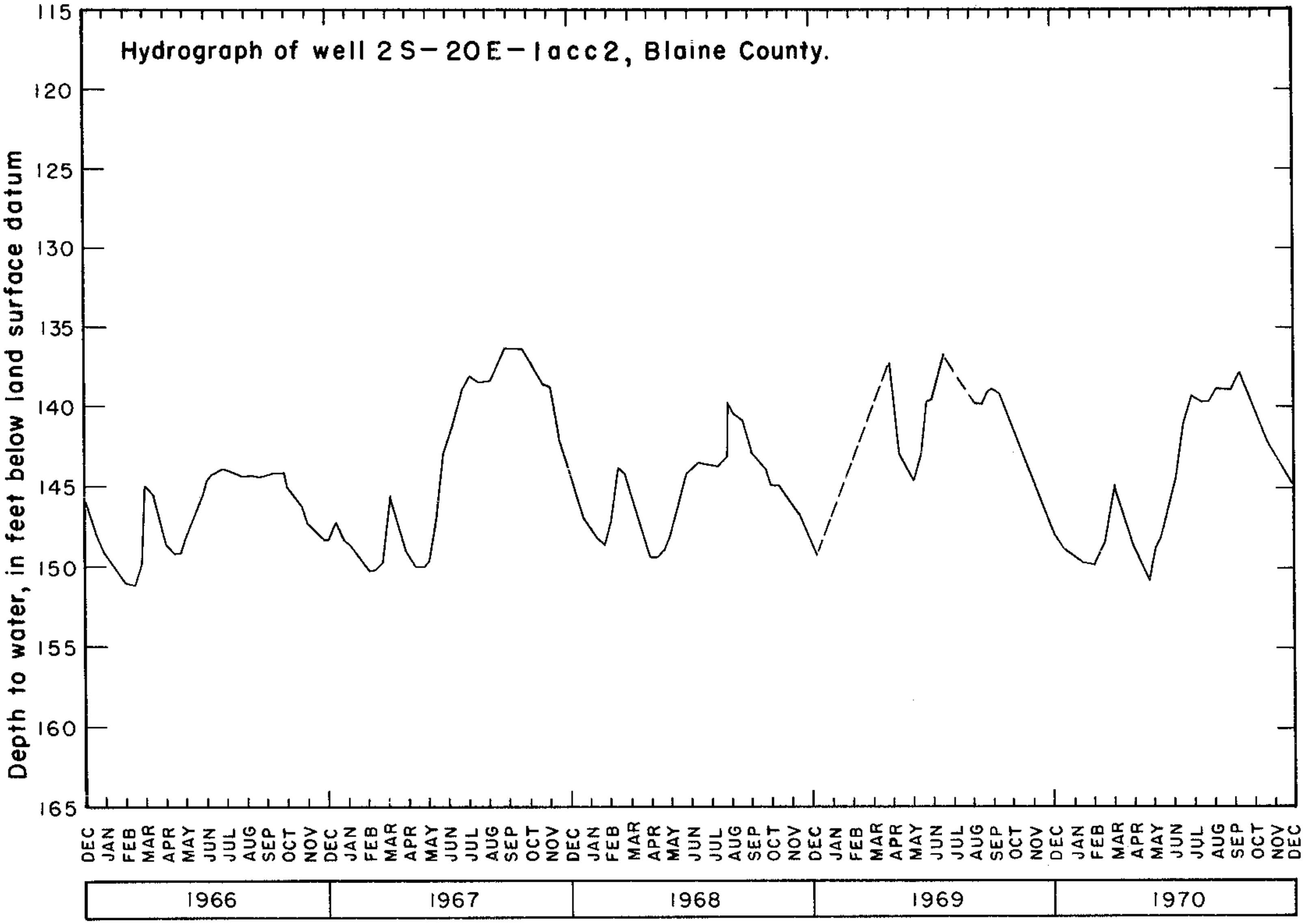


FIGURE 11. Hydrograph of well 2S 20E 1acc2, Blaine County.

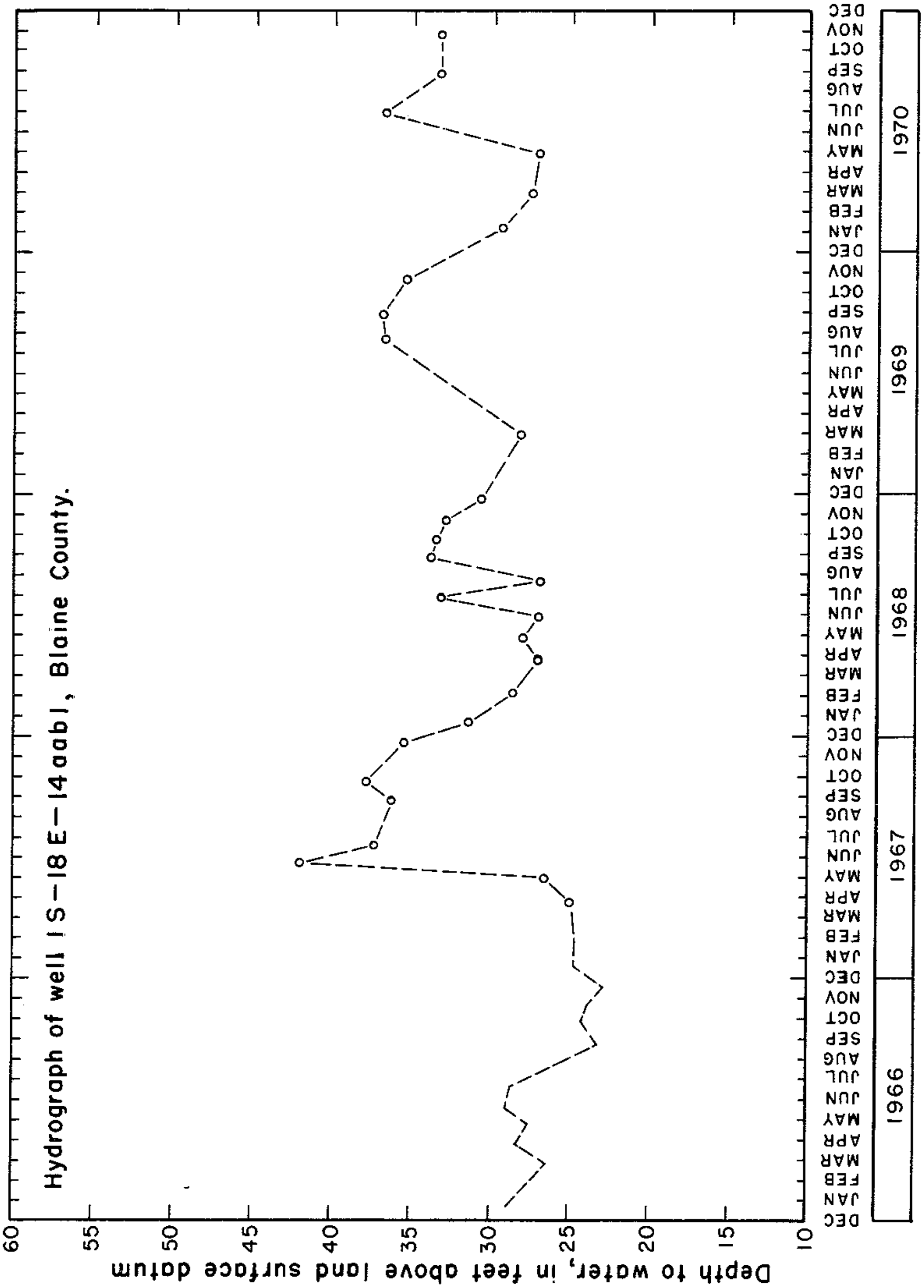


FIGURE 12. Hydrograph of well 1S 18E 14aab1, Blaine County.

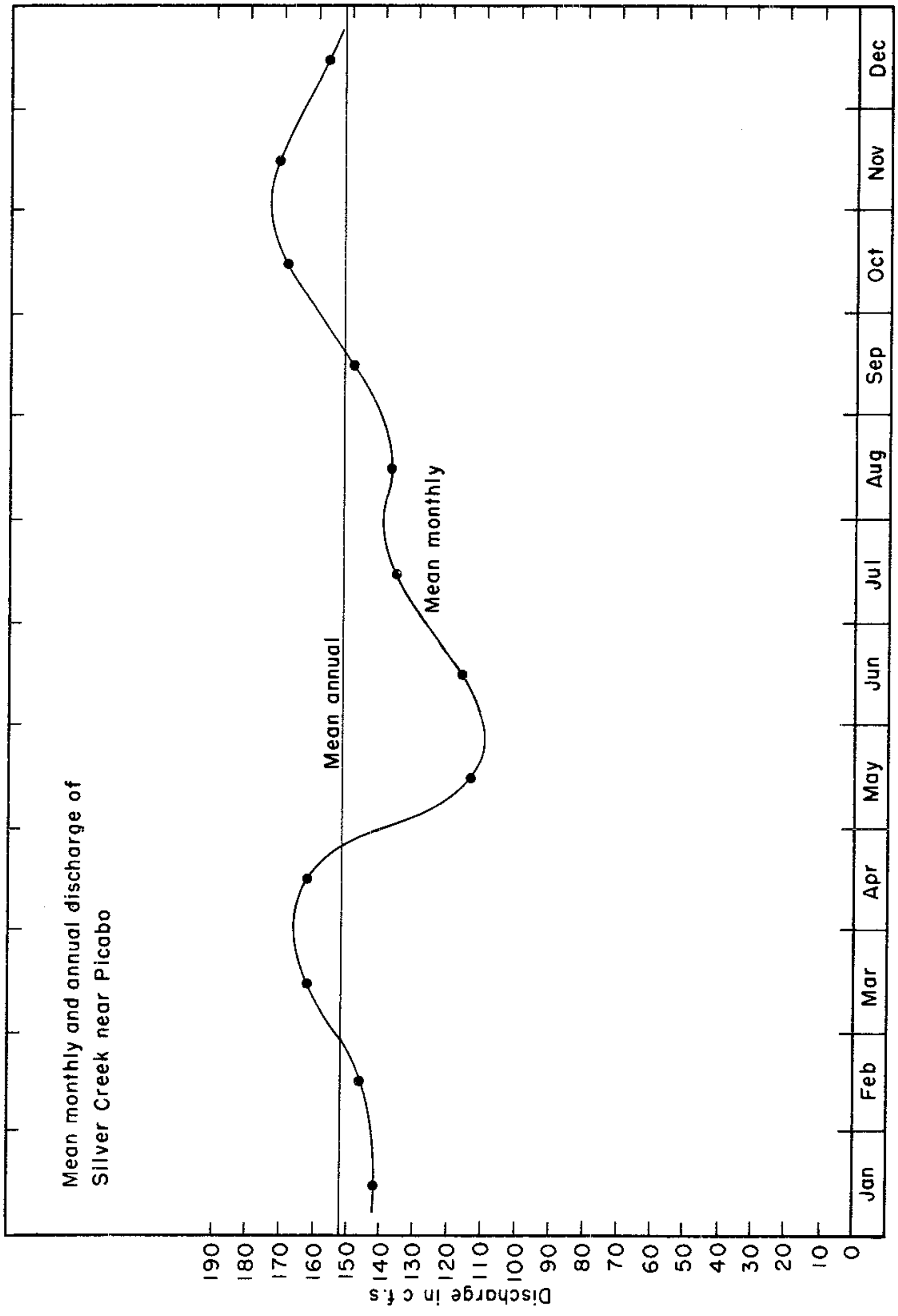


FIGURE 13. Mean monthly and annual discharge of Silver Creek near Picabo, Idaho.

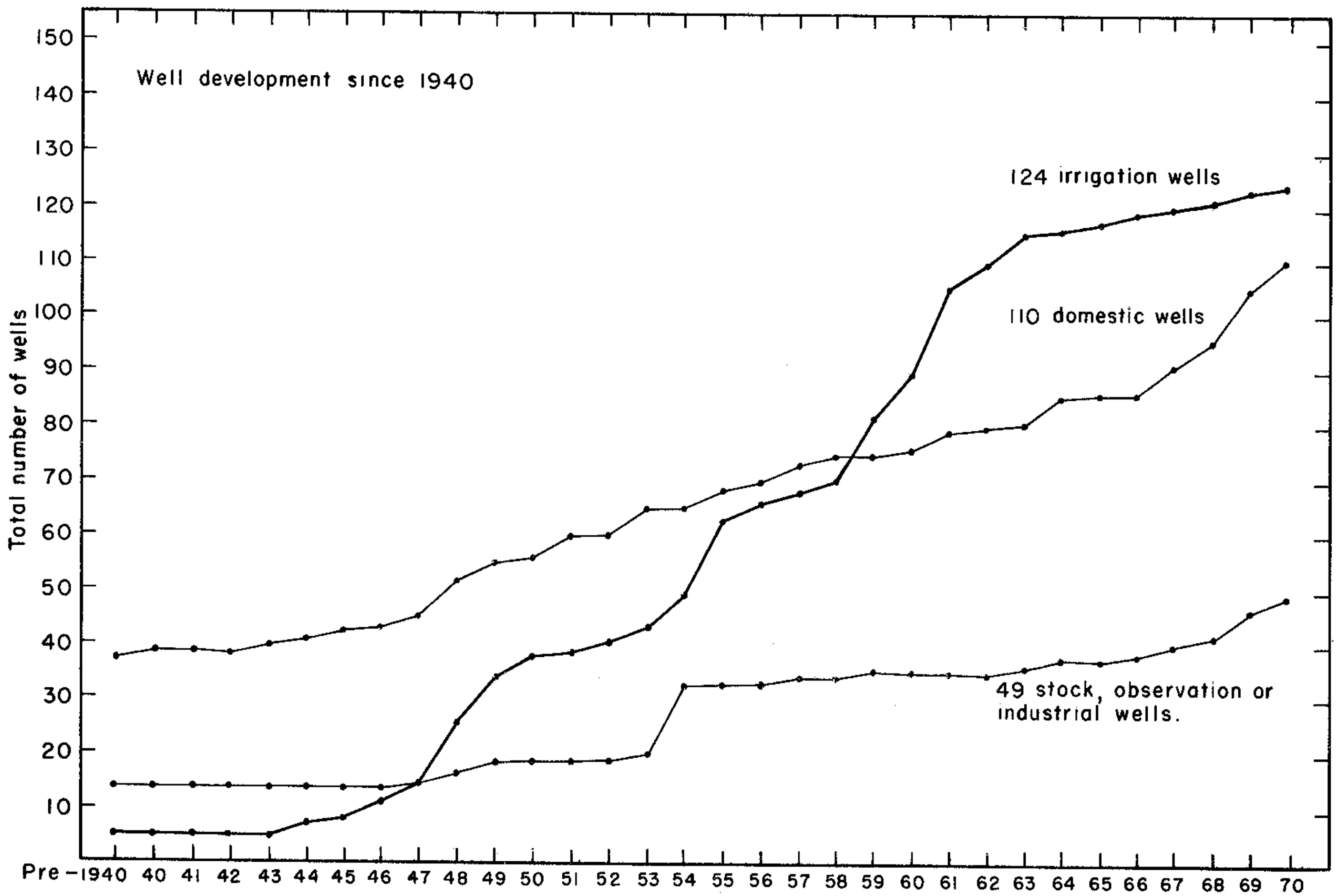


FIGURE 14. Total number of wells, Big Wood River-Silver Creek area.

Water Table Ground-Water System - The unconfined or water table system present in the basin lies primarily in the Bellevue and Picabo subareas (fig. 15). The aquifer is composed primarily of sand and gravel alluvial fill with few fine-grained sediments. The hydrologic properties of an aquifer system may be described by several parameters, the most comprehensive, perhaps, being that of transmissivity (T), which is defined as the quantity of water in gallons per day that will flow through a one foot vertical strip the full saturated thickness of the aquifer under a hydraulic gradient of 100 percent, generally expressed in gallons per day per foot (gpd/ft). R. O. Smith (1959, p. 35) calculated on the basis of five aquifer tests that T values for the basin ranged from approximately 800,000 gpd/ft to approximately 2.2 million gpd/ft. Additional data collected for this report indicates T values in the water table system are in the lower part of Smith's estimate.

The depth-to-water in May 1970 in the Bellevue subarea ranged from approximately 3 feet below land surface at the north boundary to approximately 93 feet in the southern portion (fig. 16). The depth-to-water in wells measured in the Picabo subarea in May of 1970 ranged from approximately 3 feet to 135 feet (fig. 16). This wide range is the result of the variance in depth and construction of wells and the land surface elevation at the well site. The apparent depression in the depth-to-water map (fig. 16) in portions of sections 17, 18, 19 and 20, Township 1 South, Range 20 East is present because the area is topographically higher than the surrounding valley floor. The elevations of the water surface in this area, however, are consistent with the general water table.

Contours of water-level elevation (fig. 15) indicate that ground water is moving from north to south in the basin.

A shallow ground-water divide is present from an area in Section 25, Township 1 North, Range 18 East to the Picabo Hills front in Section 18, Township 1 South, Range 18 East (fig. 16) roughly parallelling U. S. Highway 93. This ground-water divide is believed to occur because of the large intercharge of water between the river and the ground-water system. Ground water to the east of the divide either surfaces as recharge to Silver Creek or flows underground out of the basin to the southeast to eventually join the ground water in the Snake Plain Aquifer. Ground water to the west of the divide moves in a southwesterly direction, discharging into Spring, Crystal and Willow creeks as well as the Big Wood River. A small amount leaves the southwest outlet as underflow. The ground-water divide shifts slightly to the west from May to October, which is believed to be the result of the large increase in recharge to the water table system during the irrigation season.

The gradient or slope of the water surface averages approximately 10-15 feet per mile for most of the basin. Local steepening of the contours to approximately 50 feet per mile occurs south of Bellevue, east of Glendale Bridge. This is believed to be the result either of a large amount of water entering the ground-water system from surface irrigation and leakage from the Bypass Canal, or from a lateral change in permeability of the sediments deposited in the basin.

The yield-to-wells in the water table system ranges from 4 gallons per minute (gpm) to approximately 4,500 gpm. This wide range is the result of a number of factors: the purpose for which the well was drilled, pump size, depth of penetration of the aquifer, aquifer materials, and area of the well exposed to the aquifer materials.

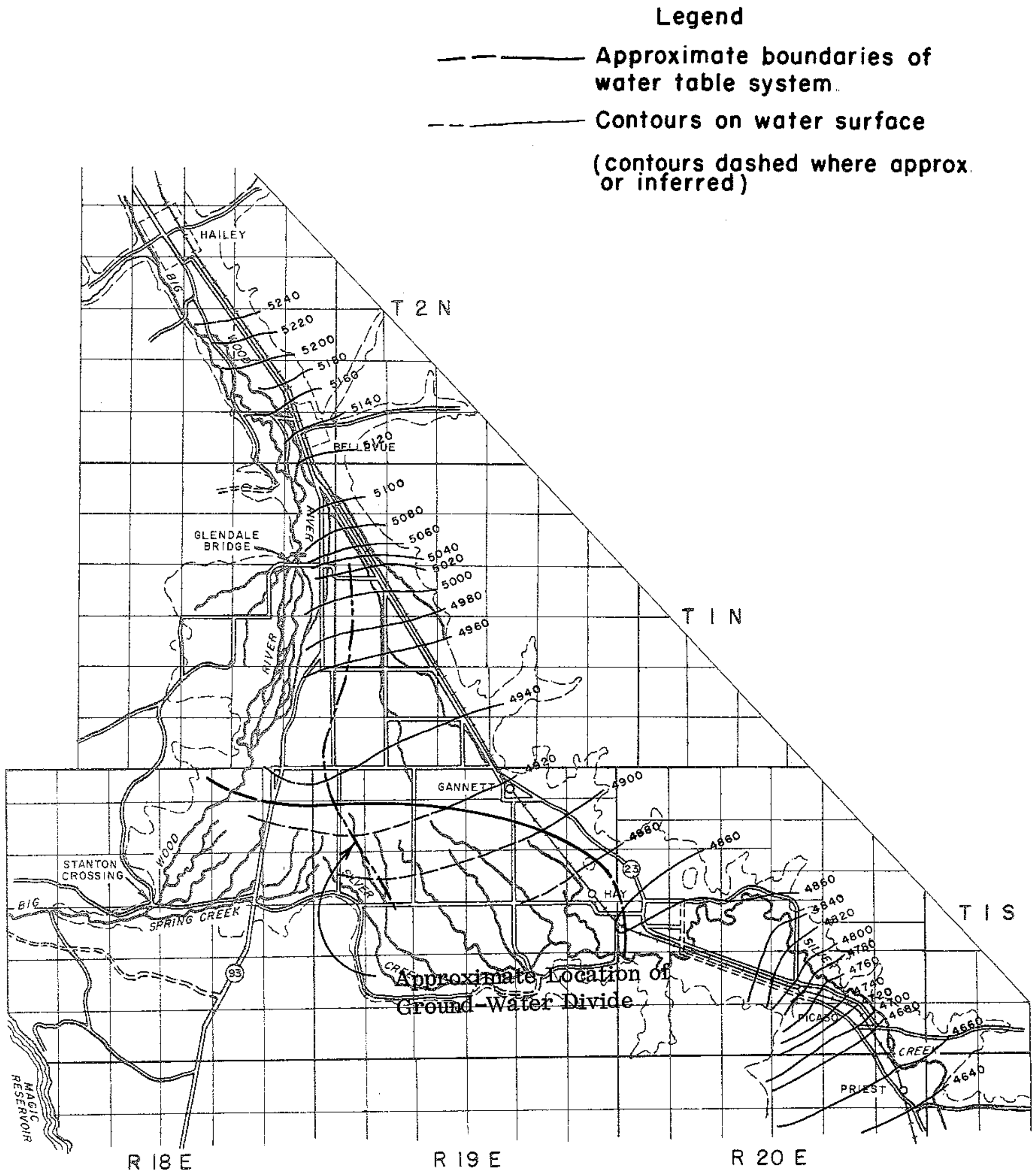


FIGURE 15. Approximate boundaries of water-table system and contours on water surface, Big Wood River-Silver Creek area.

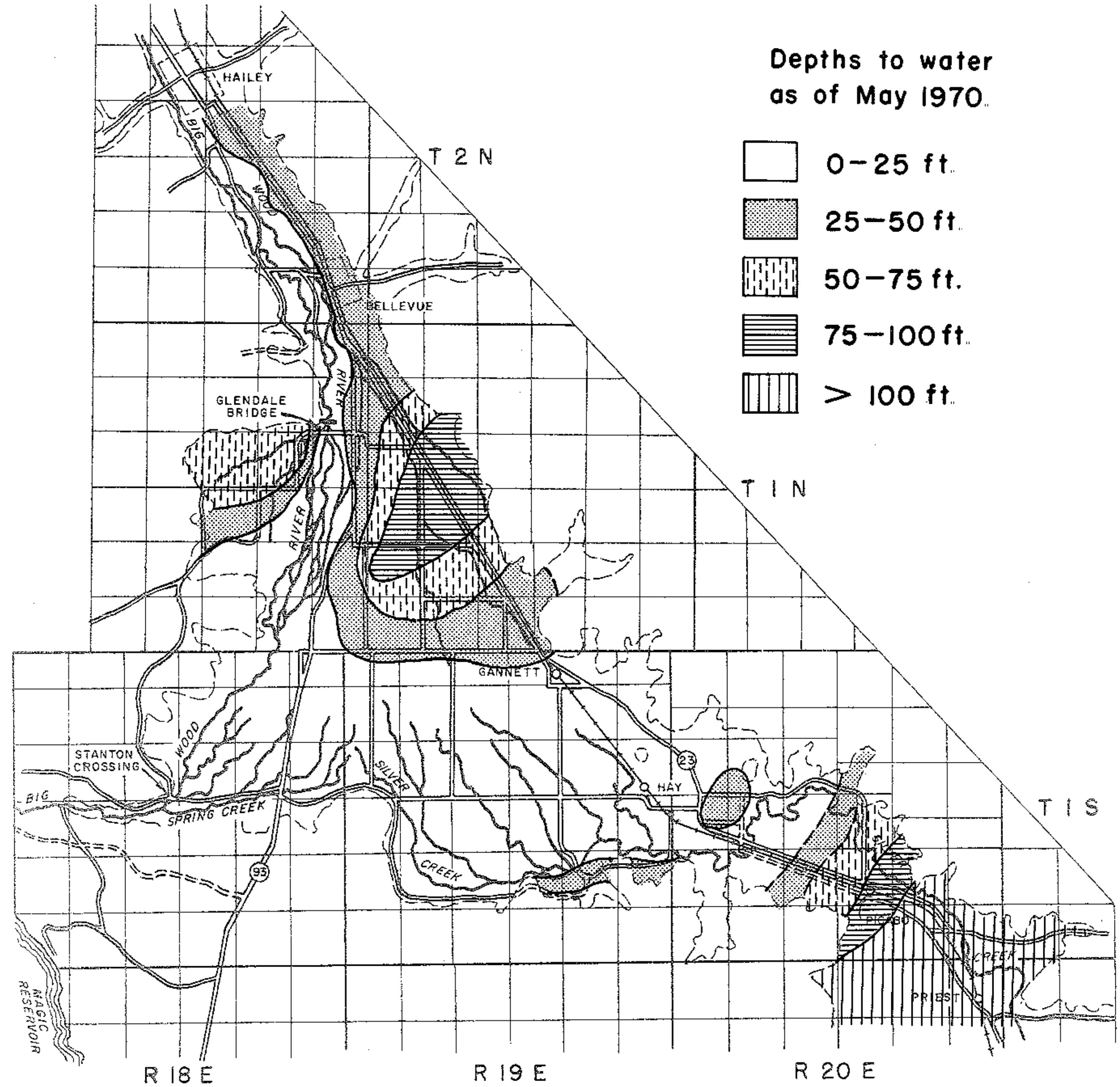


FIGURE 16. Depths to water as of May 1970, Big Wood River-Silver Creek area.

Artesian System - The artesian ground-water system is present in the Gannett subarea and overlaps slightly into the other two subareas (fig. 17).

Contours of water level elevation indicate that the water in the artesian aquifer system is moving in two general directions, from north to the southwest and from the north to the southeast. The shape of the contours indicates a ground-water divide in the artesian system very similar to that found in the water table system (fig. 17).

The yield-to-wells in the artesian system is generally high. Irrigation wells in the Gannett subarea are reported to produce from 1,000 gpm to approximately 5,000 gpm. Some flowing wells in the area discharge four to five cfs under free flow conditions and one discharges approximately 7.5 cfs.

Most of the existing artesian wells have 8 inch casings and discharge a sufficient amount of water for irrigation under present conditions and methods of application. If artesian pressure declines are experienced, farmers in the area may have to either drill additional wells or begin pumping existing ones.

Water Table - Artesian System Relationship - The water table and artesian ground-water systems are hydraulically connected in the study area. Water entering the basin in the northern portion of the area moves downward into the underlying unconfined ground-water system. The ground water in this system moves southward through the coarse-grained sediments until it reaches an area just north of Baseline Road, where the fine-grained content of the sediments increases. Significant silt and clay beds occur in the sand and gravel sequence, beneath which much of the water moving through the basin is trapped (fig. 18). This gives rise to the artesian pressures found in the southern portion of the basin (fig. 17). The portion of the water not trapped beneath the confining beds continues through the upper coarse material. It is this water plus some upward leakage from the artesian aquifer that feed the springs and seeps present in the area.

The present level of well development in the water table system has not had significant effect on the amount of ground water moving into the confined or artesian system. Large scale development in the future, however, could decrease the volume of inflow to the extent that artesian pressure declines might occur. However, because most of the land overlying the water table system has already been developed, this is not likely to occur.

Water-Level Fluctuations - Water-level fluctuations in the Silver Creek area have been monitored since 1954 by six observation wells operated by the U. S. Geological Survey. Hydrographs of these wells show water-level declines of as much as four feet for the period 1959-61. This decline appears to be the result of several drier-than-average years. The ground-water system is so responsive to changes in precipitation and runoff that this decrease in recharge is reflected almost immediately. Water levels in the area have generally risen since 1961.

One hundred forty wells were measured periodically from May to October 1970. The water-level fluctuations from May to August and from May to October are shown in figures 19, 20, 21 and 22. Water-level fluctuations from May to August vary widely; water levels rose from 0.1 foot to more than 25 feet in most parts of the area. Declines did occur in

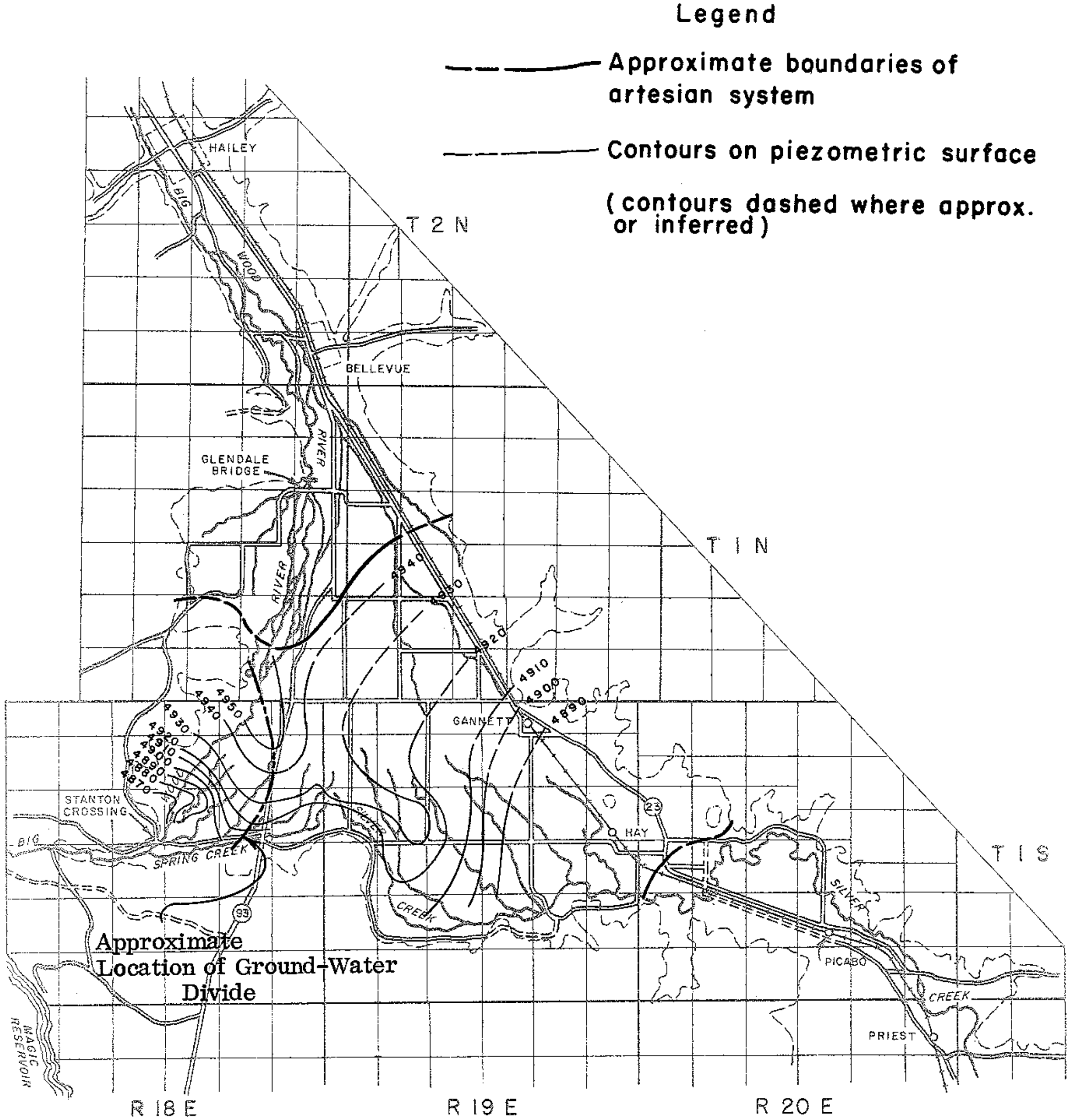
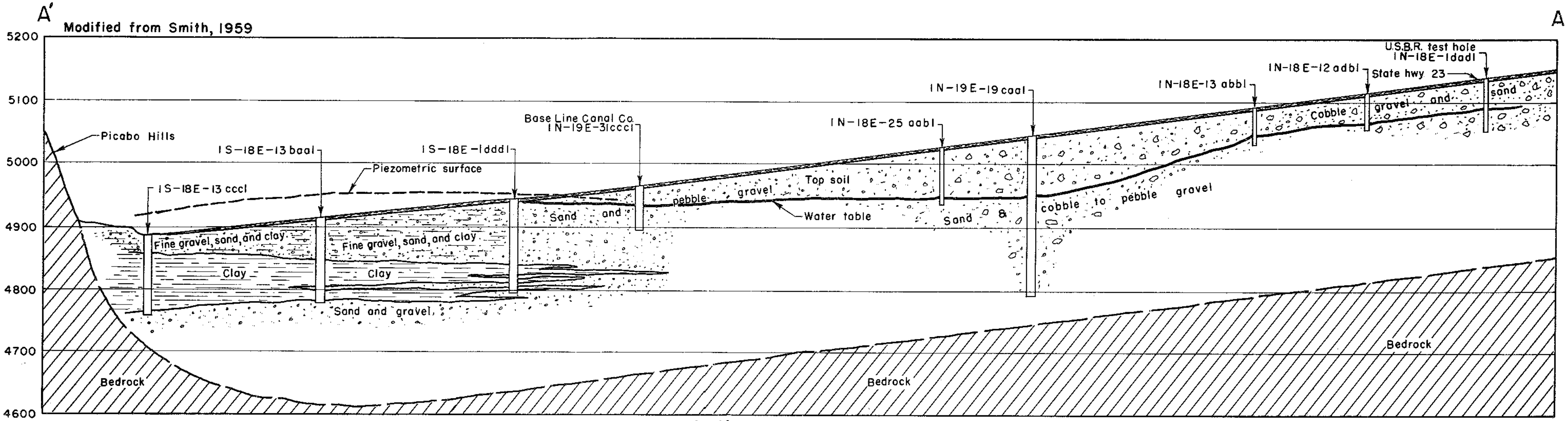


FIGURE 17. **Approximate boundaries of artesian system and contours on piezometric surface, Big Wood River-Silver Creek area.**



(FIGURE 18) Generalized geologic section along line A–A' showing position of the water table and Piezometric surface as of May 1970.

1 0 1 Mile

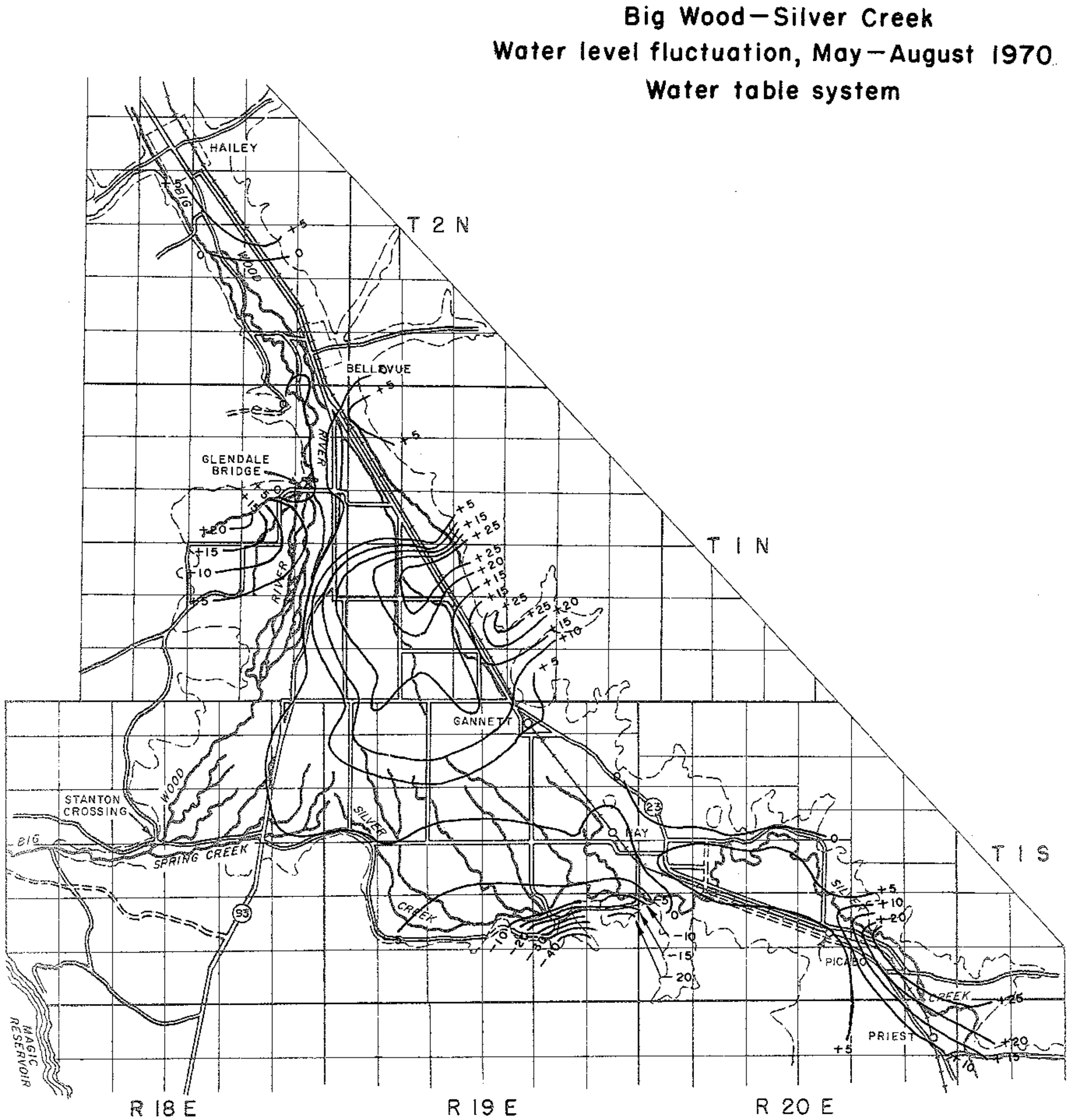


FIGURE 19. Water level fluctuation, May-August 1970, water table system, Big Wood River-Silver Creek area.

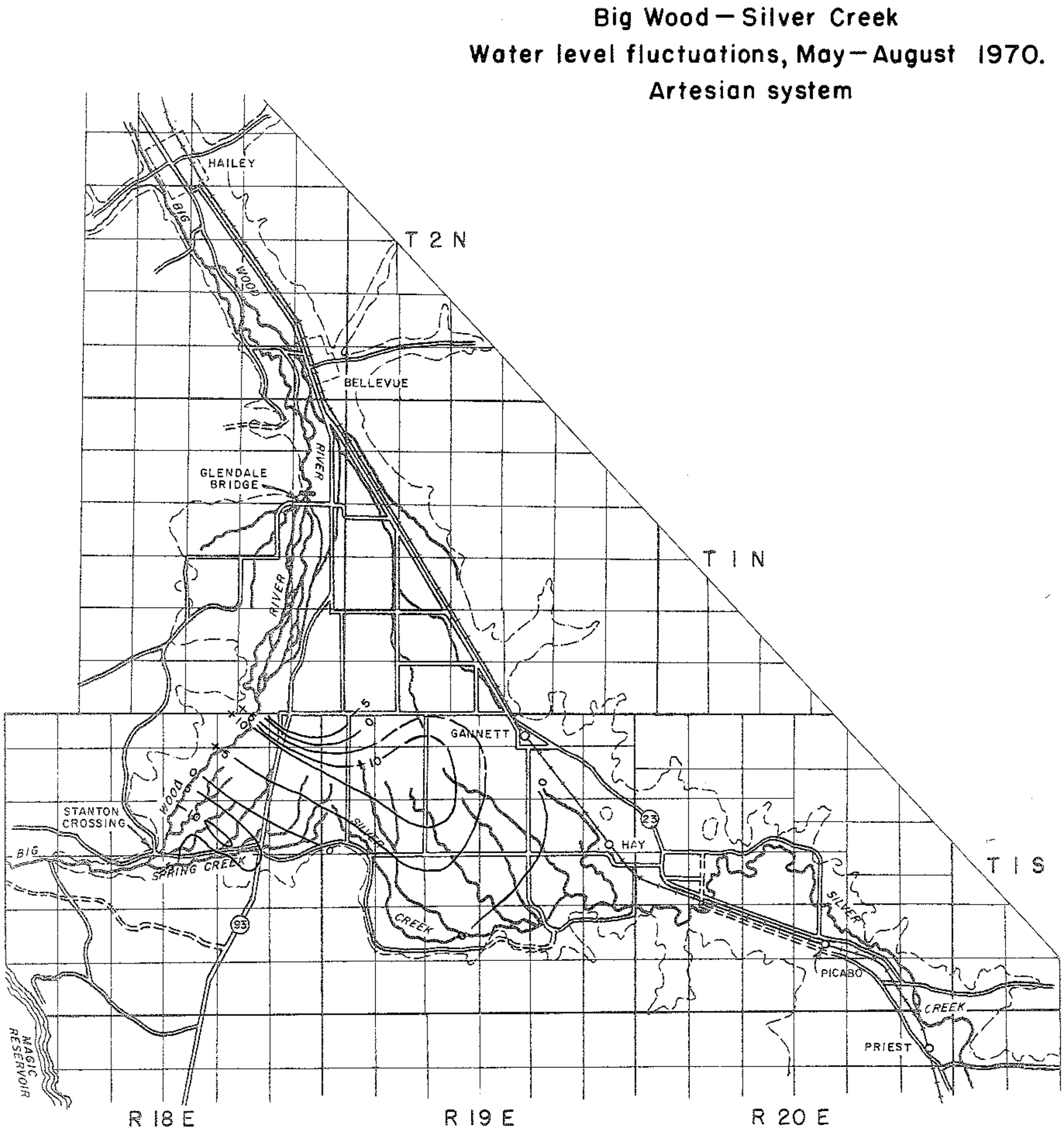


FIGURE 20. Water level fluctuation, May-August 1970, artesian system, Big Wood River-Silver Creek area.

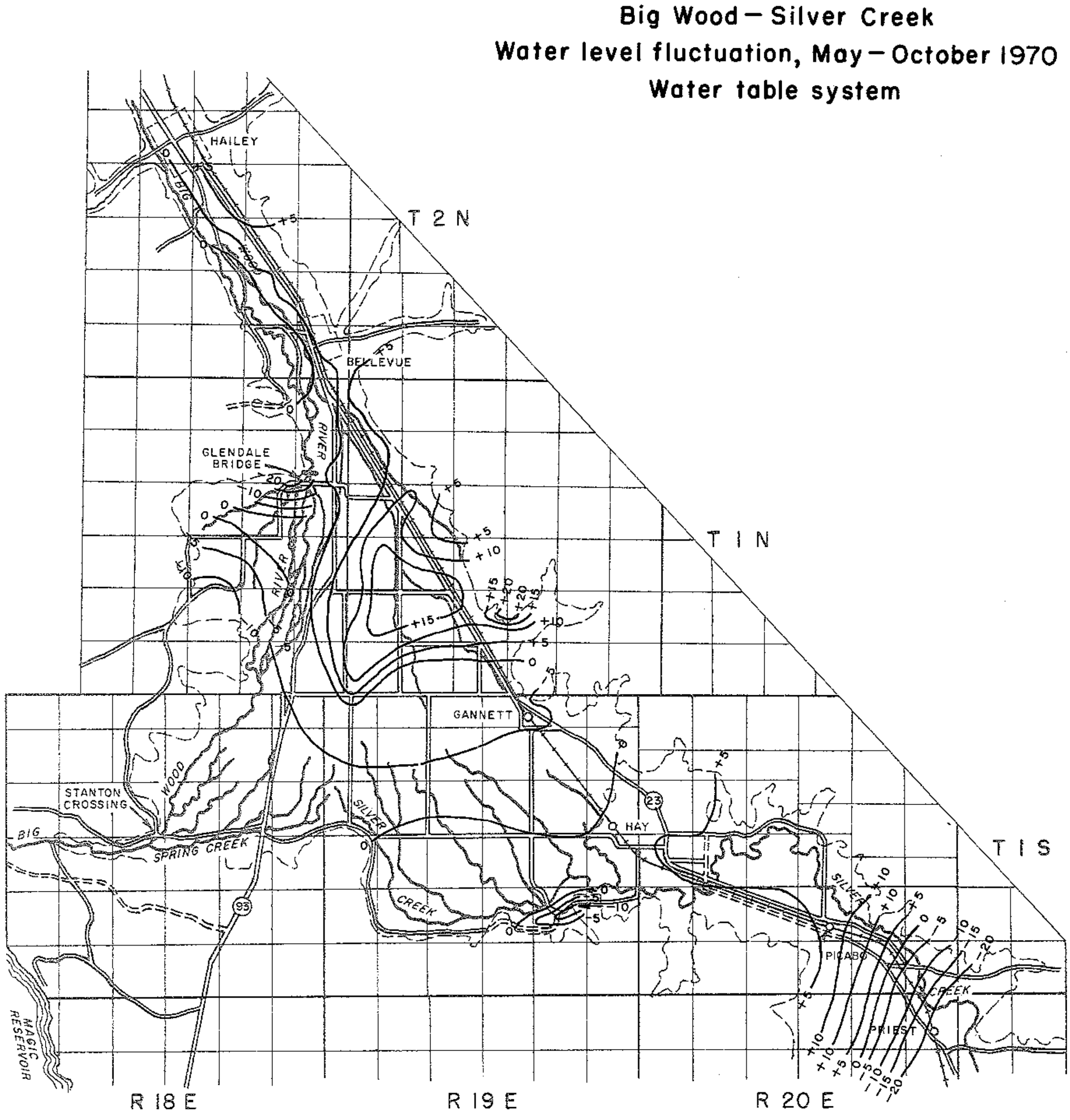


FIGURE 21. Water level fluctuation, May-October 1970, water table system, Big Wood River-Silver Creek area.

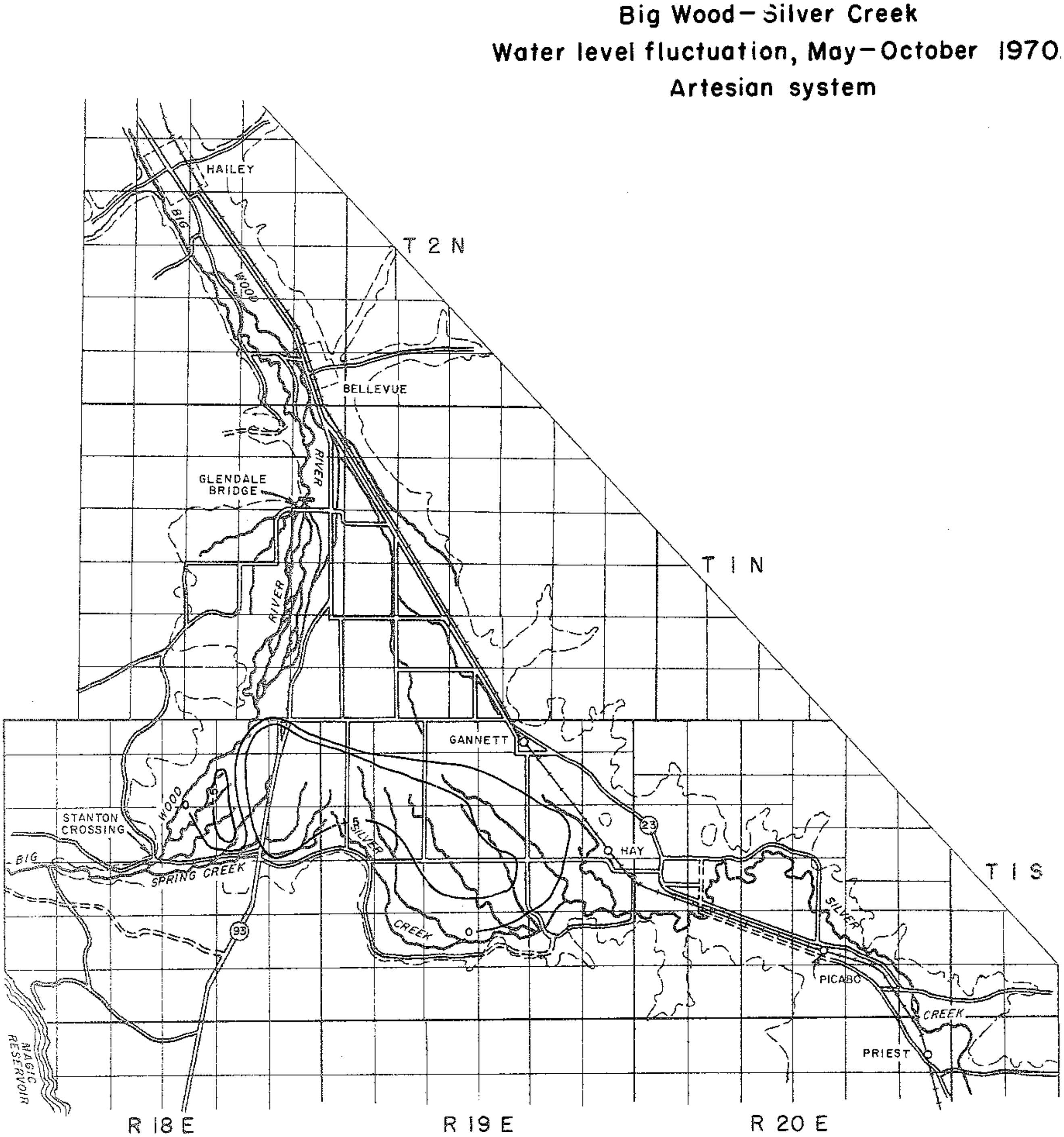


FIGURE 22. Water level fluctuation, May-October 1970, artesian system, Big Wood River-Silver Creek area.

several small areas in the basin. The rise in water throughout the rest of the area is believed to be the result of (1) recharge from snowmelt and runoff entering the ground-water system and (2) a lack of large ground-water withdrawal for irrigation. Water-level declines occurred in two small areas in Township 1 South, Range 19 East (figs. 20 and 21) during this period. Both of these areas are near the mountain front and are believed to respond more quickly to runoff effects than areas further into the main valley. It is probable that the water levels in these wells would rise more rapidly in the spring and decline more rapidly than wells further from the valley walls.

Water-level fluctuations from May to October had a different pattern. Three areas of decline became evident; one in the Poverty Flats area, one in the south-central portion of the area, and one southeast of Picabo (fig. 18). The Poverty Flats decline almost certainly resulted from a lack of sufficient recharge to the area to balance the withdrawal from pumpage. The area containing the steep gradient southeast of Picabo corresponds approximately with the southeastern limit of irrigated lands. Application of water on crop and pasture land would tend to hold water levels at an artificially high level in those areas masking any natural decline which would have occurred earlier. The area of decline in the south-central portion of the area is believed to result from: (1) withdrawal of water by wells from the ground-water system for late summer irrigation and (2) a greater amount of clay and silt in the geologic section in this area, reducing transmissivity, thus slowing the movement of water through the aquifer. Water levels in the majority of the wells in the rest of area rose during the period from May to October 1970.

GROUND WATER-SURFACE WATER RELATIONSHIP

The ground water-surface water relationship in the upper portion of the study area is less complex than in the lower, or artesian, portion.

Between the Glendale Bridge and Hailey, the Big Wood River is a gaining stream; ie, it receives water from the ground-water system. Most of the tributary streams do not reach the Big Wood River as streams except during periods of peak runoff but rather as underflow through the coarse valley fill material of the Big Wood River Valley. Downstream from the Glendale Bridge for a distance of approximately four to five miles the Big Wood River is braided, and becomes a losing stream (plate 2). During certain portions of the year, the Big Wood Channel below Glendale Bridge is totally dry because of diversions into the Bypass Canal. Below the braided reach of the river a substantial amount of ground water from underflow as well as excess irrigation water begins to enter the channel once again, replenishing the flow through the southwest outlet of the valley.

Silver Creek and its associated feeder streams, springs and seeps are formed by the discharge of ground water in an area south of the Baseline Road, extending from Highway 93 to Gannett (plates 2 & 3). The overlying sediments become progressively finer in a down-valley, or southerly direction, becoming extremely fine south of Baseline Road. Since these sediments do not transmit water as readily as the sand and gravel to the north, they inhibit the flow of ground water, resulting in upward leakage and a rise in water levels which contribute materially to the discharge of Silver, Spring and Crystal creeks. Silver Creek is a gaining stream from its most westerly source in Section 18, Township 1 South, Range 18 East to approximately Section 20, Township 1 South, Range 20 East, at which time it becomes a losing stream to its confluence with the Little Wood River. Water lost in this reach of Silver Creek leaves the basin as underflow through the southeast outlet.

RECHARGE-DISCHARGE CHARACTERISTICS

Surface Water - Surface water inflow to the Big Wood River-Silver Creek Basin is from three primary sources: the Big Wood River, irrigation canals and ephemeral streams. The average annual discharge into the basin past the USGS gage at Hailey for the 54-year period of record was 317,000 acre-feet. During the irrigation season, most of the water flowing past the gage is diverted for irrigation and the river bed is essentially dry from the Glendale Bridge to below the Boise Baseline. Below this point some springs appear in the river bed, reestablishing flow in the river above Stanton Crossing. Irrigation canal inflow bypassing the gage at Hailey was estimated from watermaster reports on file with the Department of Water Administration. The average annual discharge, based on a 21-year period of record, was determined to be approximately 24,000 acre-feet. Quigley, Slaughterhouse, and Seaman's creeks discharge approximately 38,500 acre-feet per year into the basin (Smith, 1959, p. 21). It is assumed that all of this water percolates to the ground-water system.

Surface-water outflow from the area of study is from two major sources: the Big Wood River and Silver Creek. An insignificant quantity of water flows out of the basin in two small irrigation canals.

The discharge from the area in the Big Wood River was determined at the USGS gage near Bellevue located in Section 20, Township 1 South, Range 18 East. The average annual discharge past this gage was approximately 214,000 acre-feet, based on 31 years of record. The discharge from Silver Creek was gaged at a site near Picabo. A 26-year base period was selected to approximate the average annual discharge of 112,000 acre-feet past this gage.

Ground Water - Recharge to the ground-water system in the Big Wood River-Silver Creek Basin occurs from precipitation, underflow from the upper Big Wood River watershed, percolation from the river channel and irrigation canals and infiltration of irrigation water applied in excess of crop needs.

The volume of precipitation in the study area was calculated by summing the product of the area between each altitude zone and the precipitation for that zone. Data deficiencies, especially in the higher altitude zones, make an estimate of precipitation somewhat conjectural but it is believed to be sufficiently accurate for the purposes of this report. The estimated annual precipitation for the study area is 236,000 acre-feet.

The average annual underflow from the Big Wood River Basin above Hailey was estimated by Smith (1959, p. 21) to be approximately 34,000 acre-feet. This estimate was based on data from an aquifer test at well 1N 19E 6cb1 and the existing ground-water gradient of 34 feet per mile.

Water loss from the channel of the Big Wood River and irrigation canals is an important source of ground-water recharge. Measurements completed on the Big Wood River at Stanton Crossing during February 1971 indicate a 60 cfs loss between the crossing and the gage near Hailey, approximately 68 percent of the total discharge at Hailey. This, however, was a single measurement which can not be utilized to project an average annual streamflow loss. It does, however, indicate the magnitude of the contribution to the ground-water system.

Unconsumed irrigation water also contributes to the ground-water system, the contribution being dependent upon the permeability of the soil, the type of crop to which the water is applied and the amount of water applied. No quantitative estimate of recharge from this source was made.

Discharge from the aquifers in the study area is accomplished by: evapotranspiration, spring discharge, ground-water pumpage and underflow out of the basin.

Evapotranspiration occurs from native vegetation, crops and phreatophytes (plants that obtain their water supply from the water table, either directly or through the capillary fringe) growing in the area. The native vegetative cover transpires nearly all of the water derived from precipitation falling on the area above the valley floor except for that falling during heavy rainstorms. Crops are grown on an estimated 23,000 acres in the basin. The consumptive use of these crops is estimated at approximately 29,000 acre-feet annually. Phreatophytes transpire approximately 3.5 ac-ft/yr (Smith, 1959, p. 22) in the basin. No calculation of the total evapotranspiration was made because of the lack of recent data concerning the total acreage covered by phreatophytes.

Pumpage of ground water for irrigation was not estimated for this report. Most of the ground-water pumpage is for supplemental irrigation supply and varies widely from year to year. The amount pumped, however, is believed to be insignificant when compared to the total water resource.

Underflow from the basin is believed to be small. Smith (1959) reported that the outlet section at the southwestern end of the valley is underlain by nearly impermeable granitic rocks which would allow very little ground-water flow through this area. Data gathered in the southeastern outlet near Picabo indicate that a relatively permeable section of basalt and sediment exists there. Smith (1959) estimated that approximately 38,000 ac-ft/yr flows through this section. This estimate was based on an aquifer test of well 2S 20E 1ac2 and a ground-water gradient of approximately 20 feet per mile. Data gathered for this study agree with these calculations and no significant change in the estimate need be made.

The data gathered for this report could not be itemized as a formal water budget because of deficiencies of high altitude precipitation records and certain deficiencies in water budget equations for basins having both native and agricultural regimens Table 2, however, shows the approximate distribution of the water resources of the Big Wood-Silver Creek Basin. It may be seen from the table that nearly all of the water entering the basin leaves as surface outflow or is evapotranspired by plants. The estimate of evapotranspiration was based on the assumption that unless water levels in well change significantly, thus denoting a change in aquifer storage, outflow from the basin must equal inflow. This indicates a sensitive equilibrium between the surface- and ground-water systems in the basin. Because of this sensitivity and the direct connection between the surface- and ground-water systems, withdrawal or use from one will effect the other. If, for example, a large amount of additional pumpage were to occur, the streamflow in Silver Creek and the Big Wood River would decrease. However, because of the high degree of connection, the total water supply in the basin would decrease by only the amount of water evapotranspired by crops and the rest would return to the ground-water system or to the streams through overland flow. Artesian pressures would decline slightly and static water levels in the water table system would be slightly lower.

TABLE 2

WATER BALANCE FOR THE BIG WOOD RIVER-SILVER CREEK AREA

(Rounded to nearest 1,000)

INFLOW	Acre-foot/year
Precipitation	236,000
Big Wood River	317,000
Irrigation Canals	24,000
Quigley, Slaughterhouse and Seaman's Creeks	39,000
Ground Water	34,000
Total	650,000
OUTFLOW	
Big Wood River	214,000
Silver Creek	112,000
Ground Water	38,000
Evapotranspiration (Crops, Native Vegetation, Phreatophytes)	286,000
Total	650,000

WATER QUALITY

Most of the ground-water quality data was taken from USGS Water Supply Paper 1478. Two additional samples were taken by the Department of Water Administration in October 1970.

Water quality in the study area was found to be good for domestic, stock, industrial and agricultural uses. Only minor differences exist in the quality of surface and ground water. A more detailed discussion of the chemical characteristics of the water resources of the area is presented in the following sections.

SURFACE WATER

The water quality of the Big Wood River and Silver Creek are similar, as shown in table 3. The water in Silver Creek is slightly higher in nitrates (NO_3) and significantly higher in

TABLE 3

CHEMICAL ANALYSES OF WATERS FROM THE BIG WOOD RIVER-SILVER CREEK STUDY AREA

(Chemical constituents in parts per million)

Analyses by U S Bureau of Reclamation except as noted

	Source Location	Date of Collection	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved Solids	Hardness as $CaCO_3$ Total	Hardness as $CaCO_3$ Noncarbonate	Percent Sodium	Sodium Adsorption Ratio	Residual Sodium (meq/l) Carbonate	pH	Specific Conductance (micromhos at 25°C)	Alkali Factor
	Ground Water																							
* 1	2N-19E-28dcS1	2-14-45	63	-	-	34	20	-	-	156	7	3	0	-	-	176	167	-	-	-	-	7.8	-	-
2	2N-18E- 9bd1	8-19-54	46	-	-	51	15	5	0.8	201	12	1	-	3.1	0.04	-	189	24	5	0.2	0	7.5	383	38
3	2N-18E-15bb1	8-19-54	50	-	-	55	16	5	0.8	220	14	2	-	5	0.02	-	203	23	5	0.1	0	7.4	417	31
4	2N-18E-25cd2	10- 8-54	53.5	-	-	57	22	6	1.2	242	26	4	-	4.3	0.00	-	233	34	5	0.2	0	7.5	473	20
5	1N-18E- 1bc1	9- 9-54	54	-	-	54	11	7	Tr	199	13	2	-	1.9	0.00	-	180	17	8	0.2	0	7.4	384	47
6.	1N-18E-13aa1	9- 9-54	52	-	-	55	10	8	Tr	197	14	1	-	1.9	0.00	-	178	17	9	0.3	0	7.6	385	.53
7	1N-18E-14cb1	8-19-54	54	-	-	69	18	8	1.6	268	13	3	-	13.0	0.00	-	246	27	6	0.2	0	7.4	504	50
8	1N-18E-25aa1	9- 9-54	52	-	-	55	14	5	0.4	206	13	2	-	5.0	0.02	-	195	26	5	0.1	0	7.9	392	33
9	1N-18E-26cb1	9- 9-54	54	-	-	27	7	19	Tr	112	18	6	-	2.5	0.01	-	96	4	30	0.8	-	8.1	285	79
10.	1N-19E- 6cb1	8-19-54	46	-	-	66	14	8	0.8	239	14	3	0	6.2	0.07	-	222	26	7	0.2	0	7.5	446	47
11	1N-19E-17ba1	10- 8-54	52	-	-	58	18	5	0.8	251	13	4	-	5.0	0.00	-	219	13	5	0.2	0	7.5	471	29
12	1N-19E-26acS1	10- 8-54	48	-	-	24	10	9	1.6	124	4	5	-	2.5	0.00	-	101	0	16	0.4	0.02	7.3	247	1.00
**13	1N-19E-31ca1	11- 7-54	52	16	-	52	9.7	4	1.1	197	12	2	0.1	5.6	0.04	206	170	8	5	0.1	0	7.9	345	29
**14	1N-19E-32ab1	9- 9-54	51.5	16	-	56	10	4	1.0	214	13	2	0.2	3.2	0.05	214	181	6	5	0.1	0	7.4	362	27
15	1S-18E- 1dd1	8-19-54	48	-	-	44	10	6	3.1	157	14	1	-	1.2	0.06	-	151	22	8	0.2	0	7.7	311	40
16.	1S-18E- 2dd1	8-19-54	50.5	-	-	53	11	5	0.8	190	13	1	-	5.0	0.07	-	178	22	6	0.2	0	7.5	368	36
17	1S-18E-13dd1	8-19-54	49.5	-	-	48	11	5	0.8	174	13	1	-	4.3	0.00	-	165	22	6	0.2	0	7.7	341	.36
18	1S-18E-14aa1	8-19-54	51	-	-	50	11	6	0.8	181	13	1	-	5.0	0.09	-	170	22	6	0.2	0	7.7	340	43
19	1S-18E-23ab1	8-19-54	54	-	-	49	12	6	0.8	186	13	1	0	5.6	0.07	-	172	19	6	0.2	0	7.7	363	.43
20.	1S-19E- 1cc1	10- 8-54	52	-	-	36	12	23	1.6	171	10	15	0	12	0.00	-	139	0	26	0.8	0.02	7.2	408	92
**21	1S-19E- 3cc1	11- 6-54	52	18	-	40	11	5	1.2	173	13	2	0.1	4.0	0.38	183	145	3	6	0.1	0	8.4	302	33
*22	1S-19E- 3dd2	7-30-54	60	40	0.03	77	11	10	-	234	14	2	1.0	4.0	-	276	236	-	-	-	-	7.4	-	.63
23	1S-19E- 5ac1	10- 8-54	52	-	-	57	12	4	0.8	209	13	3	-	3.7	0.00	-	192	20	4	0.1	0	7.5	397	25
24	1S-19E- 8cd1	10- 8-54	48	-	-	44	10	4	0.8	162	16	2	-	3.1	0.00	-	151	18	6	0.2	0	7.6	330	22
25	1S-19E-13aa1	10- 8-54	51	-	-	41	21	7	1.6	219	17	3	-	3.1	0.00	-	189	14	7	0.2	0	7.8	417	35
*26.	1S-19E-13bdS1	7-30-54	53	24	0.07	54	18	10	0	200	18	3	1.0	1.8	-	230	209	-	-	-	-	7.6	-	.48
27	1S-19E-20bc1	9- 9-54	51.5	-	-	47	11	6	Tr	174	15	1	-	4.3	0.00	-	162	20	7	0.2	0	8.0	357	.38
*28	1S-19E-22aa1	7-29-54	48	24	0.04	46	12	-	-	140	14	-	0.2	0.8	-	-	164	-	-	-	-	7.9	-	-
29	1S-19E-22bbb1	10- 2-70		38	0.10	63	18	14	3	291	17	6	3	0.0	0.05	-	-	-	-	0.4	-	7.5	502	61
30	1S-19E-22ca1	10- 8-54	47	-	-	40	12	5	0.8	160	15	1	-	1.9	0.01	-	149	18	6	0.2	0	7.8	311	31
**31	1S-20E-17db1	9- 9-54	58	16	-	43	16	7	2.2	206	23	3	2	0.3	0.06	208	173	4	8	0.2	0	7.7	370	27
**32	1S-20E-19ac1	9- 9-54	51	32	-	65	34	17	1.8	355	23	5	2	6.2	0.02	368	302	1	11	0.4	0	8.4	605	61
33	1S-20E-22dcc1	10- 2-70		5	2.42	37	9	5	0	142	16	1	3	0.0	0.04	-	-	-	-	0.2	-	8.2	259	53
*34	1S-20E-33ddS1	2-15-45	36	0	13	16	2.8	-	-	52	5	9	0	-	-	162	51	9	-	-	-	7.2	-	20
**35	2S-20E- 1ac2	10-26-54	51	21	24	67	16	8	1.9	281	17	2	0.3	3.3	0.11	274	233	3	7	0.2	0	7.6	472	42
**36	2S-20E- 1ac2	10-29-54	51	23	-	67	15	8	2.0	281	18	2	0.2	3.3	0.10	251	228	0	7	0.2	0.03	7.6	473	40
	Surface Water																							
	Big Wood River at Hailey	9- 9-54	53.5	-	-	42	11	6	0.4	160	14	1	-	1.9	0.00	-	150	19	7	0.2	0	8.2	324	.40
	Big Wood River at diversion dam above Glendale Bridge	9- 9-54	58	-	-	41	14	5	-	160	15	2	-	1.9	0.00	-	160	29	7	0.2	0	8.4	339	29
	Big Wood River at Stanton Crossing	9- 9-54	66	-	-	48	12	7	0.4	188	12	1	0	1.9	0.01	-	169	15	8	0.2	0	8.2	365	54
	Silver Creek in NW¼ NW¼ S. 20, T 1S R 19E	10- 8-54	60	-	-	57	14	6	1.2	217	14	2	-	2.5	0.00	-	200	22	6	0.2	0	8.2	415	38
	Silver Creek in SE¼ SE¼ S. 26, T 1S, R 20E	9- 9-54	60.5	-	-	48	16	6	0.4	189	15	1	-	2.5	0.05	-	186	31	7	0.2	0	8.7	405	.38

* Analysis by Idaho Department of Health

** Analysis by U S Geological Survey

total dissolved solids (TDS) than the water in the Big Wood River. Since much of the flow of Silver Creek is the result of irrigation water recharging the ground-water system, it is readily apparent that irrigation water percolating through the soil will dissolve many chemicals present in the soil. Since most fertilizers contain a high percentage of nitrate, it is reasonable to assume that at least part of the nitrates in Silver Creek water is due to application of fertilizers to the soil.

Most of the major diversions out of the Big Wood River are located upstream from Glendale Bridge. After much of this water has been applied to the land, a certain percentage of it containing a higher concentration of various ions, returns to the channel of the Big Wood River as underflow. This return flow occurs in the reach between Glendale Bridge and Stanton Crossing. This explains the higher concentration of certain ions in the water of the Big Wood River at Stanton Crossing than at the Glendale Bridge.

Water temperature, as shown in table 3, increases in a downstream direction in the Big Wood River ranging from 53.5° F at Hailey to 58° F at Glendale Bridge to 66° F at Stanton Crossing. In Silver Creek temperature appears to remain relatively close to 60° F in the upper reaches.

Natural waters contain varying amounts of dissolved solids, which when dissociated, form charged units called ions. A measure of the degree of ionization of water is accomplished by determining the electrical conductivity (E.C.) of a water sample. Electrical conductivity values, measured in units of reciprocal resistance called micromhos (mmhos) and referred to an index temperature of 25° Centigrade (°C), range from a low of 324 mmhos in the Big Wood River at Hailey to a high of 415 mmhos in Silver Creek in the NW¼ NW¼ of Section 20, Township 1 South, Range 19 East, B.M.

GROUND WATER

Ground-water quality varies little throughout the area. Water from the deeper artesian system is virtually indistinguishable from that of the unconfined, water table system.

The ground water in the study area is a calcium-bicarbonate type, is generally less basic than the surface water and is higher in nitrate, calcium, chloride and potassium. Ground water in the basin has pH values ranging from 7.2 to 8.4 indicating slightly alkaline conditions.

The temperature of the ground water ranges from 36° F (1S 20E 33ddS1) to 63° F (2N 19E 28dcS1) with the exception of a hot water area located in the SW¼ of Section 16, Township 1 South, Range 20 East, B.M. This area has been developed by three wells containing water with temperatures ranging from 91° F to 103° F. These three wells are artesian, but have low head at land surface. Electrical conductance values of the ground water in the area range from 247 mmhos to 605 mmhos.

The suitability of water for domestic and agricultural purposes was determined using two guidelines: the sodium adsorption ratio (SAR) (Hem, 1970, p. 228) and an "alkali factor" (Pomeroy, 1962). The sodium adsorption ratio, which relates percentage of sodium to the other major cations, calcium and magnesium, is plotted versus E.C. (fig. 23) resulting

SODIUM ADSORPTION RATIOS

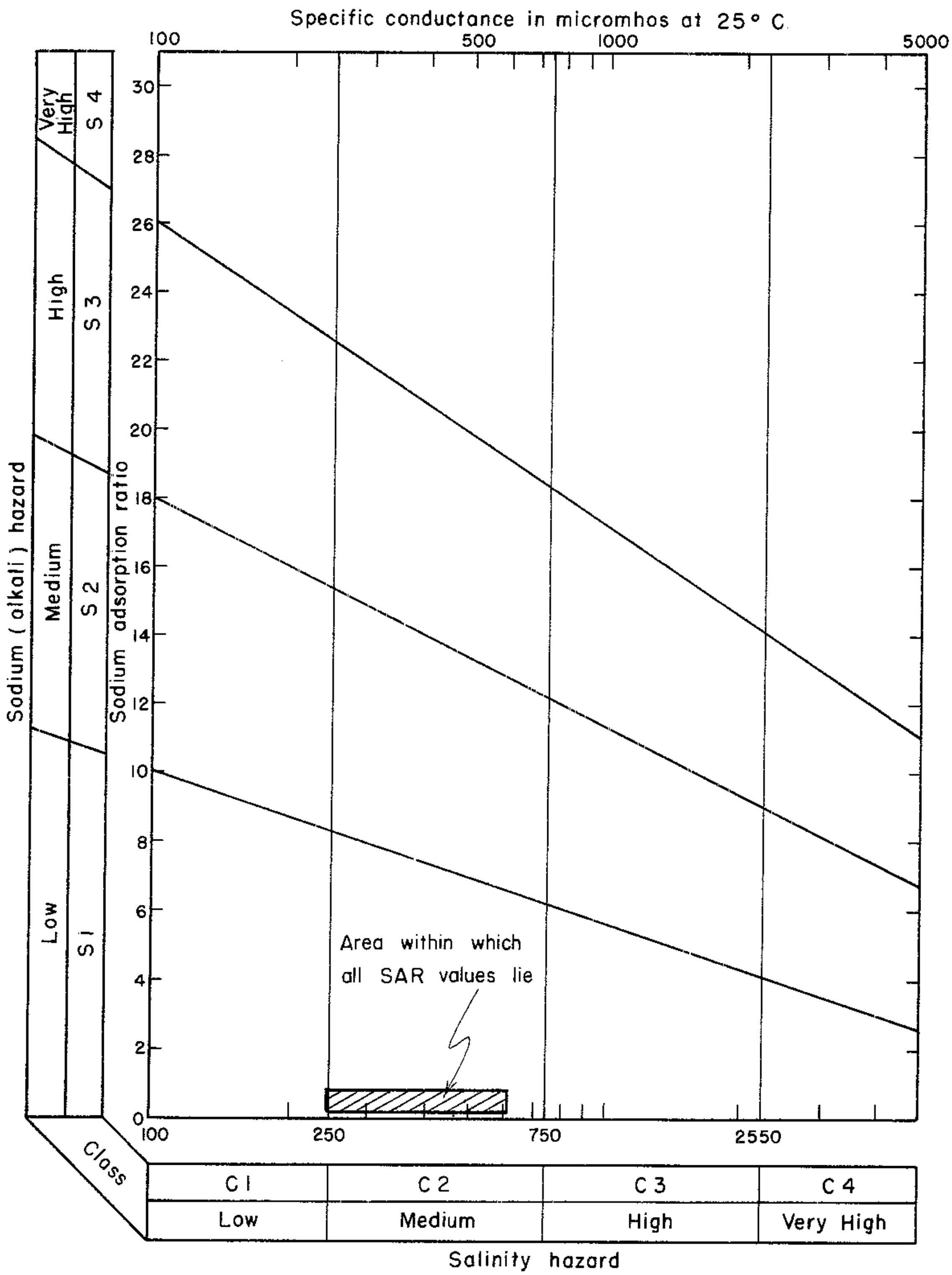


FIGURE 23. Classification of ground water for irrigation in the Big Wood River-Silver Creek area.

in a diagram which shows the salinity and sodium hazard present in any water sample. All water in the study area is of low sodium hazard and medium salinity hazard, making it suitable for nearly all crops.

The "alkali factor", a term used to describe the ratio of sodium to chloride plus sulfate, is another indicator of the suitability of water for domestic and agricultural uses, but is perhaps best suited for evaluation of irrigation waters. The range of values for all ground water in the study area is from 0.20 to 1.00, the average being 0.43. This is considered acceptable for all domestic and agricultural uses. Surface water averages only slightly lower, at 0.40. Total dissolved solids (TDS) in the ground-water system range from a low of 162 parts per million (ppm) to a high of 368 ppm. From the limited data available, it seems apparent that there is some increase in TDS in a down-gradient direction.

WATER RIGHTS

The Department of Water Administration has 103 active permits and licenses for appropriation of ground water in the study area. This represents a potential withdrawal of 353 cfs of ground water for the irrigation of 26,711 acres of land (fig. 24). Applications have been received for an additional 20 cfs on 1,672 acres, suggesting a possible future total withdrawal of 373 cfs for irrigation of 28,383 acres. The primary interest in development has been in Township 1 South, Range 19 East, B.M., although development in the lowland areas of Township 1 South, ranges 18 and 20 East has been extensive. The greatest activity in filing for ground water was in 1959, when 12 applications were received.

Eighteen active permits and licenses for appropriation of surface water from Silver Creek exist which provide for diversion of 88.13 cfs (fig. 25). There are 34 court decreed water rights on Silver Creek providing for diversion of 142.2 cfs.

SUMMARY AND CONCLUSIONS

The Big Wood River-Silver Creek study area contains a complexly interconnected hydrologic system. The relationship between the surface- and ground-water systems is such that any stress on one system will result in an effect on the other.

The aquifers in the basin are bounded on all sides by rocks of low permeability except at the inlet near Hailey and at the outlets at the southeast and southwest corners of the study area. The primary aquifer in the basin is a series of fluvioglacial sediments from which water is obtained under both confined and unconfined conditions. Wells drilled into the consolidated rocks surrounding the basin yield very little water.

Recharge to the aquifers in the study area is from precipitation, loss from the Big Wood River and irrigation canals, percolation of water applied in excess of consumptive use of crops and underflow from the Big Wood River Basin above Hailey. The total annual amount of inflow to the basin which includes recharge and surface water is estimated at 650,000 acre-feet.

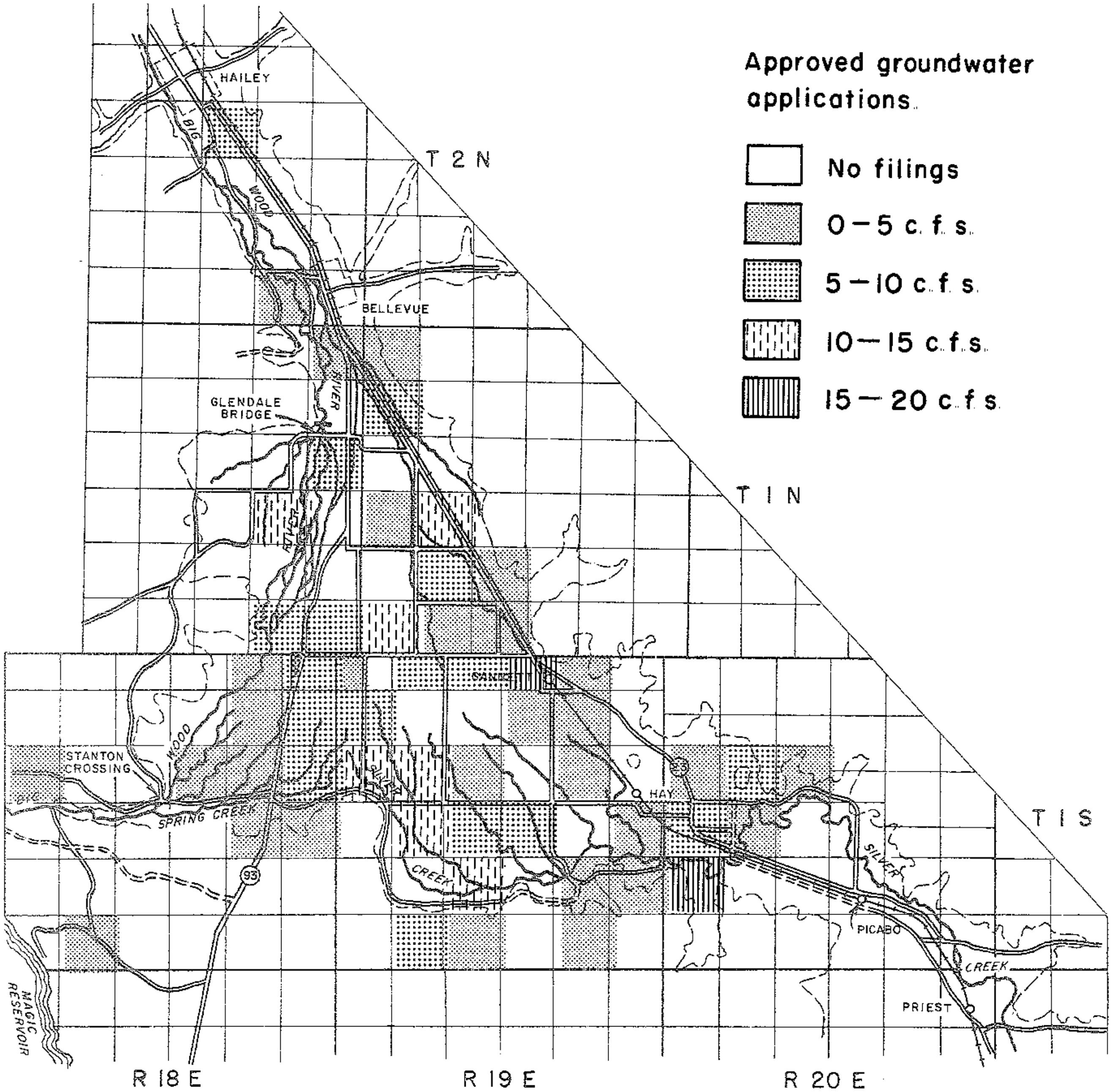


FIGURE 24. Approved ground-water applications, Big Wood River-Silver Creek area.

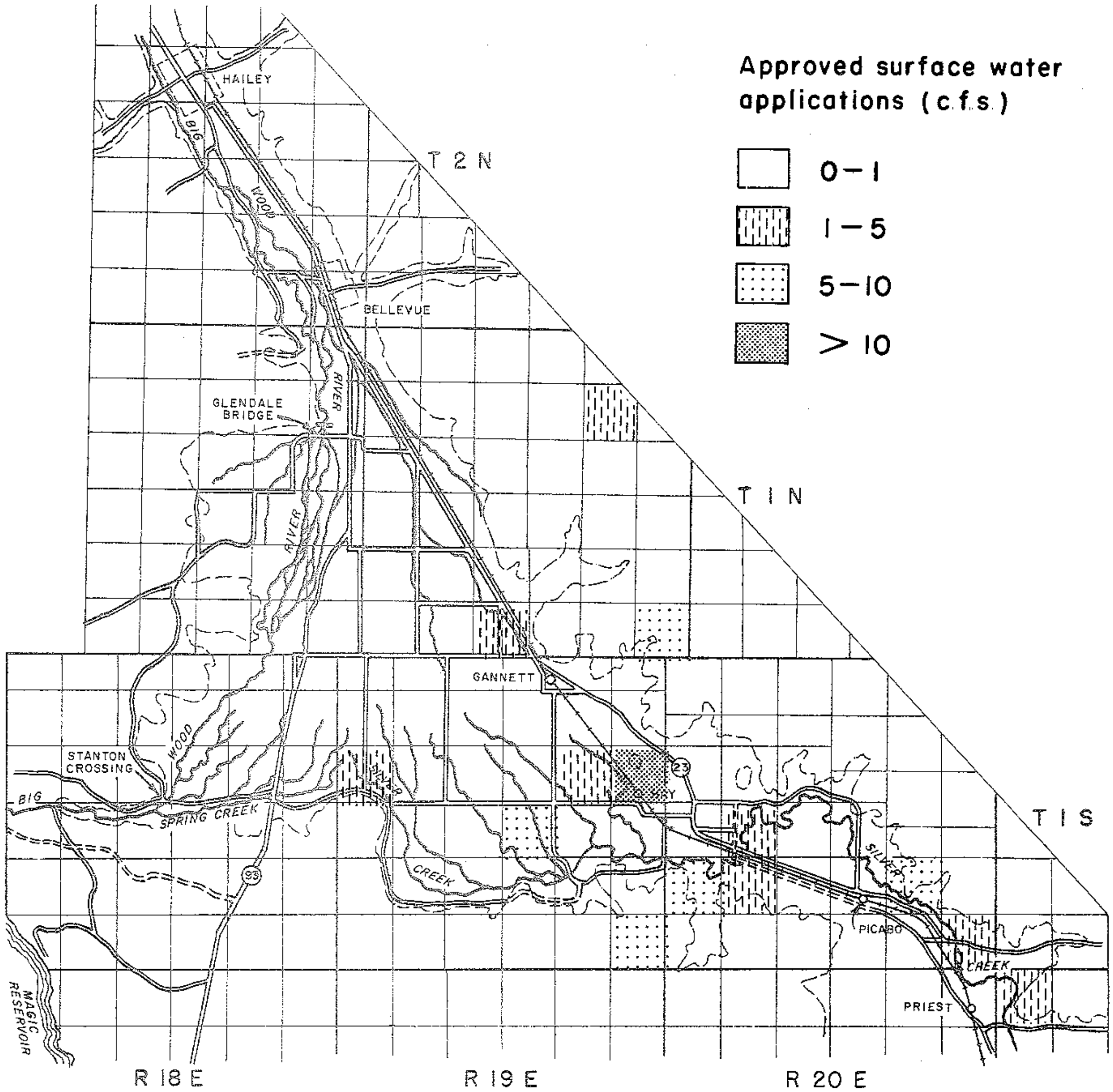


FIGURE 25. Approved surface-water applications, Big Wood River-Silver Creek area.

Discharge from the basin occurs as surface water outflow, evapotranspiration, and ground-water underflow. Because there has been no long term ground-water level decline which would indicate a change in the amount of ground water in storage, it is believed that the system is in a state of dynamic equilibrium. It is, therefore, concluded that discharge from the basin is approximately equal to inflow, or 650,000 acre-feet annually.

Ground- and surface-water quality is good in the area; the water being suitable for nearly any use feasible in the basin.

The Department of Water Administration has on file applications for the appropriation of ground water and licensed water rights for diversion of 373 cfs of ground water and 163 cfs of surface water.

It is further concluded that: (1) the present level of development has not adversely affected the water resources of the basin, and (2) additional large scale development could adversely effect water levels in existing wells. The amount of decline would be dependent upon the quantity of water withdrawn and the consumptive use of the crops grown. The net amount of water removed from the aquifers would only be that consumptively used by vegetation and that amount leaving as surface runoff.

It is recommended that no restrictions on ground- or surface-water development be initiated at this time. It is also recommended that any future studies of the basin attempt to determine the aquifer thickness at Hailey and at the southeast and southwest outlets by geophysical methods in order to more accurately determine inflow and outflow characteristics.

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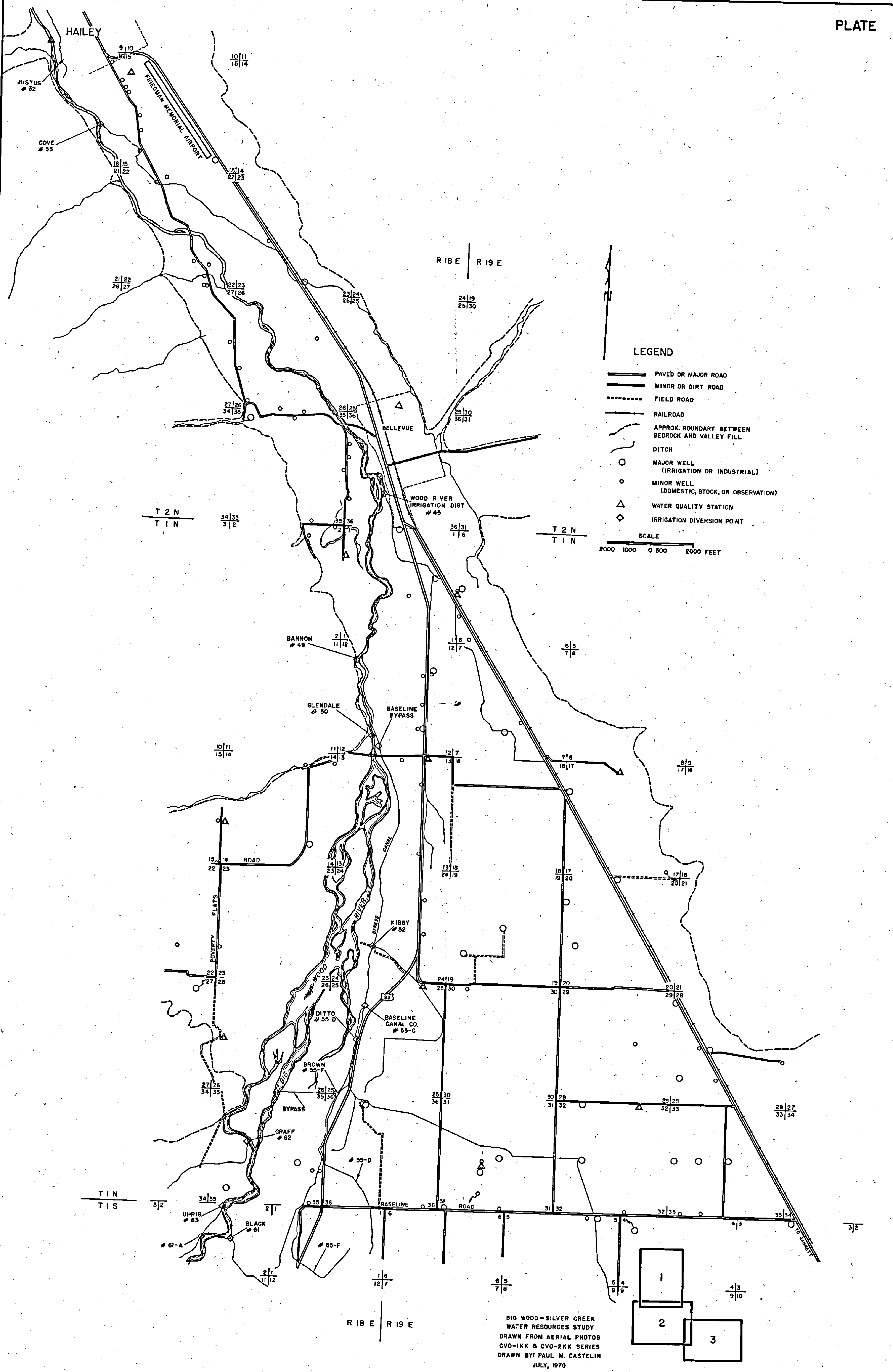


BIG WOOD - SILVER CREEK
WATER RESOURCES STUDY
DRAWN FROM AERIAL PHOTOS
CVO-1KK & CVO-2KK SERIES
DRAWN BY: PAUL M. CASTELIN
JULY, 1970

PLATE 2

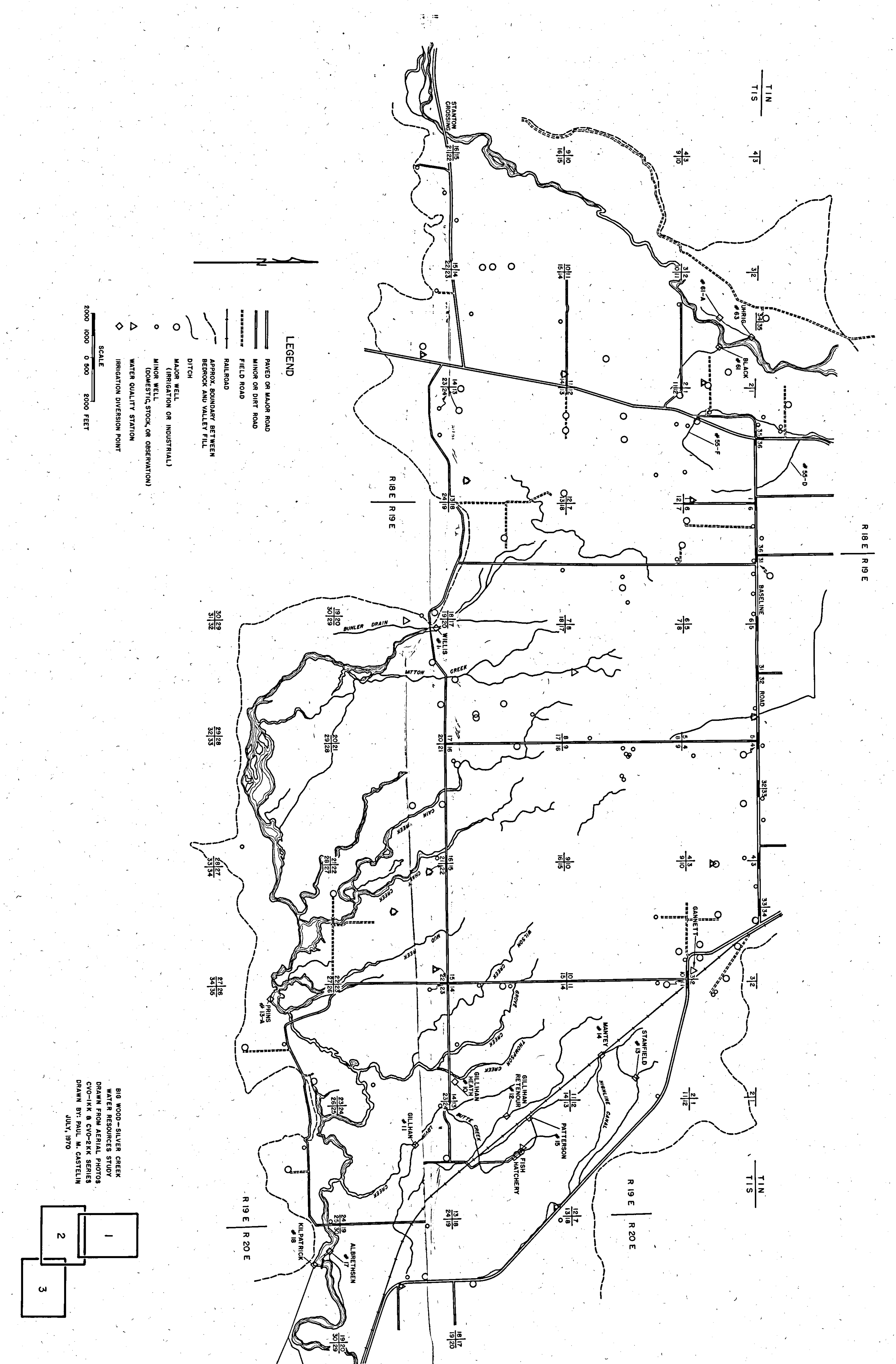
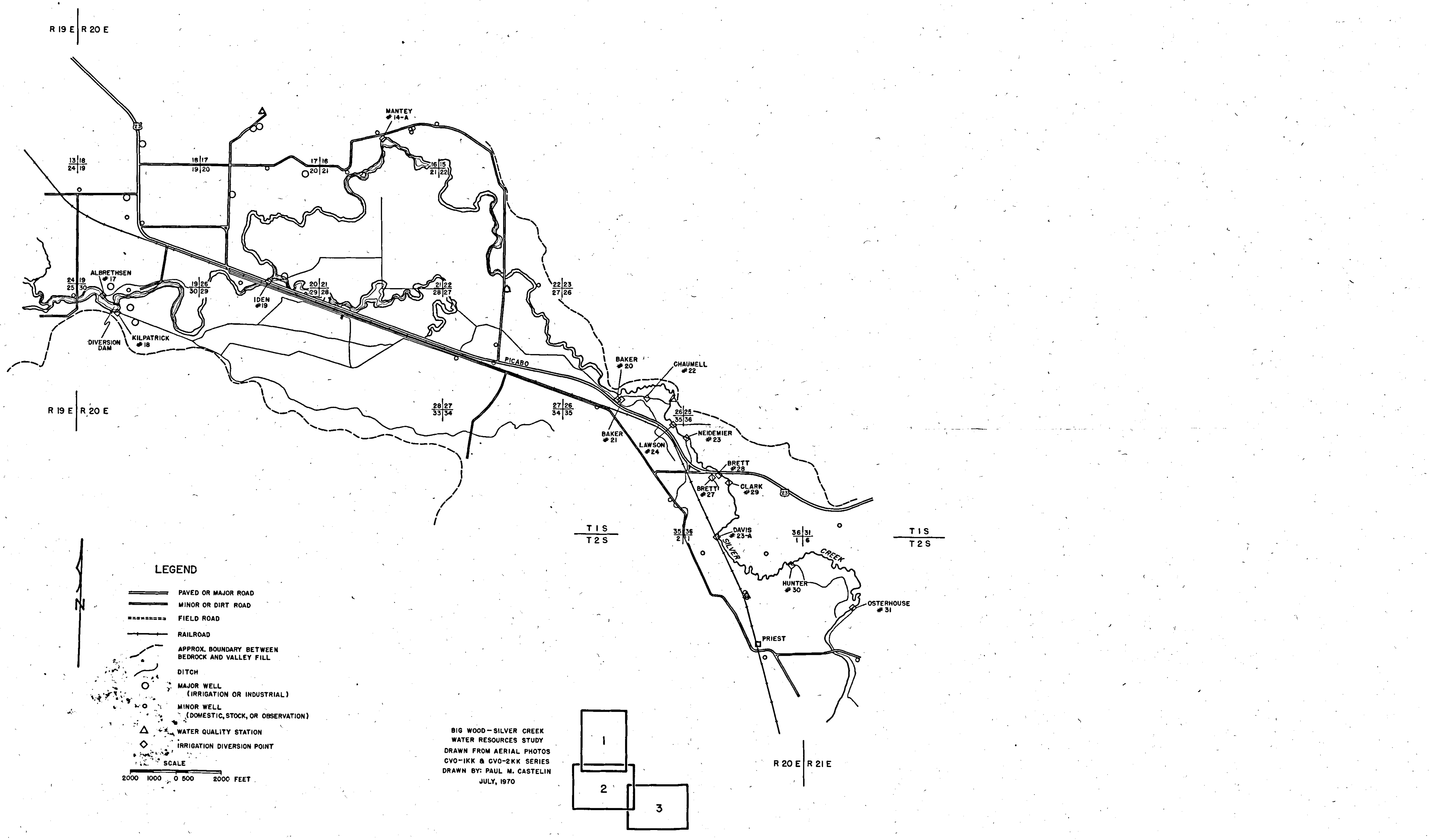

LEGEND
PAVED OR MAJOR ROAD
MINOR OR DIRT ROAD
FIELD ROAD
RAILROAD
APPROX. BOUNDARY BETWEEN BEDROCK AND VALLEY FILL
DITCH
MAJOR WELL (IRRIGATION OR INDUSTRIAL)
MINOR WELL (DOMESTIC, STOCK, OR OBSERVATION)
WATER QUALITY STATION
IRRIGATION DIVERSION POINT
SCALE
2000 1000 0 500 2000 FEET
BIG WOOD—SILVER CREEK
WATER RESOURCES STUDY
DRAWN FROM AERIAL PHOTOS
CVO-1KK & CVO-2KK SERIES
DRAWN BY: PAUL M. CASTELIN
JULY, 1970
STANTON CROSSING
T 1 N
T 1 S
R 18 E
R 19 E
R 20 E
BASELINE ROAD
BUHLER DRAIN
WILLIS
PATTON CREEK
CAIN CREEK
CHASE CREEK
MUD CREEK
WILSON CREEK
GROVE CREEK
THOMPSON CREEK
BUTTE CREEK
LOVING CREEK
HIGHLINE CANAL
GANNETT
FISH HATCHERY
UHRIG #63
#61-A
BLACK #61
#55-F
#55-D
PRINS #15-A
MANTEY #14
STANFIELD #13
GILLHAN HEATH #10
GILLHAN RETENOUR #12
GILLHAN #11
PATTERSON #15
KILPATRICK #18
ALBRETHSEN #17
SHEET 2 OF 3
1
2
3

PLATE 3



SHEET 3 OF 3