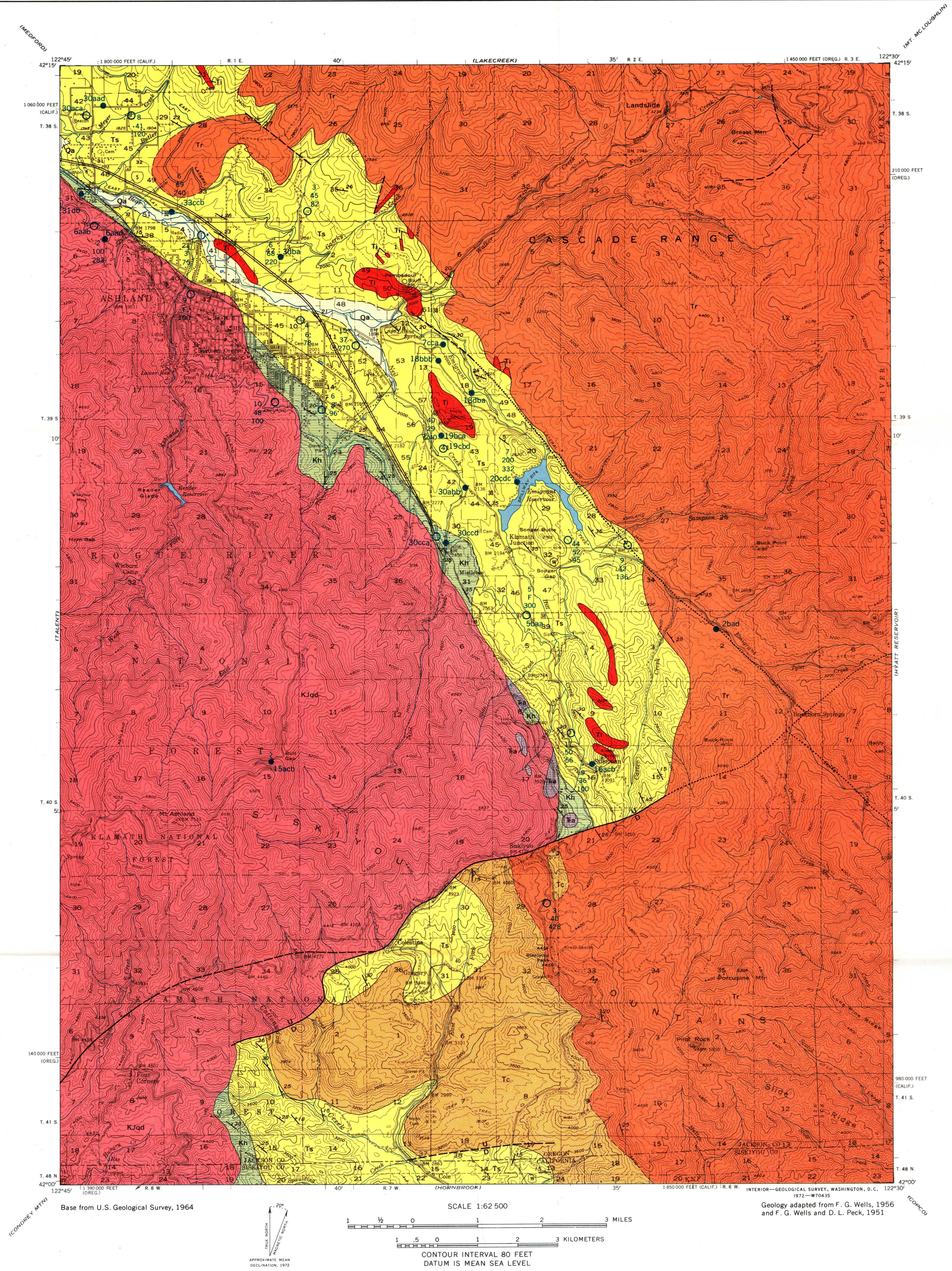
PREPARED IN COOPERATION WITH THE
OREGON STATE ENGINEER AND JACKSON COUNTY



GEOHYDROLOGIC MAP

EXPLANATION

QUATERNARY — *Pleistocene and Holocene*

Qa — Alluvium

Sand, gravel, and silt deposited by Bear Creek and tributaries. Poorly sorted, cross-bedded, gray and blue-gray sand; subrounded to subangular cobbles; brown, tan, and yellow silt. Maximum thickness about 30 feet. Some local occurrences in addition to those shown on map

Permeable zones in places, but most are too thin, above water table, or too shallow to develop for water without possibility of inducing pollution (see current well-drilling regulations of the State Engineer)

TERTIARY — *Pliocene(?)*

Ti — Intrusive rocks

Diorite and gabbro sills and basalt and rhyolite dikes. Intrude nonmarine sedimentary rocks

Verified occurrences lie above water table. Intrusive rocks penetrated below water table would probably yield less than 3 gpm (gallons per minute) to wells

Oligocene(?)

Tr — Roxy Formation

Mostly volcanic flows, with various textures; color ranges from black through purple to pink to white. Locally contains layers of tuff and volcanic breccia

Capable of yielding 10 gpm or more to wells where sufficient saturated thickness is penetrated. Water is probably of suitable chemical quality for most uses

Eocene

Tc — Colestin Formation

Water-deposited tuff and conglomerate, containing a few interbedded volcanic flows

Capable of yielding more than 10 gpm to wells where sufficient thickness lies below the water table. Water is probably of suitable chemical quality for most uses

Ts — Nonmarine sedimentary rocks

Buff to dark-gray sandstone, claystone, and shale, with some tuff and conglomerate. Formerly assigned to the marine Umpqua Formation as revised by Wells and Peck (1961)

Generally capable of yielding 5–15 gpm to wells, but yields range from less than 1 to more than 50 gpm. Water is usually of suitable chemical quality, but contains some constituents in excessive quantities in a few areas

CRETACEOUS — *Upper Cretaceous*

Kh — Hornbrook Formation

Greenish to buff sandstone with layers of conglomerate containing pebbles of quartz diorite, gneiss, and greenstone. Some wells in the valleys probably pass through the Eocene nonmarine sedimentary rocks and penetrate this unit

Capable of yielding 5–10 gpm to wells in some areas, but in others yields less than 3 gpm. Chemical quality of water generally adequate

JURASSIC OR CRETACEOUS — *Upper Jurassic or Lower Cretaceous*

KJqd — Quartz diorite

Light-gray, medium-grained rock composed of sodic plagioclase and quartz with minor amounts of hornblende or biotite. Yield to wells commonly 1–5 gpm. Chemical quality of water good

TRIASSIC — *Upper(?) Triassic*

℞a — Applegate Group

Mostly altered lava flows, flow breccias, pyroclastic rocks, and gneissic crystalline rocks. Only a few exposures in Ashland quadrangle

Above water table. No known wells

Contact

Dashed where approximately located

U D

Fault

Dashed where approximately located; dotted where concealed. U, *upthrown side;* D, *downthrown side*

28

Strike and dip of sedimentary beds

7cca

Well and number for which water analysis is listed in table

6aab

Well and number for which log shown in this report

15acb

Spring and number for which water analysis is listed in table

10 Reported yield, in gpm
48 Depth to water, in feet
100 (F indicates level is above land surface)
Total depth, in feet

Well and characteristics. See well characteristics map for summary by sections

CHEMICAL ANALYSES OF WATER

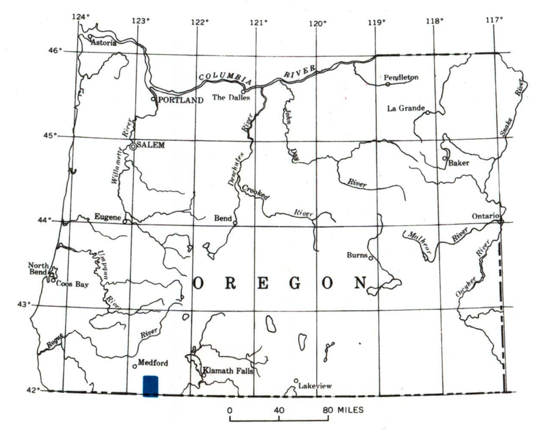
[Analyses by U.S. Geological Survey, except as noted]

Well or spring number	Owner or user	Principal geologic source	Depth interval of water-bearing zone (feet)	Date of collection	Temperature °C	Temperature °F	Milligrams per liter: Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids[1]	Hardness as $CaCO_3$	Specific conductance (micromhos per cm at 25°C)	pH	Sodium-adsorption-ratio (SAR)
38S/1E–30aad	R.P. Busey	Ts	90–310	5–27–69	......	......	27	....	66	24	26	1.0	366	0	15	4.0	0.3	6.2	0.10	350	263	576	7.6	0.7
31db	Jackson Hot Spring	Ts	(spring)	4–22–52	35.0	95	65	[2]0.07	2.8	1.4	95	1.2	11	36	26	80	2.0	.2	2.9	318	13	460	9.3	3.7
33ccb	Walter Hamby	Ts	69–240	5–27–69	......	......	26	....	71	25	29	1.0	389	0	13	9.0	.3	4.5	.15	370	280	610	7.7	.8
39S/1E– 3dba	H.S. Merrick	Ts	68–220	5–27–69	......	......	21	....	67	22	16	1.6	338	0	14	1.5	.3	5.9	.00	315	258	531	7.5	.2
6aad	K.T. Krumdieck	KJqd	100–240	5–28–69	......	......	42	....	34	21	6.3	3.3	197	0	12	4.5	.2	9.4	.16	230	172	355	7.4	.2
39S/2E– 7cca	Lithia water	Ts	?	5–28–69	......	......	81	[2]13	192	131	1,800	73	3,410	0	22	1,570	.3	36	74	[3]5,670	1,020	8,140	7.2	24
18bbb	Chisum Ranch	Ts	33–145	6–10–69	......	......	25	....	49	17	36	1.2	311	0	9.6	35	.2	.0	.18	295	192	487	7.6	.9
18dba	R.L. Wyant	Ts	15–209	5–27–69	......	......	35	....	50	25	32	1.5	353	0	8.6	2.5	.2	1.6	.13	331	228	536	7.8	.9
19bca	W.V. Person	Ts	46–240	6–11–69	14.0	57	14	....	37	14	153	1.4	497	0	18	33	1.3	3.6	.82	521	150	853	7.7	5.4
20cdc	Emigrant Park	Ts	240–310	6–10–69	......	......	23	....	96	21	113	1.8	489	0	18	117	.2	1.4	.33	633	326	1,070	7.4	2.7
30abb	G.L. Bullen	Ts	30–125	5– 8–51	12.0	54	10	.03	1.2	.3	149	3.7	271	52	17	9.5	.9	.4	1.25	378	4	578	9.0	32
30ccd	A.H. Warren	Kh	21–105	5–10–69	......	......	23	....	78	16	31	1.2	243	0	118	8.5	.3	.3	.43	397	260	608	7.4	.8
40S/1E–15acb	Bull Gap Picnic Area	KJqd	(spring)	6–26–63	......	......	19	.03	3.0	.3	2.8	.4	20	0	.2	.2	.1	.2	......	39	9	31	6.3	.1
40S/2E– 2bad	E.D. Hopkins	Qa	47	6–11–69	......	......	60	[2]5.8	74	25	15	.7	370	0	7.0	7.5	.1	.0	.08	371	288	576	6.8	.4
5baa	Frank Bedogne, Jr.	Kh	132–300	6–11–69	13.5	56	26	....	37	21	126	3.5	520	0	18	10	1.1	.0	1.9	501	179	801	7.4	4.1
16acb	R.O. Rumsey	Kh	52–100	5–29–69	14.0	57	14	....	41	16	56	2.3	280	0	58	2.5	.3	.8	.22	329	168	535	8.1	1.9
....	Ashland Munic. Supply[4]	....	....	8–14–69	......	......	18	.03	8.1	2.0	3.3	.6	31	0	2.6	2.4	.1	.25	......	54	28	......	7.4	.3

[1]Calculated values with bicarbonate (HCO_3) recomputed as carbonate.
[2]Includes dissolved and suspended iron.
[3]Includes 5.8 mg/l of lithium (Li).
[4]Analysis by Charlton Laboratories, Portland, Oreg.

INTRODUCTION

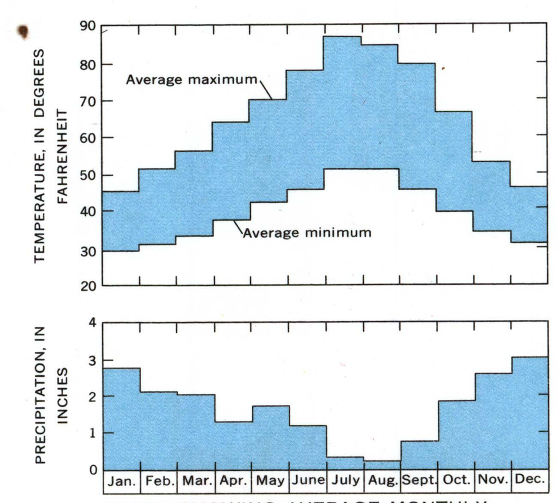
This hydrologic atlas presents ground-water information in a form that will enable water users, potential water users, and planners to estimate the likelihood of obtaining ground water in adequate quantity and suitable quality at desired locations.



INDEX MAP SHOWING LOCATION OF REPORT AREA

The Ashland quadrangle is in the southwestern part of Oregon along the Oregon-California border. The population of the area is concentrated in and near the city of Ashland in the upper Bear Creek valley, about 20 miles above the confluence of Bear Creek with the Rogue River. The Siskiyou Mountains border the valley on the south and west, and the Cascade Range borders the valley on the east.

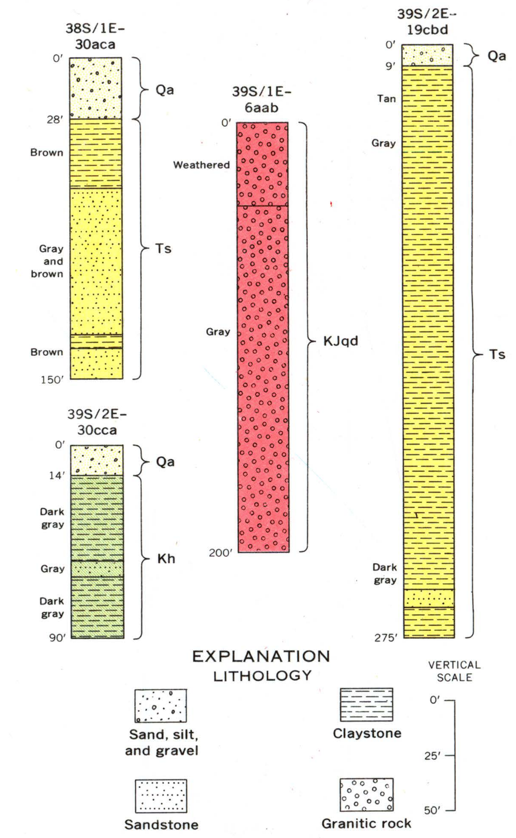
Most of the population of approximately 15,000 resides in valley areas at altitudes of 1,800 to 2,000 feet, where the climate is relatively mild. Here, annual precipitation has varied from 10 to 30 inches, and averages about 20 inches. In some of the mountainous areas annual precipitation exceeds 30 inches. The seasonal distributions of precipitation and temperatures are shown in the graphs, which provide a basis for estimating seasonal demands for water for domestic or agricultural uses. The economy is dependent on tourism, recreation, fruit packing, lumber, and wood products.



GRAPH SHOWING AVERAGE MONTHLY TEMPERATURE AND PRECIPITATION AT ASHLAND
(Based on data of U.S. Weather Bureau)

Highline canals at 2,000–2,400 feet altitude on either side of the valley provide water for agricultural use and for municipal use in the city of Ashland. The water is obtained from several streams and reservoirs in the Cascade Range; the supply system is split near the upper end of the valley to serve the western highline canal.

Outside the area served by the Ashland municipal water system, domestic water supplies are derived almost entirely from privately owned wells. There are no significant withdrawals of ground water for industrial, municipal, or agricultural use.



LOGS OF SELECTED WELLS

GEOHYDROLOGY

The surficial distribution of the geologic units is shown on the geohydrologic map. Some details of the geology that are important to the development of ground water are obscured locally or are not mappable at the published scale. Although alluvium is somewhat more widespread than shown, it is mostly thin and unsaturated where not mapped. The alluvium occurs mostly in low areas near streams, where there have been few housing or other developments by man. Alluvium serves as an aquifer for only a few wells. (See map explanation.) Fracturing and depth of weathering in the quartz diorite may greatly affect well performance, but the areas of fractures and weathering were not mapped.

Intrusive rocks and the Applegate Group have limited occurrence or lie above the water table; therefore, they do not serve as aquifers within the area.

The Roxy and Colestin Formations are generally permeable, but they occur largely in high or rugged areas where depth to water may be great or where there has been no demand for water.

Much of the quartz diorite lies in rugged areas, but the pressure of home development near Ashland has resulted in an increasing number of water wells being drilled in this formation.

The nonmarine sedimentary rocks and the Hornbrook Formation underlie the relatively low, smooth terrain that has been populated and developed first. Thus, these formations have been most extensively developed for ground water.

Most wells are completed in the same formations shown on the map, which represents only the surface geology. However, some of the deeper wells, particularly those on the west side of the valley, may completely penetrate the nonmarine sedimentary rocks to obtain water from the underlying Hornbrook Formation. Logs of selected wells are shown below. Wells and springs used in this report are numbered according to the diagram below.

The aquifers are recharged by precipitation that infiltrates the land surface. Beneath some higher areas, water may accumulate in perched or semiperched zones above a main water table, but in the lower areas water occurs in a single zone of saturation even though the permeability within the zone varies. Movement of ground water is downvalley, in the same general direction as the surface drainage.

Trends of ground-water levels are estimated from records of an observation-well network maintained by the Oregon State Engineer. The well in this network that is nearest the study area is one owned by the city of Phoenix, 8 miles northwest of Ashland. The well is completed in nonmarine sedimentary rocks and is pumped heavily. Its water level fluctuates 6 to 10 feet seasonally and has shown a slight overall decline since records began in 1960. Problems of significant regional water-level changes are unlikely near Ashland, where ground-water development is mostly by domestic wells. However, water levels in some individual wells completed in poorly permeable formations could show long-term declines.

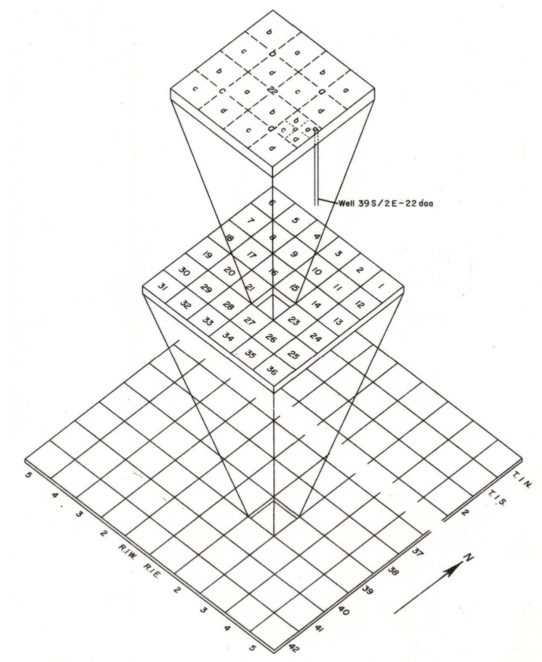


DIAGRAM SHOWING WELL- AND SPRING-NUMBERING SYSTEM

CHEMICAL CHARACTER OF THE GROUND WATER

Alluvium commonly yields water of calcium bicarbonate type. The water is very hard, but dissolved solids usually are not excessive.

Although no analyses were made of water from the Roxy or Colestin Formation in the Ashland quadrangle, in nearby areas these formations usually yield water with a somewhat higher proportion of sodium and chloride than in the alluvium, and most water is hard or very hard.

The water in the nonmarine sedimentary rocks varies locally in chemical character. In some places it is a calcium bicarbonate water, and in other places it is of a sodium bicarbonate type. Also found is a highly concentrated sodium bicarbonate chloride water, locally known as Lithia water (well 39S/2E-7cca).

The Lithia water was first developed about 1911 from springs and numerous wells and was promoted as having therapeutic values. The water is still piped 3 miles to fountains at the Ashland library and city parks. Lithia-type water appears to be restricted to a small area and may be associated with pegmatite bodies or faulting beneath the sediments.

The chemical character of ground water is summarized by the analyses shown in the table.

FACTORS AFFECTING THE USABILITY OF GROUND WATER

STANDARDS

The Federal Water Pollution Control Administration (1968) recommends drinking-water standards for public supplies that are based on those of the U.S. Public Health Service. Some of the standards that apply to samples listed in the table of chemical analyses include:

Constituent	Recommended permissible limit of concentration, in milligrams per liter
Iron (Fe)	0.3
Sulfate (SO_4)	250
Chloride (Cl)	250
Fluoride (F)	[a]1.2
Arsenic (As)	.05
Nitrate (NO_3) + nitrite (NO_2), expressed as nitrate	44
Dissolved solids	500

[a]Value based on climate in vicinity of Ashland.

Of the constituents listed, excessive iron causes staining of plumbing fixtures and laundry and can give a peculiar taste to the water. Chloride in excess of about 500 mg/l (milligrams per liter) and dissolved solids in excess of 1,000 mg/l give a salty or mineral taste to the water. Sulfate causes permanent hardness of water and in excessive concentrations can have a laxative effect on persons not accustomed to the water. Fluoride is beneficial up to the recommended limit because it retards dental decay, but in concentrations of more than several milligrams per liter can eventually cause darkening or mottling of children's teeth. Large amounts of nitrate can cause methemoglobinemia (blue-baby effect) in infants.

Excessive hardness is undesirable but seldom is cause for rejection of a water supply. Commercial softeners can be used for most supplies. The U.S. Geological Survey uses the following rating for hardness:

Hardness range as $CaCO_3$ (mg/1)	Rating
0–60	Soft
61–120	Moderately hard
121–180	Hard
More than 180	Very hard

Boron in high concentrations has a toxic effect on plants; yellowing of leaves is one symptom. Some plants are more sensitive than others; among the more sensitive are citrus, peaches, apples, pears, and walnuts. Water that contains more than 4 mg/l of boron may be unsuitable even for tolerant crops (Federal Water Pollution Control Adm., 1968, p. 153).

The SAR (sodium-adsorption-ratio) indicates the effect that an irrigation water will have on soil-drainage characteristics. Water with a high SAR value eventually causes clogging of most soils. An SAR of about four is the limit for crops that are sensitive to the effects of soil clogging (Federal Water Pollution Control Adm., 1968, p. 115–117).

LOCAL WATER QUALITY

Only a few samples were analyzed for iron; however, excessive iron is likely to be a problem only in some wells yielding water from alluvium or very shallow nonmarine sedimentary rocks.

Excessive sulfate is not likely to occur. However, obnoxious odors caused by small amounts of hydrogen sulfide have been reported for some wells, but do not necessarily indicate a high concentration of sulfate. Water samples from the Ashland area were not analyzed for hydrogen sulfide.

Excessive chloride probably occurs only near the Lithia area, or along some fault zones.

Concentrations of fluoride and boron are not a problem in the Ashland quadrangle, as they are in places to the northwest in the adjacent Medford quadrangle.

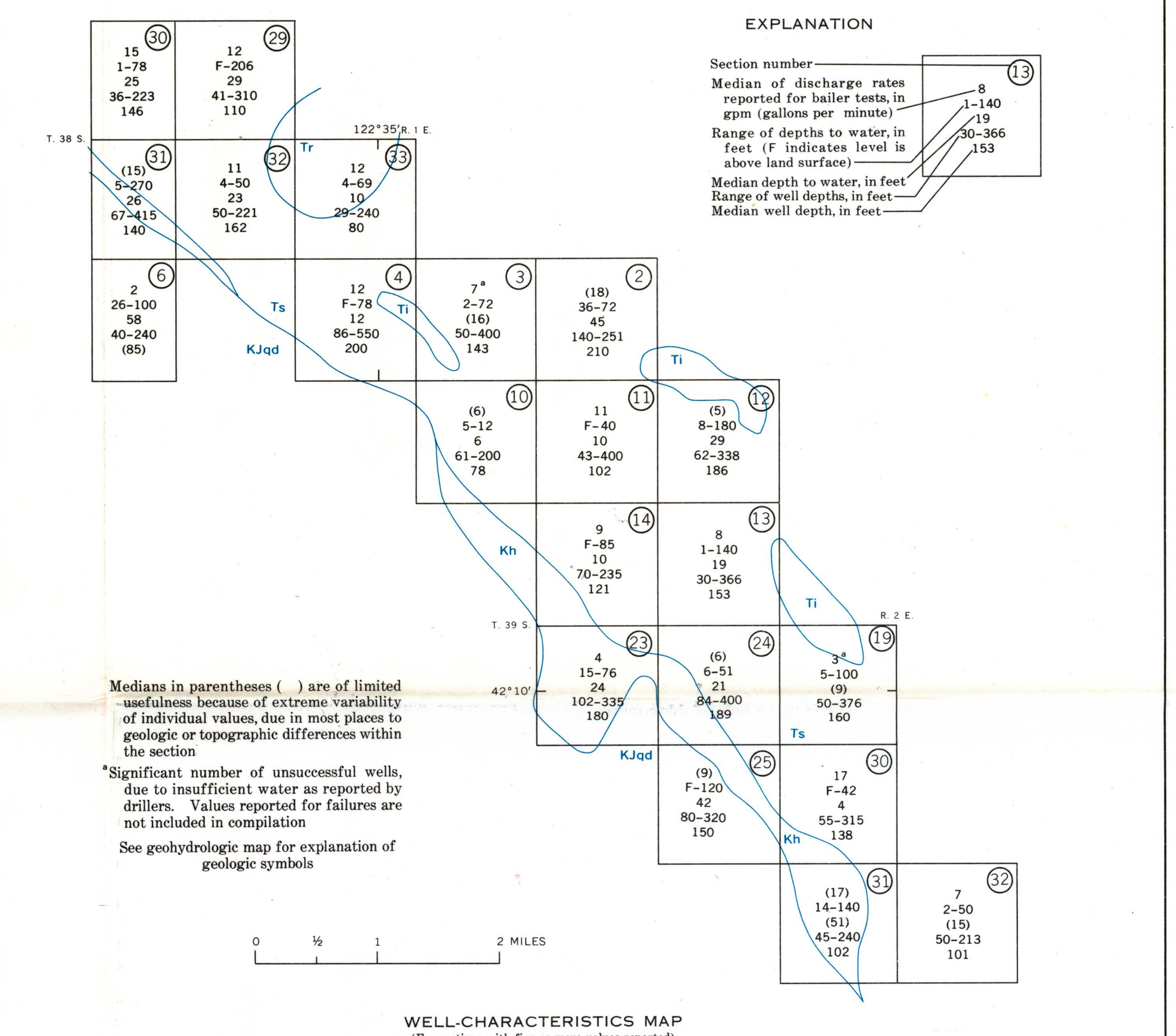
No samples exceeded the nitrate limits. Because high concentrations often result from pollution, however, it may be advisable to make bacteriological checks on water known to have more than about 10 mg/l of nitrate.

Most of the ground water is considerably harder than the Ashland municipal supply (28 mg/l, or 2 grains per gallon). Users of ground water may find commercial softeners to be beneficial.

Elsewhere in Oregon, sodium bicarbonate water is more likely to contain arsenic than are other types of water, but arsenic in samples from the Medford area to the northwest did not exceed recommended limits. Near Ashland, only the Lithia water was analyzed for arsenic, and no measurable amount was found.

All waters likely to be used for irrigation are suitable for that purpose because their sodium adsorption ratios and specific-conductance values are low.

WELL-CHARACTERISTICS MAP



WELL-CHARACTERISTICS MAP
(For sections with five or more values reported)

The map, which is the same scale as the geohydrologic map, covers only the northwest quarter of the quadrangle, because of the lack of sufficient data for wells in the remainder of the area. The map is intended to help the prospective owner or driller of a well to estimate probable depths and performance to be expected within the sections shown. The proposed location should first be determined from the geohydrologic map before using the well-characteristics map. If the location is near the edge of a square-mile section and if data from adjacent sections reflect similar geologic conditions, the adjacent data can be used to refine judgment of the expected results.

The map is based on about 250 water-well drillers' reports submitted to the Oregon State Engineer from 1955 through August 1969. Reports of wells indicated to be abandoned after drilling and reports containing ambiguous data were not used.

Most wells in the Ashland area are constructed similarly—6-inch diameter, without casing opposite the aquifers, and bailer tested for productive capacity. Thus, data from most wells reflect comparable conditions and may be used to show the probable ground-water potential by area.

Locations of wells commonly have been reported by the drillers on the basis of township, range, and section or donation land claim; without extensive checking in the field, precisely known well locations within a section are few.

The median is the value for which half of the reported values are greater and half are less. The usefulness of the median can be shown with an example, as in sec. 13, T. 39 S., R. 1 E. Median depth to water was 19 feet, and none of the water levels was less than 1 or more than 140 feet below land surface. Similarly, the median well depth was 153 feet, and none was less than 30 or more than 366 feet. The median discharge rate for bailer tests (not permanent production) was 8 gpm (gallons per minute). This value does not take into account the amount of drawdown below static water level that was necessary to produce a given rate of discharge.

In areas underlain by the least permeable materials, some wells are "overtested"—that is, the reported rate of withdrawal may have been attained only with substantial or complete drawdown of the water level, which would indicate that the well could not produce this discharge on a sustained basis.

WATER USE

Most of the wells in the area provide water for domestic or household use. Domestic use is not continuous; there are peak demands during the day when water is used for several purposes simultaneously, and slack periods when none is used. In addition to these fluctuations, water use varies seasonally. Use during the warm, dry months of July and August is likely to be at least several times the use during the cold, wet months of December and January. (See graphs of temperature and precipitation.) Thus a well that is adequate during winter might prove insufficient during summer. Ordinarily, a well capable of yielding 5 to 10 gpm is sufficient for a single household; smaller yields can be adequate where a storage tank or reservoir is used.

Near Ashland, quantities of water obtainable from wells are generally adequate for household use but not for irrigation or other large uses. In some areas the average expected yield from wells is 2 gpm or less, whereas in other areas the average yield is at least 15 gpm. The ground water is generally of good chemical quality, although most is hard, and some contains excessive amounts of iron.

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AVAILABILITY AND QUALITY OF GROUND WATER IN THE ASHLAND QUADRANGLE, JACKSON COUNTY, OREGON

By
J. H. Robison

1972

For sale by U.S. Geological Survey, price $1.00