WATER RESOURCES DEPARTMENT GROUND WATER REPORT NO. 27

STATE OF OREGON

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DIRECTOR

GROUNDWATER IN THE NEWBERG AREA, NORTHERN WILLAMETTE VALLEY, OREGON

BY

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[Plates are in pocket]

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CONVERSION FACTORS

Factors for converting English units to metric units are shown to four significant figures. However, in the text the metric equivalents are shown only to the number of significant figures consistent with the values for the English units.

English	Multiply by	Metric
acres	4,047	m^2 (square meters)
acre-ft (acre-feet)	1,233 .001233	m^3 (cubic meters) hm^3 (cubic hectometers)
ft (feet)	.3048	m (meters)
gal (gallons)	3.785	L (liters)
gal/min (gallons per minute)	.06309	L/s (liters per second)
(gal/min)/ft (gallons per minute per foot)	.207	(L/s)/m (liters per second per meter)
in (inches)	25.40	mm (millimeters)
mi (miles)	1.609	km (kilometers)
mi^2 (square miles)	2.590	km^2 (square kilometers)
°F (degrees Fahrenheit)	5/9 after subtracting 32	°C (degrees Celsius)

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By F. J. Frank and C. A. Collins

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ABSTRACT

The Newberg area is part of a rapidly growing area near metropolitan Portland in the northern Willamette Valley of northwestern Oregon. The area consists of a series of uplands bounded by narrow, low-lying plains and valleys, and is approximately 360 square miles (930 square kilometers) in size.

Volcanic and marine sedimentary rocks ranging in age from Eocene to Pleistocene and nonmarine sedimentary deposits ranging in age from Pliocene to Holocene underlie the area.

In the western part of the area, many of the wells that tap the Tillamook Volcanics of Eocene age and marine sedimentary rocks of Eocene and Oligocene age produce insufficient water for most uses. However, small quantities of water can be developed for domestic uses from wells that tap these rocks.

The most important aquifer in the area is the Columbia River Basalt Group. Wells drilled into the basalt generally produce from 15 gallons per minute (0.95 liters per second) to 1,000 gallons per minute (63 liters per second).

With the exception of the Troutdale Formation, the nonmarine sedimentary deposits are composed of poorly permeable sand and silt and lack the necessary thickness to store large volumes of water. Therefore, they are not important as productive aquifers. Where the Troutdale Formation is sufficiently thick to yield large volumes of water, yields of most wells tapping that formation range from 20 gallons per minute (1.3 liters per second) to 150 gallons per minute (9.5 liters per second).

Ground water from the Columbia River Basalt Group and the nonmarine sedimentary deposits is chemically suitable for domestic and most other uses. Some of the wells drilled into the marine sedimentary rocks produce water that is too mineralized for general use.

In the east side of the study area, where the basalt aquifers are heavily pumped, water levels of some wells have declined about 1 foot (0.3 meter) per year. This decline, which has been measured for 10 years, is not general throughout the Columbia River Basalt Group. A more complete well-monitoring network is needed to measure declines in water levels and possible changes in chemical quality. Such a network should make it possible to detect problem areas so that steps could be taken to avoid overdraft of the basalt aquifers in the Newberg area.

INTRODUCTION

The Newberg area is part of the rapidly growing area near metropolitan Portland. Because of this rapid growth, water needs continue to increase. Much of the area is not served by central water and sewage systems, and individual homes depend on wells for water supply. To obtain ample water supplies, wells commonly must be drilled to depths of several hundreds of feet. Locally, some wells produce water of poor quality.

The purpose of this report is to (1) determine the general availability and quality of ground water, (2) determine the extent of present ground-water development, (3) determine the areal extent and the potential for development of each major aquifer, and (4) provide information that will aid homeowners and local officials in providing for future water needs.

The ground-water resources of the area were described in a general way in a report on ground-water resources of the Willamette Valley by Piper (1942). Related ground-water studies in or adjacent to the area have been made by Price (1967a, 1967b) and Hart and Newcomb (1965). Records of ground-water levels for a number of wells in the study area have been collected over a number of years by the Oregon Water Resources Department (formerly the office of the Oregon State Engineer). Some of those records have been published in the State Engineer's ground-water report series (Sceva and DeBow, 1965, 1966; Bartholomew and DeBow, 1970; Bartholomew, Graham, and Feusner, 1973).

This investigation is part of a continuing cooperative program between the Oregon Water Resources Department and the U.S. Geological Survey to evaluate the ground-water resources of Oregon. Many of the data for this investigation were supplied by well owners, operators, and drillers. The helpful cooperation of these people and especially of the well owners who permitted access to their wells to collect ground-water data is gratefully acknowledged.

GEOGRAPHIC FEATURES

The Newberg area covers about 360 mi^2 (930 km^2) in the northern part of the Willamette River valley in northwestern Oregon. The location and boundaries of the study area are shown in figure 1. The principal towns and cities of the area are Newberg, Sherwood, Wilsonville, West Linn, Yamhill, Dundee, and Carlton. Principal occupations are related to the raising of various agricultural products; legume seeds and wheat are the most important crops. Other important agricultural crops are filberts and prunes.

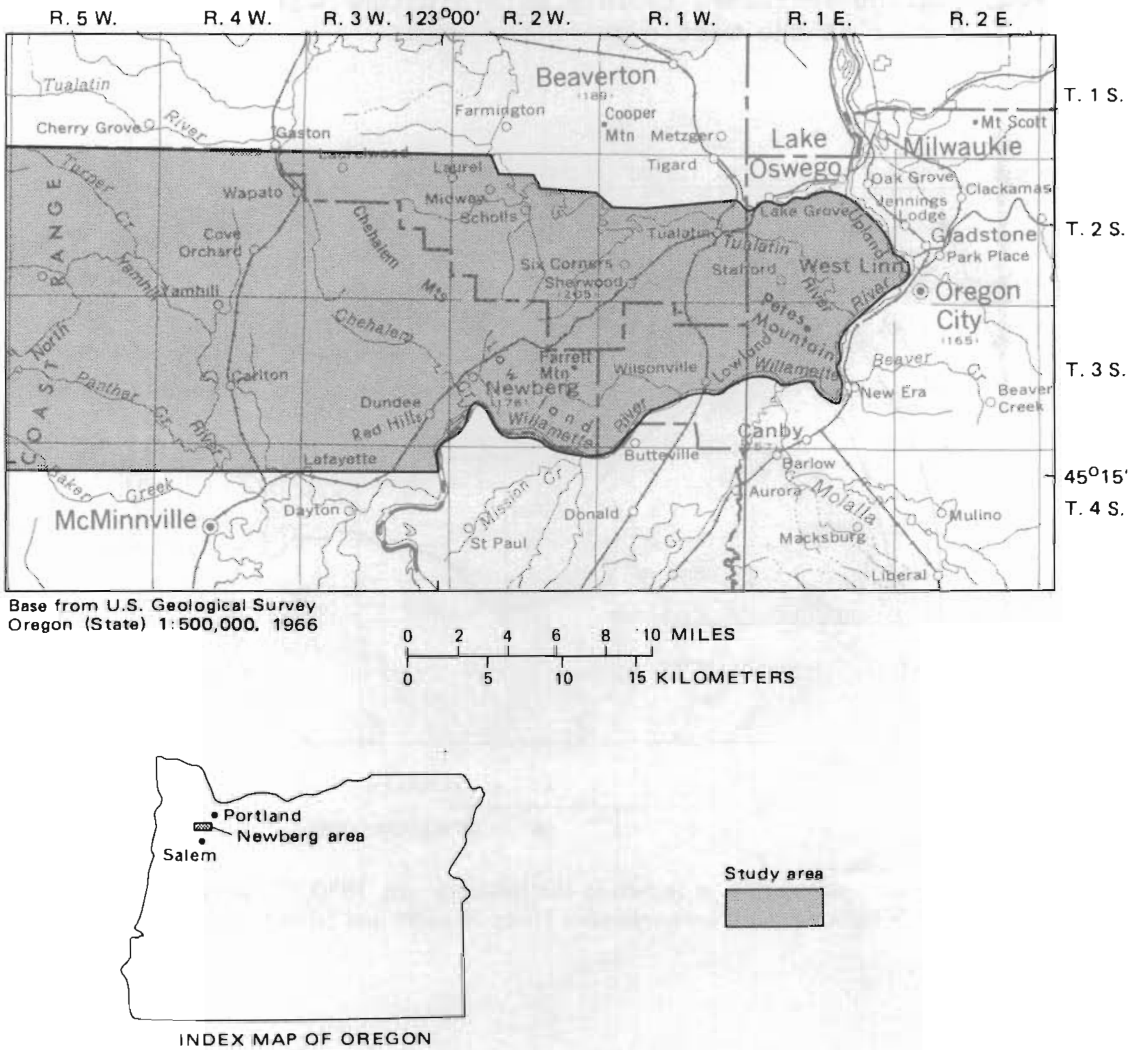

Figure 1.--Location and general features of the Newberg area.

Industries of importance are related to forest products and range from lumber production to the manufacture of wood and paper products.

Climate

The area has a temperate climate characterized by wet winters and generally dry summers. The isohyetal map (fig. 2) shows that amounts of precipitation vary only slightly throughout the central and eastern parts of the area. At the west side of the project area, in the foothills of the Coast Range, precipitation increases rapidly with altitude and is as much as 80 in (2,000 mm) per year at the west edge of the area.

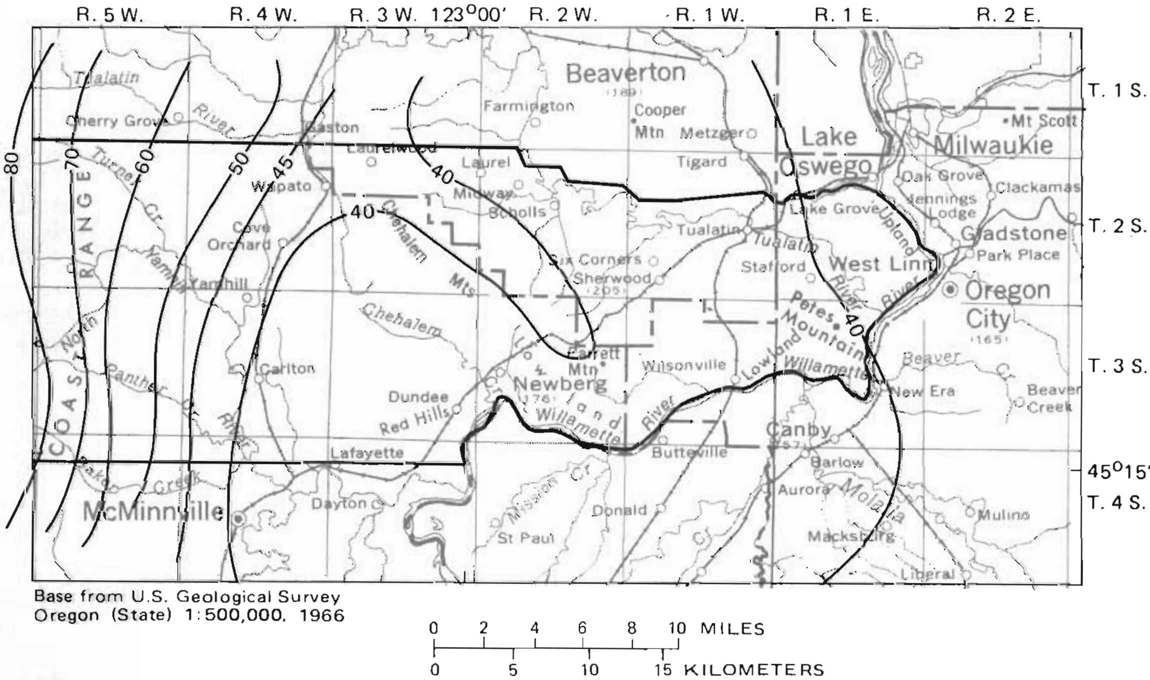

Figure 2.—Annual precipitation, in inches, in the Newberg area, 1930-57. Modified from Appendix B, Willamette Basin comprehensive study of water and related land resources (1969).

Since 1893, climatological data have been collected by the National Weather Service at McMinnville, immediately south of the study area. Figure 3 shows annual precipitation for 1941-75 at McMinnville. The annual precipitation for that period ranged from 27.70 in (704 mm) in 1944 to 61.56 in (1,564 mm) in 1968.

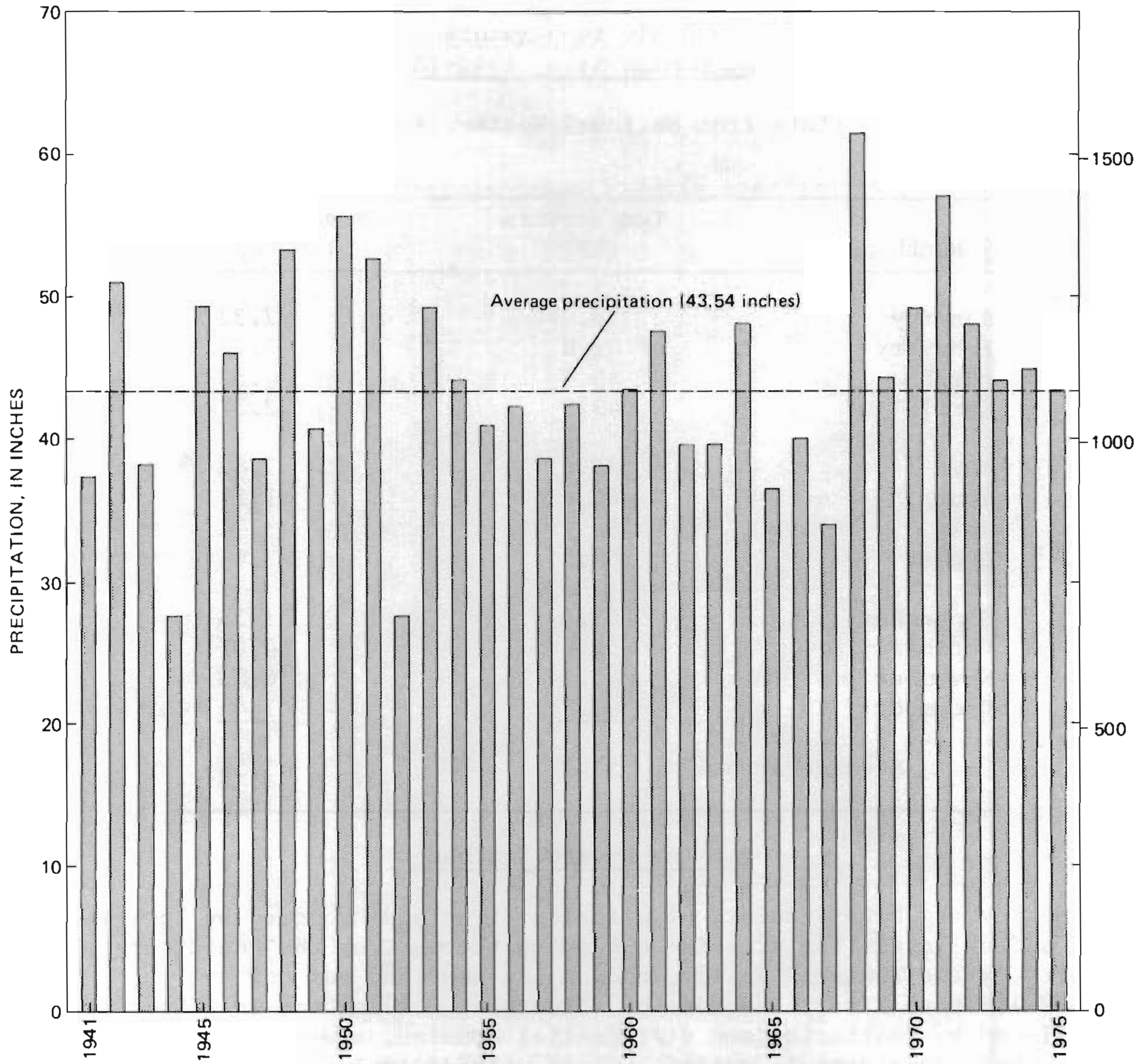

Figure 3.—Annual precipitation at McMinnville, 1941-75.

As shown in table 1, the average annual precipitation at McMinnville is 43.54 in (1,100 mm), most of which occurs as rain. The wettest months of the year are November through January, during which time about 50 percent of the average annual precipitation occurs. In both July and August, normal precipitation is less than an inch.

According to National Weather Service records, the average annual temperature at the McMinnville station is 51.9°F (11.1°C). January, generally the coldest month, has an average temperature of 38.4°F (3.5°C). July is generally the warmest month, with an average temperature of 65.2°F (18.5°C). The average frost-free growing season is about 200 days.

Table 1.--Average monthly temperature and precipitation at McMinnville, 1941-75

[Data from National Weather Service]

Month	Temperature (°F)	Precipitation (inches)
January	38.4	7.33
February	42.8	5.17
March	45.3	4.63
April	49.9	2.37
May	55.6	1.86
June	60.6	1.17
July	65.2	.44
August	64.9	.64
September	61.0	1.58
October	52.6	4.07
November	45.1	6.83
December	40.8	7.45
Average annual	51.9	43.54

Topography and Drainage

The Newberg area consists of a series of uplands bounded by low-lying plains and valleys. The area is bounded on the west by the Coast Range, on the north by the Tualatin Valley, and on the east and part of the south side by the Willamette River. Because of structural folding and localized faulting followed by weathering and differential erosion, several uplands within the area have considerable relief. These uplands include (1) the Red Hills of Dundee, with an altitude of 1,087 ft (330 m); (2) Chehalem Mountains, with an altitude of 1,629 ft (500 m); (3) Parrett Mountain, with an altitude of 1,247 ft (380 m); (4) Petes Mountain, with an altitude of 839 ft (250 m); and (5) the eastern foothills of the Coast Range, with an altitude of about 2,000 ft (610 m).

Cross section B-B' (pl. 1) shows the topographic relationship of the Red Hills of Dundee and the Chehalem Mountains to the lowlands of the Chehalem and Tualatin Valleys, although the effect is exaggerated by the expanded vertical scale of the cross section. Between the Chehalem Valley and the top of the Chehalem Mountains escarpment, the altitude rises 1,100 ft (335 m) within a distance of 1.5 mi (2.4 km). On the northeast side of the mountains, the altitude decreases 1,100 ft (335 m) in 3 mi (4.8 km), indicating a general gradient about half that of the southern flank of the Chehalem Mountains.

The lowland along the northern boundary of the area makes up a part of the Tualatin Valley and has an altitude of about 200 ft (60 m). Another lowland area extends along the Willamette River from Newberg to about 4 mi (6 km) east of Wilsonville along the southern boundary of the area. The lowland in the western part of the area consists of the narrow Chehalem Valley and the low-lying areas along the North Yamhill River and has altitudes of from 90 to 200 ft (27 to 61 m).

Parts of the northern and eastern lowlands are drained principally by the Tualatin River, which flows into the Willamette River near West Linn. The western lowland areas are drained by the North Yamhill River, and the area north and west of Newberg is drained by Chehalem Creek.

GEOLOGIC UNITS AND THEIR WATER-BEARING PROPERTIES

Consolidated rock units, ranging from Eocene to early Pleistocene age, and unconsolidated deposits of Pliocene to Holocene age underlie the area. The consolidated rocks include basalt; tuff breccia; marine sedimentary rocks of siltstone, shale, and sandstone; and intrusive rocks. The unconsolidated deposits are nonmarine and include silt, clay, sand, and gravel.

The geology of the area, compiled from the work of Schlicker and Deacon (1967), Hart and Newcomb (1965), and Warren, Grivetti, and Norbisrath (1945) is shown on plate 1. A brief discussion of salient features and of rock units and their water-bearing properties is given below.

Tillamook Volcanics

The Tillamook Volcanics, of Eocene age, are the oldest rocks in the area and include basaltic lava, tuff, and breccia, which are interbedded in places with well-indurated marine siltstone and sandstone. These rocks have a thickness of several thousand feet in the project area and have been intruded by numerous dikes and sills of gabbro, basalt, and diabase. The formation is well weathered, and much of it is soft and crumbly. The Tillamook Volcanics has low permeability, and many of the wells that tap it yield only from 2 to 5 gal/min (0.13 to 0.32 L/s). A few wells yield more than 10 gal/min (0.63 L/s).

Marine Sedimentary Rocks

The marine sedimentary rocks consist mainly of tuffaceous and basaltic sandstone, siltstone, and shale, locally interbedded with carbonaceous siltstone and claystone. They overlie or are interbedded with the Tillamook Volcanics. Locally, the marine sedimentary rocks are deeply weathered. Total thickness of these rocks probably exceeds 5,000 ft (1,500 m) in the project area. These rocks are of Eocene and Oligocene age and include the Yamhill and Spencer Formations described by Schlicker and Deacon (1967).

The marine sedimentary rocks are generally of low permeability and yield water slowly to wells. Many wells tapping these rocks produce less than 5 gal/min (0.3 L/s). However, not all the materials in the marine rocks have low permeability. Locally, wells that produce from 10 to more than 200 gal/min (0.63 to 13 L/s) tap shale and sandstone. Some of the wells drilled into the marine rocks produce highly mineralized water that is unsuitable for drinking and for many other uses. The occurrence of mineralized water is most prevalent in lowland areas and at greater depths where there is little chance for dilution or displacement by fresh-water circulation. Many of the wells containing mineralized water have been abandoned.

Intrusive Rocks

Intruded into the Tillamook Volcanics and marine sedimentary rocks are dikes and sills of gabbro, basalt, and diabase. These intrusive rocks of Eocene(?) age are of generally low permeability and will not yield appreciable quantities of water to wells. Several wells known to have been drilled in the intrusive rocks have been abandoned because of low yields.

Columbia River Basalt Group

The Columbia River Basalt Group forms the bedrock of Parrett Mountain, Chehalem Mountains, Petes Mountain, and the Red Hills of Dundee. In the study area (pl. 1), it underlies parts of the Newberg lowlands, the Tualatin Valley, and the Wilsonville-Sherwood area. The group, a series of lava flows of middle and late Miocene age overlying the marine sedimentary rocks, has been deformed by gentle folding and minor faulting. It has been folded into anticlines in the uplands and into synclines in the valleys. In many places in the uplands, the top of the basalt is deeply weathered, forming a reddish-colored residual lateric soil.

Most of the major structural features of the basalt are caused by folding, although some are largely the result of displacement along faults. The major known fault in the area trends northeast and separates Parrett Mountain from the east end of the Chehalem Mountains. The structure of the Columbia River Basalt Group and the occurrence of water from these rocks are discussed in detail in a report by Hart and Newcomb (1965).

The basalt consists of a series of individual lava flows. The flows are mostly of blocky, jointed lava, and each flow has its own system of joints. Between some of the successive flows are zones of ash, soil, breccia, cinders, or broken rock that are porous enough to permit the movement of water. These zones, including the uppermost part of one flow and the basal part of the overlying flow, are commonly called interflow zones and are the main aquifers (water-bearing and water-yielding zones) in the basalt. The basalt ranges in thickness from a few to about 1,000 ft (300 m); individual flows range from 10 to 100 ft (3 to 30 m). As shown in the following sections, yields of wells drilled into the Columbia River Basalt Group are highly variable. Yields of wells drilled into the basalt range from about 15 gal/min (0.9 L/s) in the upland areas to as much as 1,000 gal/min (63 L/s) from wells drilled into the basalt in some lowland areas.

Helvetia Formation

The Helvetia Formation of Schlicker and Deacon (1967) is a poorly indurated sedimentary deposit of reddish-brown sand, silt, and clay overlying the Columbia River Basalt Group. Thin beds containing granitic, quartzitic, and basaltic pebbles occur locally. The deposits are difficult to distinguish from the residual soils derived from weathering of the Columbia River Basalt Group. The formation is considered by Schlicker and Deacon (1967) to be correlative with the earliest Troutdale Formation sediment. According to Schlicker and Deacon, data from wells indicate that in the lowland along the Tualatin River the Helvetia Formation may include the fine sediments below the base of the Troutdale. However, in well logs, the Helvetia Formation cannot be differentiated from other unconsolidated units in the valley fill. The formation is not important as an aquifer in the area.

Troutdale Formation

The Troutdale Formation in the project area is composed mostly of silt and clay with occasional beds of fine sand and some gravel. These nonmarine sedimentary deposits unconformably overlie the Columbia River Basalt Group; where the basalt is not present, they lie directly on the older marine rocks. Well information indicates that the Troutdale Formation ranges in thickness from a few feet to about 480 ft (150 m). Maximum thicknesses occur near Wilsonville and in places along the Tualatin River (pl. 1, sections B-B' and C-C').

The Troutdale Formation underlies the valleys along the North Yamhill, Tualatin, and Willamette Rivers and the lowland area near Newberg. In most places, the formation is concealed beneath the Willamette Silt or the alluvium and is exposed only in the bottom of steep ravines and along the Willamette River from Newberg to Wilsonville. Yields of wells tapping the Troutdale Formation range from 4 to 360 gal/min (0.2 to 23 L/s).

Boring Lava

The Boring Lava is a gray olivine basalt only a few feet thick, with blocky jointing. In the project area, the Boring Lava is exposed in one small area south of Lake Oswego, where it directly overlies Columbia River Basalt Group. Because of small areal extent and thin flows, the Boring Lava is not an important aquifer.

Upland Silt

The Upland silt of Schlicker and Deacon (1967) overlies ridges and flatter parts of the Chehalem Mountains. It consists of micaceous sandy and clayey silt with occasional rounded basalt pebbles and generally has a thickness of 3 to 6 ft (1 to 2 m). It generally lies directly on weathered basalt of the Columbia River Group, but in places it overlies the Helvetia Formation. The Upland silt cannot be distinguished from weathered basalt in drillers' logs. (See logs of wells 2S/3W-14bac and 3S/2W-3cad.) The silt is not an aquifer in the study area because it occurs above the main water table.

Willamette Silt

The Willamette Silt underlies most of the lowlands within the study area and extends onto the surrounding uplands to an altitude of about 250 ft (80 m). It lies on the erosional surface of all the older bedrock units, and locally it unconformably overlies the Troutdale Formation.

The Willamette Silt is composed of thinly bedded silt containing lenses of fine sand and clay. Locally it contains scattered pebbles of granite and quartzite. In general, it ranges in thickness from a few feet to 50 ft (15 m) and is thickest (about 50 ft, or 15 m) adjacent to the Willamette River. At higher altitudes near Newberg and Wilsonville, its thickness is only 5 to 10 ft (1.5 to 3 m). Near Yamhill and Carlton, the Willamette Silt is generally less than 30 ft (9 m) thick.

Because the permeability of the Willamette Silt is low, the formation yields water slowly to wells. In the study area, only a few shallow wells produce water from the Willamette Silt.

Alluvium

As used in this report, the alluvium includes the younger alluvial and lacustrine deposits mapped by Schlicker and Deacon (1967). They are composed of silt, clay, sand, and gravel, with some peat soils where drainage is poor. In the project area, alluvium is deposited on the Willamette Silt in the flood plains of the Tualatin and Willamette Rivers and along the North Yamhill River. Along Chehalem Creek the alluvium lies directly on marine rocks. In most of the area, the alluvium ranges in thickness from 10 to 30 ft (3 to 9 m). These deposits are water bearing where they are relatively thick, permeable, and in hydraulic contact with adjacent streams. However, in most places, the deposits lack the necessary thickness to store much water and have poor permeability (silt and clay), and therefore are not important as aquifers.

GROUND WATER

Ground water is water that occurs in a saturated zone beneath the land surface. Precipitation in the project area maintains the local supply of ground water. Much of the precipitation runs off to streams; part of it evaporates into the atmosphere and some infiltrates into the ground. Part of the water that infiltrates into the ground is retained as soil moisture which is used by plants, part evaporates directly from the soil, and the remainder percolates downward to form a zone of saturation. The water table is the upper surface of the zone of saturation, where the pressure is atmospheric. Ground water moves by force of gravity downgradient to points of discharge such as springs, seeps along stream channels, or wells. Permeable rock materials or formations that yield usable quantities of water to wells or springs are called aquifers.

Some ground water can be obtained nearly everywhere in the project area. However, because of different geologic and hydrologic conditions, the occurrence, quality, and availability of ground water vary considerably from place to place.

Recharge and Discharge

The aquifers of the area are recharged mostly during late autumn and winter--the season of greatest precipitation. Most of the rocks and deposits in the Newberg area are of low permeability; consequently, recharge to these units is small. Besides permeability of the soil and rocks, recharge depends on factors such as slope, vegetative cover, attitude of the rocks, and precipitation rate.

Recharge in the area is mostly from direct infiltration of precipitation. Aquifers in the lowlands also may receive some recharge by seepage from streams during periods when ground-water levels are lower than adjacent stream levels. However, the generalized water levels (shown on pl. 2) indicate that adjacent to most stream courses the water table is at a higher altitude than is the stream surface. Consequently, most streams gain water from the aquifers rather than lose water to the aquifers. Where hydrologic conditions are favorable, wells may be pumped to induce infiltration from nearby streams. In the Newberg area, induced recharge from streams is unlikely because of the low permeability and yield of shallow deposits near the stream.

In general, the uplands are areas of recharge and the lowlands are areas of discharge. The basalt probably receives recharge in all parts of the uplands, but in the higher hills, such as Chehalem and Petes Mountains, impermeable layers may impede the downward movement of water toward the main water table. However, on the lower slopes of these hills, recharge is greater because the main water table is at shallow depth and there are fewer impermeable layers above it. Also, in that part of the area small streams that carry runoff from these hills lose flow where they cross the upturned edges of interflow zones between the individual basalt flows. In some parts of the area a tight, poorly permeable surface of silt and clay rejects much of the rainfall, which becomes runoff to local streams. Therefore, the basalt aquifer in some parts of the uplands and foothills receives only a small part of the annual precipitation.

Although the permeability of the Willamette Silt is generally quite low, water from precipitation and other sources percolates down through the formation to help recharge more permeable aquifers in the underlying deposits.

Ground water in aquifers is discharged naturally at seeps and springs, by evapotranspiration, and artificially by wells. Discharge from springs and seeps helps to sustain the flow of the Willamette River and other streams.

Fluctuations of water levels in wells commonly indicate changes in the volume of ground water in storage. Because these fluctuations occur mostly in response to changes in the rates of recharge or discharge of ground water, the volume of ground water stored in a reservoir varies seasonally and annually.

Hydrographs in figure 4 show fluctuations of water levels in wells 2S/3W-15bbd and 2S/4W-18cdd in response to recharge and discharge. The hydrographs indicate that the ground-water levels in the area rise as precipitation

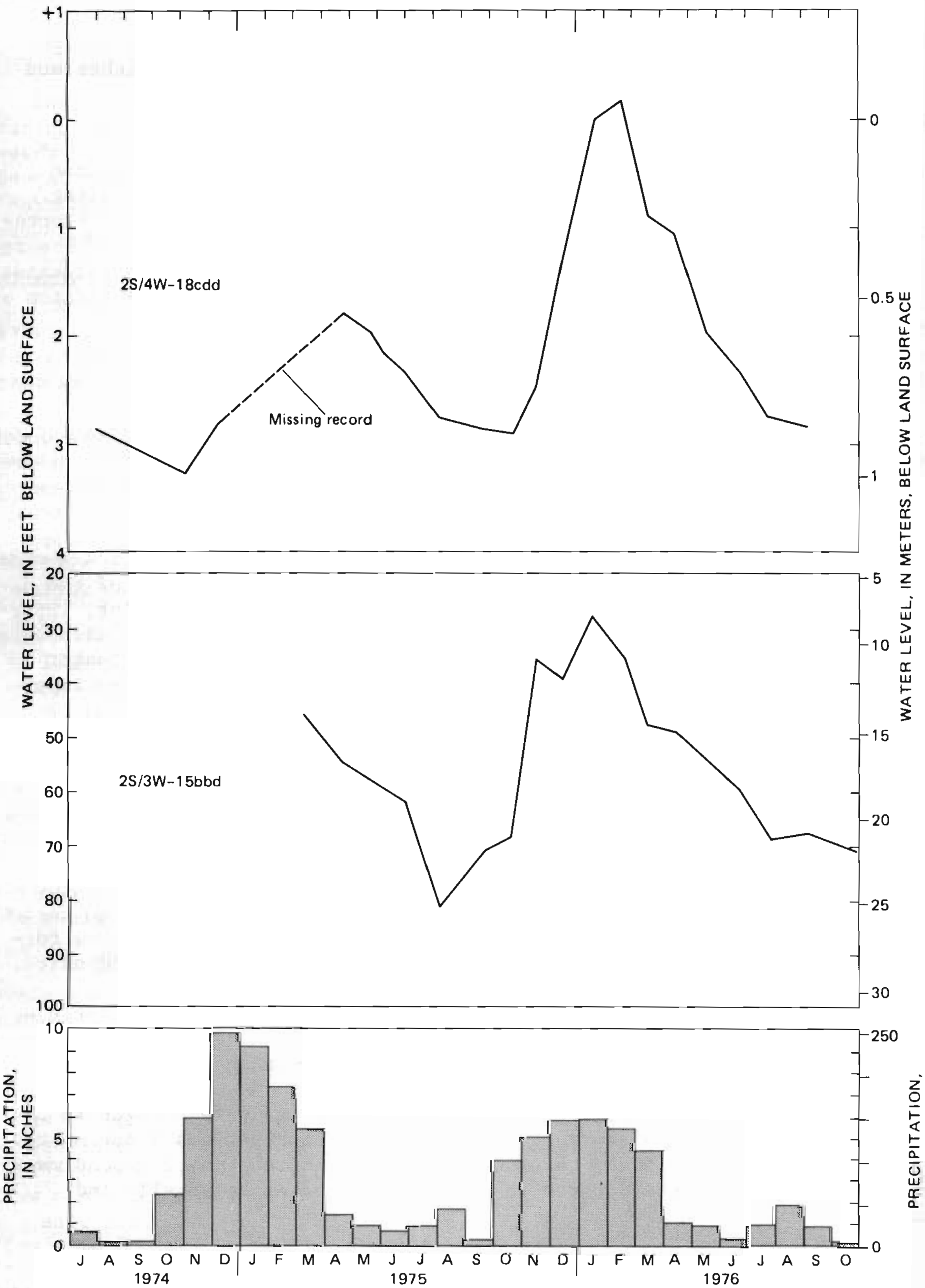

Figure 4.—Relation between monthly precipitation at McMinnville and changes of water levels in wells 2S/3W-15bbd and 2S/4W-18cdd.

and infiltration increase during October and November, continue at a high level during the wet winter months, and decline as rainfall diminishes and evapotranspiration and water use increase during spring and summer.

As indicated in a later section, ground-water levels of the Columbia River Basalt Group are subject to long-term water-level declines in some heavily pumped areas where use of ground water is continually increasing. Although ground-water levels in the alluvium and Troutdale Formation fluctuate seasonally, they generally show no net change from year to year. The recovery of water levels each winter to approximately the same level indicates that these aquifers are supported by recharge from the direct infiltration of precipitation and that, in general, recharge balances discharge.

General Features of Occurrence

Throughout the greater part of the study area, ground water occurs under unconfined or water-table conditions. Ground water characteristically moves downgradient approximately at right angles to the water-table contours and toward the nearest stream or other point of discharge. In the Newberg area, the water table is generally highest beneath upland areas and lowest beneath the valleys (pl. 2). Therefore, the water table has a configuration similar to that of the land surface, but more subdued. There are many local variations in configuration, some of which reflect seasonal changes.

In addition to the regional water table, other water tables of small areal extent may occur in the basalt in parts of the uplands where the downward movement of ground water is impeded by impermeable rock layers (Hart and Newcomb, 1963, p. 31; Foxworthy, 1970, p. F10). This ground water is separated from the underlying regional water table and in this report is referred to as "perched ground water." The occurrence of these perched water bodies is suggested by the altitudes of water levels plotted on plate 2. Water levels in many of the wells on high ridges are less than 50 ft (14 m) below land surface, whereas nearby wells at lower altitudes have much deeper water levels. In many places, springs that issue from perched water bodies contribute water to streams. Some of the springs have been developed as sources of domestic water.

Plate 2 is a generalized map that shows water-level contours, water-level altitudes, and the locations of wells throughout the area. Water levels range in altitude from less than 100 ft (30 m) along the Willamette River to 1,100 ft (338 m) in the northern part of the Chehalem Mountains.

In places in the deeper basalt and sedimentary aquifers, ground water occurs under confined conditions. Confined ground water is under pressure greater than atmospheric and is held in the zone of saturation by an overlying bed or layer of material through which it cannot pass readily. In a well that penetrates such a body of confined ground water, the water will rise above the bottom of the confining bed. Water will flow naturally from a well that penetrates a body of confined ground water where the hydrostatic head is above land surface.

Chemical Quality

Ground water contains mineral matter dissolved mainly from the soil and rock through which it has percolated. Therefore, water quality can differ from place to place within the same aquifer or from one aquifer to another.

Table 2 contains 63 ground-water analyses, 47 of which were made by the U.S. Geological Survey and the rest by commercial laboratories. Table 3 shows the common chemical constituents dissolved in natural waters, the probable sources of the constituents, their significance with respect to use, and the recommended limits for drinking water. The recommended limits for drinking water are from criteria established by the National Academy of Sciences and the National Academy of Engineering (1973) and from preliminary regulations of the Environmental Protection Agency (1975). The Environmental Protection Agency standards were made in accordance with the Safe Drinking Water Act and became effective in June 1977. The standards apply to all drinking-water systems that serve at least 25 persons daily or have at least 15 service connections.

Table 4 shows field specific-conductance values for water obtained from wells in the area. Specific conductance is a measure of the ability of water to conduct electrical current and is expressed in micromhos per centimeter at 25°C. Numerically, the dissolved-solids content of water, in milligrams per liter, is commonly 55 to 80 percent of the specific-conductance value.

Variations in Chemical Quality of the Water

Variations in chemical quality of the ground water are related generally to the geologic environment. These variations depend chiefly on the rock type forming the aquifer, the topographic setting of the well, and, in places, the depth of the well. The chemical diagrams on plate 1 illustrate that there is no definite pattern in the distribution of the various chemical types of water in the area.

Waters that have the highest dissolved-solids content are in parts of the area where (1) marine deposits are the main aquifers, (2) the main aquifers of sand and gravel are thin and wells penetrate underlying marine rocks which contribute water high in dissolved solids, and (3) deep wells are drilled in the Columbia River Basalt Group in some of the low-lying areas.

In places, water from the marine aquifers has a high concentration of sodium and chloride or sodium and bicarbonate ions. Mineralized water obtained from the basalt typically contains high concentrations of calcium, sodium, and chloride. Water from spring 2S/5W-29cdas (table 2) has a dissolved-solids content of 14,100 mg/L. The water from this spring flows from the Tillamook Volcanics and has a higher concentration, proportionally, of calcium than do other water samples analyzed from these rocks.

Where wells tap marine sedimentary rocks, they may yield highly mineralized water locally. This is particularly true of wells drilled below the regional water table in lowlands where circulation of ground water is slow.

The water in the Columbia River Basalt Group is generally of good quality, having moderate hardness, low chloride, and iron concentrations that are generally within recommended limits. However, in some parts of the area, the quality of water in the basalt varies with depth. Two Dammasch State Hospital wells (3S/1W-15cac and -16ddd, tables 2 and 4) that tap permeable zones 700 to 800 ft (213 to 244 m) below the top of the basalt produce water with hardness of 230 and 413 mg/L and chloride of 177 and 417 mg/L, respectively. In contrast, well 3S/1W-1cda produces water having hardness of 119 mg/L and chloride concentration of 8 mg/L.

Mineralized water from the underlying marine sedimentary rocks may move upward in response to the lowering of head in the basalt. The lowering of head is caused by heavy pumping and increasingly greater use of water. The possibility of the upward movement of saline water is greater in a synclinal or downwarped area, where such movement can occur by way of tension cracks or through a fault zone (Hart and Newcomb, 1963, p. 54).

Suitability for Use

The concentration of certain constituents of ground water determines the suitability of the water for various uses. Calcium and magnesium cause hardness, and excessive hardness in water is objectionable for domestic and industrial uses. In this report, the following numerical ranges and terms are used to classify hardness of water:

Hardness range (mg/L of $CaCO_3$)	Description
0-60	Soft
61-120	Moderately hard
121-180	Hard
More than 180	Very hard

Iron concentrations of greater than 0.3 mg/L may cause staining of porcelain fixtures and laundry, but are not harmful if consumed in drinking and do not affect use of the water for irrigation. As shown in table 2, most ground water analyzed from the Columbia River Basalt Group contained low concentrations of iron. Of the 63 ground-water samples analyzed, most of those high in iron content were from wells tapping marine sedimentary rocks or the Troutdale Formation, which suggests that excessive iron concentration may be a general problem in water from these units.

Boron is an essential element for plant growth; however, excessive boron is harmful to many plants. According to the National Academy of Sciences and the National Academy of Engineering (1973), a maximum concentration of 0.75 mg/L is recommended for sensitive plants. Recommended maximum concentrations are 1 mg/L for semitolerant plants and 2 to 4 mg/L for tolerant plants. At concentrations of more than 4 mg/L of boron, water is generally unsatisfactory for most crops. In the 45 samples analyzed for boron, concentrations ranged from 0 to 2.1 mg/L. With the exception of water from wells 2S/3W-21cdb, 2S/4W-23cc, 2S/4W-29ddb, and 3S/3W-9bda, which tap the marine rocks, and from spring 2S/5W-29cdas, all water analyzed was suitable for even the most boron-sensitive plants.

No water analyzed exceeded the recommended limits for arsenic. However, water from well 3S/4W-34bdc contained 0.04 mg/L of arsenic, which is more than is generally found in ground water.

Water analyzed from spring 2S/5W-29cdas (tables 2 and 5) had a dissolved-solids content of 14,100 mg/L, a chloride concentration of 8,600 mg/L, and hardness of 9,000 mg/L. The water from this spring, which flows from the Tillamook Volcanics, is too mineralized for nearly all uses. Water from well 2S/4W-23cc, tapping the marine deposits, had a hardness of 5,400 mg/L. The hardness of the water from the basalt aquifers ranged from 12 to 430 mg/L. Deeper zones in the basalt tend to contain water of greater hardness than do the shallow zones.

All analyses of water from the Columbia River Basalt Group indicate that the water has a low SAR (sodium-adsorption-ratio) and is therefore suitable for irrigation. However, analyses of water from some of the wells tapping the marine sedimentary rocks (pl. 1 and table 2) show high SAR ratios. The SAR indicates the effects that irrigation water will have on soil-drainage characteristics. Water with a high SAR value lowers the permeability of soils and eventually causes clogging, which makes the soil unsuitable for cultivation. An SAR of about 4 is the limit for crops that are sensitive to the effects of soil clogging (Federal Water Pollution Control Adm., 1968, p. 115-117). SAR values are presented, along with analytical data, in table 2.

Water samples from 22 domestic wells were analyzed for fecal coliform bacteria. Although these organisms are not necessarily harmful in themselves, their presence indicates pollution from fecal wastes. The membrane-filter technique was used to test water for fecal coliform bacteria. None was detected in any of the water samples analyzed. Although these spot tests did not indicate ground-water pollution, further study would be required to validate the presence or absence of ground-water pollution in the area.

Use of Ground Water

The principal uses of ground water in the area are for public, irrigation, industrial, and domestic supplies. As used in this report, public supplies include water used for school and recreational facilities in addition to that used by municipal agencies and water districts that serve suburban and residential areas; irrigation supplies include water used for irrigation of crops and pastures, but not yards, gardens, and grounds of industrial plants; industrial supplies include water used in sand, gravel, and cement operations as well as meat processing and other light industries; and domestic supplies include water from private wells used for household requirements, watering stock, and irrigation of lawns and small gardens.

The most important aquifer in the area is the Columbia River Basalt Group. Other units supply only minor quantities of water, perhaps 10 percent of that from the basalt. During 1975, total pumpage of ground water from the Columbia

River Basalt Group was estimated to be 5,500 acre-ft (6.8 hm^3). The estimated volumes withdrawn from the basalt are shown in the following table.

Type of supply	Estimated 1975 withdrawals (acre-feet)
Public	2,200
Irrigation	1,800
Industrial	900
Domestic	600
Total	5,500

Public Supply

In past years, the cities of Lake Oswego, West Linn, and Tualatin obtained most of their water supplies from basalt aquifers of the Columbia River Basalt Group within the study area. At present, these cities obtain most of their water supplies from surface-water sources outside the study area. Wells are used mainly for auxiliary water supply. The towns of Wilsonville and Sherwood rely wholly on water from basalt aquifers. The town of Dundee has four pumping wells, three of which tap the basalt. Several schools and recreational facilities also utilize water from these aquifers. Basalt aquifers also supply water for six water districts that serve suburban areas and for several private wells which serve from 5 to 10 families each. (See table 4.) During 1975, an estimated 2,200 acre-ft (2.7 hm^3) of ground water was pumped for public supplies.

Irrigation

By determining the number of acres and types of crops irrigated with well water, it was estimated that approximately 1,800 acre-ft (2 hm^3) of ground water was pumped for irrigation during 1975.

Industrial

Most of the water used for industry in the area is used in sand, gravel, and cement operations. Meat-processing plants, poultry plants, industries related to forest products, and other light industries use ground water. About 900 acre-ft (1 hm^3) was pumped for use by these industries in 1975.

Domestic

Most of the wells in the area, particularly in the rural and suburban parts, are used for domestic supplies, and many of those wells also supply water for livestock and irrigation of lawns and gardens. The volume of ground water used for domestic supplies from the basalt was estimated on the basis of population and a per capita use of 75 gal (284 L) per day for all uses. Estimated ground-water use for domestic purposes in 1975 was 600 acre-ft (0.74 hm^3).

Ground-Water Conditions and Availability by Subareas

On the basis of geologic, hydrologic, and physiographic conditions, as described in the following sections, the study area is divided into several subareas. Ground-water conditions are described separately for each subarea. The locations of the subareas are shown in figure 5.

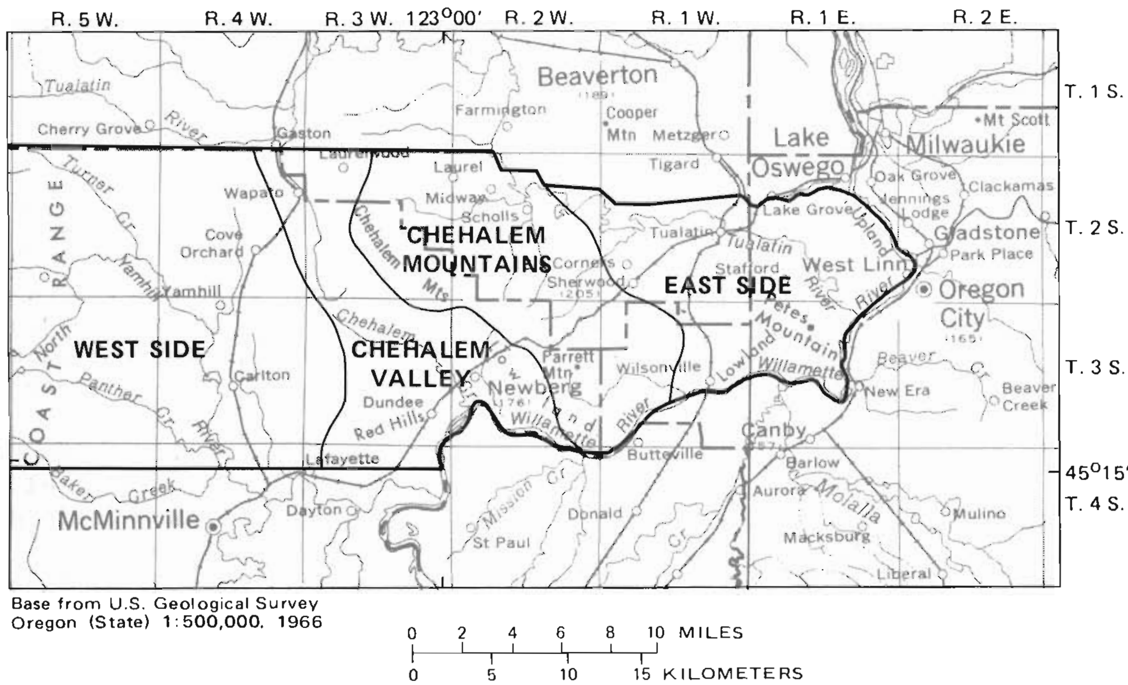

Figure 5.—Ground-water subareas.

West Side

The west-side subarea includes the foothills of the Coast Range, the North Yamhill River valley, and the foothills north and east of the valley.

The foothills of the Coast Range lie along the west side of the project area, generally west of the North Yamhill River valley, in R. 5 W., and are mapped as Tillamook Volcanics on plate 1. Altitudes range from about 100 ft (30 m) along the valley to 2,000 ft (600 m) in the western parts of the foothills. This part of the subarea is underlain primarily by volcanic rocks which, in places, are interbedded with marine sandstone and siltstone or are intruded by younger intrusives. These rocks are of low permeability and generally yield small quantities of water to wells. Wells range in depth from about 50 to more than 500 ft (15 to 150 m), but most are between 100 and 200 ft (30 and 60 m) deep. Yields of wells listed in table 4 range from 2 to more than 20 gal/min (0.13 to 1.26 L/s), but generally are less than 10 gal/min (0.6 L/s). The average yield in table 4 is 8 gal/min (0.5 L/s), and the average specific capacity (the rate of discharge of water from a well divided by the drawdown of water level within the well) is about 0.15 (gal/min)/ft [0.003 (L/s)/m] of drawdown. An average 8-gal/min (0.5 L/s) well would have a pumping level 53 ft (16 m) below its static water level. Many wells in the foothills of the Coast Range have been abandoned because of insufficient yields. (See "Remarks" for wells 2S/5W-15acc and -33bbd, table 4). The water from volcanic rocks in the Coast Range foothills is generally of acceptable quality for most uses. However, highly mineralized water from spring 2S/5W-29cdas is of the calcium chloride type and has a total dissolved-solids content of 14,100 mg/L (tables 2, 5).

The North Yamhill River valley extends along the North Yamhill River and is mapped as Willamette Silt or alluvium on plate 1. It includes much of T. 3 S., R. 4 W., and the south-central part of T. 2 S., R. 4 W. The alluvial deposits of the valley are too thin to store much ground water and are not important as aquifers. In most places, these deposits are underlain by sandstone, siltstone, and shale of marine origin. Most wells in this valley produce water from these sedimentary rocks. Wells in the marine sedimentary rocks range from about 50 to more than 200 ft (15 to 60 m) in depth and average about 125 ft (38 m). Yields range from 2 to 30 gal/min (0.13 to 1.9 L/s) and average about 12 gal/min (0.76 L/s), but more than half the wells in table 4 yield 10 gal/min (0.6 L/s) or less. Specific capacities range from 0.01 to 6 (gal/min)/ft [0.0002 to 0.12 (L/s)/m]. The wells with lowest yields commonly also have the greatest drawdown; for instance, well 3S/4W-35abd yields only 2 gal/min (0.13 L/s) with a drawdown of 170 ft (52 m) (table 4). The best well in the marine rocks is well 3S/4W-5aac, which has both the highest yield (30 gal/min, or 1.9 L/s) and highest specific capacity [6 (gal/min)/ft, or 0.12 (L/s)/m]. This well taps marine sandstone underlying Willamette Silt near the edge of the valley.

Sediments correlative with the Troutdale Formation of the adjoining Eola-Amity Hills, which were studied by Price (1967b), underlie a narrow strip of the valley about three-fourths of a mile (1.2 km) wide along each side of the North Yamhill River and extending from the town of Carlton to the southern border of the project area. This formation consists of clay, sand, and gravel deposits and has a thickness of about 30 ft (9 m). (See logs of wells 3S/4W-28ddc and -34bdc, table 6.) Wells drilled into these deposits generally are less than 100 ft (30 m) deep and yield from 10 to 35 gal/min (0.6 to 2 L/s) of good-quality water suitable for most uses.

The foothills to the north and east of the North Yamhill River valley are mapped on plate 1 as marine sedimentary rocks and are underlain by sandstone, siltstone, and shale. These marine rocks are generally of low permeability, and many wells drilled into them produce less than 5 gal/min (0.3 L/s). Yields of the wells range from 1 to 30 gal/min (0.06 to 1.9 L/s), but are generally less than 10 gal/min (0.6 L/s). Wells in this part of the area range in depth from 58 to 300 ft (18 to 90 m). The average depth of the wells is about 140 ft (42 m).

A major problem in developing ground water in the foothills is the mineral content of the water, particularly in the deeper zones of the marine rocks. Locally, some of the water from the marine sandstone, siltstone, and shale is too mineralized for most uses. Because of highly mineralized water and low yields, some of the wells have been abandoned.

In the uplands and foothills, much of the water produced by wells is from shallow, discontinuous water bodies. Many seeps and springs that flow from the foothills are outlets for this water. Many of the springs flow throughout the year and are utilized for domestic water supplies.

The towns of Yamhill and Carlton obtain their water supplies from surface-water sources--Yamhill from Turner Creek and Carlton from Panther Creek. Because of the low yields of wells and the local occurrence of saline water, many rural residents obtain their water supplies from the municipal systems of Yamhill and Carlton.

Chehalem Valley

The Chehalem Valley subarea includes the Chehalem Valley, the Red Hills of Dundee, and the lowland near Newberg.

The Chehalem Valley is narrow and extends into the Newberg lowland northwest of Newberg. As shown on plate 1, both sides of the valley are bounded by foothills composed of marine rocks. The valley is covered with 10 to 25 ft (3 to 8 m) of alluvial materials underlain by marine sandstone, siltstone, and shale. The marine rocks beneath the valley are quite permeable, and wells tapping them reportedly yield 9 gal/min (0.6 L/s) (well 3S/3W-9acd) to 200 gal/min (13 L/s) (well 3S/3W-9bba). The average yield is 52 gal/min (3 L/s) and the average specific capacity is about 1 (gal/min)/ft [0.20 (L/s)/m]. Wells drilled in the valley range in depth from 45 to 240 ft (14 to 73 m) and have an average depth of 140 ft (43 m). Water levels in the Chehalem Valley are stable and have fluctuated within a seasonal range of about 25 ft (8 m) throughout the period of existing record, as shown by the hydrograph of well 2S/3W-31acb (fig. 6).

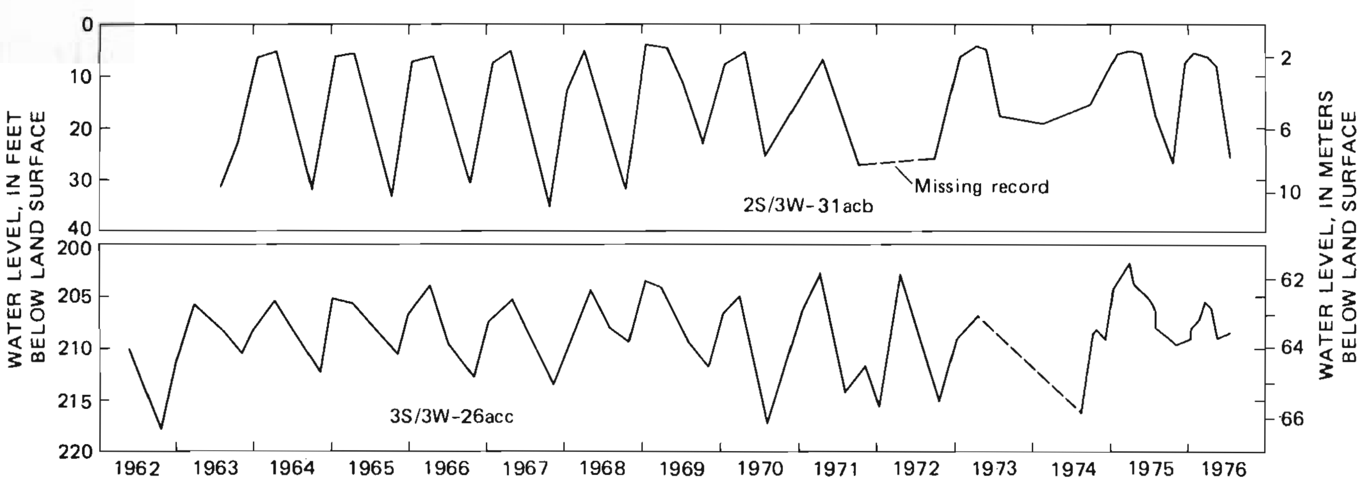

Figure 6.—Hydrographs of wells 2S/3W-31acb and 3S/3W-26acc.

The quality of the water produced by wells less than 100 ft (30 m) deep drilled into the marine rocks beneath the Chehalem Valley is suitable for most purposes. However, water-quality data and drillers' logs indicate that deeper wells (depths of greater than 200 ft, or 60 m) are likely to produce water of undesirable quality. (See logs and chemical analyses of wells 3S/3W-9dba and -11caa, tables 2 and 6.)

The Red Hills of Dundee, south of the Chehalem Valley and southwest of Newberg, range in altitude from 200 to 1,000 ft (60 to 305 m). The hills are underlain by marine sedimentary rocks and are capped by the Columbia River Basalt Group (pl. 1). Well information (see log of well 3S/3W-26acc, table 6) indicates that the basalt is about 400 ft (120 m) thick on the east side of the Red Hills of Dundee. However, the basalt becomes thinner on the west side and at the southern end of the hill.

Water from the basalt in the Red Hills of Dundee occurs under unconfined conditions. In the higher parts of the hills, the main water table is generally more than several hundred feet below land surface. Therefore, some wells drilled at the higher altitudes must be drilled to considerable depths. However, many small bodies of perched ground water occur locally above the regional water table. These water-bearing zones yield water for many domestic uses and serve as outlets for many springs. Two springs flowing from the basalt above Henry Creek are being used for auxiliary water supplies by the city of Lafayette, which is less than a mile south of the project border. The reported flow from these two springs combined is about 37 gal/min (2.3 L/s). Wells used for municipal supplies by the towns of Lafayette and Dundee produce 100 to 180 gal/min (6.3 to 11 L/s). (See wells 3S/3W-27abd1 and 2, table 4.)

Domestic wells, most of which are drilled at higher altitudes in parts of the hills not served by municipal water systems, range in depth from 125 to 530 ft (38 to 160 m) and have an average depth of about 255 ft (78 m). The yields of the wells range from 6 to 25 gal/min (0.38 to 1.6 L/s). The average specific capacity of these wells is about 0.09 (gal/min)/ft [0.02 (L/s)/m].

The hydrograph of the Dundee municipal well 3S/3W-26acc, which taps the basalt, shows no decline in water levels for the years 1962-76. (See fig. 6.) This indicates that at least here, and possibly elsewhere in the subarea where the basalt is more permeable, thicker, and has greater storage capacity, discharge is in balance with natural recharge. In the southern part of the uplands, the basalt is thinner and some wells are drilled through the entire basalt sequence into the less permeable underlying marine rocks. In that area, water levels reportedly have declined more than 30 ft (9 m) (wells 4S/3W-5abb and 4S/3W-5bad) in 8 years.

The chemical quality of the water in the Red Hills of Dundee is satisfactory for most uses. However, wells that penetrate the marine rocks beneath the basalt may produce water of undesirable quality.

The lowland near Newberg joins the Chehalem Valley on the west and includes the city of Newberg and extends east to the foothills of the Chehalem

Mountains and south to the Willamette River. The surface of the lowland is covered with Willamette Silt to a depth of 10 to 40 ft (3 to 12 m). The northern edge of the lowland consists of marine sedimentary rocks and basalt. As shown on plate 1, the Troutdale Formation is exposed in the bottoms of several ravines and creek beds near Newberg. This formation underlies the Willamette Silt in most places in the lowland. In places the Troutdale is very thin or absent, and marine rocks directly underlie the Willamette Silt. (See log of well 3S/2W-21adb, table 6.) Where present in the lowland south and west of Newberg, the Troutdale Formation has a thickness ranging from 10 to about 200 ft (3 to 60 m).

In the lowland, domestic wells tapping the Troutdale Formation range in depth from 58 to 200 ft (18 to 60 m). Average depth of wells is about 108 ft (33 m). Commonly, the yields of these wells range from 6 to 16 gal/min (0.38 to 1.0 L/s) and average about 10 gal/min (0.06 L/s). Specific capacities of the wells range from 0.08 to 0.27 (gal/min)/ft [0.02 to 0.06 (L/s)/m]. The highest yielding well in the Troutdale Formation in the lowland is well 3S/2W-33bbb (table 4), which is southeast of Newberg near the Willamette River in a part of the lowland mapped as alluvium (pl. 1). This well is 100 ft (30 m) deep and is reported to produce 360 gal/min (23 L/s) with a drawdown of 23 ft (7 m). It has a specific capacity of about 16 (gal/min)ft [3 (L/s)/m].

In places near the foothills of the Chehalem Mountains (pl. 1) along the northeast and southeast boundaries of the lowland, thin flows of basalt are covered with a thin layer of Willamette Silt. The basalt, where it occurs, has an irregular surface and lies directly on marine sedimentary rocks. Wells drilled deep into the marine rocks usually produce water of higher salinity than do those drilled into the basalt or the Troutdale Formation. Some of these wells have been abandoned because the water was of unsuitable chemical quality. (See well 3S/2W-21cdd, table 4.)

Some of the better wells in the lowland near Newberg are in that part adjacent to and extending south and east of the Red Hills of Dundee. Here, the sand, silt, and clay of the Troutdale Formation have a uniform thickness of about 60 to 70 ft (18 to 21 m) and are quite permeable. Wells in this part of the area produce from 10 to 110 gal/min (0.60 to 7 L/s). For instance, Dundee municipal well 3S/3W-36aaa is 115 ft (35 m) deep and yields 110 gal/min (7 L/s).

In most of the lowland, the variation of thickness of alluvial aquifers and in places the shallow depth to the underlying marine rocks generally preclude the existence of many wells that produce more than 30 gal/min (2 L/s). Generally, domestic supplies for homes and farms are readily obtainable, and water from most wells in the area is of suitable quality for most uses.

Chehalem Mountains

The Chehalem Mountains subarea includes Parrett Mountain and consists of a series of northwest-trending uplands which reach altitudes of 1,629 ft (496 m) on Bald Peak in the Chehalem Mountains and 1,247 ft (380 m) on Parrett Mountain. The uplands have been dissected by many small streams whose canyons range in depth from 300 to 500 ft (90 to 150 m). The Chehalem Mountains are underlain by the Columbia River Basalt Group, which is overlain in places by silt which caps the ridges. (See pl. 1.)

Parrett Mountain is separated from the east end of the Chehalem Mountains by a major northeast-trending fault (pl. 1). This fault may act as a barrier to the lateral transmission of water and thereby isolate the ground-water system of Parrett Mountain from the area to the north.

The main aquifer is the Columbia River Basalt Group. Other aquifers include the alluvium and the Troutdale Formation on the north and northeast fringe of the subarea and the marine sedimentary rocks in places along the foothills and at lower altitudes in the uplands.

At higher altitudes, the regional water table generally exceeds a depth of 200 ft (60 m) below the land surface. Consequently, many domestic wells must be drilled to depths of several hundred feet to obtain water. (See wells 2S/2W-31bdc and 2S/3W-15dcb, table 4.)

Because many of the wells drilled in the upland parts penetrate isolated ground-water bodies perched high above the regional water table, wells (as shown by data in table 4) have a large range in depth, water level, and yield. Some of the wells have water levels of less than 50 ft (15 m) below land surface, whereas other wells drilled nearby or at lower altitudes have much deeper water levels.

Many of the perched water bodies yield sufficient water for domestic uses, except during summer when water use is greatest and the small volumes of water stored in these perched bodies are quickly depleted. As a result, many of the wells have had to be deepened--some several times. (See table 4.) As residential developments increase in parts of the uplands where isolated water bodies occur, more wells will be drilled into these water bodies and wells may be too closely spaced, resulting in excessive mutual interference between pumping wells and in local overdraft. The hydrograph of well 2S/3W-27aaa (fig. 7) is representative of water-level fluctuations in perched-water zones in the Chehalem Mountains subarea.

The north and northeast edges of the subarea are mapped as Willamette Silt and Quaternary alluvium on plate 1. As shown by logs of wells 2S/2W-8bbd and -13dda (table 6), wells drilled here penetrate several hundred feet of sand, silt, and clay before entering basalt. Most of the wells in the lowland part of the subarea produce water from the Columbia River Basalt Group. Here, the water occurs under water-table and confined conditions. The water from wells 2S/2W-5dcb and 2S/3W-1dad (table 4) occurs under confined conditions and flows at the surface.

Near the Tualatin Valley, along the north and northeast edges of the Chehalem Mountains, the top of the basalt extends beneath the regional water table. Here, wells that tap the basalt generally have higher yields than those that tap discontinuous water bodies at higher altitudes. Those wells also are more likely to retain their original specific capacities during

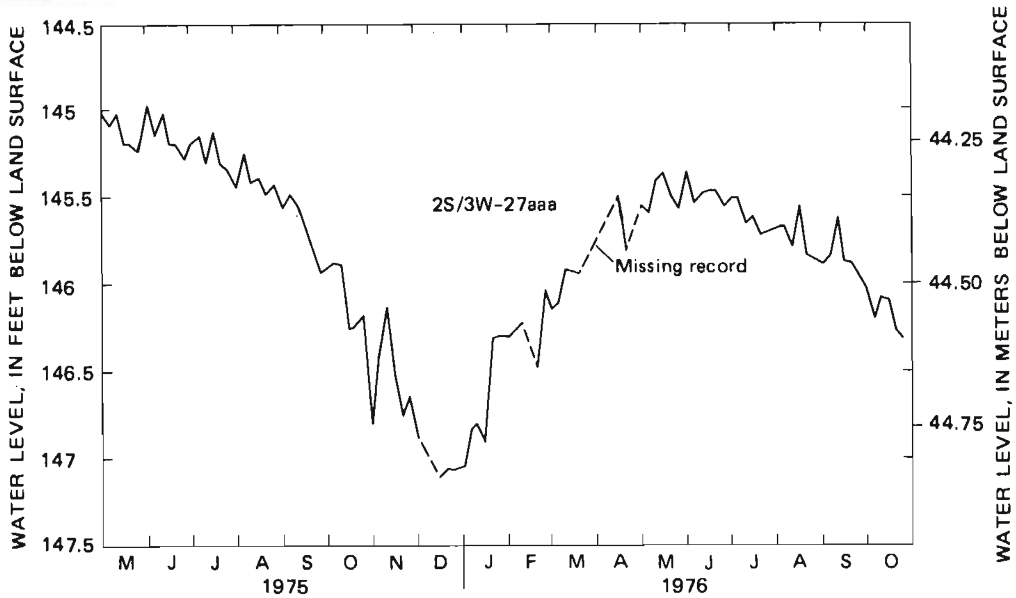

Figure 7.–Hydrograph of well 2S/3W-27aaa.

long periods of pumping because the aquifers in the main zone of saturation are not readily dewatered by pumping.

In the Chehalem Mountains subarea, wells (listed in table 4) range in depth from 10 ft (3 m) (well 2S/3W-3dcc) to 698 ft (212 m) (well 2S/2W-30adb) and average about 300 ft (90 m). Yields range from 3.5 to 125 gal/min (0.22 to 7.8 L/s) and average about 18 gal/min (1.1 L/s). Well 2S/3W-13abd has the highest yield (125 gal/min, or 7.8 L/s) with a specific capacity of 0.89 (gal/min)/ft [0.18 (L/s)/m]. Specific capacities of the wells range from 0.03 (gal/min)/ft [0.006 (L/s)/m] for well 2S/2W-31ada to 6 (gal/min)/ft [1.2 (L/s)/m] for well 2S/3W-11bab.

The chemical quality of the water in this subarea is generally suitable for most uses, as shown by the chemical analyses of wells 2S/2W-5dcb and 2S/3W-13abd, -14bac, and -15bbd (table 2). In some places in the uplands, water from the Columbia River Basalt Group contains undesirable concentrations of iron, and wells that penetrate the marine sedimentary rocks below the basalt may pump water of undesirable quality.

East Side

The east-side subarea includes (1) the Wilsonville-Sherwood locality, (2) part of the Tualatin River valley, (3) lowland near Wilsonville, (4) Petes Mountain, and (5) the upland extending between West Linn and Lake Oswego.

The Wilsonville-Sherwood locality extends from the town of Sherwood south through the center of R. 1 W. of Ts. 2 S. and 3 S. to the Willamette River and is mapped mostly as Willamette Silt and Columbia River Basalt Group (pl. 1). This locality has the highest yielding wells in the Newberg study area. High-producing wells tap the Columbia River Basalt Group, which is the main aquifer in this part of the subarea. The structure of the basalt here is synclinal,

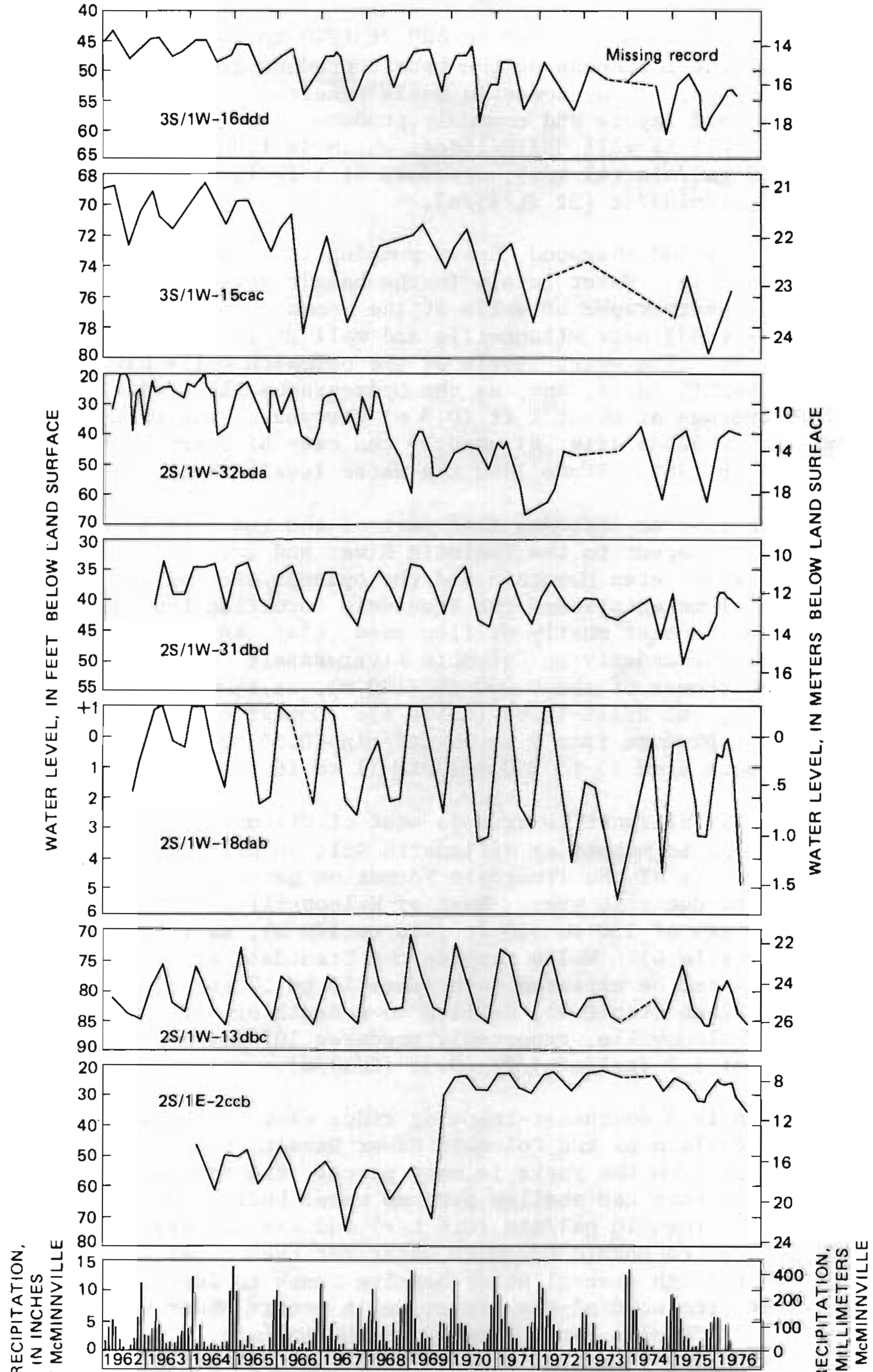

Figure 8.—Hydrographs of selected wells and precipitation at McMinnville.

and basalt thickness ranges from 700 to 800 ft (210 to 240 m), and wells that penetrate a sufficient thickness of the basalt produce from 100 to 1,000 gal/min (6.3 to 63 L/s). Many domestic wells penetrate permeable zones at the tops of shallow basalt layers and commonly produce 10 to 50 gal/min (0.63 to 3 L/s). The best well is well 3S/1W-16ddd, which is 1,000 ft (305 m) deep, has a yield of 780 gal/min (49 L/s), drawdown of 5 ft (1.5 m), and a specific capacity of 156 (gal/min)/ft [32 (L/s)/m].

Near Wilsonville and Sherwood, heavy pumping is localized and withdrawals have increased steadily. Water levels in the basalt wells have declined, as illustrated by the hydrographs of wells at the Dammasch State Hospital (3S/1W-15cac and -16ddd) near Wilsonville and well 2S/1W-31dbd near the city of Sherwood (fig. 8). The water levels of the Dammasch wells have been observed for more than 10 years, and, as the hydrographs illustrate, they have declined on the average of about 1 ft (0.3 m) per year. The water levels of municipal well 2S/1W-32bda (fig. 8) used by the city of Sherwood show a gradual decline from 1965 to 1969. Since 1969 the water levels have remained stable.

The east-side subarea includes that part of the Tualatin River valley north of Sherwood, adjacent to the Tualatin River and extending east along the Tualatin River between Petes Mountain and the uplands east of the river. Because the alluvial materials and the Troutdale Formation that underlie this part of the subarea consist mostly of fine sand, clay, and silt, most wells produce water from the underlying Columbia River Basalt Group. The Troutdale Formation has a thickness of about 400 ft (120 m), as shown by logs of wells 2S/1W-20dab, -30acc, and 2S/1E-19ccb (table 6). Domestic wells that tap the Troutdale Formation produce from 9 to 40 gal/min (0.56 to 2.50 L/s), and wells in the basalt produce from 15 to 250 gal/min (1 to 16 L/s).

The lowland near Wilsonville extends east of Wilsonville to the foothills of Petes Mountain and is mapped as Willamette Silt on plate 1. Here, alluvium and stratified deposits of the Troutdale Formation generally yield adequate volumes of water for domestic uses. East of Wilsonville, the Troutdale Formation has a thickness of 350 to 550 ft (110 to 170 m), as shown by the log of well 3S/1E-16cad (table 6). Wells tapping the Troutdale at depths of 100 to 150 ft (30 to 46 m) can be expected to produce 15 to 30 gal/min (0.95 to 2 L/s). Well 3S/1E-22bcb (table 4), drilled to a depth of 442 ft (135 m) in the Troutdale east of Wilsonville, reportedly produces 105 gal/min (7 L/s) with a specific capacity of 1.7 (gal/min)/ft [0.35 (L/s)/m].

Petes Mountain is a southeast-trending ridge east of the Wilsonville syncline and is underlain by the Columbia River Basalt Group. Along the ridge, springs issue from the rocks in many places, and some provide water for domestic use. Wells that tap shallow perched water bodies in Petes Mountain usually produce less than 10 gal/min (0.6 L/s) and are not dependable sources of water. Therefore, to obtain adequate water for even domestic supplies, most wells are drilled through several water-bearing zones to depths exceeding 500 ft (150 m). Water from most of the deeper wells occurs under water-table conditions, and yields of wells range from 30 to 300 gal/min (2 to 20 L/s) (table 4). In Petes Mountain, the highest yielding well is 3S/1E-4acc, which is 1,000 ft (305 m) deep, has a yield of 300 gal/min (19 L/s), and a specific capacity of 2.4 (gal/min)/ft [0.50 (L/s)/m]. This is a community well and supplies water for 20 homes.

Until 1969, the upland between West Linn and Lake Oswego was one of the most heavily pumped parts of the study area. Formerly, wells tapping the basalt underlying this upland were the source of much of the water supply for Lake Oswego and West Linn. Because of heavy pumping, water levels of some of the wells started to decline. These declining water levels and the resultant decrease in production necessitated deepening many wells tapping the permeable zones of shallow basalt flows. At present (1977), Lake Oswego and West Linn obtain water for municipal uses from surface-water sources outside the project area. Water levels in wells in this locality tend to recover with the cessation of heavy pumping, as shown by the hydrograph of well 2S/1E-2ccb (formerly owned by the city of Lake Oswego) (fig. 8). The water level in this well declined about 3 ft (0.9 m) per year from 1964 to 1969. With the cessation of pumping during 1969, the water level in the well rose about 25 ft (8 m) and at present seems to be stabilized, but shows seasonal fluctuation of about 8 ft (2.4 m). According to Hart and Newcomb (1965), the water level in this well was about 20 ft (6 m) below land surface in 1951. That the water level of well 2S/1E-2ccb has almost recovered to its reported level of 1951 is indicated by the hydrograph of this well (fig. 8). The water levels of many other wells that have been pumping for years show no long-term decline. Well 2S/1E-21cab (see table 4), drilled in 1926, supplies water for 48 families and reportedly has shown no decline in water level and yield throughout the years.

In contrast to water levels in the basalt aquifers, which in many places show long-term declines, water levels in the alluvial and Troutdale sediments show only seasonal fluctuations and generally return to their original levels.

The quality of water from most wells in the east-side subarea is generally good for most uses. However, in areas of heavy pumping, which causes a substantial lowering of water levels, some deep wells that tap the basalt at depth beneath the regional water table tend to have a higher proportion of dissolved constituents, such as chloride. In some places, water from the Troutdale Formation contains objectionable concentrations of iron.

OUTLOOK FOR THE FUTURE

Ground water for domestic use is generally available throughout the Newberg area, but the volume of water that can be developed varies considerably from place to place. Many wells that tap the marine sedimentary rocks and the Tillamook Volcanics in the western part of the area have been abandoned because of insufficient water and, in some cases, because of undesirable quality. However, at most places, quantities of water for domestic and stock supplies can generally be developed from wells that tap these rocks.

In the west-side subarea, particularly near the towns of Yamhill and Carlton, adequate ground-water supplies are not readily obtainable, and, therefore, surface-water supplies are being used. It is expected that in the future surface-water facilities in this part of the area will be expanded.

In most of the Newberg area, the alluvium and the Troutdale Formation are too thin to store large volumes of water. However, wells tapping the Troutdale Formation produce adequate water for most domestic uses. Small to moderate quantities of additional water can be developed from the Troutdale Formation east of Wilsonville and locally south and west of Newberg, where the formation is known to yield as much as 100 gal/min (6 L/s) to wells. The water levels in wells in the Troutdale generally do not change from year to year because local pumping does not exceed the rate at which the formation is recharged.

Additional water is available from the Columbia River Basalt Group, and this aquifer can be expected to be more fully developed in the future. Where pumping is heavy, as near Wilsonville and Sherwood, most wells produce water from several interflow zones of high permeability that occur below the regional water table. Elsewhere, many domestic wells may produce water from poorly permeable interflow zones or from isolated aquifers of limited extent containing perched water above the regional water table.

In localities of heavy pumping, the continued increasing withdrawal of ground water from the Columbia River Basalt Group has resulted in local overdevelopment and a decline in water levels. Since about 1962, the water levels have declined in the Dammasch State Hospital and Sherwood localities. In the Dammasch locality, water levels are declining about 1 ft (0.3 m) per year. Elsewhere, declines have been insignificant, and little change has been observed in either water levels or volumes of water obtainable from domestic wells.

Water levels in a few wells that tap the basalt have been observed for 10 to 12 years; however, a more complete network of observation wells is needed. An expanded network maintained on a continuing basis would (1) help to define more accurately the seasonal fluctuations of water levels, (2) provide data for relating water-level changes to pumping, and (3) give early warning of any possible overdraft from the aquifer. Quality of water from wells also should be monitored because of the known history of mineralization that has accompanied heavy pumping and lowered water levels in some parts of the area.

Although the Columbia River Basalt Group includes many water-bearing zones below the regional water table, the group acts as a single reservoir system. Excessive pumping from any of the water-bearing zones in any part of the area will eventually lower the water levels and the productivity of basalt wells in other parts of the area. That this eventuality is possible is suggested by the history of ground-water development in the Cooper Mountain-Bull Mountain area, north of the Newberg study area.

The Cooper Mountain-Bull Mountain area is geologically and hydrologically similar to the Chehalem Mountains and east-side subareas of the Newberg study area. However, the Cooper Mountain-Bull Mountain area has a larger population than the Newberg area, and pumping from the Columbia River Basalt Group increased rapidly in the 1960's. This resulted in excessive declines in water levels in the basalt, reduction in well capacities, and the necessity to deepen many domestic wells 50 to 100 ft (15 to 30 m). To stabilize water levels and to prevent further depletion of the basalt aquifers, the Cooper Mountain-Bull Mountain area was declared a critical ground-water area by the Oregon State Engineer (now Oregon Water Resources Department) in 1974, and restrictions were placed on pumping and construction of new wells.

With a monitoring program, as previously described, to determine changes in water levels and chemical quality, it should be possible to detect problems as they develop and to take necessary steps to avoid overdraft of the basalt aquifer in the Newberg study area.

Studies should be made on the economic feasibility of artificial recharge of the basalt aquifers. As previously noted, only a small volume of the annual precipitation recharges these aquifers; the rest is lost mostly through overland runoff to streams. Much of the precipitation that is now lost could be utilized to replenish these aquifers. The technical feasibility of artificially recharging basalt aquifers was demonstrated by Foxworthy and Bryant (1967) and Foxworthy (1970).

Additional water supplies can be obtained from surface-water sources, such as the Willamette River, to supply heavy concentrations of population within the area. The utilization of all available ground- and surface-water resources will ensure dependable water supplies for the future and allow continued economic growth without depletion of the basalt aquifers.

GROUND-WATER DATA

Data summarized in table 4 are representative of ground-water data collected in the study area during this investigation. Information in the well-records table (table 4) was obtained from reports compiled by well drillers, from well owners and operators, and from field data collected during this study.

Table 5 contains records of eight springs that are fairly representative of the many springs in the upland parts of the area. The locations of wells and springs listed in the tables are shown on plate 2.

Table 6 contains lithologic logs of representative wells drilled in the study area. Nearly all the logs were obtained from drillers' reports submitted to the Oregon Water Resources Department. The reports were edited for consistency of terminology.

Additional unpublished ground-water data, including well reports and ground-water-level records are on file in the offices of the Oregon Water Resources Department, Salem, Oreg., and the U.S. Geological Survey, Portland, Oreg.

WELL- AND SPRING-NUMBERING SYSTEM

Designations of wells discussed in this report are based on the official system for rectangular subdivision of public lands. The well number indicates the location of the well or test hole by township, range, section, and its position within the section. This method of well numbering is illustrated in figure 9. The first numeral indicates the township; the second, the range; and the third, the section in which the well is located. The letters following the section number locate the well within the section. The first letter denotes the quarter section (160 acres, or 0.65 km^2); the second, the quarter-quarter section (40 acres, or 0.16 km^2); and the third, the quarter-quarter-quarter section (10 acres, or 0.04 km^2). For example, well 2S/4W-16cdc is in SW¼SE¼SW¼ sec. 16, T. 2 S., R. 4 W. Where two or more wells are in the same 10-acre (0.04 km^2) subdivision, serial numbers are added after the third letter. A spring is identified by the addition of an "s" after the final letter.

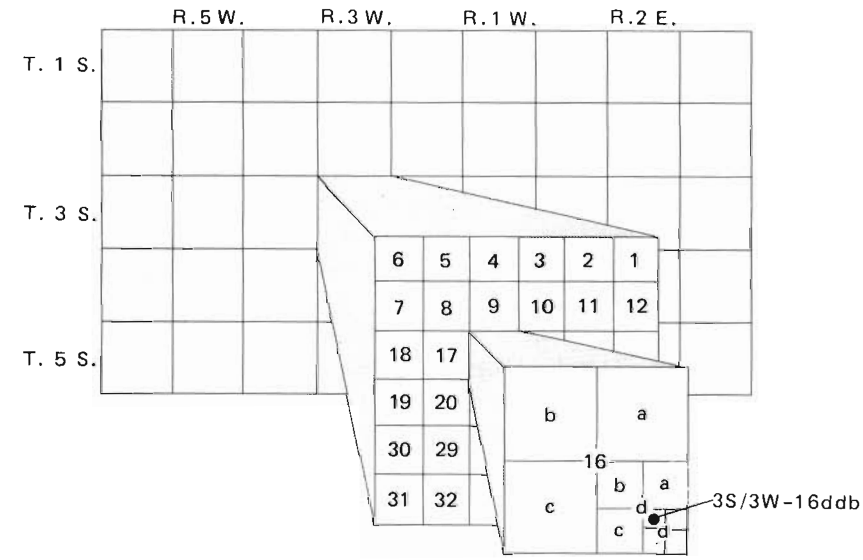

Figure 9.--Well- and spring-numbering system.

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HYDROLOGIC DATA

Table 2.--Chemical analyses of water in the Newberg area

[Analyses by the U.S. Geological Survey unless otherwise noted]

Location number	Water-bearing unit 1/	Depth of well (feet)	Date of collection or analysis	Milligrams per liter																			Sodium-adsorption-ratio (SAR)	Specific conductance (micromhos/cm at 25°C)	pH	Temperature	
				Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3) + nitrite (NO_2) as N	Phosphate, ortho as P	Boron (B)	Arsenic (As)	Dissolved solids, calculated from determined constituents	Hardness (Ca, Mg)	Noncarbonate hardness				(°C)	(°F)
2S/1W-16dca	Tcr	495	5-17-76	56	0.76	0.020	57	14	120	12	115	0	1.0	270	0.3	0.16	0.13	0.12	0.000	589	200	110	3.7	1,130	7.2	11.5	53
-22ccd 2/	Tcr	342	--	81	.20	--	--	--	--	--	3/ 146	0	--	--	--	--	--	--	--	--	88	--	--	--	7.5	--	--
-27ccd	Tcr	244	12-18-75	56	.04	.010	24	7.2	8.4	3.5	105	0	10	5.9	.1	1.9	.11	.002	.000	176	90	3	.4	190	7.2	10.5	51
-32bdb 4/	Tcr	347	4- 6-65	52	16	<.050	19	9.5	10	2.0	3/ 122	0	.5	3.3	.4	.15	.06	--	<.005	172	87	0	--	205	6.6	--	--
2S/2W-5dcb	Tcr	315	6-10-75	43	.03	.000	26	14	16	4.8	170	0	2.6	9.1	.1	.00	.10	.000	.000	200	120	0	.6	310	6.3	--	--
-13ccd	Tcr	120	11-13-75	54	.03	.000	17	6.7	7.9	2.5	107	0	.8	1.3	.1	.08	.11	.010	.000	144	70	0	.4	175	6.8	11.0	52
-23bbd	Tcr	290	do	43	8.1	.160	19	6.3	9.2	2.8	124	0	1.3	2.0	.1	.02	.05	.020	.000	153	73	0	.5	215	6.6	9.0	48
2S/3W-13abd	Tcr	330	6-10-75	63	.03	.005	16	6.0	6.9	3.9	88	0	1.1	2.5	.1	.11	.11	.000	.001	144	65	0	.4	180	6.3	--	--
-14bac	Tcr	305	11-12-75	54	.07	.005	12	5.8	5.9	2.6	86	0	1.9	1.7	.1	.01	.07	.010	.000	127	54	0	.4	145	7.3	12.5	54
-15bbd	Tcr	317	6-10-75	25	.15	.005	4.8	1.0	3.6	.9	14	0	.7	3.0	.0	1.0	.01	.006	.001	51	16	5	.4	69	7.0	--	--
-21cdb	Tm	290	11-11-75	8.2	.02	.020	6.4	1.5	350	2.8	808	28	16	32	1.1	.07	.37	1.9	.000	848	22	0	32	1,450	9.2	10.0	50
-27aaa	Tcr	245	4-27-76	57	.03	.000	14	6.6	7.1	4.8	93	0	3.8	2.5	.2	1.1	.15	.020	.000	147	62	0	.4	150	6.9	9.5	49
-31acb	Tm	64	6- 5-75	32	.34	.020	4.6	.1	96	1.5	200	0	31	10	.2	.00	.83	.430	.002	277	12	0	12	430	6.4	10.5	51
-34aca	Tm	155	11-12-75	61	.16	.020	14	5.7	11	2.2	88	0	2.2	5.1	.1	.73	.19	.010	.000	149	58	0	.6	160	6.8	11.5	53
2S/4W-4ccd	Tm	100	11-11-75	26	7.4	.260	20	7.7	9.3	1.0	102	0	8.0	2.8	.1	.03	.05	.020	.000	133	82	0	.4	195	6.7	11.0	52
-6dcas 5/	Tm	--	2-24-76	43	.000	.000	24	9.1	7.3	.7	122	0	2.6	3.3	.1	.40	.04	.004	.000	152	97	0	.3	195	6.7	14.0	57
-14bad	Tm	142	6- 5-75	67	2.4	.080	9.0	2.0	6.3	1.6	40	0	5.1	2.2	.1	.00	.15	.000	.000	116	31	0	.5	93	5.8	13.5	56
-18cdd	Tev	204	6- 4-75	27	.72	.050	43	8.0	19	.7	169	0	9.4	4.5	.1	.01	.01	.004	.001	196	140	2	.7	320	7.4	13.0	55
-23cc	Tm	92	4-19-51	19	.25	1.5	1,980	113	824	12	51	0	30	5,010	.2	--	--	2.1	--	8,010	5,400	5,360	24	13,300	7.0	--	--
-29dbd	Tm	150	6- 4-75	10	.13	.005	10	1.2	150	.7	266	19	73	12	.5	.02	.00	1.4	.001	409	30	0	12	730	8.4	13.0	55
2S/5W-29cdas	Tev	--	do	11	.08	.060	3,600	.0	1,600	3.6	28	0	230	8,600	.4	.00	.02	1.3	.000	14,100	9,000	9,000	7.3	24,300	8.3	11.5	53
-31bba	Tev	91	do	17	.09	.000	1.8	.4	58	.1	146	0	6.8	3.5	.2	.06	.01	.220	.001	160	6	0	10	266	7.6	9.5	49
2S/1E-2ccb 4/	Tcr	225	11- 4-53	40	.9	--	30	11	6/ 10	--	3/ 182	0	13	22	.0	--	--	--	--	216	128	--	--	--	7.3	--	--

See footnotes at end of table.

Table 2.--Chemical analyses of water in the Newberg area--Continued

[Analyses by the U.S. Geological Survey unless otherwise noted]

Location number	Water-bearing unit[1]	Depth of well (feet)	Date of collection or analysis	Milligrams per liter: Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3) + nitrite (NO_2) as N	Phosphate, ortho as P	Boron (B)	Arsenic (As)	Dissolved solids, calculated from determined constituents	Hardness (Ca, Mg)	Noncarbonate hardness	Sodium-adsorption-ratio (SAR)	Specific conductance (micromhos/cm at 25°C)	pH	Temperature (°C)	Temperature (°F)
2S/1E-9dad[4]	Tcr	502	11- 4-53	--	[7]0.1	0.0	17	6.0	[6]6.1	--	[3]85	0	10	12	0.02	--	--	--	--	158	67	--	--	--	6.8	--	--
-15aab[4]	Tcr	526	5-18-61	68	.60	<.050	16	14	8.7	2.6	[3]113	0	.6	5.9	.2	0.30	0.40	--	--	172	96	--	--	180	6.8	--	--
-15dba[4]	Tcr	470	do	63	<.05	.070	18	15	8.2	3.9	[3]129	0	2.2	4.4	.2	.20	.55	--	--	178	107	--	--	200	7.3	--	--
-16bdd	Tcr	907	4- 9-76	66	.02	.000	20	12	9.9	3.3	140	0	2.3	2.6	.1	.08	.17	0.006	0.000	186	99	0	0.4	260	7.0	12.5	54
-21bdc[4]	Tcr	195	1- 6-65	55	<.02	<.050	21	10	8.8	4.0	[3]133	0	1.0	3.0	.3	.28	.30	--	<.005	168	95	--	--	201	6.8	--	--
-21cab[4]	Tcr	165	do	55	.26	<.050	19	11	8.5	2.5	[3]113	0	1.5	3.0	.2	.26	.25	--	<.005	156	92	--	--	179	6.5	--	--
-32dac[2]	Tcr	780	5- 9-73	80	.04	<.020	12	5.5	10	--	[3]110	0	5	3	.1	.07	--	--	<.005	170	53	--	--	--	6.9	--	--
-33bbb	Tcr	600	4-10-76	61	.01	.000	19	11	7.5	3.3	130	0	.8	2.2	.1	.26	.10	.002	.000	170	93	0	.3	200	7.1	10.0	50
-34bdc	Tt	200	do	18	.38	.050	48	5.8	120	3.9	72	0	.0	260	.0	.16	.46	.200	.000	494	140	85	4.4	800	7.6	11.0	52
3S/1W-1adb[2]	Tcr	577	5-30-73	64	.09	<.020	18	7.0	14	2.8	[3]123	0	3	2	.2	1.1	--	--	<.005	172	75	--	--	--	7.0	--	--
-1cda[2]	Tcr	783	7-16-70	58	.06	<.020	20	7.9	7.0	1.2	[3]127	0	19	7.5	.3	.03	--	--	.003	183	82	--	--	--	7.4	--	--
-1cda[2]	Tcr	783	8- 7-72	46	.52	.260	28	12	11	4.0	[3]178	0	2.4	7.7	.2	--	--	--	.004	199	119	--	--	--	7.7	--	--
-5bcd	Tcr	230	12-18-75	55	.02	.000	14	4.3	5.8	2.3	72	0	1.4	4.0	.1	.73	.10	.000	.001	126	53	0	.3	160	6.9	9.5	49
-15cac[2]	Tcr	920	10-14-70	45	.26	.040	71	13	64	3.8	[3]118	0	2.5	177	.2	.05	--	--	.001	434	230	--	--	--	7.5	--	--
-16ddd[2]	Tcr	1,000	do	46	.98	.080	112	32	112	5.8	[3]115	0	1.3	417	.2	.03	--	--	.001	783	413	--	--	--	7.6	--	--
-16ddd[2]	Tcr	1,000	7-28-76	47	.01	.100	140	20	100	5.8	111	0	.1	400	.2	.01	.05	.070	0	768	430	340	2.1	1,410	7.6	--	--
-23daa	Tcr	638	4-10-76	53	.02	.020	54	23	17	5.8	128	0	.0	120	.1	.04	.03	.010	.000	336	230	120	.5	520	7.6	--	--
-28aac	Tcr	245	12-18-75	34	.15	.290	72	19	87	11	92	0	1.3	280	.2	.00	.06	.020	.000	551	260	180	2.4	650	7.7	11.0	52
3S/2W-3adc	Tcr	305	11-13-75	42	.04	.000	11	5.1	7.0	1.5	74	0	1.8	.9	.1	.00	.05	.002	.000	106	48	0	.4	122	6.9	10.0	50
-14bcc	Tcr	445	11-12-75	59	.02	.005	16	8.2	8.7	3.4	115	0	1.4	1.8	.1	.02	.10	.020	.000	156	74	0	.4	185	7.1	11.5	53
-19ccb	Tcr	224	6-10-75	60	.02	.005	19	8.4	9.8	3.5	111	0	4.0	3.3	.1	.00	.03	.000	.000	163	82	0	.5	185	5.9	--	--
-21adb	Tt	184	11-12-75	18	1.5	.180	70	5.3	610	5.0	217	0	2.7	940	.2	.02	.02	.710	.000	1,760	200	19	19	3,170	7.7	12.5	54
-26bda	Tcr	465	do	60	.02	.000	14	6.2	8.3	3.7	102	0	1.4	1.3	.2	.14	.09	.000	.000	146	61	0	.5	170	7.2	7.5	45

See footnotes at end of table.

Table 2.--Chemical analyses of water in the Newberg area--Continued

[Analyses by the U.S. Geological Survey unless otherwise noted]

Location number	Water-bearing unit 1/	Depth of well (feet)	Date of collection or analysis	Milligrams per liter: Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3) + nitrite (NO_2) as N	Phosphate, ortho as P	Boron (B)	Arsenic (As)	Dissolved solids, calculated from determined constituents	Hardness (Ca, Mg)	Noncarbonate hardness	Sodium-adsorption ratio (SAR)	Specific conductance (micromhos/cm at 25°C)	pH	Temperature (°C)	Temperature (°F)
3S/2W-34abd	Tt	197	5-18-76	54	1.3	0.300	39	5.5	220	12	231	0	5.0	310	0.4	0.29	0.33	0.240	0.000	764	120	0	8.7	1,170	7.2	11.5	53
3S/3W-9dba	Tm	240	12-17-75	26	.16	.010	7.5	.4	350	1.9	263	0	5.3	390	.9	.01	.12	1.7	.000	914	20	0	34	1,050	8.0	13.5	56
-11caa	Tm	46	do	45	2.2	.250	17	5.8	8.0	2.2	94	0	4.1	4.3	.1	.13	.20	.007	.006	137	66	0	.4	180	7.2	11.5	53
-22cbd	Tcr	375	11-11-75	37	.02	.000	4.3	2.2	4.2	1.0	36	0	.6	.6	.1	.95	.05	.002	.000	72	20	0	.4	72	7.5	11.0	52
-26acc	Tcr	471	6-10-75	29	.04	.000	27	7.8	12	2.5	125	0	12	3.8	.1	.00	.01	.000	.000	156	100	0	.5	270	7.9	--	--
-30dab	Tm	147	do	11	.06	.000	8.1	.0	110	1.1	281	0	12	5.8	.3	.00	.03	.250	.001	287	20	0	11	510	8.0	13.5	56
-36aaa	Tt	115	do	38	.32	.040	19	8.6	6.4	.8	94	0	5.6	4.3	.1	.01	.02	.000	.001	130	83	6	.3	175	6.1	10.5	51
3S/4W-2adc	Tm	65	6- 5-75	29	.58	.14	95	16	58	.7	172	0	21	190	.2	.00	.03	.02	.000	496	300	160	1.5	970	7.1	12.0	54
-6bcd	Tm	77	6- 4-75	26	1.3	.20	32	10	81	.6	226	0	59	29	.3	.01	.07	.14	.003	351	120	0	3.2	630	7.2	12.0	54
-34bdc	Tm	73	11-11-75	37	.01	.34	39	12	13	2.1	204	0	1.3	3.8	.2	.01	.61	.01	.042	211	150	0	.5	330	7.7	11.5	53
3S/5W-17bda	Tm	120	6- 4-75	18	.05	.000	15	.5	47	.2	142	0	8.0	5.1	.1	.01	.01	.27	.001	164	40	0	3.3	265	7.7	13.5	56
3S/1E-4acc 2/	Tcr	1,000	3-15-71	64	.3	<.01	20	8.8	12	5.5	3/ 141	0	4.1	7.4	.2	.16	--	--	<.01	191	85	--	--	--	7.3	--	--
-16cad	Tcr	1,005	4- 9-76	6.6	.01	.15	35	5.9	19	5.1	188	0	.0	5.8	.1	.01	.00	.04	.000	170	110	0	.8	295	8.0	11.0	52
-18bdb2	Tt	178	do	30	.03	.12	28	16	11	3.4	196	0	.0	2.8	.1	.03	.07	.000	.001	188	140	0	.4	280	7.5	13.5	56
-21aad2 8/	Tt	265	10- 1-73	.6	7/ .7	9/ .3	14	8.0	65	--	--	--	--	4.9	.1	.02	--	--	.003	--	83	--	--	--	7.8	--	--
-22bbd 8/	Tt	307	6- 5-74	77	.9	.16	34	8.0	27	2.0	3/ 188	0	0	12	.3	1.1	--	--	<.005	255	120	--	--	--	7.6	--	--
4S/3W-5dbb	Tm	408	4-27-76	26	.07	.01	70	19	51	11	303	0	120	5.8	.2	1.4	.01	.08	.000	459	250	5	1.4	680	7.4	11.0	52

1/ Tcr, Columbia River Basalt Group; Tev, Tillamook Volcanics; Tm, marine sedimentary rocks; Tt, Troutdale Formation.
2/ Analysis by MEI Charlton Laboratories, Portland, Oreg.
3/ Value calculated from total alkalinity reported as $CaCO_3$.
4/ Analysis by Oregon State Board of Health.
5/ Small "s" indicates spring.
6/ Reported as sodium plus potassium.
7/ Total iron.
8/ Analysis by Northwest Testing Laboratories, Portland, Oreg.
9/ Total manganese.

Table 3.--Sources and significance of common chemical constituents of water

Constituent	Recommended limits for drinking water[1] (mg/L)	Principal sources	Significance with respect to use
Silica (SiO_2)	--	Dissolved from soils and rocks in the area.	May form scale in pipes used in zeolite-type water softeners and in boilers.
Iron (Fe)	0.3	Common iron-bearing minerals present in most rocks in the area.	More than about 0.3 mg/L may stain laundry and utensils. Larger quantities may color and impart objectionable taste to water.
Manganese (Mn)	.05	Manganese-bearing minerals	Same objectionable features as iron. Causes dark-brown or black stain.
Calcium (Ca) and magnesium (Mg).	--	Dissolved from soils and rocks in the area.	Principal causes of hardness and the major constituents in scale deposits.
Sodium (Na) and potassium (K).	--	do	Large amounts in combination with chloride may give water a salty taste. Excessive amounts of sodium may reduce soil permeability and limit use of water for irrigation. Potassium is essential for proper plant nutrition.
Bicarbonate (HCO_3) and carbonate (CO_3).	--	All carbonate minerals in the presence of carbon dioxide that is especially abundant in soil and atmosphere.	In combination with calcium or magnesium, causes carbonate hardness resulting in the deposit of boiler scale when used with hot-water facilities.
Sulfate (SO_4)	250	Gypsum, iron sulfides, and other sulfur compounds. Also commonly present in many industrial wastes.	Sulfates of calcium and magnesium form hard scale and are cathartic and unpleasant to taste.
Chloride (Cl)	250	Chloride salts, largely NaCl, in the consolidated rocks of marine origin.	In high concentrations imparts salty taste and may accelerate corrosion in pipes and other fixtures.
Fluoride (F)	[2]2.0	Occurs in trace amounts in many soils and rocks.	Optimum concentrations tend to reduce decay of children's teeth; concentrations greater than several milligrams per liter may cause mottling of the enamel of the teeth.
Nitrate (NO_3) + nitrite (NO_2), as N).	10	Decayed organic matter, sewage, and nitrates in soil.	Values substantially higher than local average may suggest pollution. An excess of 10 mg/L in drinking water may cause methemoglobinemia, the so-called "blue-baby" disease in infants.
Phosphate (P)	--	Dissolved from soils and rocks in the area. Also found in soaps and detergents.	Phosphate is essential to all forms of life. In certain forms, phosphates can interfere with coagulation processes at water-treatment plants.
Arsenic (As)	.05	Occurs naturally in water in varying concentrations.	Prolonged consumption of water containing an excessive amount of arsenic may cause chronic poisoning.
Boron (B)	--	Occurs in trace amounts in some of the rocks in the area.	Essential in small amounts for proper plant nutrition. Unsuitable in concentrations of more than 4 mg/L for even the most tolerant crops.

1/ Recommended limits by National Academy of Sciences and National Academy of Engineering (1973). Exceptions are arsenic, fluoride, and nitrate, for which limits are set by the Environmental Protection Agency (1975).

2/ Recommended values based on average maximum daily air temperature in a given area.

Table 4.--Records of representative wells

Well number: See page 30 for description of well-numbering system.
Type of well: Dg, dug; Dr, drilled.
Finish: B, open bottom (not perforated or screened); P, perforated; Sc, screened.
Altitude: Altitude of land surface at well, in feet above mean sea level, interpolated from topographic maps.
Water level: Depths to water below land surface given in feet and decimals were measured by the Geological Survey; those in whole feet were reported by others or estimated.
Specific conductance of water: Field determination, in micromhos per centimeter at 25°C.
Type of pump: C, centrifugal; J, jet; N, none; P, piston; S. submersible; T, turbine; hp, horsepower.

Well performance: Yield in gallons per minute, and drawdown in feet below nondischarging water level, reported by owner, operator, driller, or pump company.
Use: D, domestic; In, industrial; Ir, irrigation; PS, public supply; S, stock; U, unused.
Remarks: Ca, chemical analysis of water in table 2 ; H, hydrograph in report; L, driller's log of well in table 6 ; P, B, or At, pumped, bailed, or air tested for the indicated number of hours, when drawdown was measured. Remarks on adequacy, dependability, and general quality are reported by owners, tenants, drillers, or others.

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
										T. 2 S., R. 1 W.									
13dbc	D. D. Olson	Dg	--	87	40	--	B	--	--	Gravel	192	77.81	3-31-76	--	N	--	--	U	H.
14aab	Tigard School Dist. 23T	Dr	1952	684	--	--	--	--	--	Basalt	190	18	do	280	S, 5	--	--	U	
14aca	Mr. Kwong	Dr	1971	590	6 5	576 590	P, 582-590	582	8	Gravel	180	51	9-10-71	330	J, 3	15	349	D	B 2 hr.
14ccc	Boyd Carr	Dr	1973	208	6 5	190 208	P, 190-207	193	10	Sand	160	41.84	3-26-76	440	S, 1	15	140	D	B 1 hr.
15bda	T. C. Wasson	Dr	1962	695	6	526	B	680	14	Basalt	150	--	--	--	S	35	160	D	B 4 hr, L. Well flows small volume of water. Has water softener.
15dac1	Richard Cox	Dr	1971	600	6 5	70 600	P, 580-600	510 582	-- --	Clay and basalt Basalt	143	--	--	--	S	15	100	D	At 2 hr. Well flows small volume of water.
15dac2	W. D. Dendurent	Dr	1972	125	12 6	20 68	P, 45-65	45	20	Sand and gravel	151	30.27	3-26-76	130	S, 2	12	32	D	At 2 hr.
16dbd	J. E. Van Nortwick	Dr	1965	235	6	196	B	187	--	Basalt	143	31	7-29-65	270	S, 1	30	175	D	B 1 hr.
16dca	Howard Martine	Dr	1956	495	6	485	B	485	10	do	125	Flows	3- 2-76	700	J, 1½	14	40	D	B, L, Ca. Flows 1½ gal/min.
17acb	E. F. Robinson	Dr	1964	128	6	54	B	116	12	do	205	70.35	3-25-76	220	S, 3/4	30	30	D	B 1 hr.
17cba	James Larsen	Dr	1972	200	6	60	B	176	16	do	170	34.82	do	145	S	40	165	D	P 2 hr.
18ada	Yoshio Hasuike	Dr	1969	392	12	52	B	370	19	do	190	60.09	3-24-76	180	T, 15	260	50	Ir	P 7 hr.
18dab	James Hasuike	Dr	1951	150	10	--	--	--	--	--	195	.62	1-17-76	150	T, 15	--	--	Ir	H.
19bdd	E. C. Schlickting	Dr	1965	310	8	228	B	--	--	Basalt	167	32.69	3-24-76	175	S, 2	65	35	D	B 1 hr.
20adc	M. F. Dittman	Dr	1967	600	6	548	B	524	--	do	145	15.92	3-30-76	480	S, 1	18	16	D	B 2 hr.
20dab	D. W. Parr	Dr	1974	460	6	436	B	436	24	do	145	15	4-24-74	530	S, 7½	100	365	S	At 2 hr, L.
21dca	Mr. Anderson	Dr	1964	273	6 5	241 273	B	--	--	Clay and sand	130	8	9- 1-64	--	J, ½	20	235	U	B 2 hr. Well deepened from 78 ft.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
										T. 2 S., R. 1 W.--Continued									
22ccd	Coaxco, Inc.	Dr	1974	342	6	310	B	320	22	Basalt	144	18.48	3-30-76	250	S, 1	15	287	In	At 2 hr, L, Ca.
22cdc	Portland Concrete Pipe Products Co.	Dr	1966	430	8	197	B	300 388 417	12 7 8	do do do	142	16	6-15-66	370	T, 15	100	164	In	P 18 hr.
23bab	R. R. Abernathy	Dr	1973	175	6	143	B	145	--	do	141	24.03	3-31-76	--	S, 3/4	8	143	U	B 1 hr. Well not used because of poor-quality water.
23bba	Clay Barton	Dr	1960	189	8 6	174 189	P 171-189	160	25	do	148	28.86	do	650	S, 7½	45	100	Ir	B 2 hr.
23bdb	C. H. Savage Co.	Dr	1969	70	6 5	58 70	P 56-69	56	--	Sand and gravel	125	5.03	3-30-76	950	S	24	45	In	Do.
25bca	W. C. Nelson	Dr	1965	360	6	340	B	--	--	Clay and sand	265	89.28	3-31-76	200	S, 2	10	200	D	P 5 hr, L. Well originally drilled to 238 ft in 1964.
25ccb	W. D. Bright	Dr	1974	240	6 5	90 120	P, 20-120	218	16	Basalt	243	49.46	4- 2-76	175	S, 2	18	8	D	P 3 hr.
26dca	Charles Hoff	Dr	1969	158	6	68	B	121 151	5 7	do do	265	38.74	do	210	S	45	40	D	B 1 hr.
27abb	Donald M. Drake Co.	Dr	1973	400	8	334	B	--	--	do	140	16.63	12-11-75	250	S, 10	60	290	In	P 2 hr.
27ccd	Tigard Sand & Gravel	Dr	1968	244	10 8	84 --	B	137 174	-- 23	do do	220	75	12-19-68	190	S, 25	400	148	In	P 4 hr, L, Ca.
28bcb	David Cereghino	Dr	1968	144	12 10	22 52	B	--	--	do	165	20.92	12-12-75	--	S	325	84	Ir	P 58 hr. Used to irrigate 20 acres.
28bcc	do	Dr	1971	125	6	50	B	93	21	do	144	9.90	4- 1-76	150	S, 7½	110	108	D	P 2 hr.
28caa	A. E. Denley	Dr	1958	110	6	42	B	--	--	do	220	72.70	12-12-75	--	S, 3	24	0	In	B 3 hr.
29bdd	Clarence Langer, Jr.	Dr	1974	248	6	178	B	200	--	do	202	49.56	4- 1-76	265	S, 1½	20	40	D	P 4 hr.
30acc	J. J. Burris	Dr	1967	585	6	490	B	--	--	do	182	42	5- 9-67	240	S, 1	7	200	D	P 2 hr, L.
30dab	R. A. Zittlemoyer	Dr	1965	470	6	410	B	410	--	do	198	48.17	4- 1-76	210	S, 3	42	35	PS	B 1 hr. Water supply for trailer court.
31aba	City of Sherwood	Dr	1968	458	14	99	B	--	--	do	201	44	4-28-69	205	T, 60	414	249	PS	P 4 hr.
31dbd	C. S. Kennerly	Dr	--	400	6	--	B	--	--	do	210	33	4- 1-76	180	T, 15	--	--	Ir	H.
32aaa	D. C. Cochran	Dr	1970	95	6	22	B	81	7	do	160	23.90	12-12-75	200	S, 3/4	45	71	D	P 2 hr.
32bda	City of Sherwood	Dr	1946	339	12	115	B	--	--	do	195	38	4- 1-76	150	T, 75	875	--	PS	P, H.
32bdb	do	Dr	1923	347	8	121	B	--	--	do	193	49	do	160	T, 30	350	--	PS	P, Ca.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com-pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thick-ness (feet)	Water-bearing zone(s): Character of material	Alti-tude (feet)	Water level: Feet below datum	Water level: Date	Specific conduct-ance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Draw-down (feet)	Use	Remarks
T. 2 S., R. 1 W.--Continued																			
33dda	Tualatin Valley Sportsman Club	Dr	1973	230	6	20	B	--	--	Basalt	230	66.42	12-12-75	--	S, 1	52	167	D	P 2 hr. Well deepened from 109 ft.
34aca	Dave Sanderson	Dr	1962	120	6	37	B	--	--	do	315	93	12-21-62	300	S, 3/4	20	0	D	B 2 hr.
34dda1	Lee Thompson	Dr	1967	410	6 5	73 218-319	P, 269-299	-- --	203 280	do do	290	81	1-25-67	--	S, 5	30	7	Ir	P 2 hr. Well deepened from 347 ft.
34dda2	do	Dr	1969	579	6	--	--	--	--	do	290	--	--	--	--	106	370	Ir	P 2 hr. Well deepened from 242 ft.
34ddb	do	Dr	1967	370	8	370	B	88 294 357	5 7 11	do do do	280	51	2-11-63	--	S, 5	50	14	Ir	B 2 hr.
34ddc	B. B. Summers	Dr	1966	380	6	80	B	--	--	do	245	57.49	12-11-75	170	S, 5	65	260	Ir	P 1 hr. Used to irrigate 10 acres of pasture.
35dbb	W. A. Shope, Jr.	Dr	1972	235	6	46	B	165	--	do	340	33.08	4- 2-76	150	S, 1½	25	175	D	B 2 hr.
36cda	Edward Lacy	Dr	1974	221	6	76	B	207	14	do	387	131.6	do	165	S	35	60	D	B 1½ hr.
T. 2 S., R. 2 W.																			
5dcb	Joseph Weibel	Dr	1974	315	8	255	B	280 290	10 25	Basalt do	142	Flows	4-18-75	240	S, 25	95	87	Ir	P 1½ hr, L, Ca. Flows 18 gal/min.
6dcd	W. A. Reese	Dg	1950	55	48	55	--	--	--	--	202	10.55	4-17-75	250	J, 1	--	--	D	
7add	Kreszenz Brungard	Dr	1954	375	6	--	--	--	--	--	185	14.05	do	--	T, 10	100	200	Ir	P.
7cad	Kenneth Williams	Dr	1974	185	6	133	B	140	--	Basalt	238	71.6	4- 1-75	--	N	18	--	U	At 1 hr.
8bbd	Melvin Finegan	Dr	1956	612	8	227	B	343 585	-- 20	do do	180	10	5-29-56	--	T, 20	185	210	Ir	P 4 hr L.
8dad	Robert Wolff	Dr	1972	324	8 6	260 290	B	294	15	do	190	28.4	4-18-75	240	S, 5	35	225	Ir	At 2 hr.
9aaa	Jim Sweitz	Dr	1974	185	6 5	150 185	P, 170-184	170	14	Sandstone	135	.39	4-25-75	280	J, 3/4	6	170	D	B 1 hr.
9abd	Fred Barby	Dr	1968	266	6	240	B	250	16	do	132	Flows	do	--	N	40	41	PS	B 1 hr. Used as water supply for labor camp.
9bcd	Kelvin Grove Farm	Dr	1969	140	6	140	P, 62-140	124	--	Sand and gravel	175	37.4	do	240	S	25	51	D	At 2 hr.
10cac	M. B. Petrich	Dr	1972	375	6	365	B	365	10	Basalt	148	Flows	do	355	S, 3	27	215	D	B 2 hr.
10ccd1	General Telephone Co.	Dr	1965	398	6 5	328 398	P, 323-398	230 374	2 6	Sand Gravel	170	18	8-10-65	450	S, 1	18	92	D	B 2 hr, L.
10ccd2	Sam Gotter	Dr	1962	600	6	508	B	570 595	3 5	Basalt do	165	10.00	2- 7-75	400	S, ½	40	65	D	B.
10dbd	Garry Berrier	Dr	1973	390	6	369	B	--	--	do	138	1.45	5- 2-75	400	S, 1½	20	258	D	B 2 hr.
11ccd	T. H. Itel	Dr	1972	260	6 5	94 102	P, 94-102	94	7	Gravel and sand	147	20.9	do	--	S	20	28	D	B 1 hr.
12bcd	N. L. Turner	Dr	1968	305	6	244	B	187 290	-- 15	-- --	155	30	do	210	J, 1	30	10	D	B 2 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com- pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Thick- ness (feet)	Character of material	Alti- tude (feet)	Water level: Feet below datum	Date	Specific conduct- ance of water	Type of pump and hp	Well performance: Yield (gal/ min)	Draw- down (feet)	Use	Remarks
									T. 2 S., R. 2 W.--Continued										
12dbc	J. Page	Dr	1968	420	6 5	360 420	P	--	--	--	163	30	4-17-68	--	S, 2	20	14	D	B 3 hr.
13aac	Alois Amstad	Dr	1972	248	8 6	200 190-240	P, 200-238	198	7	Basalt	133	37.61	3-23-76	580	S, 3	40	67	D	B 6 hr.
13ccd	D. F. Wachlin	Dr	1949	120	6	68	B	--	--	do	252	39.87	5- 8-75	200	S, 5	50	--	D	B, Ca.
13dda	D. E. Jeans	Dr	1970	290	6	225	B	258	32	do	145	15.15	3-23-76	160	S, 1½	90	275	D	P 2 hr, L.
14bbc	D. J. Bennett	Dr	1973	340	6	324	B	338	2	do	171	52.21	5- 7-75	260	S	18	80	D	B 2 hr.
14cdc	Roger Berryhill	Dr	1971	260	8	44	B	--	--	do	275	17.93	5- 8-75	180	S, 7½	250	229	Ir	At 2 hr.
15daa	R. M. Schnieder	Dr	1968	225	6 5	130 225	P, 185-225	--	--	--	182	56.46	5- 7-75	180	S	20	125	D	B 1 hr.
15dbc	Charles Obenhaus	Dr	1967	100	6	80	B	85	15	Basalt	200	14.80	5- 6-75	220	S	20	5	D	B 2 hr.
16bcd	Wolsburn Farms Water Dist.	Dr	1974	280	6	180	--	180 210 240	10 30 40	do do do	265	146.2	2- 7-75	190	S, 5	125	157	PS	At 2 hr, L.
16cca	Mountainside Cemetery Assoc.	Dr	1959	229	8	54	B	--	--	do	285	70.25	4-15-76	--	S	--	--	Ir	
16ddb	K. S. Smith	Dr	1972	200	6	130	B	184	8	do	175	13.50	5- 6-75	210	S, 1½	15	190	D	At 2 hr.
17bbb	D. P. Gosselin	Dr	1972	140	6	55	B	60	--	do	192	22.65	4-17-75	180	S, ½	20	90	D	At 1 hr.
17bdc	Charles Newton	Dr	1949	272	6	130	B	241	--	do	170	2.4	4-15-75	180	S, 1	30	20	D	
17dba	Unknown	Dr	--	--	6	--	B	--	--	do	260	87.12	4-10-75	215	S, 1½	--	--	D	
18acb	Anthony Bolek	Dr	1970	285	6	52	B	247 263	4 19	do do	320	130.2	4- 1-75	235	--	30	--	D	At 1 hr.
18dda1	S. R. Jensen	Dr	1973	127	6 5	76 120	P, 100-120	100	20	do	360	52.5	9- 3-73	75	S, 1	20	55	D	P 2 hr.
18dda2	C. A. Hansen	Dr	1972	200	6	41	B	--	--	do	670	81.85	4- 2-75	100	S	15	60	D	At 1 hr.
19abd	Hubert Janicke	Dr	1973	395	6	111	B	--	--	do	535	315.15	7- 3-75	180	S, 2	12	90	D	Do.
19ccd	F. S. Craner	Dr	1971	155	6	60	P, 55-59	67 120 145	12 13 10	do do do	720	138.4	4- 1-75	140	S, 1	15	58	D	B 1 hr.
19cdc	Drey Murphy	Dr	1969	675	6	51	B	658	14	do	690	430	9-26-69	115	S, 5	25	245	D	P 4 hr, L.
19ddc	William Bridges	Dr	1971	380	6	85	B	80	--	do	683	282.55	4- 3-75	135	S, 3	25	55	D	At 1 hr. Originally drilled to 275 ft in 1970.
20acb	Richard Eagle	Dr	1974	185	6	20	B	154	22	do	250	79.80	4-17-75	--	S, 1	30	80	D	P 2 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
										T. 2 S., R. 2 W.--Continued									
20baa	W. B. Ogden	Dr	1971	185	6	61	B	58	--	Basalt	320	122.50	4- 4-75	135	S, 3/4	15	--	D	At 1 hr.
20bac	Laurence Hayes	Dr	1973	335	6	85	B	80	--	do	415	147.4	do	--	S, 2	12	137	D	At 1 hr. Originally drilled to 230 ft in 1969.
20dcb	B. M. Weitzel	Dr	1972	273	6	97	B	248	--	do	530	225.65	4-17-75	185	S, 1	10	6	D	B 1 hr.
21baa	C. F. Taylor	Dr	1969	110	6	36	B	92	11	do	204	43.12	5-13-75	200	S, ½	11	68	D	P 2 hr.
22aaa	Pomeroy Sorum	Dr	1972	140	6	97	B	--	--	do	320	58.35	5- 8-75	140	S, 1½	25	75	D	At 1 hr.
22acc	R. D. Smith	Dr	1969	258	6	109	B	--	--	do	360	185.6	5- 9-75	120	S, 1½	20	20	D	B 1 hr.
22ada	James Nester	Dr	1970	320	6	47	B	287	20	do	422	272.25	do	--	S	12	50	U	P 2 hr.
22bdc	Kenneth Streeter	Dr	1971	125	6	80	B	68	--	do	170	18.94	5-13-75	195	S, 3/4	20	90	D	At 2 hr.
23bbd	Denny Zikes	Dr	1969	290	6	260	B	74 278	-- --	do do	340	104.65	5- 7-75	215	S	16	115	D	B 2 hr, L, Ca.
23bca	M. A. Holznagel	Dr	1966	262	6	65	B	52	--	do	425	183.25	do	150	S, 1½	10	20	D	B 1 hr.
23cda	D. R. Brush	Dr	1972	535	6	72	B	34 514	26 15	Clay Basalt	485	268.90	5-18-75	150	S, 10	70	25	Ir	P 6 hr.
24bab	Werre Bros.	Dr	1964	281	6	60	B	--	--	do	238	25	2- 2-64	--	P	24	35	D	B ½ hr. Originally drilled to 175 ft; deepened in 1964.
24dcb	R. Brunhaver	Dr	1967	170	6	73	B	135	27	do	245	82.42	3-23-76	130	S	12	79	D	P 1 hr.
25aaa	Howard Gillingham	Dr	1971	245	6	187	B	224	14	do	190	47.30	3-24-76	180	S, 3	50	197	D	P 2 hr, L.
26cbc	Guy Shafer	Dr	1971	505	6	133	B	166	--	do	760	376.55	5-16-75	125	S	18	--	D	At 1 hr.
26dab	D. C. Edy	Dr	1965	135	6	72	B	54	25	do	470	34.26	do	100	S, ½	6	84	D	B 1 hr. Water reportedly high in iron.
27cdd	R. L. Jones	Dr	1973	185	6	145	B	164	9	do	940	125.73	5-13-75	85	S	15	18	D	P 2 hr.
27dcb	Frank Koby	Dr	1973	440	6	105	B	415	3	do	810	296.05	5-13-75	240	S, 2	10	180	D	B 2 hr.
28ada	J. G. Oliver	Dr	1940	130	6	--	B	--	--	do	645	80.5	4-24-75	--	S	--	--	D	
29bca	R. M. Schultz	Dr	1973	394	6	52	B	--	--	do	620	115.6	4-16-75	--	S, 5	35	284	D	At 1½ hr.
29dbd	Chuck Carrington	Dr	1974	365	6	123	B	--	--	do	760	241.94	4-23-75	--	S	15	60	D	At 1 hr.
29ddc	E. P. McMurtry	Dr	1965	200	6	140	B	--	--	do	812	138.45	do	175	S, 1½	27	30	D	B 1 hr.
30adb	E. B. Smith	Dr	1973	698	6	124	B	275 608	-- --	do do	840	291.9	4- 4-75	145	S, 5	20	373	D	At 2 hr, L.
30cad	Otho Weaver	Dr	1958	210	6	69	B	85 137 197	-- -- 13	do do do	1,035	120	2- 7-75	63	S, ½	3½	90	D	B 1 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s)			Altitude (feet)	Water level		Specific conductance of water	Type of pump and hp	Well performance		Use	Remarks
								Depth to top (feet)	Thickness (feet)	Character of material		Feet below datum	Date			Yield (gal/min)	Drawdown (feet)		
T. 2 S., R. 2 W.--Continued																			
31ada	Glenn Brown	Dr	1974	425	6	40	B	--	--	Basalt	1,260	316.5	4-16-75	95	S, ½	7	250	D	B 1 hr.
31bbc	Steve Brooks	Dr	1968	500	6	33	B	--	--	do	1,312	290	6-26-68	--	S	9	210	D	At 1 hr.
31bdc	J. J. Hayes	Dr	1972	660	6	36	B	641	14	do	1,385	459.55	2-10-75	170	S	25	169	D	At 2 hr.
32abb	Jarvis Thompson	Dr	1962	138	6	138	P, 45-118, 118-138	125	13	do	935	37.6	4-23-75	110	S, 1	18	71	U	B 1 hr.
32bca	William Fergus	Dr	1971	185	6	70	B	70	--	do	1,100	128.05	do	--	N	4	30	U	At.
33acc	H. P. Kern	Dr	1974	140	6	140	P, 85-125	85	20	do	1,040	48.07	4-24-75	70	S	50	70	D	P 2 hr.
33dbc	D. G. Kern	Dr	1970	600	6	12	B	--	--	do	1,090	463	12-31-70	80	S, 1½	9	--	D	At 1 hr.
34bbb	D. H. Latham	Dr	1974	545	6	107	B	238 528	5 11	do do	875	335.55	4-24-75	180	S, 3	8	198	D	P 2 hr. Originally drilled to 250 ft; deepened in 1974.
34bbd	C. R. Watson	Dr	1975	500	6	84	B	488	6	do	870	366.35	do	140	S	60	108	D	P 2 hr.
34dcb	Donald Pollock	Dr	1971	620	6	185	B	596	16	do	538	411.65	5-13-75	200	S, 3	25	268	D	Do.
35abc	Ruth Pratt	Dr	1974	345	6	66	B	85	--	do	583	207	5-15-75	180	S, 2	10	118	D	B 1 hr.
35cca	R. B. Joyce	Dr	1969	380	6	138	B	--	--	do	740	83.37	do	--	N	20	150	U	At.
36aba	James Hasuike	Dr	1969	585	12	108	B	311 568	5 17	do do	320	135.10	3-24-76	--	T, 40	733	62	Ir	P 6 hr, L.
36bcd	Carl Schaltenbrand	Dr	1965	368	8	57	B	250 335	16 33	do do	395	182.55	5-15-75	170	S, 2	25	110	D	B 1 hr. Originally drilled to 266 ft.
36bdd	Albert Hollenberger	Dr	1975	475	6	54	B	--	--	do	445	227.93	do	--	N	45	175	U	At 1½ hr. Originally drilled to 205 ft.
T. 2 S., R. 3 W.																			
1add	C. J. Leiferman	Dr	1961	324	6	273	B	260 308	5 16	Basalt do	181	11.75	3- 6-75	230	S, 3½	45	35	Ir	B 1 hr.
1dad	Richard Egger	Dr	1951	264	8	95	B	120 188 220	15 1 1	do do do	165	Flows	3- 7-75	265	T	125	245	Ir	P 1 hr, L. Flows about 30 gal/min.
2ddd	D. A. Barnes	Dr	1971	172	6	92	B	162	--	do	430	115.5	do	90	S, 1	20	--	D	B 1½ hr.
3dcc	J. W. Lulich	Dg	1972	10	36	10	B	7	3	do	930	1.4	3- 4-75	57	S, 2	19	1	D	P ½ hr.
4ddb	Mark Walker	Dr	1969	525	6 5	75 250	P, 110-250	110	--	do	980	252.2	do	375	S, 1½	12	150	D	B 1 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
										T. 2 S., R. 3 W.--Continued									
7dbb	Mabel Barnes	Dr	1974	51	6	20	B	--	--	Shale	210	13.39	8-20-75	450	S, ½	½	37	D	B.
8cda	Albert De Lisle	Dr	1968	510	8 6	75 510	P, 250-510	250	--	do	570	168.4	do	400	S, 2	10	400	D	B 1 hr.
8cdb	Jean Leconte	Dr	--	125	6	125	--	--	--	--	540	47.0	do	130	J, 3/4	--	--	--	
9dad	Walter Bilden	Dr	1957	100	8	42	B	83	--	Basalt	1,235	41.9	2-25-75	160	J, 1	3½	100	D	B
9ddc	Ladson Ouzts	Dr	1968	88	6	80	P, 30-80	--	--	--	1,110	3	2-14-68	80	S	40	10	D	B 1 hr.
10aab	Eric Milling	Dr	1961	201	6	57	B	--	--	Basalt	965	61.6	3- 4-75	--	P, 5	5	52	D	B 4 hr.
10bbb	J. H. Rebman	Dr	1967	410	6	30	B	--	--	do	1,095	189.3	do	150	S	7	215	D	B 1 hr, L.
10dca	Seth Jackson	Dr	1970	470	6	70	B	422	20	do	1,108	311.4	3- 5-75	195	S	10	156	D	P 2 hr.
11bab	Hugh Ward	Dr	1968	335	6	59	B	309	17	do	740	299.7	3- 6-75	278	S, 3	25	4	D	P 24 hr.
11dba	B. J. Verdegan	Dr	1969	410	6	64	B	399	8	do	655	323.65	3-11-75	95	S, 1½	8	45	D	At 2 hr.
11dda	W. H. Stark	Dr	1970	200	6	40	B	178	7	do	610	130.6	3- 6-75	110	S, 1½	20	57	D	P 2 hr.
12aaa	Richard Sohler	Dr	1958	130	6 5	107 130	P, 105-130	105	25	do	190	21.65	do	125	J, 1	10	90	D	B ½ hr.
12dab	J. E. Stoller	Dr	1963	268	6	73	B	265	3	do	393	111.9	3-12-75	235	S, 1	15	5	D	B 1 hr.
13abd	D. D. Rogowski	Dr	1968	330	8	72	B	--	--	do	520	174.1	3-13-75	125	S, 20	125	140	Ir	B 1 hr, L, Ca.
13bad	Francis Cook	Dr	1968	365	6 5	133 360	P, 300-360	275 326	-- --	do do	560	284.5	3-14-75	180	S	11	65	D	B 1 hr.
13bbd	Adolph Lange	Dr	1973	120	6	73	B	103	--	do	665	Flows	3-11-75	160	C	18	90	D	B 1 hr. Reported to flow 8 gal/min.
13dcd	William Arrington	Dr	1971	395	6	135	B	100	--	do	552	298.95	3-12-75	165	S, 3	10	75	D	At 1 hr.
14bac	Stanley Beerli	Dr	1973	305	6	62	B	276	12	do	845	132.1	3- 5-75	145	S, 2	40	68	D	P 2 hr, L, Ca.
14cdb	B. B. Cochran	Dr	1972	230	6	68	B	196	--	do	715	167.05	3-11-75	180	S, 1	10	62	D	P 2 hr.
15bbd	Kenneth Dumler	Dr	1964	317	6	173	P, 70-173	--	--	do	1,380	46.12	do	69	S	5	147	D	B ½ hr, L, Ca, H.
15bda	Mellott Bros.	Dr	1965	370	6	132	B	--	--	do	1,300	314.95	2-24-75	115	S, 2	5	--	D	B 1 hr.
15dcb	M. E. Dunn	Dr	1974	605	6	44	B	--	--	do	1,240	145.5	2-25-75	160	S, 3	8	320	D	At 1 hr, L.
16aaa	E. L. Gammon	Dr	1957	317	6 5	140 317	P, 277-317	--	--	do	1,460	227.3	2-24-75	88	S, 1	10	60	D	B 1 hr.
16add	Robert Miller	Dr	1966	375	6	130	B	--	--	do	1,550	355.7	do	125	S, 1	5	35	D	B ½ hr.
17caa	Elwood Brown	Dr	1966	150	6	40	P, 19-40	19	--	Shale	420	80	9-16-66	360	S	11	55	D	B 1 hr.
17cdc	Gorham Nicols	Dr	1968	160	6	50	B	--	--	do	420	63.11	8-21-75	270	S	9	80	D	Do.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
T. 2 S., R. 3 W.--Continued																			
18cac	Mike DeLay	Dr	1969	220	6	42	P, 23-42	--	--	Shale	220	49.37	8-21-75	1,000	S	8	--	D	B 1 hr.
18cad	R. R. Blatter	Dr	1968	45	6	22	--	--	--	Sandstone	220	23.4	do	320	S	20	15	D	Do.
19abc	Charles Stiller	Dr	1964	85	6	--	--	--	--	--	230	40.85	do	320	S, 3/4	--	--	D	
20cbb	R. B. Roe	Dr	--	--	6	--	--	--	--	--	242	10.60	8-20-75	--	--	--	--	U	Old school well, not being used.
21cdb	D. L. Peterson	Dr	1970	290	6	22	B	210	--	Shale	378	71.74	8-21-75	1,450	S, 2	5	150	D	B 1 hr, L, Ca. A nearby well drilled to 360 ft produced saltwater.
22adb	S. E. Asher	Dr	1974	335	6	100	B	--	--	Basalt	1,100	181.30	2-21-75	195	S, 1	10	115	D	At 1 hr. Originally drilled to 125 ft.
22bbb	A. G. Proctor	Dr	1958	564	8	37	B	450	--	do	1,495	450	11-10-58	145	--	6	164	D	B 1 hr. Several small perched-water bodies tapped in drilling this well.
22ddb	Clara Parrish	Dr	1966	234	6	127	B	162 211	4 17	do do	1,230	150.65	2-21-75	140	S, 1½	20	30	D	B 1 hr.
23bbb	Bruce Cramer	Dr	1973	288	6	69	B	281	--	do	890	68.4	3-14-75	160	--	26	12	D	Do.
24aaa	G. D. Hein	Dr	1969	350	6	60	B	--	--	do	500	254.5	3-28-75	260	S, 2	15	--	D	B 1 hr. Well deepened from 304 ft.
24bcd	R. P. Blair	Dr	1966	195	6	128	B	--	--	do	500	118.2	3-13-75	100	S, 1	13	60	D	B ½ hr.
24daa	David Buffam	Dr	1972	500	6	60	B	--	--	do	670	379	3- 7-72	165	S	9	121	D	At 2 hr. Well deepened from 289 ft.
25add	J. J. Campbell	Dr	1973	195	6	--	--	126 189	-- --	do do	905	143.25	3-28-75	220	S, 3/4	--	--	D	
25bac	G. O. Kendall	Dr	1973	555	6	108	B	165	--	do	1,100	349.7	3-27-75	240	S, 1½	11	--	D	At 1 hr.
25cca	C. W. Shepersky	Dr	1974	430	6	36	B	--	--	do	1,325	324.10	2-11-75	--	--	15	--	D	Do.
25ccc	Val Arnold	Dr	1973	235	6	61	B	195	--	do	1,325	168	4- 4-75	--	S	2	--	D	Do.
25ccd	Edward Van Domelin	Dr	1974	440	6	250	B	432	8	do	1,340	355.34	2-13-75	--	S	12	1	U	Do.
26acb	Ronald Bjur	Dr	1969	90	6	80	P, 21-80	--	--	do	1,233	16.7	2-14-75	47	S	40	20	D	B 1 hr.
27aaa	Fred Tyson	Dr	1974	245	6	27	B	--	--	do	1,320	146.05	4-14-76	150	N	10	79	UU	P 2 hr, L, Ca, H.
27abc	H. G. Harkema	Dr	1969	161	6	160	P, 100-160	127	--	do	955	116.50	8-11-75	110	S	20	15	D	B 1 hr.
27bdd	David Hogue	Dr	1971	330	6	268	B	290	17	Shale	810	115.41	8-21-75	400	S, 2	8	205	D	Do.
28cda	Forest Johnson	Dr	1969	75	6	41	B	35	--	Basalt	325	12.66	do	320	S	7	20	D	Do.
29aad	G. K. Higgenson	Dr	1973	390	6	242	P, 50-240	--	--	Sandstone	642	43.99	do	105	S, 2	8	--	D	Do.
30aab	Lyle Blossom	Dr	1963	65	6	42	B	28	--	Shale	245	37.14	8-27-75	400	S, 3/4	20	20	D	Do.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Thickness (feet)	Character of material	Altitude (feet)	Water level: Feet below datum	Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Drawdown (feet)	Use	Remarks
										T. 2 S., R. 3 W.--Continued									
31acb	M. Nagely	Dr	1952	64	8	64	P, 39-64	40	24	Shale	180	5.88	1-13-75	430	S, 10	--	--	Ir	L, Ca, H.
31cdb	M. W. Reeves	Dr	1971	152	6	33	B	--	--	do	580	34.57	8-22-75	150	S, 1	25	60	D	B 2 hr.
32bad	James Sheetz	Dr	1973	275	6	207	P, 45-205	--	--	Sandstone	515	48.96	do	220	S, 1	10	--	D	B 1 hr.
33add	William Sayles	Dr	1969	63	6	63	P, 44-62	42	16	Shale	340	33.63	8-28-75	200	S	20	6	D	Do.
33cab	Frank Wilson	Dr	1973	180	6	40	B	155	15	Sandstone	420	130.90	8-22-75	340	S	37	57	D	At 1 hr.
34aca	Sam Steel	Dr	1968	155	6 5	100 95-145	P, 23-100, 96-144	--	--	Shale	600	33.48	8-28-75	175	S, ½	20	70	D	B 1 hr, L, Ca. Originally drilled to 105 ft.
34cba	Larry Fox	Dr	1973	368	6	265	P, 121-261	120	--	do	460	27.91	8-22-75	105	S, 1½	12	225	D	B 2 hr.
35dad	Paul Craig	Dr	1970	290	6	204	B	262	4	Basalt	700	158.15	8-29-75	100	S	6	114	D	Do.
35dda	James Sherwood	Dr	1971	220	6	185	P, 85-185	210	10	do	660	118.90	do	150	S	13	--	D	B 1 hr.
36dda	Donald Cooley	Dr	1974	273	6	140	B	--	--	--	890	107.64	do	260	S, 1½	50	120	D	At 1½ hr.
										T. 2 S., R. 4 W.									
2abb	William Harris	Dr	1961	250	6	23	B	--	--	Sandstone	220	15	7-21-61	--	J	4½	--	D	P. Well has been deepened several times to obtain more water.
3aaa	J. H. Hensley	Dr	1964	190	6	190	P, 118-190	181	6	Shale	460	118	10- 9-64	--	--	10	50	D	B 1 hr.
3acb	Roland Cutright	Dr	1961	85	6	70	P, 22-70	43 67	3 69	do do	360	11.09	8-13-74	--	S	16	50	D	Do.
4baa	C. D. Stark	Dr	1970	175	6	175	P, 115-175	--	--	Sandstone	300	70	6-22-70	--	--	9	85	D	At 1 hr.
4ccd	Bruce Keefer	Dr	1973	100	6	23	B	--	--	do	270	13.87	8- 1-74	190	S, 1/3	3	93	D	B 1 hr, L, Ca.
4dad	H. C. Gratty	Dr	1969	286	6	50	B	--	--	Clay	700	135	8-14-69	--	--	--	--	D	
6cbd	Kenneth Mills	Dr	1974	137	6	32	B	89	--	Shale	1,000	29	5-30-74	--	--	30	24	D	B 1 hr.
9cbb	Clarence Miller	Dr	1972	122	6	32	B	--	--	do	300	29.1	8- 2-74	--	S	12	94	D	Do.
9ddd	Bob Randall	Dg	--	29½	60	--	B	--	--	--	740	16.02	8- 9-74	--	J	--	--	D	
10bbc	J. B. Newberry	Dr	1959	130	6	90½	B	104	6	Sandstone	660	78.32	8-13-74	250	S, 1	6	52	D	B ½ hr, L.
10cbc	Edward Turgeon	Dr	1971	178	6 5	90 178	P, 83-88, 122-126, 132-138, 160-176	130	--	Shale	720	58	2- 8-73	--	--	4	100	D	B 1 hr.
11ccc	Jack Oeffner	Dr	1970	77	6	31	B	--	--	do	280	18.48	8-13-74	500	J, 3/4	30	16	D	Do.
12cac	Earl Lingle	Dr	1968	123	6	20	B	--	--	Siltstone	260	21	3- 2-68	--	S	10	95	D	Do.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Thickness (feet)	Character of material	Altitude (feet)	Water level: Feet below datum	Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Drawdown (feet)	Use	Remarks
										T. 2 S., R. 4 W.--Continued									
13ccc	David Whitworth	Dr	1940	85	6	--	B	--	--	--	239	11.76	8-26-75	--	S, ½	--	--	--	
14aac	A. J. Mayer	Dr	1969	123	6	120	P, 60-120	97	3	Shale	550	63	2-11-69	--	--	18	20	D	B 1 hr.
14bad	Earl Turner	Dr	1971	142	6	78	B	--	--	do	570	96.36	8-14-74	100	S, 1	30	64	D	B 1 hr, L, Ca.
16abc	Pat Patterson	Dr	1970	130	6 5	50 130	P, 50-130	--	--	do	600	20	5- 5-70	--	--	10	80	D	At 1 hr.
16cdc	Jack Cook	Dr	1948	80	6	--	B	--	--	--	400	13.58	8- 8-74	--	J	10	--	D	
17cdc	Robert Epler	Dr	1966	60	6	60	P, 25-60	42	14	Shale	320	26.2	8- 1-74	--	J, ½	7	43	D	B 1 hr.
18acb	Philip Kuehnel	Dr	1971	222	6	63	P, 56-63	56	7	do	370	22	9-14-74	--	S	6	178	D	B 2 hr.
18cdd	R. W. Reeves	Dr	1971	204	6	27	B	--	--	Basalt	340	2.86	8- 1-74	320	N	3	190	C	B 1 hr, L, Ca, H.
21dad	R. J. Katilas	Dr	1971	115	6 5	36 35	P, 37-115	40	--	Sandstone	370	21	5-11-71	--	--	7½	94	D	At 1 hr.
22ccc	L. E. Ragan	Dr	1971	205	6	18	B	--	--	Shale	280	24.34	8-27-71	--	S, 1	4½	190	D	At 2 hr.
22ddd	Ruth Knapp	Dr	1973	58	6	51	P, 47-51	47	3	do	270	6	7-17-73	--	--	1	49	D	B 1 hr.
23cac	Jack Huddleston	Dr	1971	106	6	40	B	56	--	do	340	39.37	8-21-74	650	S	10	75	D	Do.
23cc	Lillie Bangs	Dr	1945	92	6	--	--	--	--	do	255	1	9- -45	13,300	J, ½	8	--	--	Ca.
24aac	William Wallace	Dr	1975	135	6 5	60 135	P, 55-135	--	--	do	585	51.85	8-26-75	100	S, 1	20	--	D	At 1 hr.
25daa	A. J. McMahan	Dr	1973	165	6	--	B	--	--	--	290	7.83	do	1,000	S, 1½	--	--	D	
27acc	Carl Smith	Dr	1973	137	6	20	B	--	--	Shale	300	50.94	2-31-74	--	J, ½	20	60	D	B 1 hr.
27cda	Jay Hanson	Dr	1968	92	6	20	B	--	--	--	205	10	2-12-68	--	--	10	40	D	Do.
28aac2	Les Clyde	Dr	1970	146	6	18	B	--	--	--	265	31.74	8-31-74	--	S, 3/4	8	132	D	B 2 hr.
28bdd	Irvin Hermans	Dr	1974	120	6	20	B	--	--	Shale	350	43.95	8- 2-74	--	S	8	--	D	B 11 hr, L.
29dbd	F. Wilhelm	Dr	1929	150	6	--	B	--	--	do	240	40	6-11-75	1,700	S	--	--	D	Ca.
32bad	Fred Fidel	Dg	--	32	48	--	--	--	--	--	270	7.50	8- 8-74	--	N	--	--	U	
33dbb	A. L. Streight	Dr	1971	85	6 5	28 80	P, 35-80	45	--	Shale	255	22.2	8-21-74	--	S, ½	7½	--	D	At 1 hr.
34dbb	Cliff Hacker	Dr	--	100	12	--	--	--	--	--	260	77.85	7-31-74	--	S	--	--	D	
35dac	C. F. Laughlin	Dr	1960	300	6	184	B	--	--	Shale	230	2.92	8- 2-74	--	T	40	43	U	B 1 hr, L. Water is "salty."
36ddd	Donald Fuerst	Dr	--	88	6	--	--	--	--	--	580	12.5	8-28-75	140	J, 1½	--	--	D	

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s)			Altitude (feet)	Water level		Specific conductance of water	Type of pump and hp	Well performance		Use	Remarks
								Depth to top (feet)	Thickness (feet)	Character of material		Feet below datum	Date			Yield (gal/min)	Drawdown (feet)		
										T. 2 S., R. 5 W.									
15acc	NW Premium Pork	Dr	1973	75	6	28	B	65	10	Basalt	480	9.48	8- 6-74	--	S	20	55	D	B 1 hr. A 202-ft well at this location abandoned; no water.
23ddd	Alex Nesbit	Dr	1963	85	6	21	P	52	--	do	210	20	12- 9-63	--	J, ½	3	60	D	B 1 hr.
25acd	Bill Perkins	Dr	1973	76	6	27	B	--	--	Shale	210	14.84	8- 6-75	--	J, ½	7	52	D	Do.
26bad	William Sanders	Dr	1972	110	6	20	B	45	--	Basalt	340	6.82	8- 6-74	--	S, 3/4	10	80	D	At 1 hr.
26daa	Harley Belt	Dr	1972	85	6	30	B	40	--	Shale	280	15	7-11-72	--	--	20	2	D	B 2 hr.
30dcc	E. A. Hutchens	Dr	1972	50	6	24	B	38	12	do	390	19	8- 2-72	--	--	16	31	D	B 1 hr.
31bba	Bryce Mitchell	Dr	1969	91	6	20	B	--	--	Siltstone	440	18.95	8- 5-74	280	S, 1	25	50	D	B 1 hr, L, Ca.
32bba	E. R. Short	Dr	1960	50	6	34	B	--	--	do	400	10	10-10-60	--	--	6	50	D	B ½ hr.
33bbd	Camp Yamhill	Dr	1972	100	6	30	B	--	--	Shale	400	12	6-23-72	--	J, 1	4½	78	D	B 1 hr. Well abandoned because of insufficient yield.
34bac	John Raineri	Dr	1963	83	6	20	B	47	--	do	820	22.94	8- 6-74	350	J, ½	5	68	D	B 2 hr.
										T. 2 S., R. 1 E.									
2ccb	C. Rossman	Dr	1947	225	6	170	B	--	--	Basalt	90	26.30	4-14-76	--	T, 50	--	--	U	Ca, H. Formerly used by city of Lake Oswego. A nearby 476-ft well still used by city on standby basis.
9dad	City of Lake Oswego	Dr	1948	502	10 8	165 367	P, 130-160, 280-290, 330-340	112 437 452	18 18 5	do do do	240	141.9	3- 2-76	--	T, 50	--	--	U	L, Ca. Formerly used by city of Lake Oswego.
14acb	Marylhurst College	Dr	1947	519	12	81	B	293 497 501	8 9 11	do do do	155	120	6-17-47	--	T, 30	300	80	U	P 1 hr. Production reported to have dropped to 50 gal/min.
14bad	Convent of the Holy Names	Dr	1939	500	12	38½	B	--	--	do	190	--	--	--	T, 30	--	--	U	Production reported to have dropped.
15aab	Glenmorrie Co-operative Dist.	Dr	1956	526	10 8	107 449	B	313 460	16 --	do do	320	360	3- 4-76	--	T, 20	90	177	PS	P 20 hr, Ca.
15dba	do	Dr	1948	470	12	64	B	200 380	-- 5	do do	680	375	3- 5-76	185	T, 15	60	--	PS	Ca.
15dbc	T. C. Achilles	Dr	1972	370	6 5	33 370	P, 270-370	260 355	-- 15	do do	575	244.8	3-10-76	--	S, 2	15	115	D	
16acc	Lake Ridge Senior High School	Dr	1969	722	8	108	B	--	--	do	488	389	6-26-69	--	S	190	111	PS	P 10 hr.
16bdd	do	Dr	1969	907	8	119	B	--	--	do	495	358	3- 2-76	260	S	195	100	PS	P 16 hr, L, Ca.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com- pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thick- ness (feet)	Water-bearing zone(s): Character of material	Alti- tude (feet)	Water level: Feet below datum	Water level: Date	Specific conduct- ance of water	Type of pump and hp	Well performance: Yield (gal/ min)	Well performance: Draw- down (feet)	Use	Remarks
T. 2 S., R. 1 E.--Continued																			
17dbb	E. J. Rothenberger	Dr	1962	241	6	178	B	--	--	Basalt	230	127.8	3- 3-76	149	S, 1	12	77	D	
18caa1	Victor Colander	Dr	1958	72	6	40	B	--	--	Clay	150	14.42	do	225	J, ½	1½	--	D	B 3 hr.
18caa2	F. H. DeHoog	Dr	1955	394	6	393	B	--	--	Basalt	152	40.28	3- 4-76	--	N	20	230	U	
19ccb	Meridian Park Hospital	Dr	1974	790	10	585	B	610 720	-- --	do do	210	140	1- 5-74	--	N	70	171	U	P 2 hr, L.
19dba	E. W. Stevens	Dr	1971	255	6	143	B	240	15	do	175	88	7-21-71	320	S, 2	25	167	D	P 1 hr.
20bac	Al Bahler	Dr	1973	115	6	--	B	79	--	do	155	66.10	7-30-75	--	S, 2	37½	50	D	Do.
20bba	Rivergrove Water Dist.	Dr	1967	430	12	431	P, 345-427	--	--	do	135	185	5- 8-67	--	T	317	89	PS	P 7 hr.
20dac	Mike Lee	Dr	1974	110	6	100	B	--	--	Gravel and sand	170	75	4-29-74	--	S	40	10	D	B 2 hr.
20dda	Stafford School	Dr	1967	605	8	444	B	--	--	Basalt	170	55	3-10-67	--	T, 7	130	250	PS	P 2 hr.
21abb	Dale Maier	Dr	1961	487	6	30	B	464	--	do	420	325	12- 6-61	--	J, 3/4	8	30	D	B 1 hr. Well deepened from 200 ft.
21abd	Henry Zivney	Dr	1962	470	6	23	B	457	13	do	410	302	8- 1-62	280	S, 1½	18	50	D	B 2 hr.
21bdc	Mossy Brae Water Dist.	Dr	1949	195	10	63	B	179	11	do	220	114	1-10-49	--	S, 3	50	30	PS	P 8 hr, L, Ca. Water supply for 33 families.
21cab	Cassidy Boutz	Dr	1926	165	10	--	B	--	--	do	140	20	7-29-75	--	S, 5	--	--	PS	Ca. Water supply for 48 families.
21ccc	E. M. Riegelmann	Dr	1946	330	6	--	B	--	--	do	167	66.35	4-14-76	250	J, 1	25	160	D	P.
22bdd	George Rossman	Dr	1973	287	6	--	B	180	--	do	565	131	6-26-73	160	S, 1½	25	155	D	At 1 hr. Originally drilled to 180 ft.
22cda	T. L. Bunch	Dr	1974	401	6	19	B	386	--	do	380	308	7-13-73	160	S, 1½	18	86	D	P 1 hr.
22dac	A. C. Bock	Dr	1960	319	6	171	B	--	--	do	650	235	10-24-60	170	S, 3/4	4	84	D	B 2 hr.
23bbd	M. E. McFarland	Dr	1968	670	6	28	B	--	--	do	685	250	3-22-66	--	S, 3	10	200	D	B 1 hr, L.
23bdc1	Carl Trapp	Dr	1967	120	6	58	B	--	--	do	585	58.72	8- 1-75	200	S	10	45	D	B 1 hr.
23bdc2	do	Dr	1974	125	6	20	B	85	--	do	585	63.76	do	--	S, 3/4	9	48	D	At 1 hr.
25cbb	Orville Davis	Dr	1971	113	6	46	B	65	--	do	655	37.60	3-15-76	190	S, 1	25	78	D	B 1 hr.
26acb	T. H. Beltz	Dr	1971	98	6	29	B	72	--	do	695	68.89	3-12-76	175	S	13	32	D	P 1 hr.
27adb	E. A. Volberding	Dr	1971	125	6	40	B	50	--	do	375	11.86	7-31-75	250	S, 1	100	70	D	At 2 hr.
27ddb	J. C. Bingaman	Dr	--	508	6	70	B	--	--	do	200	--	--	280	S, 1½	10	22	D	B 2 hr.
28aba	J. H. Gerow	Dr	1975	297	6	40	B	140 270	-- 20	do do	215	111.67	3-10-76	148	S, 3	25	20	D	B 2½ hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com-pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thick-ness (feet)	Water-bearing zone(s): Character of material	Alti-tude (feet)	Water level: Feet below datum	Water level: Date	Specific conduct-ance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Draw-down (feet)	Use	Remarks
										T. 2 S., R. 1 E.--Continued									
28bbd	H. W. Cookingham	Dr	1974	100	6	99	B	79	--	Sand	155	57.32	3-10-76	200	S	18	3	D	B 2 hr.
28dcc	C. L. Schaber	Dr	1972	110	6	36	B	80	12	Basalt	160	58.62	do	134	S, 3/4	12	55	D	P 2 hr.
29dcc	Leonard Tirrill	Dr	1972	400	6	63	B	340 387	-- 10	do do	450	335	4-17-76	200	S, 1½	20	40	D	B 1 hr.
30adb	L. C. Lewis	Dr	1973	163	6	42	B	82	--	do	235	80	10-10-73	220	S	20	70	D	P 2 hr.
30cab	Frank Skinner	Dr	1967	202	6	22	B	--	--	do	305	130	5- 3-67	180	S, 1½	17	0	D	B 2 hr.
30db	Pope & Talbot, Inc.	Dr	1962	1,100	12 10 6	77 488 618	B	--	--	do	370	175	10-12-62	--	N	376	223	U	P 33 hr, L.
31adb	do	Dr	1961	336	8	43	B	--	--	do	400	211.40	7-25-75	--	N	18	60	U	B 4 hr.
31baa	Lee Hirn	Dr	1973	285	8	--	B	--	--	do	330	--	--	200	S, 10	100	--	Ir	Originally drilled to 185 ft in 1952.
31bbd1	Gene Wilhelm	Dr	1949	83	6	39	B	--	--	do	330	36.27	7-23-75	--	J, 1	10	--	D	B 1 hr.
31bbd2	do	Dr	1968	247	8	--	B	--	--	do	325	60	4-17-68	--	S, 20	140	100	Ir	P 17 hr. Originally drilled to 185 ft in 1954.
31cbb	Arnold Klann	Dr	1971	450	8	--	B	--	--	do	395	135	1-20-71	21	S, 10	20	155	D	B. Originally drilled to 138 ft, then to 322 ft.
32acd	Richard Denley	Dr	1951	665	6	450	B	--	--	do	630	620	--	450	S, 5	--	--	D	
32bac	West Linn School Dist.	Dr	1975	540	6	38	B	--	--	do	460	333	7-29-75	--	S	30	207	D	At 2 hr.
32dac	P. O. Rydman	Dr	1972	780	8	103	B	602	--	do	670	557	5- 8-73	--	N	82	16	U	P 24 hr, L, Ca.
32dba	John Powell	Dr	1966	375	6	35	B	358	15	do	550	350	12-12-66	180	S, 2	18	5	D	B 2 hr.
33add	E. L. Ungerman	Dr	1972	75	6	75	B	60	15	Gravel	151	49.3	3-11-76	160	S, ½	30	0	D	Do.
33bab	C. W. Johnson	Dr	1962	219	6	158	B	--	--	Basalt	285	179.25	do	138	S	12	21	D	B 3 hr.
33bbb	Dale Belford	Dr	1973	600	8	91	B	448	--	do	460	351	do	200	S, 15	75	21	PS	P 7 hr, L, Ca.
34bba	S. C. Sargent	Dr	1972	150	6	130	B	143	--	Sand	175	7.65	3-12-76	335	S, ½	9	68	D	B 1 hr.
34bdc	J. A. McWhinney	Dr	1960	200	6	172	B	--	--	Sand and gravel	148	70.48	3-11-76	800	S, 1	24	20	D	B 4 hr, L, Ca.
34cbc	V. C. Shorten	Dr	1975	142	6	115	B	128	--	Basalt	150	48.46	3-12-76	220	S	25	82	D	At 1 hr.
35aab	E. L. Burnham	Dr	1972	709	6	19	B	351 518	-- 20	do do	605	144.7	do	152	P, 2	12	65	D	P 2 hr, L.
35bda	R. O. Baker	Dr	1975	452	6	19	B	430	20	do	480	395.63	do	280	S, 1½	20	100	D	At 2 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
T. 3 S., R. 1 W.																			
1adb	Pat O'Callaghan	Dr	1972	577	10	80	B	314 402	16 14	Basalt do	472	230	2- 5-72	--	N	290	162	U	P 2 hr, L, Ca.
1cda	City of Wilsonville	Dr	1970	783	12 10	593 783	P, 535-585, 600-630, 720-780	--	--	do	360	112	7-25-70	--	T, 60	510	210	PS	P 24 hr, L, Ca.
2abc1	A. Sasaki	Dr	1956	535	10	50	B	400	--	do	310	125	10- 4-56	--	T, 50	700	15	Ir	P 4 hr.
2abc2	do	Dr	1961	236	6	40	B	105 137	3 --	do do	310	90	6- 1-61	180	S, 1½	25	0	D	B 1 hr.
2bbb	Lee Thompson	Dr	1968	556	8	70	B	336 548	14 4	do do	300	87.80	12-11-75	160	S, 5	600	170	Ir	P 2 hr. Originally drilled to 352 ft in 1962.
2cdc	Bonneville Power Adm.	Dr	1941	300	10	214	B	214	--	do	230	19.5	10-17-41	200	T	60	170	D	P 12 hr.
2dda	Burns Bros. Truck Station	Dr	1969	387	10	59	B	--	--	do	255	45.14	3-30-76	180	S, 10	150	40	In	P 4 hr.
3bda	Stephen Sudul	Dr	1965	90	6	29	B	--	--	do	160	4.20	3-25-76	180	J, 1	24	52	D	B 1 hr.
3cdc	Robert Pape	Dg	--	30	36	--	B	--	--	--	150	7.88	3-31-76	60	S, ½	--	--	D	
3ddb	A. C. Kaufman	Dr	1967	165	6	110	B	--	--	Basalt	220	54.90	3-25-76	180	J, 1	35	65	D	B 1 hr.
4cab	J. E. Ferry	Dr	1968	155	6	100	B	--	--	do	265	48.47	8-15-75	200	S, 3	60	0	S	Do.
5bca	Elvan Pitney	Dr	1972	230	6	43	B	101 218	9 6	do do	413	150.80	do	140	S, 1	30	98	D	P 2 hr. Originally drilled to 114 ft.
5bcd	J. J. Adams	Dr	1968	230	6	70	B	190	18	do	416	152.60	do	160	S, 1	20	104	D	P 1 hr, L, Ca.
5daa	C. A. Handley	Dr	1965	165	6	125	B	125 155	5 10	do do	310	51.4	do	160	S, 1½	30	60	D	B 3 hr.
6bba	J. R. Dobson	Dr	1969	125	6	42	B	--	--	do	240	33.4	8-12-75	220	S	25	76	D	P 2 hr.
6dac	Donald DeMoss	Dr	1972	230	6	42	B	218	8	do	340	119	10-10-72	190	S, 1½	75	111	D	Do.
7cab	Ronald Epperson	Dr	1975	700	6	--	B	--	--	do	962	480.35	8-12-75	--	N	10	30	N	
7cdc	Kurt Japel	Dr	1972	436	6	64	B	425	10	do	830	379.60	do	200	S	10	30	D	B 1 hr, L.
8cba	D. E. Kidd	Dr	1968	470	6	60	B	334 457	8 --	do do	660	305.65	8-14-75	200	S	15	158	D	P 1 hr.
8dad	Dale Rose	Dr	1970	375	6	76	B	358	17	do	493	314.20	do	150	S, 3	24	30	D	B 1 hr.
9bad	W. H. Prentice	Dr	1964	200	6	77	B	165	35	do	400	44.30	do	140	S, 1½	36	55	D	Do.
9daa	Vernon Burda	Dr	1971	230	6	65	B	198	14	do	335	162.8	do	150	S	20	74	D	P 2 hr.
10bdd	C. M. Halvorson, Inc.	Dr	1976	450	6	--	--	77	33	do	190	20	2- 4-76	--	N	1,000	--	U	

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com- pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s)			Alti- tude (feet)	Water level		Specific conduct- ance of water	Type of pump and hp	Well performance		Use	Remarks
								Depth to top (feet)	Thick- ness (feet)	Character of material		Feet below datum	Date			Yield (gal/ min)	Draw- down (feet)		
T. 3 S., R. 1 W.--Continued																			
10caa	Lee Thompson	Dr	1969	182	10	40	B	118 136 170	4 1 10	Basalt do do	180	30	1-14-76	--	S	200	150	Ir	P 2 hr.
11bac	Bonneville Power Adm.	Dr	1968	325	16 10 8	48 134 325	P, 250-260, 270-278	135	10	do	225	67.43	3-25-76	193	S, 15	141	62	D	P 8 hr.
11cad	Richard Boeckman	Dr	1955	126	6	--	--	--	--	--	205	5.60	3-26-76	190	J, ½	--	--	D	
11dbc	Elmer Boeckman	Dr	1966	180	6	155	B	156	10	Basalt	200	50	6-28-66	215	J, 1½	25	110	D	P 1 hr.
12dac	W. R. Morgan	Dr	1971	236	6	197	B	--	--	do	210	67	10-13-71	180	S	40	70	D	B 2 hr, L.
12dbc	Robert Coats	Dr	1968	230	6	176	B	--	--	do	235	68	6-12-68	200	S	30	87	D	B 2 hr.
13bac	C. W. Dillon	Dr	1967	95	6 4	70 95	P, 10-95	--	--	Sand and gravel	220	64.88	3-30-76	205	S, ½	12	15	D	P 12 hr.
14aaa	Thunderbird Mobile Court	Dr	1962	426	8	306	B	--	--	Basalt	210	69	9- 7-62	250	S	150	132	PS	P 8 hr. Supplies 112 patrons at mobile court.
14abd	Walnut Park Mobile Ranch	Dr	1968	306	6	248	B	264	42	do	180	34	5- 8-68	--	S, 7½	80	112	PS	P 2 hr, L.
14aca	do	Dr	1962	247	6 5	164 247	P, 185-195, 219-221, 237-245	189 219 240	6 1 7	Gravel Sand and gravel do	170	23	3-23-62	--	S, 5	15	107	PS	P 3 hr.
14bac	Concrete Conduit Co.	Dr	1969	262	8	181	B	--	--	Basalt	150	8	11-10-69	560	S, 5	50	107	In	B 3 hr.
14daa	Wilsonville Trailer Park	Dr	1967	517	6	404	B	--	--	do	170	43	9-22-67	390	S, 5	90	207	PS	At 2 hr.
15bcc	S. A. Nash	Dr	1970	245	6	211	B	224	12	do	205	52.81	8- 8-75	200	S	22	202	D	P 2 hr.
15cac	Dammasch State Hospital	Dr	1958	920	14	251	B	971	23	do	185	70.00	7- 2-58	--	T	515	240	PS	P 26 hr, L, Ca, H.
16bad	Howard Dugan	Dr	1965	173	6	35	B	--	--	do	315	143.72	8-13-75	140	S, 3/4	18	35	D	B 1 hr.
16cda	V. D. Amell	Dr	1962	105	6	84	B	90	--	Gravel and sand	150	41.63	do	210	S, 1	20	100	D	B.
16ddd	Dammasch State Hospital	Dr	1960	1,000	14	356	B	--	--	Basalt	185	53.00	4-15-76	1,024	T, 150	780	5	Ir	P 24 hr, L, Ca, H.
17adc	Bill Mueller	Dr	1972	152	6	43	B	70 129	-- 23	do do	370	71.73	8- 8-75	150	S	20	70	D	B 1 hr.
18aab	Nor-Pac Property	Dr	1964	190	6	51	B	105 141 188	2 20 2	do do do	640	76.19	8- 7-75	--	S, 3	25	9	D	At 2 hr.
18cad	D. W. Williams	Dr	1960	387	6	37	B	--	--	do	740	300	2-16-69	240	S, 1	4½	440	D	B 1 hr.
18cdb	Larry Cox	Dr	1974	286	6	--	B	--	--	do	700	78.73	8- 7-75	--	N	--	--	U	

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com-pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s)			Alti-tude (feet)	Water level		Specific conduct-ance of water	Type of pump and hp	Well performance		Use	Remarks
								Depth to top (feet)	Thick-ness (feet)	Character of material		Feet below datum	Date			Yield (gal/min)	Draw-down (feet)		
										T. 3 S., R. 1 W.--Continued									
19aad	R. C. O'Mealy	Dr	1975	185	6	42	B	166	12	Basalt	270	99.95	8- 1-75	--	N	58	84	U	P 2 hr.
19add	Dennis Bischoff	Dr	1972	200	6	76	B	180	5	do	320	148.86	do	180	S	30	57	D	Do.
19bbb	A. C. Witt	Dr	1969	388	6	60	B	--	--	do	760	259.70	do	120	S, 3	12	35	D	B 2 hr.
20acc	S. G. Marriott	Dr	1966	330	6	38	B	287 319	19 11	do do	380	212	7-15-66	--	N	12	52	U	B 1 hr.
21aac	Earl Bloomberg	Dr	1971	287	6	--	B	226 244	18 4	do do	170	58.92	8-13-75	275	S, 5	25	167	D	P 1 hr. Well deepened from 136 ft.
21acd	W. J. Puntenney	Dr	1969	170	6	111	B	--	--	do	135	37.64	do	350	S, 1	15	130	D	P 12 hr.
22abc	R. A. Stetzel	Dr	1966	305	6	247	B	244	--	do	173	45.59	7-31-75	300	S	13	273	D	B 1 hr.
23bad	Oregon Electric Railway	Dr	1950	347	12 8	33 347	B	314	33	do	145	--	--	--	T, 5	44	95	--	P 1 hr. Formerly supplied 50 houses.
23daa	J. C. Abele	Dr	1971	638	6	494	B	525	43	do	105	Flows	3-24-76	520	C	--	--	D	L, Ca. Reported to flow 35 gal/min.
24aaa	R. C. Cowger	Dr	1974	140	6	120	B	--	--	Sand and clay	100	22	4-26-74	330	S, 5	35	60	D	P 5 hr.
24aac	Jerome Wand	Dr	1970	185	6 5	164 185	P, 165-185	165	20	Silt and sand	100	28	1- 5-70	320	S, 5	20	52	D	B 2 hr.
28aac	Harkson Farms	Dr	1959	245	6	230	B	140 230	10 15	Basalt do	110	46.01	7-31-75	700	S, 1	30	125	D	P 1½ hr, L, Ca.
28bcb	Keith Henry	Dr	1969	260	6	151	B	168 240	6 12	do do	150	66.21	8-31-75	330	S	36	186	D	P 2 hr.
29bbd	D. A. Eichman	Dr	1956	230	6	29	B	--	--	do	400	217.05	7-31-75	160	S, 1	10	2	D	B.
30ada	G. L. Viaene	Dr	1969	260	6	28	B	--	--	do	445	130	2-20-69	150	S, 1½	18	40	D	B 1 hr.
30cbc	A. T. Brown	Dr	1974	154	6	73	B	89	--	do	468	57.07	7-22-75	115	S, 3/4	30	89	D	Do.
30dbc	W. R. Conrad	Dr	1972	460	6	19	B	--	--	do	480	237.05	2-30-75	160	S, 3	19	--	D	At 1 hr, L.
31caa	Joseph Rogers	Dr	1970	560	6	140	B	--	--	do	165	75.54	do	230	S, 5	40	164	D	At 1 hr, L, Ca. Deepened from 480 ft.
31dab	R. E. Carey	Dr	1963	167	6	156	B	151	--	do	155	70	6- 5-63	150	S, 3/4	20	0	D	B 1 hr.
32cbc	Mr. Crimmins	Dr	1962	360	6	--	--	--	--	--	110	15.15	7-25-75	240	S, 1	--	--	D	
										T. 3 S., R. 2 W.									
1bba	R. G. Murdock	Dr	1972	410	8	117	B	100	--	Basalt	475	153.75	7-15-75	200	S, 10	25	130	D	At 1 hr.
1cad	Albee Brothers	Dr	1972	155	6	20	B	128	8	do	295	48.26	7-10-75	190	S, 1	12	105	D	P 2 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Thickness (feet)	Character of material	Altitude (feet)	Water level: Feet below datum	Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Drawdown (feet)	Use	Remarks
										T. 3 S., R. 2 W.--Continued									
1daa	Wayne Watson	Dr	1974	260	6	--	B	196	22	Basalt	260	61.43	7-10-75	210	S	10	40	D	P 2 hr. Well deepened from 150 ft.
2abd	B. T. Bellinger	Dr	1975	270	6	117	B	230	35	do	590	149.64	7- 9-75	170	S, 1	10	77	D	B 2 hr.
2bbb	J. S. Weber	Dr	1967	115	6	100	B	--	--	--	810	56.27	do	45	S	8	--	D	B 1½ hr.
3abb	Ray Spath	Dr	1969	671	6	150	B	210 664	8 2	Basalt do	900	341	7- 3-69	210	S, 3	65	330	D	P 2 hr.
3adc	Chehalem Mountain Water Co.	Dr	1970	305	8	140	B	105	--	do	890	140.60	7- 8-75	122	S	30	35	PS	At 1 hr, L, Ca. Supplies water for 23 homes (100,000-gallon storage tank.
3cad	Donald Stockton	Dr	1968	600	6	93	B	512 585	5 9	do do	890	392	3-21-68	150	S, 3	58	208	D	P 1 hr, L.
4ccc	L. E. Bellinger	Dr	1967	178	6	172	P, 50-172	--	--	do	575	52.35	2- 9-75	45	S, 3/4	12	143	D	B ½ hr.
4dbb	B. H. Baggenstos	Dr	1974	410	6	87	B	369	11	do	980	300	4-10-74	100	S, 3	12	300	D	At 1 hr.
5abd	J. H. Skyberg	Dr	1973	665	6	40	B	640	20	do	1,182	411.7	2-10-75	100	S, 3	10	--	D	Do.
5bca	John Young	Dr	1974	340	6 5	80 340	P, 140-160, 300-340	150	--	Shale	910	100	9-14-73	410	S, 3	23	--	D	Do.
5bdd	Clyde Giford	Dr	1974	215	6 5	122 215	P, 195-215	68	20	Basalt	740	85	3-20-74	120	S, 1½	12	110	D	Do.
6aab1	Raymond Klohs	Dr	1966	220	6 5	50 210	P, 106-210	198	6	Shale	920	120	1-29-66	--	S, 1	20	50	D	B 1 hr. Well produces inadequate volume of water during late summer and fall.
6aab2	do	Dr	1974	300	6 4	138 250	P, 210-300	230	--	Basalt	900	210	2- 6-74	--	N	15	45	U	B 1 hr.
6bcb	Jakob Taeuber	Dr	1974	180	6	20	B	65	--	Sandstone	410	8.96	10- 1-75	750	S, 5	75	--	D,Ir	At 1 hr, L. Well used to irrigate 6 acres of alfalfa.
6dac	Gene Seifert	Dr	1974	188	6	42	B	150	--	Shale	410	73.24	10- 2-75	480	S, 3/4	10	110	D	B 1 hr.
7abc	R. G. Churchill	Dr	1969	123	6	121	P, 80-120	84	16	do	240	27.59	do	--	S, 1	15	90	D	Do.
7dbb	O. D. Pratt	Dr	--	110	6	--	--	--	--	--	200	18.09	do	410	J, ½	--	--	D	Water from well used by three families.
7dbc	do	Dr	1970	310	6 5	219 310	P, 220-310	235	10	Shale	195	13.30	do	--	S, 3/4	7	254	D	Well reported to have inadequate water supply.
7dcb	D. B. Holliday	Dr	1971	250	6	90	B	--	--	--	205	200	10-12-71	--	N	2	31	U	At 1 hr.
8add	Leonard Silvers	Dr	1973	300	6 5	48 300	P, 140-300	160 205 270	-- -- --	Claystone do do	460	130	7- 5-73	500	S, 3	14	170	D	B 1 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s)			Altitude (feet)	Water level		Specific conductance of water	Type of pump and hp	Well performance		Use	Remarks
								Depth to top (feet)	Thickness (feet)	Character of material		Feet below datum	Date			Yield (gal/min)	Drawdown (feet)		
T. 3 S., R. 2 W.--Continued																			
8bdd	J. C. James	Dr	1962	100	6	35	B	95	5	Shale	250	20	4- 5-62	675	S, 3/4	14	63	D	B 1 hr, L.
9abc	David Vance	Dr	1974	305	6	20	B	140	--	Basalt	420	111.40	10- 1-75	120	S	11	--	D	At 1 hr.
9aca	Jim DeYoung	Dr	1972	260	6	117	B	175	--	do	420	135	11-11-72	--	S, 1½	17	--	D	Do.
9bdd	William Krause	Dr	1974	135	6 5	80 135	P, 81-134	107	15	do	345	52.90	10- 1-75	115	S, 3/4	30	79	D	Do.
9cda	Lyle Lookabill	Dr	1968	205	6 5	100 205	P, 105-205	185	20	Shale	250	70	6- 8-68	600	S, 1	7	135	D	B 1 hr.
10daa	Lloyd Matz	Dr	1968	160	6	100	P, 40-100	42 90 152	13 -- 8	Basalt do do	520	43.77	7-10-75	100	S	15	85	D	Do.
10dbb	James Barnard	Dr	1971	440	6	48	B	140	--	do	590	28.09	do	130	S	25	--	D	At 1 hr.
11aca	Chehalem Mountain Water Co.	Dr	1967	320	6	31	B	265 272 305	7 13 10	do do do	460	143.75	7-16-75	175	S, 2	45	320	PS	P 1 hr, L. Well supplies water for 17 homes.
11bac	F. W. Beringer	Dr	1956	600	8	20	B	167	13	do	600	133.71	do	175	S, 2	20	30	D	B.
11ddb	Oscar Mueller	Dr	--	115	6	--	--	--	--	--	320	82.2	do	100	S, 1	12	--	D	
12acb	W. O. Pannier	Dr	1973	440	6	48	B	320	--	Basalt	440	131.85	7-17-75	160	S, 2	10	--	D	At 1 hr.
12bab	F. W. Beringer	Dr	1966	113	6	91	B	86	--	do	260	35	11- 7-66	180	J, 3/4	20	25	D	B 1 hr.
12dcd	A. F. Knudsen	Dr	1968	388	6	137	B	--	--	do	1,100	--	--	--	--	--	--	--	
13bda	G. H. Gregg	Dr	1970	570	6	69	B	162 379	-- 9	do do	1,110	315.35	9-26-75	--	N	10	115	U	P 2 hr.
14bcb	Paul Cramer	Dr	1969	445	6	41	B	--	--	do	515	240	8-18-69	195	S	12	--	D	At 1 hr.
14bcc	C. V. Slayter	Dr	1973	445	6	40	B	418	--	do	540	324.8	7-11-75	185	S, 1½	25	--	D	At 1 hr, L, Ca.
15cab	John Halley	Dr	1973	150	6 5	94 150	P, 82-150	65	--	do	190	44.72	10- 3-75	210	S, 1	16	75	D	B 1 hr. Well equipped with water softener and iron filter.
15cba	Harry Porter	Dr	1974	87	6	87	B	87	--	do	160	30	7-16-74	210	S, 3	30	50	D	At 2 hr.
15cda	John Reshak	Dr	1966	335	6 5	266 335	P, 95-125, 240-335	--	--	--	300	80	5-12-66	360	S, 1	5	255	D	B ½ hr.
16aaa	Ethel Bixby	Dr	1973	152	6	150	P, 75-150	87	--	Basalt	190	35	5- 5-73	200	S	14	100	PS	B ½ hr. This community well supplies water to five families; water reported to be high in iron.
16aab	J. J. Fortune	Dr	1975	145	6	145	P, 105-145	105	40	do	210	36.45	10-13-73	220	S, 1	9	55	D	P 2 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com-pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s)			Alti-tude (feet)	Water level		Specific conduct-ance of water	Type of pump and hp	Well performance		Use	Remarks
								Depth to top (feet)	Thick-ness (feet)	Character of material		Feet below datum	Date			Yield (gal/min)	Draw-down (feet)		
T. 3 S., R. 2 W.--Continued																			
16ada	Elbert Gleason	Dr	1972	105	6	105	P, 35-103	35	--	Basalt	185	26.88	10-13-75	--	S, 1	20	50	S	B 1 hr. Water has high iron content, bad odor and taste.
17abb	Ralph Mortensen	Dr	1971	175	6 5	40 35	P, 135-175	150	25	do	250	82.45	10-16-75	225	S, 1	30	--	D	At.
17abc	Mr. Heinsman	Dr	1971	212	6 5	176 210	P, 50-209	50	--	do	210	41.33	do	--	S, 1	10	182	U	B 1 hr.
17baa	R. N. Meads	Dr	1975	145	6	140	P, 40-140	54	--	do	200	18	7- 9-68	--	S	9	133	D	B 1 hr.
18abb	Eugene Zirschky	Dr	1968	105	6	105	P, 25-105	--	--	Clay	195	12.64	10-16-75	160	S, 3/4	6	70	D	B 1 hr, L.
18baa	George Greer	Dr	1975	200	6	--	--	--	--	--	200	21.90	10-14-75	180	S, ½	7	--	D	P.
18ccb	H. T. Benson	Dr	1972	165	6	146	P, 70-144	30	--	Clay, sand, and gravel	168	33.02	10-13-75	250	S, 3/4	10	153	D	B 10 hr. Water high in iron content. Well has iron filter.
19ccb	Valley View Memo-rial Garden	Dr	1958	224	8	24	B	118 190	2 2	Basalt do	240	116.40	1-13-75	185	T, 5	33	82	Ir	B 1 hr, L, Ca.
20ddb	Western Helicopter	Dr	1972	98	6	98	P, 40-98	75	23	Clay	165	20	7-14-72	280	S, 1/3	5½	60	D	B 2 hr.
21adb	M. L. Gettman	Dr	1970	184	6	83	P, 58-68	58	10	Sand	135	14	9-26-70	2,100	J, 1½	4	62	D	P 12 hr, L. Ca. Water re-ported to be high in iron content.
21cdd	J. L. Lezada	Dr	1971	335	6	250	B	306	20	Clay	150	51.10	10- 9-75	--	N	12	170	U	B 2 hr. Water reported to be of poor quality; has high iron content, bad odor and taste.
21dcd	Lee Wall	Dr	1956	105	6	105	P, 65-105	65	45	do	160	17.60	10-10-75	--	J, 1	7	100	D	P 1 hr.
22aaa	Richard Clay	Dr	1971	225	6	153	P, 102-180	115	--	Basalt	550	164.2	2-23-75	105	S, 1½	18	65	D	At 1 hr.
22baa	R. W. Schaad	Dr	1972	300	6 5	47 300	P, 30-80	120 220	-- --	Shale do	330	73.55	10- 3-75	410	S, 1	14	--	D	At 1 hr. Water reported to be high in iron content.
22cab	Gary Shuler	Dr	1972	115	6 5	29 115	P, 75-115	90	25	Basalt	225	35.80	7-22-75	210	S, 2	150	115	Ir	At 1 hr.
22cad	Herbert Siefken	Dr	1974	150	6 5	80 140	P, 105-145	105	--	do	222	31.54	7-23-75	180	S, 1½	145	114	Ir	Do.
23ccc	Dennell Martin	Dr	1965	230	6 5	111 102	P, 120-230	--	--	do	440	127.57	7-22-75	200	S	10	107	D	B 1 hr.
23dca	John Bauer	Dr	1975	403	6	33	B	154	--	do	665	228.25	7-23-75	--	S, 3	12	120	D	At 1 hr.
23dcc	David Bauer	Dr	1972	586	6	20	B	549	--	do	840	460	9- 2-72	200	S, 2	10	155	D	Do.
24bab	Dennis Daly	Dr	1975	178	6	90	B	140	--	do	1,055	107.83	7-22-75	--	S, 3/4	10	63	D	At 2 hr.
25bbb	W. H. Johnson	Dr	1972	155	6	20	B	144	5	do	600	101.65	7-23-75	205	S	15	50	D	P 2 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com- pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Thick- ness (feet)	Character of material	Alti- tude (feet)	Water level: Feet below datum	Date	Specific conduct- ance of water	Type of pump and hp	Well performance: Yield (gal/ min)	Draw- down (feet)	Use	Remarks
										T. 3 S., R. 2 W.--Continued									
25bbd	Ben Banyard	Dr	1972	85	6	75	B	78	7	Basalt	710	76.21	7-24-75	115	S, ½	15	2	D	P 2 hr.
25cbc	R. D. Moffett	Dr	1970	680	6	20	B	--	--	do	850	575	3-31-70	150	S	7½	--	D	At 1 hr.
26bab	Jack Dombek	Dr	1972	560	6	90	B	497	--	do	700	340	7-24-75	--	S	20	370	D	Do.
26bda	Mark Clement	Dr	1974	465	6 5	60 300	B	448	17	do	620	352	5-20-75	100	S, 5	25	83	D	P 2 hr, L, Ca.
27bbb	Robert Baker	Dr	1969	100	6	84	B	95	5	do	185	60	7-10-69	300	S, 3/4	10	20	D	B 2 hr.
27ddb	J. E. Bryson	Dr	1975	100	6	80	B	85	--	do	225	67	10- 2-75	180	--	12	20	D	P 1 hr.
28ada1	G. L. Stout	Dr	1972	300	6 5	87 300	P, 237-300	--	--	Claystone	155	38.97	10-10-75	--	N	5	270	U	At 1 hr. Well reported to have inadequate yield.
28ada2	do	Dr	1973	96	6	96	P, 22-95	20	--	Sand and silt	155	19.03	10-10-75	300	S, 3/4	6	72	D	B 1 hr. Water reported to be high in iron content. Well has water softener.
28cba	Fresh Egg Farms	Dr	1970	75	6	73	P, 30-72	26	--	Silt and sand	148	25	7-22-75	220	S, ½	10	50	In	B 1 hr. There are two other wells at this location.
28ddb	William Nottley	Dr	1965	121	6	119	P, 109-119	109	10	Sand and clay	155	76.49	10- 9-75	480	S, 3/4	8	32	D	P 72 hr. Well equipped with water softener.
29aac	Publisher Paper Co.	Dr	1961	91	6	91	P, 21-91	--	--	do	126	23.30	10-17-75	--	J, ½	10	70	D	B ½ hr. Well is gravel packed.
29dab	Bill Southwood	Dr	1973	88	6	88	P, 25-87	25	--	Sand and silt	149	23.10	do	--	C, ½	10	63	D	B 1 hr.
30aab	Kenneth Weatherly	Dr	1969	246	12 8	60 246	P, 63-83, 187-207, 227-242	62 195	4 --	Gravel Sandstone	160	37.80	12-10-75	300	S, 3	30	105	D,S	P 6 hr, L.
30acb	Richard Gillson	Dr	1972	99	6	99	P, 70-90	87	12	Sand and clay	145	48.95	do	210	S, ½	16	60	D	B 2 hr.
33bbb	Waldo Brown	Dr	1972	100	8	78	P, 47-55	33	20	Sand	85	11.09	4- 9-76	--	T, 15	360	23	Ir	P 6 hr, L.
33bbc	Glen Tolstead	Dr	1925	58	6	58	--	--	--	Sand and clay	90	12	4-15-75	210	J, 1	--	--	--	Water reported to be high in iron content.
34abd	C. M. Bishop, Jr.	Dr	--	197	8	--	--	--	--	Sand	167	83.47	4-19-75	1,120	S, 2	--	--	D	Ca.
35ac	T. H. Miller	Dr	1945	247	8	21	B	--	--	Basalt	325	177	6- -45	140	S	26	--	D	P. Well supplies water for several residences (10,000-gallon holding tank).
35cbb	James Bryson	Dr	--	246	10	--	B	--	--	--	150	--	--	220	S, 3	--	--	D,S	
35ddd	C. B. Holton	Dr	1962	150	6	--	--	--	--	--	160	56.61	7-29-75	155	S, 1	--	--	D	
36acc	Harry Vaughn	Dr	1973	590	6	20	B	470	--	Basalt	535	419	8-21-73	165	S, 2	12	170	D	At 1 hr.
36adb	Raymond Wood	Dr	1971	155	6	20	B	122	14	do	505	38.28	7-24-74	140	S	15	123	D	P 2 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
										T. 3 S., R. 3 W.									
1ddb	Vern Spenst	Dr	1973	260	6	20	B	90	--	Shale	255	15.25	12-10-75	220	S, ½	3	--	D	At 1 hr. Water reported to be high in iron.
2aac	Robert Wise	Dr	1973	80	6	45	B	63	--	Sandstone	415	31.07	8-29-75	275	S, ¼	20	60	D	At 1 hr.
3bcb	Russell Berst	Dr	1966	100	6	100	P, 40-100	80	--	Shale	315	38.06	8-28-75	520	S, 1	30	50	D	B 1 hr.
4dbc	Sam Diamond	Dr	1973	95	6	30	B	70	15	do	260	48.01	do	--	N	45	--	U	At 1 hr.
5bbc2	R. J. Kroes	Dr	1965	135	8	51	P, 19-51	25	22	Sand and silt	180	5.25	12- 4-75	360	T, 5	140	35	Ir	P 4 hr, L. Well used to irrigate 20 acres of pasture. Originally drilled to 51 ft.
6aad	do	Dr	1961	75	6	50	B	50	25	Shale	185	0	9-18-61	310	S	25	50	D	B 1 hr.
6bcc	Frank Goretta	Dr	1971	220	6	220	P, 75-95, 155-195	--	--	Shale	600	101.5	10-18-74	260	S	13	--	D	At 1 hr.
7bdd	B. G. McNelly	Dr	1975	--	6	--	--	--	--	--	530	26.32	12- 4-75	240	S, 1	10	--	D	
7caa	do	Dr	1967	240	6	--	--	--	--	--	530	--	--	240	S, 2	--	--	--	Water reported to be high in iron. Well has water-conditioning unit.
7dab	W. B. Baird	Dr	1966	240	6	242	P, 70-242	--	--	Shale	360	63	11-29-66	580	S	20	177	D	B 1½ hr, L.
8cda	Orin Stahnecker	Dr	1959	190	6	34	B	45	9	do	190	71.92	12- 4-75	600	S, ½	5	151	D	B. Well easily pumped dry. Deepened from 100 to 190 ft in 1959.
8dac	Dale Schatz	Dr	1971	215	6 5	-- --	--	--	--	do	175	29.02	12- 3-75	--	S	11	--	D	
8dad	do	Dr	1971	200	6	None	--	--	--	--	180	--	--	--	N	--	--	U	Well abandoned because of inadequate water supply.
9acd	Harlan Huffman	Dr	1973	80	6	58	P, 25-55	27	--	Clay and sand	180	26	7-14-73	220	S, ½	9	35	D	At.
9bab	West Chehalem Friends Church	Dr	1970	68	6	65	P, 35-53, 53-65	58	10	Shale	210	14	8-25-70	540	S	25	40	D	B 1 hr.
9dab	Del Weber	Dr	1967	82	6	80	P, 40-80	30	--	do	180	4.45	12- 3-75	180	S	40	25	D	B 1 hr. Well used as water supply for three houses.
9dba	Harlan Huffman	Dr	1974	240	8	46	B	160	--	do	175	3.67	do	1,050	S, 10	200	212	Ir	At 1 hr, L, Ca.
9dbb	do	Dr	1973	145	6 5	42 145	P, 25-145	--	--	Sandstone	180	5	7-16-73	--	S, 5	60	140	Ir	At 1 hr.
10aab	Harvey Nelson	Dr	1975	70	6	44	P, 27-32	30	20	do	185	4.5	12- 5-75	350	S, ½	7	--	D	Owner has another well which is 130 ft deep.
10ccd	Mike Degoia	Dr	1969	85	6	20	B	70	15	Shale	175	5.54	12- -75	415	S, 3/4	100	--	D	At 1 hr.
11caa	Steve Schmidt	Dr	1971	46	6	46	P, 21-46	22	18	Sand and clay	160	3.56	10- 9-75	180	J, ½	55	--	D	At 1 hr, L, Ca.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Thickness (feet)	Character of material	Altitude (feet)	Water level: Feet below datum	Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Drawdown (feet)	Use	Remarks
								T. 3 S., R. 3 W.--Continued											
11cab	Steve Schmidt	Dr	1971	200	6	60	B	35	--	Sand and clay	160	1	7-16-71	--	N	3½	--	D	At 1 hr. Reported to have more water at 35 ft. Owner plans to perforate at this interval.
11dcd	John Jacobson	Dr	1974	200	6	60	B	70	--	Sandstone	120	30	8- 9-74	220	S	40	150	D	At 1½ hr.
12bdd2	Earl Davis	Dr	1970	150	8	152	P, 132-150	--	--	--	150	14.38	12- 9-75	240	S, 3	30	82	D,Ir	B 96 hr.
12cdd	Lawrence Baker	Dr	1965	148	6	138	P, 20-137	--	--	Sand and clay	145	18	4- 8-65	200	S	3	130	D	B 1 hr.
12dda	Earl Gillis	Dr	1958	73	6	73	B	40	--	Clay	195	30	12- 7-58	--	S	--	--	D	
13adc	John Lagasse	Dr	1975	200	6	--	--	--	--	--	155	27.15	12-10-75	240	S	--	--	D	
13add	W. C. Noyes	Dr	1973	200	6	--	--	--	--	--	168	--	--	235	S, 1½	150	--	D	At.
14aab	Velma Schulenberg	Dr	1970	150	6	44	--	40	--	Sandstone	160	26.02	12- 4-75	200	S, 3/4	150	--	D	At 1 hr.
14aca	Melvin Phipps	Dr	1974	106	6	106	P, 40-100	103	3	do	140	2	10- 8-74	300	S, 3/4	25	10	D	P 2 hr.
14dcc	Douglas Umfleet	Dr	1974	209	6	146	P, 55-145	70 134	-- --	Basalt do	210	58	6-14-74	100	S	20	90	D	B 1 hr.
15baa	E. W. Leffler	Dr	1968	250	6 5	113 241	B	57 190 228	5 6 --	Sandstone Shale do	220	60	5- 8-68	--	S	15	165	D	Do.
15cda	John Schavorzen	Dr	1970	140	6	65	B	--	--	Basalt	320	18	11-30-70	--	S	100	--	D	At 1 hr.
16bcd	Mr. Little	Dr	1970	169	6	167	P, 105-165	110	--	Shale	460	109.39	9-18-74	500	S	11	64	D	B 1 hr.
16ddb	Elbert Olds	Dr	1968	140	6	135	P, 127-131	128	3	Basalt	620	95.6	9-17-74	170	S	10	30	D	P 5 hr.
17bda	Norm Haugen	Dr	1974	350	6	--	B	--	--	Shale	260	200	10- 1-74	580	S	4	125	D	At 1 hr. Well deepened from 285 ft.
19dbc	Stanford Laughlin	Dr	1971	120	6	56	B	60	--	Sandstone	315	10.28	12- 5-75	180	S, 3/4	20	--	D	At 1 hr.
21cdc	Les Haight	Dr	1973	125	6	32	B	85	--	Basalt	810	34	2-24-73	60	S	6	85	D	Do.
22cbd	W. L. Harvey	Dr	1972	375	6	40	B	--	--	do	970	133.03	9-17-74	90	S	10	234	D	At 1 hr, L, Ca.
23bbd	Brad Briggs	Dr	1974	265	6	19	B	210	--	do	320	152.75	9-19-74	140	S	25	110	D	At 1 hr.
23cba	Donald Gunnell	Dr	1972	435	6 5	180 435	P, 162-435	180 420	-- --	Claystone Sandstone	680	123.7	do	70	S	6	280	D	Do.
24bbb	Sam Eastman	Dr	1972	277	6	277	P, 175-195, 235-276	180	--	Clay and shale	180	24	4-15-72	--	S	27	70	D	B 1 hr.
25adb	Mr. Watson	Dr	1967	285	6	253	P, 213-253	235	50	Shale	162	119.94	4- 8-76	130	S, 2	22	222	D	P 1 hr.
26acc	City of Dundee	Dr	1960	471	16	96	B	85 376	7 7	Clay Basalt	400	207.18	6-10-75	130	S, 25	120	--	PS	P, L, Ca, H.
27abd1	do	Dr	1971	104	8	63	B	--	--	do	440	--	--	--	T, 15	180	83	PS	P 4 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com- pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Thick- ness (feet)	Character of material	Alti- tude (feet)	Water level: Feet below datum	Date	Specific conduct- ance of water	Type of pump and hp	Well performance: Yield (gal/min)	Draw- down (feet)	Use	Remarks
										T. 3 S., R. 3 W.--Continued									
27abd2	City of Dundee	Dr	1973	200	8	40	B	80 110	25 55	Basalt do	440	0	3- 8-73	--	S, 10	100	160	PS	At 2 hr.
27dcb	William Archibald	Dr	1972	235	6	53	B	223	9	do	395	203.8	9-18-74	85	S, 2	20	20	D	B 1 hr.
28dab	Chehalem Park and Recreation Dist.	Dr	1976	100	6 5	75 65-100	P, 50-100	50 73	23 27	do Shale	630	15	1-30-76	--	S	30	60	PS	At 1½ hr. Two other wells drilled to 60 ft at this location were abandoned.
30adc	Trappist Abbey	Dr	1956	147	6	46	B	92	--	Sandstone	230	--	--	--	J, ½	10	--	D	B.
30dab	do	Dr	1960	160	21 8	18 160	P, 40-60, 145-155	52 150	-- 5	Shale Sandstone	210	37.89	2-18-76	510	J, 2	32	24	D	B 2 hr, Ca. L.
31ccb	Bill Morgan	Dr	1966	100	6	100	P, 30-100	--	--	Shale	180	27.52	10- 9-74	460	S, ½	5	4	D	B 1 hr.
32bcd	Glenn Almond	Dr	1968	175	6	55	P, 50-55	--	--	do	350	10.22	4- 7-76	--	S, 3/4	7	125	D	B 2 hr.
33cdb	M. H. Haslett	Dr	1974	455	6	--	--	--	--	do	860	333.25	4- 6-76	48	S, 3	--	--	D	
34add	H. H. Tjaden	Dr	1971	204	6	200	P, 130-200	--	--	Clay	165	25	9- 8-71	--	S	15	165	D	B 2 hr.
34cad	H. L. Abbe	Dr	1971	530	6	60	B	130	--	Basalt	580	235	9-15-71	--	S	8	265	D	B 1 hr.
35ccb	B. J. Trunk	Dr	1973	290	6	160	B	190	--	Sandstone	260	71	6- 4-73	--	S	20	160	D	At 1 hr.
36aaa	City of Dundee	Dr	1972	115	12	115	P, 62-66, 98-103	62 98	4 5	Clay and sand do	80	29	10-30-72	200	T, 20	110	26	PS	P 24 hr, Ca, L. A nearby well, drilled to 265 ft, was abandoned.
36dcb	Harold Jacobson	Dr	1969	200	6 6	118 125	Sc, 118-125	118	7	Sand and silt	120	56.34	4- 8-76	--	S, 1	10	30	D	B 1 hr.
										T. 3 S., R. 4 W.									
1add	Frank Gorretta	Dr	1967	233	6	233	P, 62-168	58 104 205	2 11 --	Shale do do	600	31.13	10-18-74	360	N	6	165	U	B 1 hr, L.
2adc	Norman Kratzer	Dr	1967	65	6	65	P, 20-65	35	5	do	200	18	8-10-67	970	S, ½	10	47	D	B 1 hr, L, Ca. A 57-ft well at this location abandoned; salty water.
3dcd	Charles Vertner	Dr	1968	203	6	55	B	--	--	Claystone	280	18.65	10-18-74	--	N	3	177	U	B 2 hr.
5aac	W. F. Powell	Dr	1963	77	6	40	B	--	--	Sandstone	210	12	9-12-63	--	N	30	5	U	Do.
5ccc	Jack Frost	Dr	1967	97	6	97	P, 34-74	--	--	--	175	23	11-20-67	--	--	15	50	D	B 1 hr.
6abc	Rollie Morris	Dr	1970	110	6	18	B	--	--	--	180	--	--	--	N	--	--	U	Yielded no water; abandoned. A 90-ft well at this location abandoned; yielded no water.
6bcd	Ray Huddleston	Dr	1972	77	6	38	P, 32-36	32	4	Shale	180	19.32	10-17-74	900	S	10	40	D	B 2 hr, L, Ca.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Thickness (feet)	Character of material	Altitude (feet)	Water level: Feet below datum	Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Drawdown (feet)	Use	Remarks
								T. 3 S., R. 4 W.--Continued											
7bdd	Marcus Lambrecht	Dr	1958	125	6	--	--	20	4	Shale	210	30	9- 1-58	--	--	3	--	--	B. Well deepened several times to obtain more water.
8aac	Robert VanDyke	Dr	1966	52	6	52	P, 32-52	38	--	do	160	10	1-19-66	260	J	13	42	D	B ½ hr.
8cbd	Fidel Bros.	Dr	1963	135	6	41	B	--	--	do	180	3	12- 5-63	--	S, 1	22	110	D	B 1 hr.
9dba	Robert Chaffee	Dr	1960	100	6	30	B	--	--	do	220	26	8-25-60	--	S, 3/4	9	54	D	Do.
10aba	Charles Laughlin	Dr	1967	203	6	200	P, 106-180	178	--	Sandstone	450	107	9-19-67	--	--	16	70	D	Do.
10dbb	Mauri Mayor	Dr	1964	110	6	20	B	--	--	Shale	270	9.65	10-18-74	--	N	2	90	U	Do.
12bbc	Larry Hammer	Dr	1975	114	6	--	--	--	--	--	270	72.65	8-27-75	230	S, 3/4	16	--	D	
13bcd	E. L. Wright	Dr	1971	180	6 4½	30 180	P, 25-180	--	--	Shale	390	28	6-27-61	330	S	10	30	D	B 1 hr, L.
16dda	J. V. Chandler	Dr	1956	74	6	32	--	72	2	do	200	12	10-18-56	--	N	7	62	U	B. Water reported to be very salty.
18aaa	C. R. Swann	Dr	1960	70	6	43	P, 6-40	--	--	Clay	190	3	7-18-60	--	J, 2	20	40	D	P 5 hr.
18bdc	Chuck Finster	Dr	1973	159	6	22	B	--	--	--	350	17.58	11- 5-74	380	N	6	114	U	At 1 hr.
19cdc	Austin Warner	Dr	1956	100	6	28	P, 20-25	20	5	Shale	180	8.88	10- 6-75	--	J	25	90	U	B.
22dcc1	J. W. Park	Dr	1973	160	6	40	B	--	--	do	155	29.42	8-12-75	1,250	S, ½	2½	135	D	B 1 hr. A second well at this location is 152 ft deep and reported yield is 3½ gal/min.
24add	George Stermer	Dr	1971	94	6	45	P, 45-89	55	5	Sandstone	300	13.55	11- 5-74	150	J	8	80	D	B 1 hr.
24baa	Jess Roe	Dr	1969	185	6	106	P, 66-106	--	--	Shale	360	21	8-28-69	--	--	12	--	D	At 1 hr.
24bac	Mark Mayor	Dr	1967	88	6	88	P, 25-88	50	--	do	205	9	8- 5-67	--	--	4	82	D	B 1 hr.
25cdb	Ernest Jernstedt	Dr	1964	125	6	34	B	--	--	do	200	10	8- 6-64	1,750	S	3½	110	D	B 2 hr, L.
26cda	Leonard Jernstedt	Dr	1959	84	6	84	P, 77-84	77	7	do	160	21	10-30-59	--	--	3½	63	D	P 1½ hr.
27cca	L. K. Ritter	Dr	1969	80	6	80	P, 40-80	--	--	do	160	38.08	8-13-75	320	J, 1	10	40	D	B 1 hr.
27dad	Larry Pekkola	Dr	1973	200	6	105	B	100	--	do	185	34.14	8-12-75	6,000	S	20	150	Ir	P 1 hr. Well used to irrigate lawn and garden. Water reported to be brackish.
28ddc	P. R. Thornfeldt	Dr	1968	95	6	75	P, 66-76	52	20	Sand and gravel	160	38	5-14-68	--	--	25	17	D	B 1 hr, L.
29dcb	D. R. Morton	Dr	1975	56	6	57	P, 22-53	20	55	Clay and gravel	170	15	3-12-75	400	J	3	40	D	At 1 hr.
30acc2	W. R. Coleman	Dr	1958	87	6	--	--	--	32	Shale	200	20	9-19-58	--	J	1	60	U	B 1 hr. A 368-ft well and a 47-ft well at this location abandoned due to insufficient water. Owner on city water.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
										T. 3 S., R. 4 W.--Continued									
31dbd	Dudley Sitton	Dr	1973	260	6	None	--	--	--	--	170	40	7-24-73	--	--	--	220	U	B ½ hr. Well abandoned and casing pulled.
32aba	Maurice Bernards	Dr	1956	75½	6	75½	P, 64-75	64	11	Sand and gravel	170	33	10- 4-56	--	--	20	35	D	B, L.
34bdc	J. J. Kirsch	Dr	1962	73	6	73	P, 62-73	57	9	do	165	17.74	11-11-75	330	S, 1	30	33	D	B 1 hr, L, Ca.
34ddd	Robert Payne	Dr	1969	80	6	62	P, 42-62	40	15	do	180	14.45	8-12-75	280	S, 1½	35	15	D	B 2 hr.
35abd	Donald Pekkola	Dr	1967	190	6	None	--	--	--	--	158	19	8-11-67	--	--	2	170	N	B 1 hr. Water saline; well abandoned.
35cac	H. C. Youngburg	Dr	1959	86	6	59	P, 43-49	43 72	6 14	Gravel Shale	165	16	4-28-59	--	--	12	60	D	B.
										T. 3 S., R. 5 W.									
1cdb	C. C. Henley	Dr	1973	137	6	32	B	--	--	Shale	420	33.64	8-15-74	--	S, 3/4	8	97	D	B 1 hr.
1dbc	Robert Young	Dr	1973	151	6	22	B	--	--	do	320	21.85	do	600	S, 3/4	9	126	D	Do.
2ada	W. C. Remior	Dr	1970	555	6	30	B	--	--	do	470	400	8-20-70	--	--	12	135	D	At 1 hr, L.
2caa	Z. D. Ham	Dr	1969	117	6	40	B	--	--	Claystone	700	33.66	8-15-74	300	S, 3/4	17	85	D	At 1 hr.
3aab	James Broxterman	Dr	1969	240	6	20	B	--	--	Shale	800	37.50	do	210	S, ½	8	--	D	Do.
4acc	W. A. Coon	Dr	1966	90	6	20	P, 20-80	54 78	6 2	do do	480	21.47	do	210	S, ½	9	65	D	B 1 hr.
12cda	M. E. Duncan	Dr	1970	117	6	23	B	64	--	Basalt	320	3	1-30-70	--	--	7	45	D	Do.
12dcd	John Duncan	Dr	1969	70	6	18	B	50	--	do	225	7.19	8-16-74	260	S, 1/3	4	60	D	Do.
16baa	J. R. Heltsley	Dr	1969	153	6	24	B	--	--	Claystone	780	92.4	8-19-74	450	S	2	120	D	Do.
17bda	Harold Payne	Dr	1969	120	6	30	B	--	--	do	880	24	4-15-69	250	S	7	87	D	B 1 hr, L, Ca.
22daa1	Ray Little	Dr	1972	255	6	27	B	--	--	Shale	480	28	7-21-72	180	S	3	220	D	B 2 hr.
22daa2	do	Dr	1972	195	6	31	B	31	--	do	480	72	7-31-72	--	--	7	113	D	B 2 hr. Well used as water supply for several families.
23acc	R. L. Wynne	Dr	1972	92	6	19	B	32	--	Basalt	260	66.40	8-20-74	320	S	10	21	D	B 1 hr.
24cdc	Cleo Stockwell	Dr	1972	182	6	19	B	42	--	do	240	20.76	do	--	S, 3/4	8	105	D	B 1½ hr.
32daa	Edward DeWyse	Dr	1973	200	6	22	B	73	--	do	1,440	46	6-28-73	--	--	10	131	D	B 1 hr.
35cbc	Doug Nyseth	Dr	1973	420	6	74	B	85	--	Sandstone	890	58	3-29-73	--	--	7	362	D	At 1 hr, L.
36ccb	Frank Collins	Dr	1973	110	6	106	B	110	--	Shale	760	28.50	8-20-74	220	S, 3/4	6	--	D	

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
										T. 3 S., R. 1 E.									
2bcd	Marshall Leisman	Dr	1956	200	6	19	B	116	12	Basalt	170	111.14	3-19-76	155	S, 1	9	90	D	
3cca	Ben Tannler	Dr	1968	179	6	30	B	--	--	do	725	113.47	3-15-76	--	S, ½	2	10	D	B 1½ hr.
3dbb	S. H. Haagenson	Dr	1960	632	6	54	B	97 400 535	-- -- --	do do do	515	291.10	3-19-76	80	S	8	275	D	B 2 hr. Well deepened from 222 ft.
4acc	John Webber	Dr	1969	1,000	10	84	B	540 820	20 2	do do	800	665	4-28-70	--	T, 100	300	125	PS	P 8 hr. L, Ca. Well used as water supply for 20 homes.
4dda	W. F. Perley	Dr	1973	639	8	90	B	526	21	do	740	360	9- 3-73	180	S, 15	60	275	D,S	P 3 hr.
5ccd	Daryl Bodle	Dr	1973	220	6	20	B	198	14	do	280	100	4-11-73	--	S	18	25	D	
5dbb	Phillip Allhands	Dr	1973	235	6	19	B	180	--	do	410	172.53	7-17-75	200	S, 1½	22	55	D	P 2 hr. Water reported to be hard. Well has softener attachment.
5dcb	L. S. Olszewski	Dr	1973	175	6	60	B	129	--	do	300	107	10-30-73	--	S	32	50	D	P 2 hr.
5ddc	J. S. Burgess	Dr	1968	302	6	--	B	--	--	do	390	198.30	7-17-75	--	S, 2	25	--	D	Do.
6abd	Paul Stangarone	Dr	1973	455	6	42	B	--	--	do	520	265	6-30-73	--	S, 1	10	170	D	At 1 hr.
6bcc	R. G. Ernst	Dr	1972	250	6	--	B	--	--	do	350	160.02	7-18-75	180	S, 3	50	--	D	
6dac	Tualatin Sand & Gravel	Dr	1975	767	12 8 6	41 298 332	P, 200-278, 288-298	166	12	do	275	97	10-14-65	--	S, 1	60	75	D	P 2 hr, L.
7ada	Stan Smith	Dr	1974	185	6	28	B	166	12	do	230	82.30	7-17-75	--	S, 1	60	75	D	P 2 hr.
7bcb	Fred Edmonds	Dr	1949	235	6	118	B	--	--	do	255	62	do	--	T, 7½	250	120	Ir	P 10 hr.
8bba	Robert Marcum	Dr	1973	200	6	40	B	165	--	do	280	110	8-11-73	--	S	50	90	D	P 1 hr.
8cac	E. C. Meek	Dr	1973	380	10	58	B	218	--	do	230	59	12-19-73	--	S, 15	37	239	Ir	Do.
10bbd	Mike Wells	Dr	1974	460	6	20	B	370 435	-- 20	do do	620	340	2-22-74	130	S, 1½	16	100	D	At 2 hr.
10bcd	Virgil Skyles	Dr	1972	507	6	None	B	--	--	do	620	319	4-27-74	160	S	20	181	D	P 2 hr.
15bcb	James Stobaugh	Dr	1967	533	6	19	B	--	--	do	490	401	6- 8-67	--	S, 3	14	126	D	P 1 hr.
15bcd	H. G. Stuart	Dr	1973	400	6	52	B	379	--	do	440	360	9- 5-73	--	S, 1½	20	5	D	B 1 hr.
15cbb	P. A. Tennis	Dr	1967	500	6	53	B	110 361 406	5 -- --	do do do	425	323	10-21-67	280	S, 1½	15	177	D	P 2 hr.
16baa	W. A. Kaiser	Dr	1966	235	8	70	B	--	--	do	255	110	5- 3-66	--	S, 7½	37	0	D	B 2½ hr. Well used as water supply for several families.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year completed	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thickness (feet)	Water-bearing zone(s): Character of material	Altitude (feet)	Water level: Feet below datum	Water level: Date	Specific conductance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Drawdown (feet)	Use	Remarks
T. 3 S., R. 1 E.--Continued																			
16bcd	W. A. Kaiser	Dr	1969	621	8	363	B	400	--	Basalt	205	57.53	7-15-75	260	S, 40	360	198	Ir	P, L.
16cad	do	Dr	1970	1,005	10	540	B	725	--	do	200	62	4- 9-71	520	T, 75	475	367	Ir	P 6 hr, L, Ca.
17cda	P. D. Olson	Dr	1974	145	6	143	B	--	--	Sand and gravel	190	81	6-22-74	--	S, ½	32	62	D	P 2½ hr.
17cdb	Bruck Filbert Nursery	Dr	1968	152	6	154	B	--	--	do	190	101.55	7-15-75	320	S, 1½	24	55	D	P 4 hr.
18bab1	Dale Hendron	Dr	1971	165	6 5	120 165	P, 120-165	120	--	Shale	215	97.35	7-16-75	280	S, 1½	15	30	D	B 1 hr.
18bab2	Stephen Milliron	Dr	1972	126	6	126	P, 80-120	82 109	9 1	Gravel and sand do	215	50	7-15-75	--	S	30	30	D	P 3 hr.
18bdb1	E. Ray	Dr	1971	503	6	449	B	212 444	-- --	Sand Basalt	210	73.91	7-16-75	260	S	37½	430	D	P 1 hr.
18bdb2	John Hughes	Dr	1971	178	6 5	0-140 120-188	--	85 174	2 4	Sand and gravel Sand and clay	210	112.43	do	280	S, 1	25	60	D	P 8 hr, L, Ca. Deepened from 85 ft.
21aad2	Clackamas County Park Commission	Dr	1973	265	6	255	B	255	10	do	70	4.65	7-24-75	400	S	100	195	D	At 1 hr, L, Ca. Another well at this location abandoned at 440-ft depth.
22bbd	P. H. Hebb	Dr	1974	307	10	·174	B	--	--	--	95	--	--	--	--	--	--	U	Ca. Well to be used for Riverside water system.
22bcb	do	Dr	1959	442	10	442	P, 419-425	419	5	Gravel and sand	75	50	11- 4-59	580	T	105	250	PS	P 24 hr, L. Water supply for Riverside water system.
22dad	V. O. Labsch	Dr	1963	76	6	76	B	--	--	do	90	31	7-30-63	180	S	45	0	D	B 1½ hr.
T. 4 S., R. 2 W.																			
1aba	Unknown	Dr	1974	190	6	--	--	--	--	--	195	131.30	6-10-74	150	S	25	--	D	Water level affected by recent pumping.
1bbb1	G. D. Kenyon	Dr	1972	80	6	80	P, 30-80	60	10	Sand and silt	100	24.50	7-25-75	1,150	S, 1/3	3	38	D	At 1 hr.
1bbb2	do	Dr	1972	58	6	58	P, 30-58	35	10	Sand	100	2.28	do	--	N	9	54	D	Do.
T. 4 S., R. 3 W.																			
3bac	N. V. Fleming	Dr	1973	265	6	60	B	130 250	10 10	Basalt do	280	54.48	do	100	S, 3	90	91	D	At 1 hr.
4bad	Dwight Brown	Dr	1971	300	6	91	B	210	--	do	650	207.1	4- 7-76	40	S, 2½	8	80	D	B 1 hr.

Table 4.--Records of representative wells--Continued

Well number	Owner	Type of well	Year com-pleted	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Finish	Water-bearing zone(s): Depth to top (feet)	Water-bearing zone(s): Thick-ness (feet)	Water-bearing zone(s): Character of material	Alti-tude (feet)	Water level: Feet below datum	Water level: Date	Specific conduct-ance of water	Type of pump and hp	Well performance: Yield (gal/min)	Well performance: Draw-down (feet)	Use	Remarks
									T. 4 S., R. 3 W.--Continued										
5abb	City of Lafayette	Dr	1968	210	8	198	P, 23-198	--	--	Sandstone	400	18	10-23-68	--	S	145	127	PS	P 6 hr, L.
5bad	do	Dr	1967	175	8	175	P, 30-175	--	--	do	380	10	9- 1-67	--	S	126	122	PS	P 7½ hr.
5dbb	Milo Mitchell	Dr	1974	408	6	40	B	--	--	Sandstone and shale	450	260.05	4- 7-76	680	S, 1½	7	275	D	B 1 hr, L, Ca. Originally drilled to 285 ft in 1969.
6bbb	Ed Banke	Dr	1959	157	6	43	B	--	--	Shale	180	30	4-20-59	--	J, ½	1	126	D	B.
									T. 4 S., R. 4 W.										
5bcb	Otto Spurger	Dr	1964	75	6	75	B	--	--	Sand and clay	160	20.25	3-13-75	35	S	12	25	D	B 2 hr.

Table 5.--Records of representative springs in the Newberg area

[Use: D, domestic; PS, public supply; and U, unused. Remarks: Ca, chemical analysis of water in table 2]

Spring number	Owner	Altitude (feet)	Geologic source1/	Occurrence	Yield: Gallons per minute	Yield: Date	Use	Specific conductance (micromhos/ cm at 25°C)	Remarks
2S/3W-4dbds	City of Laurelwood	700	Tcr	Flows from small ravine	10-15	8-20-75	PS	120	Water is piped to two storage tanks and supplies 40 families.
2S/3W-23ddas	Charles Remington	920	do	do	--	--	PS	125	Supplies water for 3 families and 30 head of livestock and for seasonal use of a nut-processing plant.
2S/4W-6dcas	Glen Phillips	620	Tm	Flows from soil mantle on hillside	25	2-24-76	D	195	Water flows from 4-in-diameter pipe buried in hillside. Adequate supply for two families and some irrigation. Ca.
2S/5W-29cdas	Bryce Mitchell	380	Tev	Flows from volcanic rock outcrop	½	6- 4-75	U	24,300	Water flows from 3-in-diameter pipe driven into outcrop. Spring was popular source of "mineral water" in early 1900's. Ca.
3S/1E-3dcbs	Erwin Notdurft	560	Tcr	Flows from small ravine	15-20	3-19-76	D	140	Water collected by three 100-ft-long trenches across hillside flows into a 4-ft-diameter concrete-tile cistern 15-ft deep.
3S/2W-13cdds	Richard Kimball	960	do	do	10	7-17-75	D	50	Water collected from three springs and piped to springhouse. It is then pumped to points of use.
3S/3W-32dbas	City of Lafayette	540	do	do	15	3- 3-75	PS	35	Water flows from several collector boxes into a storage tank. Supplies 15 families.
4S/3W-5abcs	do	450	do	do	37	do	PS	--	Water flows from several collector boxes into a storage tank. Supplies supplemental water for city of Lafayette.

1/ Tcr, Columbia River Basalt Group; Tev, Tillamook Volcanics; Tm, marine sedimentary rocks.

Table 6.--Drillers' logs of representative wells

2S/1W-15bda. T. C. Wasson. Altitude 150 ft. Drilled by Steinman Bros., 1962. Casing: 6-in. diam to 526 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Clay, silty, brown	18	18
Sand, brown, fine-grained	18	36
Sand, gray, fine-grained	22	58
Clay, gray, gritty	20	78
Sand, blue, fine-grained, with trace of gravel	1	79
Clay, brown, gray, and blue	291	370
Clay, gray, and coarse broken rock	15	385
Conglomerate, gray	115	500
Conglomerate, yellow	24	524
Rock, gray, soft, with clay seams	29	553
Basalt, gray	127	680
Rock, black, soft, water-bearing	14	694
Rock, gray, hard	1	695

2S/1W-16dca. Howard Martine. Altitude 125 ft. Drilled by Frank Zell, 1956. Casing: 6-in. diam to 485 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Clay	30	30
Sand	21	51
Clay	92	143
Silt, with pieces of wood	2	145
Clay, blue	30	175
Clay, with streaks of shale	205	380
Clay, red	90	470
Gravel, pea-sized, with decomposed rock	15	485
Basalt	10	495

2S/1W-20dab. D. W. Parr. Altitude 145 ft. Drilled by A. M. Jannsen Drilling Co., 1974. Casing: 6-in. diam to 436 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil, brown, and silty clay	3	3
Sand and silt, brown, with occasional brown clay streaks	22	25
Sand, brown, muddy, and pea-sized gravel	25	50
Clay, blue, silty, with occasional black sand streaks	25	75
Clay, blue, with cemented gravel	10	85
Clay, blackish-brown, with streaks of cemented gravel	10	95
Clay, gray-brown, sticky	60	155
Sand, gray, silty	5	160
Clay, gray, silty, with some gravel and sand	10	170
Clay, blue, hard, sticky, with gritty streaks	20	190
Clay, gray and blue, sticky	85	275
Clay, brown, sticky, with some gritty and soft rock fragments	25	300
Clay, brown, hard, sticky	50	350
Clay, blue, with black sand and soft pea-sized gravel	15	365
Gravel, blue and black, hard, cemented	10	375
Clay, brown, gritty	20	395
Gravel and sand, brown and black, hard, cemented	10	405
Basalt, black and brown, fractured, with some reddish-brown clay fragments	30	435
Basalt, brown, broken, with some gravel-type fragments	25	460
Basalt, soft, brown	10	470

2S/1W-22ccd. Coaxco, Inc. Altitude 144 ft. Drilled by A. M. Jannsen Drilling Co., 1974. Casing: 6-in. diam to 310 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Sand, brown, "dirty"	15	15
Sand, black, muddy, and pea-sized gravel	20	35
Clay, blue-gray, silty	15	50
Sand and silt, black	10	60
Clay, blue-gray, silty, with sand seams	10	70
Sand, black, and blue clay streaks	10	80
Clay, brown	5	85
Clay, blue, sticky, and cemented pea-sized gravel	15	100
Clay, blue-gray and brown, sticky	20	120
Clay, brown, hard	20	140

2S/1W-22ccd.--Continued

Materials	Thickness (feet)	Depth (feet)
Clay, gritty, brown, with some soft rock seams	15	155
Clay, red-brown, with some grit and soft rock	45	200
Clay, brown, gritty, hard	20	220
Clay, black-brown, gritty	10	230
Clay, brown, sticky, hard	10	240
Rock, brown, soft, with clay seams	40	280
Basalt, brown, with some decomposition	20	300
Basalt, black-brown, with streaks of gray and green rock	20	320
Basalt, gray and brown, broken, with perforated zones	20	340
Basalt, brown, broken	2	342

2S/1W-25bca. W. C. Nelson. Altitude 265 ft. Drilled by American Well Drilling Co., 1964. Casing: 6-in. diam to 340 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil	4	4
Clay, brown, sandy	41	45
Sand, brown	92	137
Clay, brown and blue	84	221
Clay, gray	9	230
Sandstone, black	8	238
Clay, blue and black	37	275
Clay, blue-gray	65	340
Shale, blue, sandy	20	360

2S/1W-27ccd. Tigard Sand & Gravel. Altitude 220 ft. Drilled by A. M. Jannsen Drilling Co., 1968. Casing: 10-in. diam to 84 ft, 8-in. diam to 244 ft; perforated 134-197 ft and 208-238 ft

Materials	Thickness (feet)	Depth (feet)
Basalt, broken	2	2
Basalt, gray	6	8
Basalt, gray and brown, soft	22	30
Basalt, weathered, with hard and soft layers	48	78
Basalt, brown and gray, hard	41	119
Basalt, gray	10	129
Basalt, weathered	5	134
Basalt, black	3	137
Basalt, brown and gray, water-bearing	37	174
Basalt, weathered, water-bearing	23	197
Basalt, brown and gray	11	208
Basalt, weathered	30	238
Basalt, brown and gray, hard	6	244

2S/1W-30acc. J. J. Burris. Altitude 182 ft. Drilled by John Meeker Well Drilling, Inc., 1967. Casing: 6-in. diam to 490 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil	4	4
Silt, brown, sandy	48	52
Silt, blue, sandy	52	104
Clay, brown	150	254
Rock, brown, soft	2	256
Clay, brown	8	264
Sand, blue, and gravel and clay	3	267
Clay, brown	17	284
Clay, blue, silty	7	291
Clay, with some layers of rock	120	411
Gravel, small-sized, mixed with clay	19	430
Clay, blue, with small pieces of shale	48	478
Rock, brown, medium-hard	16	494
Rock, red, hard	13	507
Rock, brown, with some soft layers	18	525
Basalt, gray	8	533
Basalt, gray, fractured in places	16	549
Basalt, gray, hard	15	564
Basalt, blue, fractured in places	16	580
Basalt, blue, hard	5	585

Table 6.--Drillers' logs of representative wells--Continued

Materials	Thickness (feet)	Depth (feet)
2S/2W-5dcb. Joseph Weibel. Altitude 280 ft. Drilled by S & M Drilling & Supply, Inc., 1974. Casing: 8-in. diam to 255 ft; unperforated		
Soil	3	3
Clay, blue, sandy	22	25
Clay, blue and green, sandy	35	60
Clay, green and blue	5	65
Clay, blue, and sandstone	20	85
Clay, greenish-blue, sandy	25	110
Clay, brown, sandy	40	150
Clay, brown	20	170
Clay, red	30	200
Clay, red, sandy	20	220
Clay, brown	10	230
Sand, brown and black	20	250
Basalt, brown, soft	20	270
Cinders, red	10	280
Basalt, brown, water-bearing	10	290
Basalt, gray, water-bearing	25	315
2S/2W-8bbd. Melvin Finegan. Altitude 180 ft. Drilled by A. M. Jannsen Drilling Co., 1956. Casing: 8-in. diam to 227 ft; unperforated		
Soil	5	5
Quicksand	95	100
Clay	125	225
Sand, gray	9	234
Basalt, brown, green, and gray	76	310
Basalt, red, water bearing at 343 ft	75	385
Basalt, brown	3	388
Basalt, black	112	500
Basalt, hard, water bearing from 585-605 ft	112	612
2S2W-10ccd1. General Telephone Co. Altitude 170 ft. Drilled by A. M. Jannsen Drilling Co., 1965. Casing: 6-in. diam to 328 ft, 5-in. diam 319-398 ft; perforated 323-398 ft		
Soil	2	2
Sand, brown and blue, very fine	146	148
Clay, brown	12	160
Sand, green, and clay	15	175
Clay, blue	5	180
Clay, brown, sandy	16	196
Clay, brown	34	230
Sand, water-bearing (2 gal/min)	2	232
Clay, green and brown	93	325
Clay, brown, sticky, hard	23	348
Clay, brown, hard, with some rock particles	20	368
Rock and gravel, cemented	6	374
Gravel, pea-sized, water-bearing	6	380
Clay, hard	18	398
2S/2W-13dda. D. E. Jeans. Altitude 145 ft. Drilled by B & S Drilling Co., 1970. Casing: 6-in. diam to 225 ft; unperforated		
Soil, brown	2	2
Clay, brown	16	18
Sand, gray, fine-grained	14	32
Clay, blue	8	40
Sand, gray, fine-grained	18	58
Clay, gray	20	78
Sand and silt, fine	136	214
Shale, brown	7	221
Basalt, gray, soft	37	258
Basalt, brown and gray, porous, water-bearing	32	290
2S/2W-16bcd. Wolsburn Farms Water Dist. Altitude 265 ft. Drilled by A. M. Jannsen Well Drilling Co., 1974. Casing: 6-in. diam to 180 ft; unperforated		
No record	180	180
Basalt, brown, fractured, water-bearing	10	190
Basalt, gray-black, hard, fractured	20	210
Basalt, gray, broken, with green and brown rock; water-bearing	30	240
Basalt, gray and brown, extremely broken; perforated rock with green rock; water-bearing	30	270
Basalt, gray, fractured, water-bearing	10	280
2S/2W-19cdc. Drey Murphy. Altitude 690 ft. Drilled by B & S Drilling Co., 1969. Casing: 6-in. diam to 51 ft; unperforated		
Soil, brown	2	2
Clay, brown	14	16
Shale, brown	26	42
Basalt, gray, hard	16	58
Basalt, gray, broken	36	94
Basalt, gray, hard	62	156
Basalt, brown and gray, broken	6	162
Basalt, gray, hard	30	192
Basalt, gray, porous	52	244
Basalt, gray, hard	44	288
Basalt, gray and brown	10	298
Basalt, gray, hard	98	396
Basalt, brown and yellow, porous	17	413
Basalt, gray, porous	57	470
Basalt, gray, hard	89	559
Basalt, gray, porous	35	594
Basalt, gray, hard	64	658
Basalt, gray and yellow, water-bearing	14	672
Basalt, gray, hard	3	675
2S/2W-23bbd. Denny Zikes. Altitude 340 ft. Drilled by S & M Drilling & Supply, Inc. Casing: 6-in. diam to 260 ft; unperforated		
Clay, red and brown	74	74
Basalt, black, hard, water-bearing	181	255
Basalt, black, broken, with brown clay	5	260
Basalt, black, hard	18	278
Basalt, hard, creviced	12	290
2S/2W-25aaa. Howard Gillingham. Altitude 190 ft. Drilled by Raymond A. Borchers Well Drilling, 1971. Casing: 6-in. diam to 187 ft; unperforated		
Soil, brown	2	2
Clay, brown	16	18
Sand, brown, fine	8	26
Clay, blue	12	38
Sand, brown, fine	108	146
Clay, brown	28	174
Basalt, gray, broken	40	214
Basalt, red, porous	10	224
Basalt, gray, porous, water-bearing	14	238
Basalt, gray, hard	7	245
2S/2W-30adb. E. B. Smith. Altitude 840 ft. Drilled by Ralph Turner Drilling Co., 1973. Casing: 6-in. diam to 124 ft; unperforated		
Soil	2	2
Clay, red	16	18
Clay, brown	48	66
Clay, yellow, sandy	42	108
Basalt, brown, soft	14	122
Basalt, blue, medium-hard	26	148
Basalt, brown	7	155
Basalt, blue, medium-hard	99	254
Basalt, brown	21	275
Basalt, blue, hard, water-bearing	230	505
Basalt, black	7	512
Basalt, blue, hard	96	608
Basalt, black, broken, water-bearing	90	698

Table 6.--Drillers' logs of representative wells--Continued

Materials	Thickness (feet)	Depth (feet)
2S/2W-36aba. James Hasiuke. Altitude 320 ft. Drilled by Haakon Bottner Drilling Co., 1969. Casing: 12-in. diam to 108 ft; unperforated		
Soil	2	2
Clay, brown	19	21
Clay, red, sandy	18	39
Sandstone, yellow	19	58
Gravel and boulders, water-bearing	4	62
Boulders, large	14	76
Clay, brown and gray	25	101
Rock, brown, soft	9	110
Rock, gray, medium-hard	64	174
Rock, black, soft	24	198
Rock, gray and black, hard	78	276
Rock, black, soft, water-bearing	8	284
Rock, brown, soft	5	289
Rock, black, hard	22	311
Rock, red, soft, water-bearing	5	316
Rock, black, hard	16	332
Rock, black, with seams of black clay	6	338
Rock, black	16	354
Clay, blue	2	356
Rock, black, with layers of gray clay	94	450
Rock, black, soft to hard	118	568
Rock, black, soft, water-bearing	17	585
2S/3W-1dad. Richard Egger. Altitude 165 ft. Drilled by A. M. Jannsen Drilling Co., 1951. Casing: 8-in. diam to 95 ft; unperforated		
Clay	43	43
Sand	30	73
Clay	18	91
Basalt, decomposed	6	97
Basalt, water bearing from 120-125 ft (40 gal/min)	28	125
Basalt, gray, hard, water bearing from 188-189 ft and 220-221 ft	115	240
Basalt	4	244
Wood, with some charcoal	1	245
Basalt, black, soft	19	264
2S/3W-10bbb. J. H. Rebman. Altitude 1,095 ft. Drilled by Ralph Turner, 1967. Casing: 6-in. diam to 30 ft; unperforated		
Soil	2	2
Clay, brown	8	10
Sandstone, yellow	15	25
Rock, brown, soft	10	35
Lava, red	15	50
Rock, brown, broken	30	80
Rock, blue, medium-hard	55	135
Rock, brown, soft	55	190
Rock, blue, hard	22	212
Rock, brown, soft	43	255
Rock, blue, hard	30	285
Lava, black	25	310
Rock, gray, hard	25	335
Lava, yellow	15	350
Rock, black, hard	60	410
2S/3W-13abd. D. D. Rogowski. Altitude 520 ft. Drilled by Ralph Turner Drilling Co., 1968. Casing: 8-in. diam to 72 ft; unperforated		
Soil	2	2
Clay, red	21	23
Sandstone, red	7	30
Sandstone, yellow	30	60
Rock, brown, broken	270	330

Materials	Thickness (feet)	Depth (feet)
2S/3W-14bac. Stanley Beerli. Altitude 845 ft. Drilled by Raymond A. Borchers Well Drilling, 1973. Casing: 6-in. diam to 62 ft; unperforated		
Soil	2	2
Clay, brown	26	28
Shale, gray	24	52
Basalt, gray, medium-hard	42	94
Basalt, brown and gray	2	96
Basalt, gray, medium-hard	10	106
Basalt, brown and gray	12	118
Basalt, gray, with clay seams	10	128
Basalt, gray, hard	76	204
Basalt, gray and brown	18	222
Basalt, gray, hard	54	276
Basalt, brown and yellow, porous, water-bearing	12	288
Basalt, gray, hard	17	305
2S/3W-15bbd. Kenneth Dumler. Altitude 1,380 ft. Drilled by John Meeker Well Drilling, 1964. Casing: 6-in. diam to 173 ft; perforated 70-173 ft		
Clay with a boulder at 25 ft	26	26
Basalt, light-brown	45	71
Basalt, brown, medium-soft	65	136
Basalt, medium-hard	52	188
Basalt, soft	10	198
Basalt, hard	32	230
Basalt, brown, medium-soft	30	260
Basalt, blue, hard	29	289
Basalt, medium-soft	10	299
Basalt, hard	2	301
Shale	16	317
2S/3W-15dcb. M. E. Dunn. Altitude 1,240 ft. Drilled by Ralph Turner Drilling Co., 1974. Casing: 6-in. diam to 44 ft; unperforated		
Soil	2	2
Clay, brown	26	28
Rock, brown, soft	4	32
Rock, blue and brown, medium-hard to hard	430	462
Rock, blue, seamy	8	470
Rock, blue, hard	60	530
Lava rock, brown	13	543
Rock, blue, hard	35	578
Lava rock, black	10	588
Rock, blue, medium-hard	17	605
2S/3W-21cdb. D. L. Peterson. Altitude 550 ft. Drilled by Ralph Turner Drilling Co., 1970. Casing: 6-in. diam to 22 ft; unperforated		
Soil	1	1
Rock, blue, hard	9	10
Clay, yellow	30	40
Shale, brown	155	195
Shale, blue	15	210
Shale, brown	80	290
2S/3W-27aaa. Fred Tyson. Altitude 1,320 ft. Drilled by Raymond A. Borchers Well Drilling, 1974. Casing: 6-in. diam to 27 ft; unperforated		
Soil, brown	2	2
Clay, brown	3	5
Basalt, gray, broken	16	21
Basalt, gray, soft to hard	83	104
Basalt, gray and brown	8	112
Basalt, gray, and clay seams	26	138
Basalt, gray and brown	18	156
Basalt, gray, and clay seams	31	187
Basalt, gray and brown	31	218
Basalt, gray, hard	6	224
Basalt, gray, brown, and yellow, water-bearing	14	238
Basalt, gray, hard	7	245

Table 6.--Drillers' logs of representative wells--Continued

Materials	Thickness (feet)	Depth (feet)
2S/3W-31acb. M. Nagely. Altitude 180 ft. Drilled by Wilcox Drilling & Pump Co., 1952. Casing: 8-in. diam to 64 ft: perforated 39-64 ft		
Shale	35	35
Silt, fine, and shale	20	55
Shale, coarse	9	64
2S/3W-34aca. Sam Steel. Altitude 600 ft. Drilled by Meeker Well Drilling, 1968. Casing: 6-in. diam to 100 ft; perforated 23-100 ft		
Soil	5	5
Clay, brown	14	19
Rock, brown, soft	16	35
Rock, brown, medium-hard, broken	42	77
Shale, blue	23	100
Shale, blue-gray	5	105
2S/4W-4ccd. Bruce Keefer. Altitude 270 ft. Drilled by A. J. Gaunt, 1973. Casing: 6-in. diam to 22½ ft; unperforated		
Clay, reddish-brown	17	17
Sandstone, brown, firm	23	30
Sandstone, gray	50	80
Sandstone, grayish-brown	20	100
2S/4W-10bbc. J. B. Newberry. Altitude 660 ft. Drilled by Meeker Well Drilling, 1959. Casing: 6-in. diam to 90½ ft; unperforated		
Soil	5	5
Clay, brown	17	22
Clay, light-gray, and sand	17	39
Sandstone, brown and blue; most water between 104-110 ft	91	130
2S/4W-14bad. Earl Turner. Altitude 570 ft. Drilled by Wilcox Drilling & Pump Co., 1971. Casing: 6-in. diam to 78 ft; unperforated		
Soil	3	3
Clay, red and yellow	56	59
Shale, gray, soft	12	71
Shale, gray, firm	71	142
2S/4W-18cdd. R. W. Reeves. Altitude 340 ft. Drilled by Wilcox Drilling & Pump Co., 1971. Casing: 6-in. diam to 27 ft; unperforated		
Soil	2	2
Clay, brown and red	21	23
Shale, gray, firm	41	64
Basalt, gray, coarse-grained	140	204
2S/4W-28bdd. Irvin Hermans. Altitude 350 ft. Drilled by Arrow Drilling, Inc. Casing: 6-in. diam to 20 ft; unperforated		
Soil	2	2
Clay, brown	3	5
Shale, yellow	9	14
Shale, blue	21	35
Shale, gray	40	75
Shale, blue	45	120
2S/4W-35dac. C. F. Laughlin. Altitude 230 ft. Drilled by Meeker Well Drilling, 1959. Casing: 6-in. diam to 184 ft; unperforated		
Soil	6	6
Clay, brown and blue	12	18
Clay, blue, and some silt	6	24
Soapstone, brown	8	32
Shale, blue, hard	12	44
Shale, blue, water-bearing	21	65
Shale, blue, medium-hard	15	80
Shale, blue, sticky	14	94
Shale, blue, broken, water-bearing	2	96
Shale, gummy	8	104
2S/4W-35dac.--Continued		
Shale, very hard to medium-hard	80	184
Shale, sticky	5	189
Shale, hard	11	200
Shale, sticky	6	206
Shale, medium	5	211
Shale, broken, water-bearing	6	217
Rock, hard	9	226
Shale, blue, hard	7	233
Shale, blue	25	258
Shale, blue, very hard	6	264
Shale, blue	18	282
Shale, broken	5	287
Shale, blue	13	300
2S/5W-31bba. Bryce Mitchell. Altitude 440 ft. Drilled by Wilcox Drilling & Pump Co. Casing: 6-in. diam; unperforated		
Clay, red and yellow, with boulders	12	12
Siltstone, gray and blue, hard, with layers of gray limestone	79	91
2S/1E-9dad. City of Lake Oswego. Altitude 240 ft. Drilled by R. J. Strasser Drilling Co., 1948. Casing: 10-in. diam to 165 ft; 8-in. diam 267-367 ft; perforated 130-160 ft, 280-290 ft, 330-340 ft		
Soil	2	2
Basalt, reddish-brown	22	24
Basalt, brown and gray, hard	38	62
Basalt, brown, soft	50	112
Basalt, gray and brown; some water	18	130
Basalt, gray, hard; some caving	61	191
Basalt, gray and green	6	197
Basalt, gray and yellow, medium-hard	39	236
Basalt, gray, hard	63	299
Basalt, brown, broken	22	321
Basalt, gray, hard	6	327
Basalt, gray, with black seams, hard	18	345
Basalt, black, hard	57	402
Basalt, gray and brown	45	447
Basalt, yellow and black, decomposed	5	452
Basalt, black, with seams	4	456
Basalt, gray, hard	46	502
2S/1E-16bdd. Lake Ridge Senior High School. Altitude 495 ft. Drilled by R. J. Strasser Drilling Co., 1969. Casing: 8-in. diam to 119 ft; unperforated		
Soil	6	6
Clay, yellow	38	44
Sandstone	54	98
Basalt, brown	22	120
Basalt, gray, medium-hard	20	140
Sandstone, brown	18	158
Basalt, gray, medium-hard	8	166
Basalt, brown	16	182
Basalt, gray, medium-hard	32	214
Conglomerate	18	232
Basalt, brown	48	280
Basalt, gray, medium-hard	10	290
Basalt, brown and red	20	310
Basalt, gray	38	348
Basalt, brown, broken	42	390
Basalt, gray, medium-hard	38	428
Basalt, brown, broken	16	444
Basalt, gray, medium-hard to hard	108	552
Basalt, brown, broken	31	583
Basalt, gray, medium-hard	59	642
Basalt, brown, broken	13	655
Basalt, gray, medium-hard	15	670
Basalt, brown, broken	77	747
Clay, blue, and rock	24	771
Rock, green and black	9	780
Basalt, gray, medium-hard	13	793
Basalt, black, hard	10	803
Basalt, gray, medium-hard	19	822
Mudstone, gray	47	869
Rock and clay, black	13	882
Basalt, black	25	907

Table 6.--Drillers' logs of representative wells--Continued

2S/1E-19ccb. Meridian Park Hospital. Altitude 210 ft. Drilled by A. M. Jannsen Drilling Co., 1974. Casing: 10-in. diam to 585 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Fill	2	2
Clay, sandy	32	34
Sand, gray	16	50
Sand and gravel	7	57
Sand, gray	37	94
Clay, blue	14	108
Sand, blue, silty	24	132
Clay, blue-gray, hard	16	148
Clay, blue	38	186
Clay, blue, hard	8	194
Clay, blue	71	265
Clay, blue-gray	175	440
Clay, gray, broken	3	443
Claystone, blue-gray	22	465
Clay, blue-gray	5	470
Claystone, blue-gray	40	510
Rock, brown, broken	58	568
Rock, brown	11	579
Rock, brown, broken, with soft seams	31	610
Rock, brown, hard, broken, water-bearing	50	660
Basalt, black, hard, with green seams; fractured and honeycombed zones; water-bearing	60	720
Basalt, black, hard, with a few broken zones; water-bearing	70	790

2S/1E-21bdc. Mossy Brae Water Dist. Altitude 220 ft. Drilled by R. J. Strasser Drilling Co., 1949. Casing: 10-in. diam to 63 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil	3	3
Clay	28	31
Rock, broken, decomposed, and clay	13	44
Rock, gray, hard	135	179
Rock, soft, porous, water-bearing	11	190
Rock, hard	5	195

2S/1E-23bbd. M. E. McFarland. Altitude 685 ft. Drilled by Ralph Turner Drilling Co. to 130 ft in 1965; deepened by Ralph Turner Drilling Co. to 670 ft in 1968. Casing: 6-in. diam to 28 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil	3	3
Clay, yellow	22	25
Clay and boulders	3	28
Rock, gray	62	90
Lava, brown	5	95
Rock, blue, hard	25	120
Lava, brown	10	130
Rock, black, hard	10	140
Rock, brown, soft	35	175
Rock, black and gray, medium-hard to hard	55	230
Rock, brown, soft	5	235
Rock, black, medium-hard to very hard	255	490
Rock, gray, hard	10	500
Rock, brown, medium-hard	10	510
Rock, gray, hard	15	525
Rock, brown, medium-hard, with black layers	30	555
Rock, gray, hard	25	580
Rock, black, medium-hard to hard	90	670

2S/1E-30db. Pope & Talbot, Inc. Altitude 370 ft. Drilled by A. M. Jannsen Drilling Co., 1962. Casing: 12-in. diam to 77 ft, 10-in. diam 77-488 ft, 6-in. diam 488-618 ft; perforated 488-618 ft

Materials	Thickness (feet)	Depth (feet)
Rock, red, decomposed	24	24
Basalt, gray, red, and brown, decomposed	46	70
Basalt, gray, hard	12	82
Basalt, gray, hard, creviced	24	106
Basalt, gray, and decomposed rock	7	113
Rock, broken	14	127
Rock, gray and brown, porous, broken	12	139
Rock, broken, hard and soft layers	10	149
Basalt, red and gray	35	184
Basalt, red	15	199
Rock, gray, broken	34	233
Rock, gray, hard	37	270
Rock, gray, broken	18	288

2S/1E-30db.--Continued

Materials	Thickness (feet)	Depth (feet)
Basalt, gray and black	30	318
Rock, black, broken, with clay seams	9	327
Basalt, gray and black	40	367
Rock, black, water-bearing	8	375
Rock, gray	17	392
Rock, black, broken, and clay	6	398
Rock, gray	7	405
Rock, brown, decomposed	6	411
Rock, brown	11	422
Basalt, brown, hard	16	438
Basalt, gray	25	463
Rock, brown, decomposed	14	477
Rock, brown	10	487
Basalt, gray, hard	41	528
Basalt, brown, decomposed	11	539
Basalt, gray, hard	67	606
Basalt, brown, decomposed	14	620
Basalt, brown, hard and soft layers	40	660
Basalt, gray and black	172	832
Basalt, black, porous	3	835
Basalt, black and gray	265	1,100

2S/1E-32dac. P. O. Rydman. Altitude 670 ft. Drilled by R. J. Strasser Drilling Co., 1972. Casing: 8-in. diam to 104 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil	4	4
Clay, brown, yellow, gray, and red	78	82
Rock, brown, broken	6	88
Basalt, gray, medium-hard	155	243
Basalt, gray, broken	11	254
Basalt, gray, medium-hard to hard	117	371
Basalt, brown, broken	11	382
Basalt, gray, medium-hard	18	400
Basalt, brown and gray, broken	103	503
Basalt, gray, medium-hard	39	542
Basalt, brown, broken	11	553
Basalt, gray, hard	15	568
Basalt, gray, broken	10	578
Basalt, gray, hard	24	602
Basalt, brown, broken	24	626
Basalt, gray, hard	38	664
Basalt, brown, broken	13	677
Basalt, gray, hard	21	698
Basalt, brown, broken	14	712
Basalt, gray, hard	54	766
Basalt, gray, porous	12	778
Basalt, gray, hard	2	780

2S/1E-33bbb. Dale Belford. Altitude 460 ft. Drilled by S & M Drilling & Supply, Inc., 1973. Casing: 8-in. diam to 91 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Clay, red	8	8
Rock, brown, weathered	77	85
Rock, brown	57	142
Rock, brown, black, and green	180	322
Rock, brown, with black clay seams; crevice	43	365
Basalt, gray, hard	25	390
Rock, black, brown, and red	42	432
Basalt, gray, hard	16	448
Rock, with yellow clay seams, water-bearing	5	453
Rock, brown and red	21	474
Basalt, gray, hard	36	510
Rock, brown, with yellow clay seams	21	531
Basalt, gray, hard	16	547
Rock, black, fractured, medium-hard	28	575
Basalt, gray, hard	7	582
Sandstone, green, water-bearing	11	593
Rock, black	7	600

2S/1E-34bdc. J. A. McWhinney. Altitude 148 ft. Drilled by Simons & Gregory, 1960. Casing: 6-in. diam to 172 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Clay, yellow	61	61
Clay, blue	76	137
Sand, silty	14	151
Clay, black	43	194
Sand and gravel	6	200

Table 6.--Drillers' logs of representative wells--Continued

Materials	Thickness (feet)	Depth (feet)
2S/1E-35aab. E. L. Burnham. Altitude 605 ft. Drilled by Skyles Drilling & Supply, 1972. Casing: 6-in. diam to 19 ft; unperforated		
Soil	3	3
Clay, brown	11	14
Basalt, black and brown	154	168
Basalt, black, fractured	7	175
Basalt, black and red	29	204
Basalt, red, porous	11	215
Basalt, black, fractured	6	221
Basalt, black, hard	20	241
Basalt, red, porous	7	248
Basalt, gray	6	254
Basalt, black, fractured	12	266
Basalt, black, hard	10	276
Basalt, black, fractured	14	290
Basalt, black, hard	14	304
Basalt, black, porous	2	306
Basalt, black, with brown seams	21	327
Basalt, black, hard	24	351
Basalt, gray and black, fractured	33	384
Basalt, black, with brown seams	18	402
Basalt, black, hard	116	518
Basalt, black, softer, water-bearing	27	545
Basalt, black, medium-hard to hard	53	598
Basalt, decomposed	30	628
Basalt, green, fractured	32	660
Basalt, black, with white seams	26	686
Basalt, black, broken	16	702
Basalt, green and white	7	709
3S/1W-1adb. Pat O'Callaghan. Altitude 472 ft. Drilled by R. J. Strasser Drilling Co., 1972. Casing: 10-in. diam to 80 ft; unperforated		
Soil, brown	5	5
Clay, yellow	31	36
Sandstone, brown, broken	36	72
Basalt, gray, broken	10	82
Sandstone, brown	12	94
Basalt, gray, medium-hard, with layers of brown basalt	216	310
Basalt, gray, broken	4	314
Basalt, porous, water-bearing	16	330
Basalt, gray, medium-hard	72	402
Basalt, porous, water-bearing	14	416
Basalt, gray, hard	18	434
Basalt, gray and brown	7	441
Basalt, gray, medium-hard	20	461
Basalt, black, medium-hard to very hard	116	577
3S/1W-1cda. City of Wilsonville. Altitude 360 ft. Drilled by Haakon Bottner Drilling Co., 1970. Casing: 12-in. diam to 593 ft, 10-in. diam 585-783 ft; perforated 535-580 ft, 600-620 ft, 720-780 ft		
Soil	2	2
Clay, red	3	5
Boulders	5	10
Rock, broken, and clay	28	38
Rock, solid	2	40
Clay, red	1	41
Rock, solid, soft	24	65
Rock, gray, solid, medium-hard	13	78
Rock, solid, hard	26	104
Rock, red	12	116
Rock, black, medium-hard	98	214
Rock, broken, and gray clay	4	218
Rock, black, medium-hard	21	239
Rock, gray	49	288
Rock, brown, medium-hard	3	291
Lava, red, soft	41	332
Rock, brown, red, gray, and black, medium-hard to hard	73	405
Rock, brown and black, soft to medium-hard	140	545
Rock, gray	48	593
Clay, gray, and broken rocks	9	602
Rock, reddish-gray, solid	9	611
Rock, gray and red, soft to very hard	172	783
3S/1W-5bcd. J. J. Adams. Altitude 416 ft. Drilled by B & S Drilling Co., 1968. Casing: 6-in. diam to 70 ft; unperforated		
Soil	2	2
Clay, brown	10	12
Clay, red	14	26
Shale, brown and gray	36	62
Basalt, gray, broken	20	82
Basalt, gray, soft	42	124
Basalt, brown, broken	40	164
Basalt, gray, soft	26	190
Basalt, brown, porous, water-bearing	13	203
Basalt, gray, soft	27	230
3S/1W-7cdc. Kurt Japel. Altitude 830 ft. Drilled by John Meeker Well Drilling, 1972. Casing: 6-in. diam to 64 ft; unperforated		
Soil	4	4
Rock, brown, soft to hard	39	43
Basalt, gray, medium-soft to hard	49	92
Basalt, blue-gray, hard	6	98
Basalt, hard to very hard	44	142
Basalt, blue-gray, very hard	76	218
Basalt, hard, creviced	31	249
Rock, red-brown, soft	25	274
Basalt, medium to hard	12	286
Basalt, black, medium-hard	24	310
Basalt, gray, medium-soft	11	321
Basalt, brown, soft to very hard	97	418
Basalt, black, medium-hard	7	425
Basalt, medium-soft layers, water-bearing	10	435
Basalt, hard	1	436
3S/1W-12dac. W. R. Morgan. Altitude 210 ft. Deepened from 102 ft by Steinman Bros., 1971. Casing: 6-in. diam to 197 ft; unperforated		
Old well	102	102
Clay, red, and gravel	3	105
Clay, brown, and gravel	19	124
Clay, gray, sandy	24	148
Clay, tan	10	158
Clay, red, and small gravel	3	161
Clay, brown, sandy	10	171
Shale, blue, sticky	11	182
Clay, yellow, and coarse sand	10	192
Basalt	10	202
Clay, red, and gravel	13	215
3S/1W-14abd1. Walnut Park Mobile Ranch. Altitude 180 ft. Drilled by Skyles Drilling & Supply, 1968. Casing: 6-in. diam to 248 ft; unperforated		
Soil	3	3
Clay, brown	11	14
Gravel and small boulders	14	28
Clay, gray, blue, and brown	115	143
Clay, gray, sandy	16	159
Clay, gray	75	234
Basalt, decomposed, water-bearing	30	264
Basalt, hard	4	268
Basalt, water-bearing	16	284
Basalt, decomposed, water-bearing	14	298
Basalt, hard	4	302
Basalt, broken, water-bearing	4	306

Table 6.--Drillers' logs of representative wells--Continued

3S/1W-15cac. Dammasch State Hospital. Altitude 195 ft. Drilled by A. M. Jannsen Drilling Co., 1958. Casing: 14-in. diam to 252 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Clay, brown	35	35
Clay, sandy	5	40
Clay, blue, brown, and red	143	183
Rock	2	185
Clay, brown and red	55	240
Basalt, soft to hard	15	255
Basalt, gray, hard	135	390
Basalt, gray, creviced	8	398
Basalt, gray, hard	23	421
Basalt, brown and gray	8	429
Basalt, gray, hard	6	435
Basalt, black	25	460
Basalt, gray, soft to hard	138	598
Basalt, black	42	640
Basalt, black, soft	20	660
Basalt, black, with clay	14	674
Basalt, black, porous	3	677
Basalt, black and gray	73	750
Basalt, gray, soft to hard	66	816
Basalt, red	12	828
Basalt, gray, hard to soft	47	875
Basalt, gray, broken	9	884
Basalt, gray	30	914
Basalt, black, hard	6	920

3S/1W-16ddd. Dammasch State Hospital. Altitude 185 ft. A. M. Jannsen Drilling Co., 1960. Casing: 14-in. diam to 356 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Clay, yellow, red, and blue	96	96
Rock, with streaks of blue and red clay	144	240
Rock, black, fractured	3	243
Sand and rock	4	247
Clay and rock, mixed	58	305
Rock	5	310
Clay, red	22	332
Clay and wood	8	340
Rock, black, decomposed	6	346
Basalt, gray	26	372
Rock, fractured	78	450
Rock, black, soft	14	464
Basalt, gray	51	515
Rock, black, soft, slightly fractured	21	536
Rock, gray, hard	3	539
Rock, black, fractured, with rust-colored sandstone and shells	2	541
Rock, fractured	3	544
Rock, gray, hard	11	555
Rock, fractured	14	569
Rock, blue, gray, and black, with hard and soft streaks	67	636
Rock, gray, creviced	52	688
Rock, gray, soft to hard	64	752
Rock, black	63	815
Rock, hard, creviced	2	817
Rock, light-gray	63	880
Rock, dark-gray, hard, abrasive	28	908
Rock, broken, creviced	21	929
Rock, black and gray	42	971
Rock, black, soft, water-bearing	23	994
Rock, gray	6	1,000

3S/1W-23daa. John Abele. Altitude 105 ft. Drilled by Steinman Bros., 1956 and 1971. Casing: 6-in. diam to 494 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil	15	15
Sand, blue, coarse, silty	37	52
Clay, yellowish-green	26	78
Clay, gray, green, and blue	212	290
Clay, yellow and blue, gritty	55	345
Clay, brown, with wood at 370-395 ft	85	430
Gravel, fine, shaley	1	431
Shale, brown and black	59	490
Rock, brown, soft	87	577
Rock, gray, hard	7	584
Rock, brown and gray, medium-hard to hard	23	607
Rock, brown, medium-hard	10	617
Rock, reddish-brown	11	628
Rock, gray, medium-hard	10	638

3S/1W-28aac. Harkson Farms. Altitude 140 ft. Drilled by J. T. Miller, 1959. Casing: 6-in. diam to 230 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil	3	3
Clay, yellow	27	30
Clay, yellow, sandy	35	65
Sand and clay	30	95
Clay, yellow	45	140
Basalt, with dark clay, water-bearing	90	230
Basalt, water-bearing	15	245

3S/1W-30dbc. W. R. Conrad. Altitude 480 ft. Drilled by Arrow Drilling, Inc., 1972. Casing: 6-in. to 19 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Clay, brown	8	8
Basalt, soft	2	10
Basalt, hard	40	50
Basalt, red and brown	55	105
Basalt, gray and brown	295	400
Basalt, black, porous	10	410
Basalt, gray	25	435
Basalt, black, porous	25	460

3S/1W-31caa. Joseph Rogers. Altitude 165 ft. Drilled by Arrow Drilling, Inc., 1970. Casing: 6-in. diam to 140 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil	2	2
Clay, yellow and blue	39	41
Clay, with rock	89	130
Basalt, hard	22	152
Rock, soft	5	157
Basalt	83	240
Basalt, black	8	248
Basalt, black, hard	227	475
Rock, red	5	480
Basalt, gray and black, hard	80	560

3S/2W-3adc. Chehalem Water Co. Altitude 890 ft. Drilled by Ralph Turner, 1970. Casing: 8-in. diam to 140 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Soil	3	3
Clay, brown and yellow	47	50
Clay, yellow, sandy	55	105
Sandstone, brown	5	110
Rock, brown, soft	25	135
Rock, brown, hard	20	155
Rock, brown, medium	45	200
Rock, blue, hard	20	220
Lava, brown	18	238
Rock, blue, hard	17	255
Lava, black and brown	5	260
Rock, brown, medium	15	275
Rock, blue, hard	30	305

3S/2W-3cad. Donald Stockton. Altitude 890 ft. Drilled by B & S Drilling Co., 1968. Casing: 6-in. diam to 93 ft; unperforated

Materials	Thickness (feet)	Depth (feet)
Clay, red	34	34
Basalt	48	82
Basalt, gray and red	40	122
Basalt, gray and brown, soft	43	165
Basalt, gray, hard	17	182
Basalt, brown, broken	63	245
Basalt, gray, hard	89	334
Basalt, whitish-gray, decomposed	12	346
Basalt, black, hard	52	398
Basalt, red, soft	17	415
Basalt, black and brown, soft, porous	70	485
Basalt, gray, hard	27	512
Basalt, decomposed, water-bearing	5	517
Basalt, gray, hard	68	585
Basalt, decomposed, water-bearing	9	594
Basalt, gray, hard	6	600

Table 6.--Drillers' logs of representative wells--Continued

Materials	Thickness (feet)	Depth (feet)
3S/2W-6bcb. Jakob Taeuber. Altitude 419 ft. Drilled by Arrow Drilling, Inc., 1974. Casing: 6-in. to 20 ft; unperforated		
Soil	3	3
Clay, brown	9	12
Shale, brown	4	16
Shale, blue	49	65
Sandstone	115	180
3S/2W-8bdd. J. C. James. Altitude 250 ft. Drilled by Arrow Drilling, Inc., 1962. Casing: 6-in. diam to 35 ft; unperforated		
Soil	3	3
Clay, brown	25	28
Shale, blue, hard	68	96
Shale, blue, soft	4	100
3S/2W-11aca. Chehalem Mountain Water Co. Altitude 460 ft. Drilled by Raymond A. Borchers Well Drilling, 1967. Casing: 6-in. diam to 31 ft; unperforated		
Soil	3	3
Clay, red	16	19
Basalt, brown	5	24
Basalt, black	56	80
Basalt, black, porous	5	85
Basalt, black	165	250
Basalt, black, porous, water-bearing	15	265
Basalt, black	7	272
Basalt, brown, porous, water-bearing	13	285
Basalt, black	20	305
Basalt, black, porous, water-bearing	10	315
Basalt, black	5	320
3S/2W-14bcc. C. V. Slayter. Altitude 540 ft. Drilled by Arrow Drilling, Inc., 1973. Casing: 6-in. diam; unperforated		
Clay, red and brown	30	30
Basalt, gray, hard	175	205
Basalt, brown	25	230
Basalt, gray, hard	30	260
Basalt, brown	135	395
Basalt, gray and black, hard	15	410
Basalt, red	8	418
Basalt, brown, water-bearing	27	445
3S/2W-18abb. Eugene Zirschky. Altitude 195 ft. Drilled by Mosher Drilling Co., 1968. Casing: 6-in. diam to 105 ft; perforated 25-105 ft		
Soil	1	1
Clay, yellow	25	26
Clay, red and brown	79	105
3S/2W-19ccb. Valley View Memorial Garden. Altitude 240 ft. Drilled by Meeker Well Drilling, 1958. Casing: 6-in. diam to 24 ft; unperforated		
Clay	14	14
Boulders, soft, with decomposed rock	10	24
Basalt, medium-hard, creviced at 118-120 ft and 139 ft	115	139
Basalt, soft to hard	10	149
Clay, sticky	2	151
Basalt, brown, soft	6	157
Basalt, very hard	10	167
Basalt, brown, soft	21	188
Basalt, soft to very hard	36	224

Materials	Thickness (feet)	Depth (feet)
3S/2W-21adb. M. L. Gettman. Altitude 135 ft. Drilled by Milo Schneider Equipment Co., 1970. Casing: 6-in. diam to 83 ft; perforated 58-68 ft		
Clay, brown and blue	28	28
Sand, black, fine, cemented	26	54
Sand, black, coarse	16	70
Sand, grey, dry	2	72
Clay, blue, hard	58	130
Clay, blue	54	184
3S/2W-26bda. Mark Clement. Altitude 620 ft. Drilled by Raymond A. Borchers Well Drilling, 1974. Casing: 6-in. diam to 60 ft, 5-in. diam 60-300 ft		
Clay	14	14
Basalt, gray, fractured	40	54
Basalt, gray, hard, with fractured layers	178	232
Basalt, red, porous	8	240
Basalt, gray, hard, with fractured layers	208	448
Basalt, gray, fractured, water-bearing	17	465
3S/2W-30aab. Kenneth Weatherly. Altitude 160 ft. Drilled by Milo Schneider Equipment Co., 1969. Casing: 12-in. diam to 60 ft, 8-in. diam 60 to 240 ft; perforated 63-83 ft, 187-207 ft, 227-242 ft		
Clay, brown	6	6
Clay, silty	46	52
Clay, blue	10	62
Clay, blue, silty, with sand and pea-sized gravel	4	66
Clay, blue	10	76
Sand, brown, with clay lenses	12	88
Clay, blue and red	67	155
Clay	40	195
Sandstone	3	198
Clay, brown	33	231
Shale, brown	15	246
Rock, soft	41	287
3S/2W-33bbb. Waldo Brown. Altitude 85 ft. Drilled by Milo Schneider Equipment Co., 1972. Casing: 8-in. diam to 77 ft; perforated 47-55 ft		
Soil	6	6
Clay, brown, silty	27	33
Sand, gray	20	53
Clay, brown, silty	10	63
Clay, brown	37	100
3S/3W-5bbc2. R. J. Kroes. Altitude 180 ft. Drilled by John Meeker Well Drilling, 1965. Casing: 8-in. to 51 ft; perforated 19-51 ft		
Clay, gray	10	10
Clay, blue	7	17
Sand and silt, blue and gray	28	45
Shale	6	51
Shale, fractured	2	53
Shale, blue, firm	23	76
Shale, blue, fractured	7	83
Shale, blue, firm	22	105
Shale, fractured	4	109
Shale, gray	26	135
3S/3W-7dab. W. B. Baird. Altitude 360 ft. Drilled by Arrow Drilling, Inc., 1966. Casing: 6-in. diam to 242 ft; perforated 70-242 ft		
Clay, yellow	25	25
Shale, gray	113	138
Shale, blue, sandy	41	179
Shale, light-gray	11	190
Shale, brown	30	220
Shale, light-gray	10	230
Shale, blue	10	240

Table 6.--Drillers' logs of representative wells--Continued

Materials	Thickness (feet)	Depth (feet)
3S/3W-9dba. Harlan Huffman. Altitude 175 ft. Drilled by Arrow Drilling, Inc., 1974. Casing: 8-in. diam to 45 ft; unperforated		
Clay and rock	10	10
Clay, brown	5	15
Clay, blue	23	38
Shale, blue, sandy	14	52
Sandstone	78	130
Shale, blue	80	210
Shale, gray, hard	20	230
Shale, blue	10	240
3S/3W-11caa. Steve Schmidt. Altitude 160 ft. Drilled by Arrow Drilling, Inc., 1974. Casing: 6-in. diam to 46 ft; perforated 21-46 ft		
Soil	2	2
Clay, brown	14	16
Clay, blue	6	22
Sand, black	4	26
Clay, blue, soft	14	40
Sandstone	6	46
3S/3W-22cbd. W. L. Harvey. Altitude 970 ft. Drilled by Corvallis Drilling Co., Inc., 1972. Casing: 6-in. diam to 40 ft; unperforated		
Clay, brown, sandy, with boulders	16	16
Basalt, weathered	17	33
Basalt, hard	43	76
Basalt, brown, green, and red	122	198
Basalt, hard	43	241
Basalt, brown and green, medium-hard	118	359
Basalt, hard	16	375
3S/3W-26acc. City of Dundee. Altitude 400 ft. Drilled to 384 ft by J. T. Miller, 1954; deepened to 471 ft by George Zent & Son, 1960. Casing: 16-in. diam to 96 ft; unperforated		
Clay, yellow, tough	17	17
Clay, red	30	47
Boulders, large, with soft yellow clay	15	62
Clay, dark-colored	23	85
Clay, yellow, with soft rock	7	92
Rock, black, hard	16	108
Clay, red, hard	2	110
Rock, red, black, and gray	65	175
Rock, black, with boulders	7	182
Rock, black, hard	11	193
Rock, black, soft	3	196
Rock, soft, with shale	27	223
Rock, black	2	225
Rock, fractured, with shale	10	235
Rock, gray, hard	10	245
Rock, blue and green, fractured, with shale	5	250
Rock, black, hard	5	255
Rock, broken, hard	5	260
Rock, gray, hard	60	320
Rock, blue, soft	1	321
Rock, black, hard	55	376
Rock, black, water-bearing	7	383
Rock, black, with large crevices	1	384
Rock, black and gray	87	471
3S/3W-30dab. Trappist Abbey. Altitude 210 ft. Drilled by George Zent & Son, 1960. Casing: 21-in. diam to 21 ft; 8-in. diam 0-160 ft. Perforated 40-60 ft, 145-155 ft; gravel packed		
Clay and soil	6	6
Clay, brown	9	15
Clay, blue, gray, and black	16	31
Sandstone	8	39
Shale, gray and black	59	98
Sandstone	1	99
Shale, gray	7	106
Clay, gray	23	129
Shale, gray	2	131
Sandstone, gray	11	142
Sandstone, black and white	14	156
Shale, gray	4	160
3S/3W-36aaa. City of Dundee. Altitude 80 ft. Drilled by J. T. Miller, 1972. Casing: 12-in. diam to 115 ft; perforated 62-66 ft, 98-103 ft		
Clay, sandy	36	36
Gravel, brown	9	45
Sand, brown	9	54
Clay, blue	8	62
Shale, blue, sandy	3	65
Clay, blue	33	98
Clay, blue, sandy	4	102
Clay, brown	13	115
3S/4W-1add. Frank Gorretta. Altitude 600 ft. Drilled by John Meeker Well Drilling, 1967. Casing: 6-in. diam to 122 ft, 5-in. diam 117-233 ft; perforated 62-233 ft		
Clay, yellow and brown	23	23
Shale, gray	81	104
Shale, gray, fractured	56	160
Shale, gray	27	187
Shale, grayish-brown	13	200
Shale, white	5	205
Shale, reddish-brown, water-bearing	12	217
Shale, white	10	227
Shale, reddish-brown	3	230
Shale, gray, sticky	3	233
3S/4W-2adc. Norman Kratzer. Altitude 220 ft. Drilled by John Meeker Well Drilling, 1967. Casing: 6-in. diam to 68 ft; perforated 20-65 ft		
Soil	3	3
Claystone, brown	19	22
Shale, bluish-gray, hard	13	35
Shale, bluish-gray, fractured	5	40
Shale, grayish-brown, hard	11	51
Shale, gray, hard	14	65
3S/4W-6bcd. Ray Huddleston. Altitude 180 ft. Drilled by Wilcox Drilling & Pump Co., 1972. Casing: 6-in. diam to 38 ft; perforated 32-36 ft		
Soil	2	2
Clay, brown	16	18
Clay, blue	10	28
Clay, red, with sand and medium-sized gravel	6	34
Shale, gray, firm	43	77
3S/4W-13bcd. F. L. Wright. Altitude 390 ft. Drilled by Mosher Drilling Co., 1971. Casing: 6-in. diam to 30 ft, 4-in. diam to 180 ft; perforated 25-180 ft		
Clay, yellow and brown	18	18
Shale, gray	82	100
Lime	2	102
Shale, gray	78	180
3S/4W-25cdb. Ernest Jernstedt. Altitude 200 ft. Drilled by Wilcox Drilling & Pump Co., 1964. Casing: 6-in. diam to 34 ft; unperforated		
Clay, brown	19	19
Clay, blue	13	32
Shale and blue claystone	93	125
3S/4W-28ddc. P. R. Thornfeldt. Altitude 160 ft. Drilled by Wilcox Drilling & Pump Co., 1968. Casing: 6-in. diam to 77 ft; perforated 66-76 ft		
Clay, brown	38	38
Clay, blue	6	44
Sand, brown, with wood	8	52
Sand, coarse, and medium-sized gravel	18	70
Claystone, gray, firm	25	95

Materials	Thick-ness (feet)	Depth (feet)
3S/4W-32aba. Maurice Bernards. Altitude 170 ft. Drilled by Wilcox Drilling & Pump Co., 1956. Casing: 6-in. diam to 75½ ft; perforated 64-75 ft		
Clay, brown	24	24
Clay, blue, tough	29	53
Clay, brown, silty	9	62
Gravel, cemented	2	64
Sand, with some clay	6	70
Gravel, with some clay	5	75
Shale	½	75½
3S/4W-34bdc. J. J. Kirsh. Altitude 165 ft. Drilled by Wilcox Drilling & Pump Co., 1962. Casing: 6-in. diam to 73 ft; perforated 62-73 ft		
Clay, brown	26	26
Clay, blue	31	57
Sand, fine, compacted	9	66
Gravel, fine	2	68
Shale, gray, hard	5	73
3S/5W-2ada. W. C. Remior. Altitude 470 ft. Drilled by Ralph Turner Drilling Co., 1970. Casing: 6-in. diam to 30 ft; unperforated		
Clay, yellow	10	10
Shale, blue, soft	15	25
Shale, blue, soft, sandy	40	65
Shale, blue, medium-hard	235	300
Shale, blue, very hard	185	485
Shale, black, hard	28	513
Shale, black, medium-hard	42	555
3S/5W-17bda. Harold Payne. Altitude 880 ft. Drilled by Wilcox Drilling & Pump Co., 1969. Casing: 6-in. diam to 30 ft; unperforated		
Clay, yellow and red	23	23
Claystone, gray, firm	97	120
3S/5W-35cbc. Doug Nyseth. Altitude 890 ft. Drilled by Arrow Drilling, Inc. Casing: 6-in. diam to 73½ ft		
Clay, red	12	12
Clay, brown, soft	26	38
Clay, brown, gritty	27	65
Sandstone	355	420
3S/1E-4acc. John Webber. Altitude 800 ft. Drilled by A. M. Jannsen Drilling Co. Casing: 10-in. diam to 84 ft; unperforated		
Clay, brown, sandy, hard	54	54
Basalt, brown and gray, fractured	20	74
Basalt, gray, hard	14	88
Basalt, gray and brown, with clay lenses	115	203
Basalt, gray and brown	75	278
Basalt, gray and brown, with clay lenses	62	340
Basalt, brown, soft	32	372
Basalt, dark-brown and red	14	386
Basalt, with hard and soft layers	50	436
Basalt, weathered	8	444
Basalt, brown	12	456
Basalt, weathered	24	480
Basalt, brown and gray	60	540
Basalt, weathered	20	560
Basalt, gray, hard	7	567
Basalt, weathered	29	596
Basalt, gray, brown, and black	80	676
Basalt, brown, hard to soft	60	736
Basalt, gray and brown	50	786
Clay, black	9	795
Shale	1	796
Basalt, brown	22	818
Basalt, gray, hard	2	820
Basalt, gray, brown, and black	108	928
Basalt, black, hard	22	950
Basalt, black, creviced	30	980
Basalt, grayish-black, with clay	15	995
Basalt, black, hard	5	1,000
3S/1E-6dac. Tualatin Sand & Gravel. Altitude 270 ft. Drilled by R. J. Strasser Drilling Co., 1965. Casing: 12-in. diam to 41 ft, 8-in. diam to 298 ft, 6-in. diam to 332 ft; perforated 200-218 ft, 288-298 ft		
Clay	18	18
Basalt	34	52
Basalt, black, hard	9	61
Basalt, broken	12	73
Basalt, red	7	80
Basalt, brown, fractured	33	113
Basalt, gray, brown, and red	82	195
Basalt, black, fractured, water-bearing	27	222
Basalt, gray, medium-hard	43	265
Basalt, brown	33	298
Basalt, fractured, water-bearing	18	316
Basalt, black	81	397
Basalt, broken	97	494
Basalt, brown	19	513
Basalt, gray, brown, and black	53	566
Basalt, black and brown, medium-hard	137	703
Clay, tan, sticky	52	755
Clay, black and blue	12	767
3S/1E-16cad. W. A. Kaiser. Altitude 200 ft. Drilled by Keller Well Drilling, 1971. Casing: 10-in. diam to 540 ft; unperforated		
Clay, brown	16	16
Clay, brown, sandy	4	20
Clay, brown	16	36
Clay, brown, with some gravel	8	44
Clay, brown	13	57
Clay, brown, and gravel	8	65
Sandstone, brown, soft	15	80
Clay, blue and brown	460	540
Basalt, decomposed	4	544
Basalt, brown, soft to medium-hard	41	585
Basalt, hard	83	668
3S/1E-18bdb2. E. Ray. Altitude 210 ft. Drilled by Skyles Drilling & Supply, Inc. Casing: 6-in. diam to 449 ft; unperforated		
Clay, brown	20	20
Clay, brown, and sand	5	25
Clay, brown	12	37
Sand, brown, water-bearing	14	51
Clay, yellow	5	56
Clay, gray	10	66
Sand, gray, cemented	19	85
Sand, cemented, and small-sized gravel	6	91
Clay, gray	7	98
Sand, brown	72	170
Clay, brown	18	188
Sand, brown	9	197
Clay, blue	15	212
Sand, brown, water-bearing	53	265
Clay, blue and brown	179	444
Rock, hard	14	458
Rock, fractured	45	503
3S/1E-21aad2. Clackamas County Park Commission. Altitude 70 ft. Drilled by B & B Well Drilling, 1973. Casing: 6-in. diam to 255 ft; unperforated		
Soil, brown	2	2
Clay, dark-gray	6	8
Boulders	6	14
Clay, light-brown	46	60
Clay, dark-gray, soft	120	180
Clay, light-gray, hard	15	195
Clay, light-brown, hard	60	255
Sand, black, water-bearing	10	265

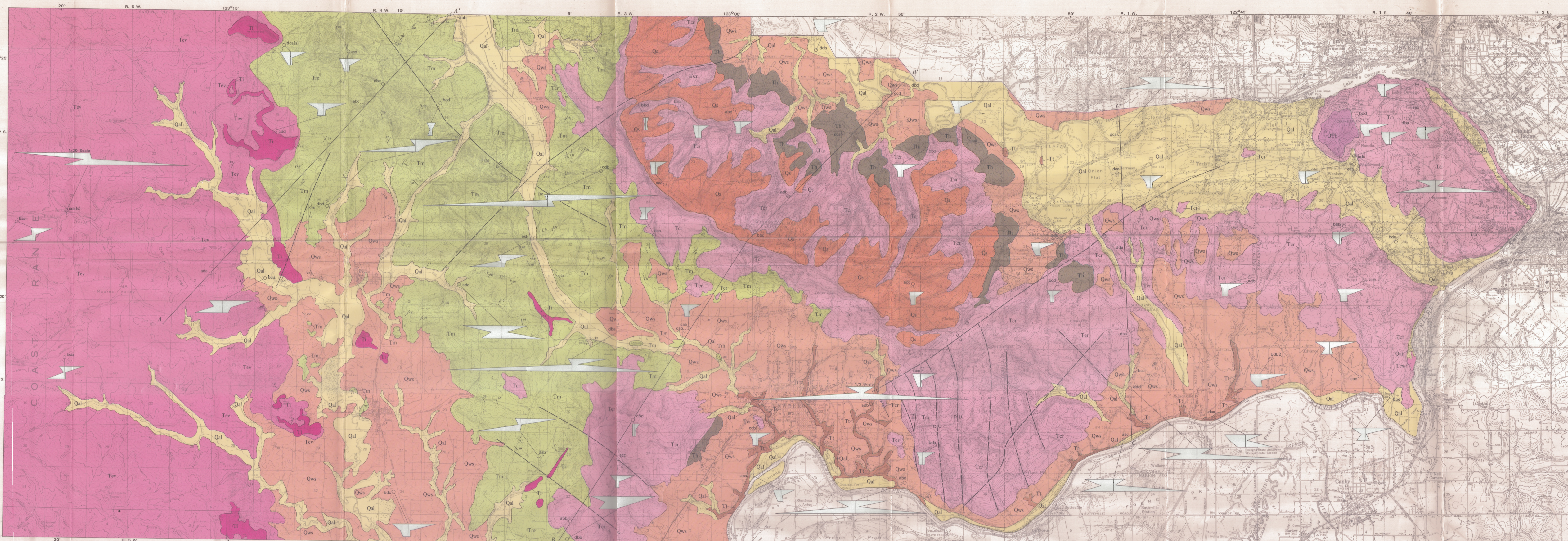
Table 6.--Drillers' logs of representative wells--Continued

Materials	Thickness (feet)	Depth (feet)
3S/1E-22bcb. P. H. Hebb. Altitude 75 ft. Drilled by R. J. Strasser Drilling Co., 1959. Casing: 10-in. diam to 442 ft; perforated 419-425 ft		
Rock, fractured	29	29
Conglomerate	24	53
Sand, packed	19	72
Gravel, large-sized	3	75
Rock, hard	15	90
Clay, blue and red	31	121
Clay, red	22	143
Clay, blue	273	416
Clay, brown	3	419
Gravel and sand, water-bearing	5	424
Clay, blue	18	442
4S/3W-5abb. City of Lafayette. Altitude 400 ft. Drilled by John Meeker Well Drilling, 1968. Casing: 8-in. diam to 198 ft; perforated 23-35 ft, 35-198 ft		
Soil	1	1
Clay, blue	15	16
Boulders	2	18
Basalt, brown, medium-soft, fractured	42	60
Basalt, brown, medium-hard, fractured	25	85
Basalt, gray, medium-soft	8	93
4S/3W-5abb.--Continued		
Basalt, medium-hard	12	105
Basalt, gray, medium-soft, fractured	40	145
Basalt, brown, medium-hard	37	182
Basalt, blue-gray, medium-hard	23	205
Shale, gray, sticky	5	210
4S/3W-5dbb. Milo Mitchell. Altitude 450 ft. Drilled by Ted Schueler Well Drilling, 1973. Casing: 6-in. diam to 40 ft; unperforated		
Clay, brown	24	24
Clay, gray	9	33
Sandstone and clay, gray	165	198
Sandstone, white, hard	49	247
Sandstone, white, hard, some clay	18	265
Sandstone, gray	20	285
Shale, gray, soft	23	308
Shale, blue, soft	9	317
Shale, gray, hard	15	332
Shale, brown, soft	11	343
Shale, green	9	352
Shale, brown, hard	10	362
Sandstone, gray	46	408

OREGON WATER RESOURCES DEPARTMENT
GROUND WATER REPORT NO. 27

PREPARED IN COOPERATION WITH THE
UNITED STATES GEOLOGICAL SURVEY

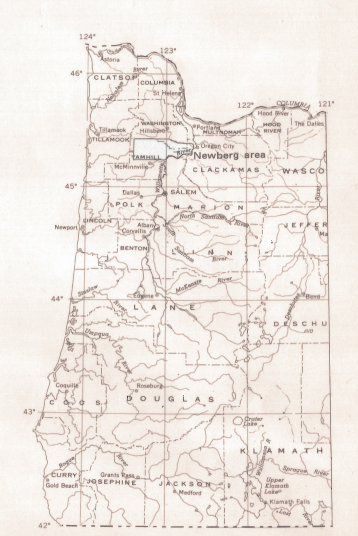
PLATE 1



Geology modified from Schlicker and Deacon (1967); Hart and Newcomb (1965); and Warren, Grivetti, and Norbisrath (1945).

CORRELATION OF MAP UNITS

Unit	Age	Period
Qal	Holocene and Pleistocene	QUATERNARY
Qws, Qs	Upper Pleistocene	QUATERNARY
QTb	Upper (?) Pleistocene to upper Pliocene	TERTIARY AND QUATERNARY
Tt, Th	Lower Pliocene	TERTIARY
Tcr	Upper and middle Miocene	TERTIARY
Tm	Upper Oligocene and upper Eocene	TERTIARY
Tev	Eocene	TERTIARY
Ti	Oligocene (?)	TERTIARY



INDEX MAP OF WESTERN OREGON SHOWING LOCATION OF STUDY AREA

DESCRIPTION OF MAP UNITS

Qal ALLUVIUM — Silt, clay, sand, peaty material, and some gravelly beds. The deposit ranges in thickness from a few feet to more than 30 feet (9 meters). Material is water bearing below the level of adjacent streams. Generally does not yield large quantities of water to wells

Qws WILLAMETTE SILT — Thinly bedded silt with thin discontinuous interbeds of clay and very fine to medium sand. Locally contains scattered granitic and quartzite pebbles. Thickness ranges from a few to about 50 feet (15 meters). Generally yields small quantities of water to wells

Qs UPLAND SILT OF SCHLICKER AND DEACON (1967) — Micaceous sandy and clayey silt. Mantles ridges and flatter areas of Chehalem Mountains. It is mostly 3 to 6 feet (0.9 to 1.8 meters) thick. Is not an aquifer in the area

QTb BORING LAVA — Blocky jointed, gray porphyritic olivine basalt. Occurs principally as thin flows, and in the study area is only a few feet thick. Not important as an aquifer in the area

Tt TROUTDALE FORMATION — Silt, clay and sand, and some gravel beds mostly concealed beneath younger alluvial deposits, exposed in ravines and along the Willamette River. Thickness generally ranges from less than 100 to as much as 450 feet (30 to 169 meters). Yields from 4 to 360 gallons per minute (0.3 to 23 liters per second) to wells

Th HELVETIA FORMATION OF SCHLICKER AND DEACON (1967) — Sand, sandy silt, and silty clay, with local thin beds containing granitic, quartzite, and basalt pebbles. Not important as an aquifer in the area

Tcr COLUMBIA RIVER BASALT GROUP — Flows of fine-grained basalt with interflow zones of breccia, ash, and soil. Thickness of unit ranges from a few feet to more than 1,000 feet (300 meters). Yields 15 to 1,000 gallons per minute (0.9 to 63 liters per second) to wells that penetrate below the regional water table. In places, yields range from 5 to 20 gallons per minute (0.3 to 1.3 liters per second) from isolated-water bodies beneath the upland

Ti INTRUSIVE ROCKS — Dikes and sills of gabbro, basalt, and diabase. Have low permeability and will yield only small quantities of water to wells

Tm MARINE SEDIMENTARY ROCKS — Tuffaceous and basaltic sandstone, siltstone, and shale. Interbedded locally with carbonaceous siltstone and claystone. Total thickness probably exceeds 5,000 feet (1,500 meters). Generally yields only small quantities of water to wells. Deep zones contain highly mineralized water

Tev TILLAMOOK VOLCANICS — A series of basaltic lavas, tuffs, and breccias with well-indurated marine siltstone and sandstone interbeds. Total thickness probably exceeds 10,000 feet (3,000 meters). Yields small quantities of water to wells

Contact — Dashed where approximately located

Fault — Dashed where approximately located; dotted where concealed; U, upthrown side; D, downthrown side

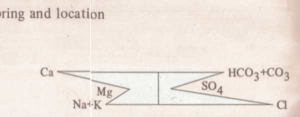
A — A′ Line of section

Horizontal beds

20 Strike and dip of beds

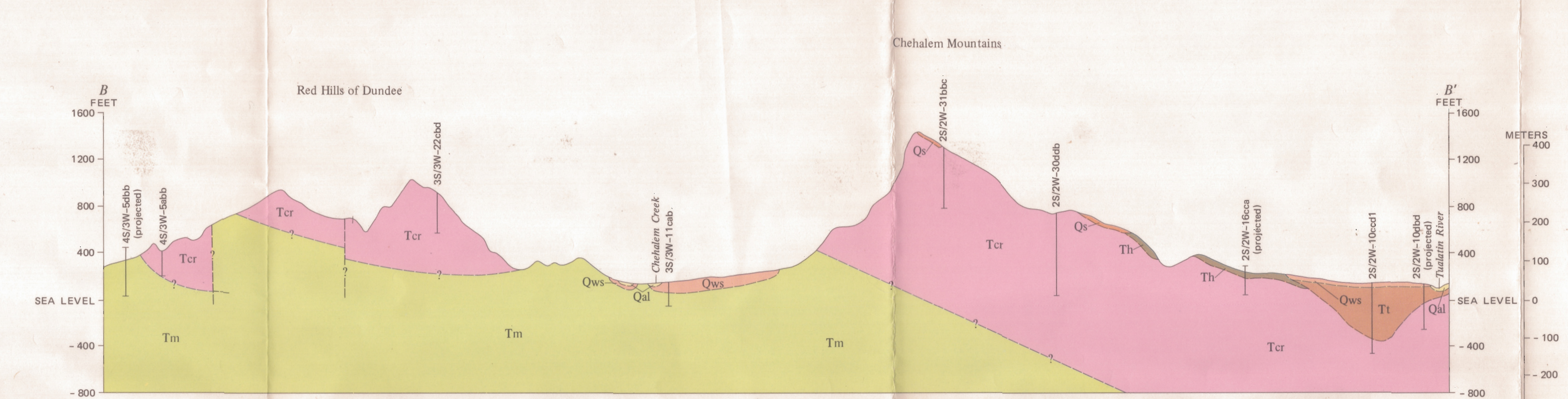
cbc Well and location

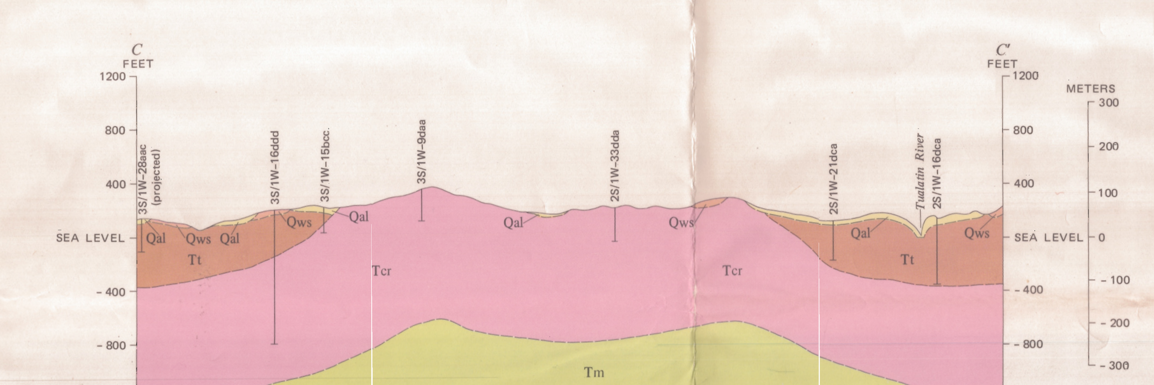
cda(s) Spring and location



Chemical diagram showing concentrations of major ions

ALL CROSS SECTIONS 6.5X VERTICAL EXAGGERATION





GEOHYDROLOGIC MAP AND SECTIONS OF THE NEWBERG AREA, OREGON

OREGON WATER RESOURCES DEPARTMENT
GROUND WATER REPORT NO. 27

PREPARED IN COOPERATION WITH THE
UNITED STATES GEOLOGICAL SURVEY

PLATE 2

MAP SHOWING WELL LOCATIONS AND GENERALIZED WATER-LEVEL ALTITUDES OF THE NEWBERG AREA, OREGON

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PLATE 2

MAP SHOWING WELL LOCATIONS AND GENERALIZED WATER-LEVEL ALTITUDES OF THE NEWBERG AREA, OREGON