A DESCRIPTION OF HYDROGEOLOGIC UNITS IN THE PORTLAND BASIN, OREGON AND WASHINGTON

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 90-4196

Prepared in cooperation with
CITY OF PORTLAND BUREAU OF WATER WORKS,
INTERGOVERNMENTAL RESOURCE CENTER, and
OREGON WATER RESOURCES DEPARTMENT

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By R.D. Swanson, W.D. McFarland, J.B. Gonthier, and J.M. Wilkinson

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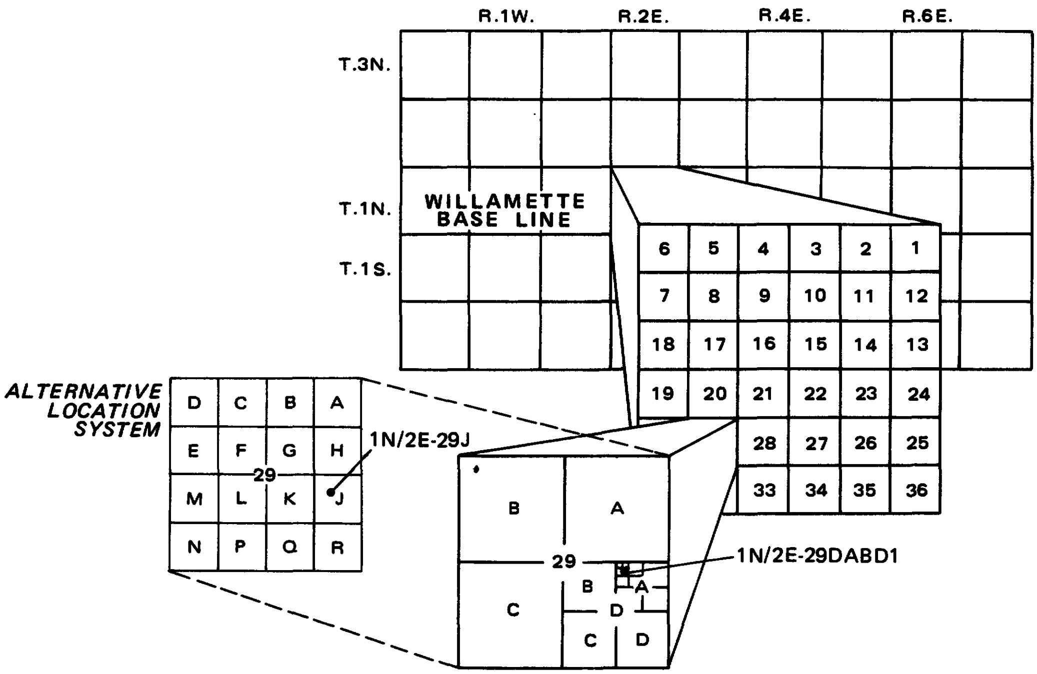
CONVERSION FACTORS AND ABBREVIATIONS

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047.	square meters (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
	Flow	
gallon per minute (gal/min)	0.0631	liter per second (L/s)

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Well-location System

The system used in this report for locating wells is based on the rectangular system for subdivision of public land. The numbers and characters represent successively the township, range, section, and location within the section by quarter section (160 acres), quarter-quarter section (40 acres), quarter-quarter-quarter section (10 acres), and quarter-quarter-quarter-quarter section (2.5 acres). Where necessary, serial numbers are added after the final letter to assure uniqueness of location numbers. An alternative location system, used previously in the State of Oregon and currently in use in the State of Washington, is also illustrated. This system uses a single capital letter to represent the quarter-quarter section (40 acres) in which a well is located.



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ABSTRACT

The increasing reliance on ground-water resources in the Portland Basin has prompted a need to evaluate the capability of the ground-water system to meet present and future demands. Toward this goal, the U.S. Geological Survey conducted a hydrogeologic study of the basin and is constructing a ground-water flow model of the aquifer system. This report describes one component of the study which involved mapping the extent, thickness, and boundaries of hydrogeologic units (aquifers and confining units) in the basin.

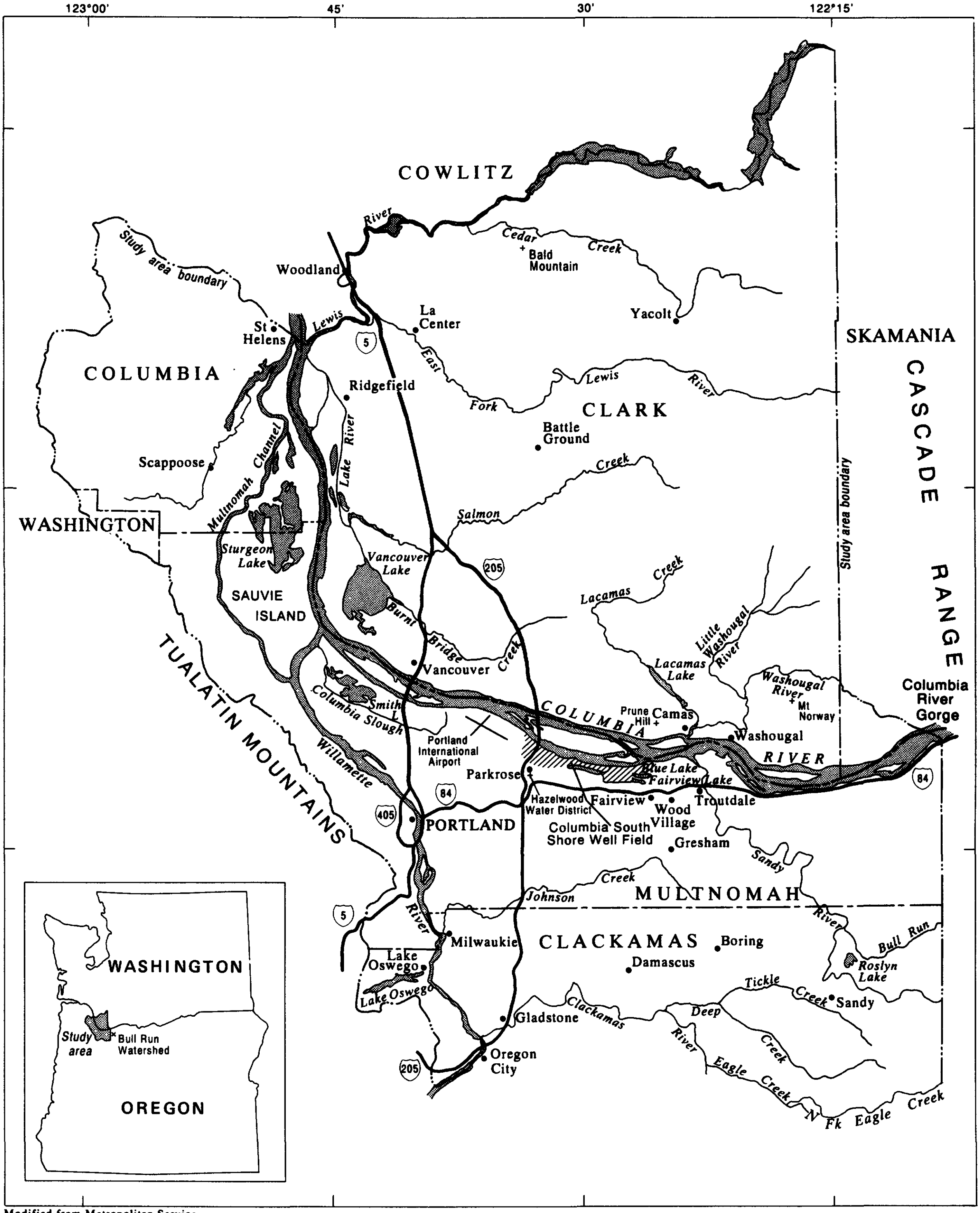
Hydrogeologic units in the basin were mapped using data from field-located water, cathodic protection, geothermal, and oil and gas wells, borehole geophysical logs, borehole sampling, and detailed surficial hydrogeologic mapping. These data were entered into a geographic information system for analysis and to produce digital maps for input into the ground-water model.

Eight major hydrogeologic units were mapped in the Portland Basin. From oldest to youngest these units include: older rocks, sand and gravel aquifer, confining unit 2, Troutdale sandstone aquifer, confining unit 1, consolidated gravel aquifer, and an unconsolidated sedimentary rock aquifer. The eighth unit is an undifferentiated fine-grained unit that is lithologically similar to the confining units. It exists where the sand and gravel aquifer and the Troutdale sandstone aquifer pinch out in the western and northwestern parts of the basin or sufficient information does not exist to map the sand and gravel aquifer.

INTRODUCTION

The Portland Basin is located in northwestern Oregon and southwestern Washington (fig. 1) and includes about 1,300 square miles. The term "Portland Basin" is used to describe the northwest-southeast trending, sediment-filled structural depression bounded by the Tualatin Mountains (locally referred to as the Portland Hills) on the west and the Cascade Range (includes Western Cascades and High Cascades) on the east, north, and south (fig. 2).

The City of Portland and many of its suburbs are centrally located in the Portland Basin and represent the largest urban area in Oregon. Both surface- and ground-water resources are important to the Portland-Vancouver metropolitan region.



Modified from Metropolitan Service District, Major Arterial map, 1984.

Figure 1. — Location of the Portland Basin study area.

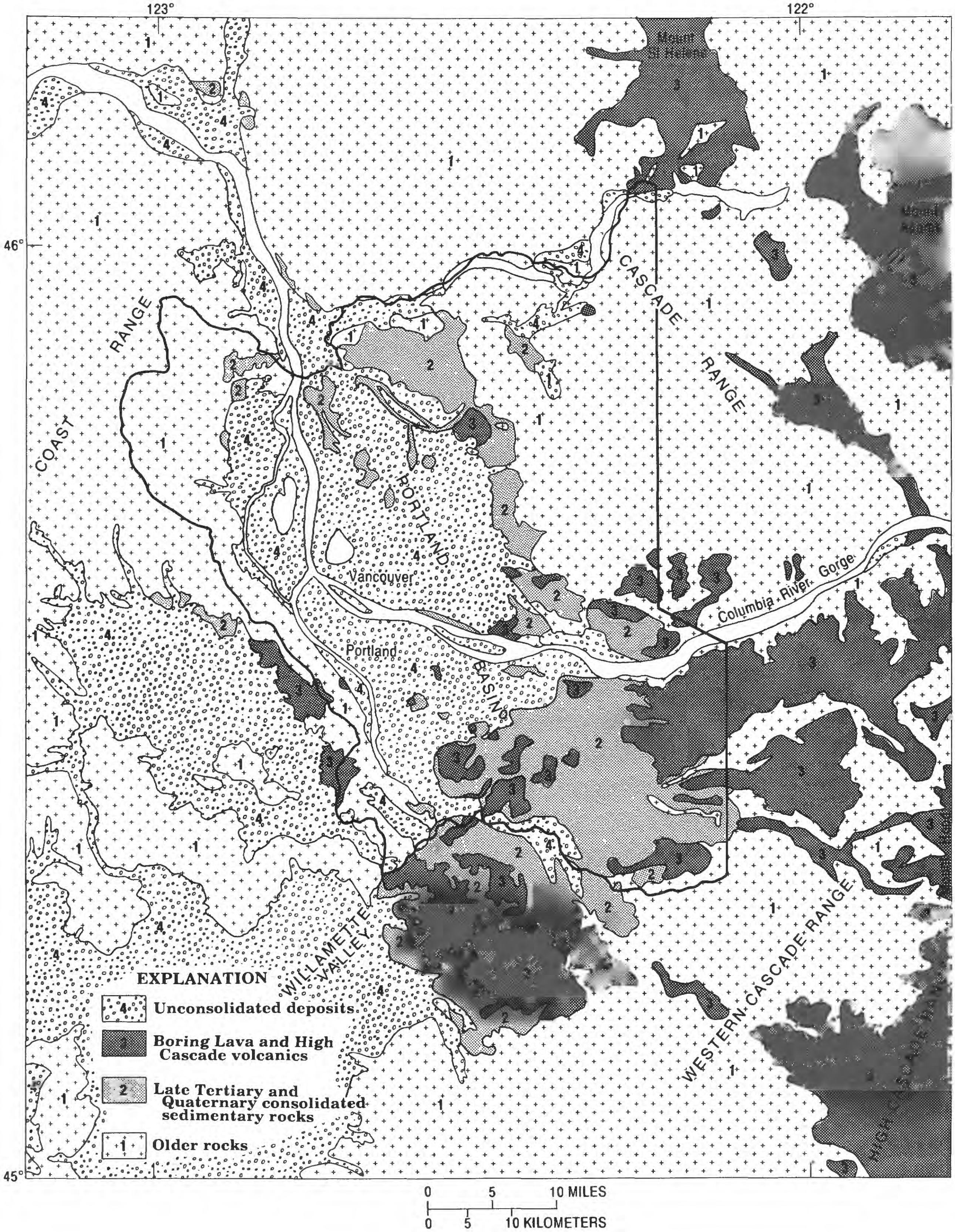


Figure 2. – Regional geography of the Portland Basin. Modified from: Wells and Peck (1961), Sherrod and Smith (1989), and Walsh and others (1987).

Portland and neighboring Oregon communities obtain most of their drinking-water supplies from the Bull Run Watershed which is approximately 20 miles southeast of Portland on the western flank of the Cascade Range. During peak-use periods in the summertime, the Bull Run surface-water system can supply more than 200 million gallons of water each day. The City of Portland has constructed a well field in the Portland Basin, capable of producing more than 100 million gallons of water each day, to provide a backup or emergency supply of water to the Portland area in the event that the Bull Run system was unable to supply the needed water. Most other water users in the Oregon part of the Portland Basin obtain water for domestic and irrigation uses from ground-water resources. These rural areas include parts of Columbia, Multnomah, and Clackamas Counties.

The Washington part of the basin, which includes all of Clark County, relies almost entirely on ground water for public supply, domestic, industrial, and irrigation water. The primary suppliers of public drinking water in the Clark County area are the City of Vancouver and the Public Utility District of Clark County. Most water in rural Clark County is supplied by individual private well systems.

Because of the increasing dependence on ground-water resources in the Portland Basin, agencies charged with managing the resource must evaluate the capability of the ground-water system to meet present and future demands. In order to make this evaluation, a better understanding of the hydrogeology of the Portland Basin was needed.

In 1987, the U.S. Geological Survey began a cooperative study with the City of Portland Bureau of Water Works, the Oregon Water Resources Department, and the Intergovernmental Resource Center[1], to describe the ground-water resources in the basin and to quantify the resources by constructing a numerical model of the ground-water flow system. To meet these objectives, a number of components of the hydrologic system must be defined. These components include recharge rates, configuration of the water table and potentiometric surfaces, ground-water/surface-water relations, ground-water pumpage rates, evapotranspiration rates, and the extent, thickness, hydraulic characteristics, and boundaries of the aquifers and confining units through which the ground water moves.

The study area boundaries (fig. 1) include the Lewis River on the north; the drainage divide of the Tualatin Mountains on the west; the Clackamas River, Eagle Creek, and the North Fork of Eagle Creek on the south; the east boundary extends from the North Fork of Eagle Creek at the east side of Lenhart Butte, northward to the boundary at the Washougal River, and along the east boundary of Clark County.

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[1]The Intergovernmental Resource Center represents and includes about 20 local governmental agencies in Clark and Skamania Counties, Washington.

Purpose and Scope

The purpose of this report is to describe the extent, thickness, lithologies, and boundaries of the aquifers and confining units in the Portland Basin. The definition of these units may be one of the better known parameters in the overall understanding of the ground-water flow system of the basin. The most productive aquifers are in the sedimentary rock basin-fill rather than in the underlying older rocks that form the structural basin. Therefore, the mapping described in this report focuses on hydrogeologic units in the sedimentary rock basin-fill.

A number of "tools" were used to map these units in the basin. Detailed surface and subsurface geologic mapping was done basin- wide to subdivide geologic formations into water-bearing and non-water bearing units. Sample well cuttings were obtained from drillers and natural gamma logs were run in open wells to assist with correlation of units between wells. Drillers' lithologic descriptions were computerized and used to draw geologic sections on both a local and basin-wide scale. The geologic sections were then used to subdivide the system into hydrogeologic units. Maps of the major hydrogeologic units, showing the altitudes of their tops and thicknesses, and outcrops are the final product of this part of the Portland Basin study.

Acknowledgments

The authors would like to thank Anthony Well Drilling, Beck Well Drilling, Hansen Drilling, A.M. Jannsen Well Drilling, Steinman Brothers Drilling, and Turner Well Drilling for providing drill-cutting samples and Northwest Natural Gas Company, Northwest Pipeline Corporation, and the City of Portland Bureau of Water Works, and the City of Vancouver for providing records of well construction in the Portland/Vancouver area. Well owners who allowed us to field visit their wells also are gratefully acknowledged. David R. Sherrod and James G. Smith of the U.S. Geological Survey Geologic Division provided a preliminary copy of their Cascade Range geologic map and Marvin H. Beeson and Terry L. Tolan from Portland State University, and Ian P. Madin from the Oregon Department of Geology and Mineral Industries provided preliminary copies of the Lake Oswego and Portland quadrangle geologic maps.

Previous Investigations

The Portland Basin study is the first study concerning the ground-water resources in the Portland-Vancouver area done on a basin-wide scale. Previous ground-water studies have focused only on parts of the basin, for example, in the Clark County, Washington, and the east Portland, and northern Clackamas County, Oregon areas. The many reports on ground-water resources and geology in the basin, both small and large scale, were used to formulate basic hydrogeologic concepts for this study.

The most recent reports concerning ground-water resources of large parts of the Portland Basin are those by Mundorff (1964), who described the geology and ground-water conditions of Clark County, Washington, and Hogenson and Foxworthy (1965), who described the ground-water resources of the east Portland area. The ground-water resources along the southern boundary of the study area, in northern Clackamas County, were described by Leonard and Collins (1983). Many of the ground-water studies in the basin have been based on geologic mapping and descriptions of geologic formations published by Trimble (1963) and Mundorff (1964).

In addition to the above reports, a number of other geologic studies provided useful information for mapping the aquifers and confining units in the basin. Sheet 1 includes an index of geologic mapping.

Many reports are available for the basin, most of them by consulting firms, usually include small areas and are of limited distribution. Valuable information, especially in Clark County, is available from these reports on water-bearing properties of aquifers as well as the extent and thickness of hydrogeologic units.

Additional U.S. Geological Survey reports that have provided information for the present study were written by Brown (1963), who described the use of ground water in the downtown Portland business district, and by Hartford and McFarland (1989), who described thickness and extent of aquifers and confining units in east Portland area. The latter report was based on extensive drilling by the City of Portland during development of their backup ground-water supply system. The Portland well field is located just northeast of downtown Portland on the Columbia River flood plain between Portland International Airport and Blue Lake (fig. 1).

The descriptions of hydrogeologic units of this study are based on earlier descriptions of aquifer and confining units in the Portland well field area by Hartford and McFarland (1989) and earlier reports by Willis (1977, 1978) and Hoffstetter (1984) describing the lithologies of these units. McFarland, Luzier, and Willis (1982) described and mapped a Pleistocene channel in the Portland well field area which is incorporated into the maps presented in this report.

Since the studies of Mundorff (1964) and Hogenson and Foxworthy (1965), a considerable number of wells have been drilled in the basin that improve our ability to map hydrogeologic units. The detailed work in the Portland well field has shown that geologic formations, used by previous workers to describe the ground-water system in the basin, can be further subdivided into aquifers and confining units.

Limited geophysical data and interpretations also are available for the basin and where possible this information was used to assist with mapping the top of the older rocks. Benson and Donovan (1974) developed a preliminary map showing the altitude of the top of the Columbia River Basalt Group throughout the basin based on available well data. Davis (1987) used gravity surveys to study the eastern edge of the Portland Basin and to estimate fault displacements and sediment thicknesses. Beeson and others (1975) mapped Columbia River Basalt Group stratigraphy and identified faults along the western edge of the basin. Perttu (1980) analyzed several gravity lines across the east area of Portland.

Methods of Investigation

In this study, data collection for hydrogeologic mapping included field location of selected water, cathodic protection, geothermal, and oil and gas wells, borehole geophysical logging (natural gamma logs), borehole sampling, and detailed surficial hydrogeologic mapping. These data were entered into a GIS (geographic information system) for analysis and to produce the maps and hydrogeologic sections needed for the study.

In the study area, more than 15,000 drillers' reports have been submitted as required by law to the States of Oregon and Washington since 1955 and 1971, respectively (McCarthy and Anderson, 1990). Prior to these dates, wells could be drilled without notifying the state. As a result, there are a number of wells in the basin for which the OWRD (Oregon Water Resources Department) and the WDOE (Washington Department of Ecology) do not have records. The total number of drilled water wells in the basin is estimated to be about 20 percent greater than the 15,000 for which records are available. Records also are not available for several thousand shallow dug wells in the basin.

Wells were visited in the field to establish a reliable map location and land-surface altitude which were used in mapping hydrogeologic units, especially where land-surface relief is great. In this study, well locations were plotted on, and land-surface altitudes estimated from, U.S. Geological Survey 1:24,000 scale topographic maps. The contour interval on these maps is generally 10 feet in the Portland Basin.

Approximately 900 wells were field visited for this study and about 600 wells were field visited in previous or concurrent studies. Most are water wells field located by U.S. Geological Survey personnel. About 100 wells are cathodic protection wells installed largely by Northwest Natural Gas Company and the City of Portland; these were located from their records. Two geothermal gradient test wells were located from Oregon Department of Geology and Mineral Industries records. One oil and gas exploration well and three geothermal gradient test wells were located from a State of Washington report (McFarland, 1983) and field records.

Several criteria were used to select wells for field location in this study. As a general rule, approximately one well in each section was selected and located; however, where numerous significant pumping wells were present in a section, there was no limit on the number of wells located. Wells with complete drillers' reports, those that were the deepest in the section, and those that were open only in a single hydrogeologic unit, were given preference. All municipal water-supply wells and many large-capacity industrial and irrigation wells also were located. Additional wells completed in shallow materials were field located to assess vertical head gradients and to define the position of the water table.

Although basic drillers' data for all 15,000 wells were entered into a data base, additional specific information was entered for the approximately 1,500 field-located wells. The latitude, longitude, and altitude of each located well were determined and digitized at the

1:24,000 scale. In addition, the borehole lithologic descriptions reported for field-located wells were entered into the data base to allow automated generation of hydrogeologic sections.

Most of the lithologic descriptions reported by well drillers were accurate. It was found that only a few of the located wells had records that did not conform generally to data from adjacent wells or nearby outcrops. The variability of terms used by drillers to describe a particular lithology was not a major problem; the use of the terms describing clayey, muddy, sandy, and gravelly lithologies was usually consistent from driller to driller. Problems commonly occurred when attempts were made to assess more subtle aspects of lithology, however, such as degree of lithification and the relative amounts of major clast size fractions; a single lithologic interval may be described as cemented sand and gravel by one driller, cemented gravel by another, or simply gravel by a third driller.

Numerous natural-gamma borehole geophysical logs collected since the early 1970's by the U.S. Geological Survey staff and the Portland Bureau of Water Works were used to correlate sandstone beds and some clay layers between wells. Sandstone is an exceptionally low gamma emitter compared with the surrounding clay layers because the sandstone contains very low amounts of potassium, thorium, and uranium which are the chief natural gamma emitting isotopes in rocks (Telford and others, 1976). Geochemical analyses of Pliocene basaltic glass sandstones in the basin show exceptionally low concentrations of potassium, thorium, and uranium (Swanson, 1986).

Geologic field mapping also was used to help describe the extent and thickness of hydrogeologic units in the basin. Several hydrogeologic units are subunits within geologic formations mapped by Trimble (1963) and Mundorff (1964). In these cases, additional field mapping was the only practical way to define the extent and thickness of these hydrogeologic units, because lithologic aspects that make them distinguishable in outcrop areas were not often evident in lithologic descriptions supplied by drillers' reports.

Geologic mapping was done in late winter, spring, and summer of 1987 concurrent with a well inventory by U.S. Geological Survey personnel. Mapping focused initially on connecting hydrogeologic units described in the Portland well field area (Hartford and McFarland, 1989) with nearby exposures of Troutdale Formation and Sandy River Mudstone along the lower Sandy River at Troutdale, Oregon. From there, mapping extended throughout the remaining parts of the basin where the Troutdale Formation, Sandy River Mudstone, and younger sedimentary rocks were exposed.

Subsurface hydrogeologic mapping was done at the 1:24,000 scale by integrating field-mapped units with geologic sections drawn through field-located wells. Basin-wide geologic sections also were used to examine relations between units throughout their extent. On the basis of these geologic sections and field-mapped units, the lithologic section for each field-located well was subdivided and assigned to the hydrogeologic unit or units that the well penetrated. The top of each hydrogeologic unit selection for each well was recorded and entered into the data base. For each hydrogeologic unit, a set of 1:24,000-scale data maps were plotted showing the altitude of the top and the thickness of the unit penetrated at each field-located well. The data maps were drawn at 1:24,000-scale to overlay U.S. Geological Survey 7-1/2 minute quadrangles. Altitude contours on the top of each unit were hand drawn. Thickness maps then were hand contoured by overlaying two sequential top maps and contouring the difference as the thickness. The 1:24,000-scale thickness maps of each unit were digitized and combined to produce a single basin-wide 1:100,000-scale thickness map for each unit. The 1:24,000 scale top-of-unit maps were photographically reduced and redrafted at a scale of 1:100,000. Additional well information, from wells that were not field checked or field located in other studies, was used to supplement the wells field located for this study. They are noted on sheets 3-10. These wells are the primary source of subsurface geologic information for Sauvie Island and the southeast part of the report area. On Sauvie Island, where little topographic relief exists, non-field-located wells were used to map the thickness of unconsolidated sediments. In the southeast part of the study area, wells mapped on a 1:62,000 base by Leonard and Collins (1983) were used to map geologic units.

GEOLOGIC SETTING

The Portland Basin is one of several structural basins filled with continental, sedimentary rocks of late Miocene(?), Pliocene, and Pleistocene age in the Willamette Valley and adjoining part of the Columbia River valley. The northwest-southeast trending basin is about 20 miles wide and 45 miles long. Older Eocene to Miocene volcanic and sedimentary rocks underlie the basin and crop out around the edge of the basin on the west, north, and east. These older rocks are not exposed in the southernmost part of the basin; therefore, the southern geologic boundary of the older rocks is less well defined. The basin is filled with consolidated and unconsolidated continental sedimentary rocks containing important water-bearing units. These sedimentary rocks and the ground-water flow system are the focus of the Portland Basin study. The regional geology of the Portland Basin is shown in figure 2.

Older Rocks

Older rocks that underlie the basin-fill sediments include several geologic formations. The Skamania Volcanics of the western Cascades and the Columbia River Basalt Group are the most extensive bedrock units in the basin. Other older rocks exposed at the basin margins include the basalts of Waverly Heights (Beeson and others, 1989), Goble Volcanics, Pittsburg Bluff, Scappoose, and the Rhododendron Formations. In this study, these older rocks are grouped into one hydrogeologic unit because of their generally poor water-bearing characteristics. The Columbia River Basalt Group, however, is used as a source of water in upland areas of the basin.

The oldest volcanic rocks exposed in the basin are the Eocene basalts of Waverly Heights, which crop out in the Lake Oswego-Milwaukie, Oregon area. Total thickness of these basalt flows is unknown, but a 600 foot thickness in the Lake Oswego area was reported by Beeson and others (1989). Also of Eocene age are the Goble Volcanics, which are volcanic-arc-derived volcaniclastics and basaltic-andesite flow rocks that crop out in northern Clark County along the south shore of the Lewis River (Wilkinson and others, 1946; Phillips, 1987a).

Marine sedimentary bedrock formations that exist in the basin, but are not mapped separately, include the Pittsburg Bluff and Scappoose Formations, which overlie the Goble Volcanics. These rocks are Eocene to Miocene age and crop out near the City of St. Helens in Columbia County, Oregon (Phillips, 1987b).

The Skamania Volcanics are an extensive bedrock unit in eastern Clark County that form the western side of the Cascade Range in Washington. Included in this formation are Eocene to Miocene volcanic and volcaniclastic rocks (Trimble, 1963; Phillips, 1987a and 1987b).

The Columbia River Basalt Group is probably the most extensive unit in the Portland Basin. These Miocene flood basalts are exposed in an anticlinal ridge along the western margin of the basin and in the canyons of the Columbia, Bull Run, and Sandy Rivers along the eastern margin of the basin. They are assumed to underlie the approximate 1,800 feet thickness of younger Tertiary and Quaternary basin-fill sedimentary and volcanic rocks in the center of the basin. The total thickness of these basalts in northwestern Oregon and southwestern Washington ranges from 0 to more than 700 feet (based on more than 690 feet of Columbia River Basalt in the Schmidt Nursery well in 1S/4E-28add, sheet 3). Trimble (1963) indicated a maximum thickness of about 1,000 feet in the basin.

The middle to upper Miocene Rhododendron Formation overlies the Columbia River Basalt Group in the southeastern part of the study area, at the western margin of the western Cascades. The Rhododendron Formation consists of debris-flow breccias and hypersthene-andesite lava flows, which have a maximum thickness of 600 feet along the Clackamas River near Estacada. The unit appears to have a limited westward extent because wells near the towns of Sandy and Barton, near the south margin of the study area completed in the Columbia River Basalt Group, did not appear to encounter the Rhododendron Formation.

Sandy River Mudstone and Troutdale Formation

The Sandy River Mudstone and the Troutdale Formation are the oldest of the basin-filling sediments in the Portland Basin. These rocks include sediment deposited by an ancestral Columbia River and local streams draining the Cascade Range as well as sediment derived from episodes of Pliocene High Cascade volcanism (Tolan, 1982; Tolan and Beeson, 1984; Swanson, 1986). The Sandy River Mudstone consists of mudstone, siltstone, sand, and claystone that directly overlie the older rocks. The Troutdale Formation consists of quartzite-bearing conglomerate and vitric sandstone that generally overlie the Sandy River Mudstone (Trimble, 1963). The Troutdale Formation is considered the most important water-bearing formation in the Portland Basin.

In this study, much of the surface and subsurface hydrogeologic mapping focused on the Sandy River Mudstone and the Troutdale Formation owing to the importance of aquifers and confining units in these formations. At the start of this project, detailed subsurface mapping of hydrogeologic units in these formations had been completed in only one area of the basin near the Columbia River, the Portland well field (Hartford and McFarland, 1989). As a result, this area was considered a hydrogeologic unit "type" area for the rest of the Portland Basin.

The detailed subsurface mapping in the Portland well field indicated that the relation between the Sandy River Mudstone and the Troutdale Formation may be more complex than originally described by Trimble (1963). In the Portland well field area and other parts of the basin, the fine and coarse-grained lithologies of these two formations interfinger with one another as shown in figure 3. Coarse-grained facies typical of the Troutdale Formation are thickest in the east and southeastern part of the basin and fine facies of the Sandy River Mudstone are more dominant toward the west.

Along the eastern margin of the basin, the Sandy River Mudstone underlies the ancestral Columbia River channel gravels and vitric sandstones of the Troutdale Formation. However, lenses of silt, micaceous sand, and ash, similar in lithology to the Sandy River Mudstone, are interlayered with the Troutdale Formation along the Sandy River and near the Clackamas River. Well cuttings and geophysical logs from southern Clark County and the Sandy-Damascus area also indicate that the Sandy River Mudstone is interlayered with vitric sandstone beds in the the Troutdale Formation.

Trimble (1963) named the Sandy River Mudstone for Pliocene age beds of mudstone, siltstone, claystone, and sand that were formerly referred to as the lower part or member of the Troutdale Formation (Trimble, 1957). Extensive exposures of this formation outcrop along the Clackamas and Sandy Rivers. In Clark County, similar sandy rocks are exposed along the East Fork of the Lewis River and in its lower tributaries. The Sandy River Mudstone thickens toward the center of the basin to a maximum thickness that may be as much as 1,400 feet at the deepest part of the Portland Basin.

The Sandy River Mudstone is composed chiefly of micaceous arkosic siltstone and fine- to medium-grained sand with minor gravelly lenses. Clay and water-laid ash layers also are present in outcrops along the Sandy and Clackamas Rivers. Many of the siltstones are massive appearing or interbedded with thin beds of fine sand. Silty sand beds show cross-stratification and ripples. Where the Sandy River Mudstone is exposed along the Sandy River and Clackamas River, it contains weakly-consolidated, medium-grained, micaceous, arkosic sand beds that range from a few inches to 10 or 15 feet in thickness. These sand beds have planar- and cross-stratification and sometimes exhibit massive structure. Similar micaceous arkosic sand beds up to 50 feet thick are exposed along the East Fork Lewis River. Lithologic descriptions from wells that penetrate below the Troutdale Formation in Clark County show sand beds that are commonly more than 50 feet thick. Vitreous carbonized wood as well as woody fragments are found throughout the Sandy River Mudstone and plant fossils are common in silty and clayey layers. Fossil plant assemblages near the Sandy River Mudstone-Troutdale Formation transition were used by Trimble (1963) to assign a Pliocene age to the Sandy River Mudstone.

The Troutdale Formation has been described in various ways and with varying terminology by previous workers. Hodge (1938) referred to the Troutdale Formation as conglomerate, sandstone, and siltstone deposits exposed along the lower Sandy River near the town of Troutdale, Oregon. Hodge's (1938) type area for the Troutdale Formation includes two distinct lithologic facies; an upper part consisting of chiefly quartzite-bearing basaltic conglomerate and coarse hyaloclastic

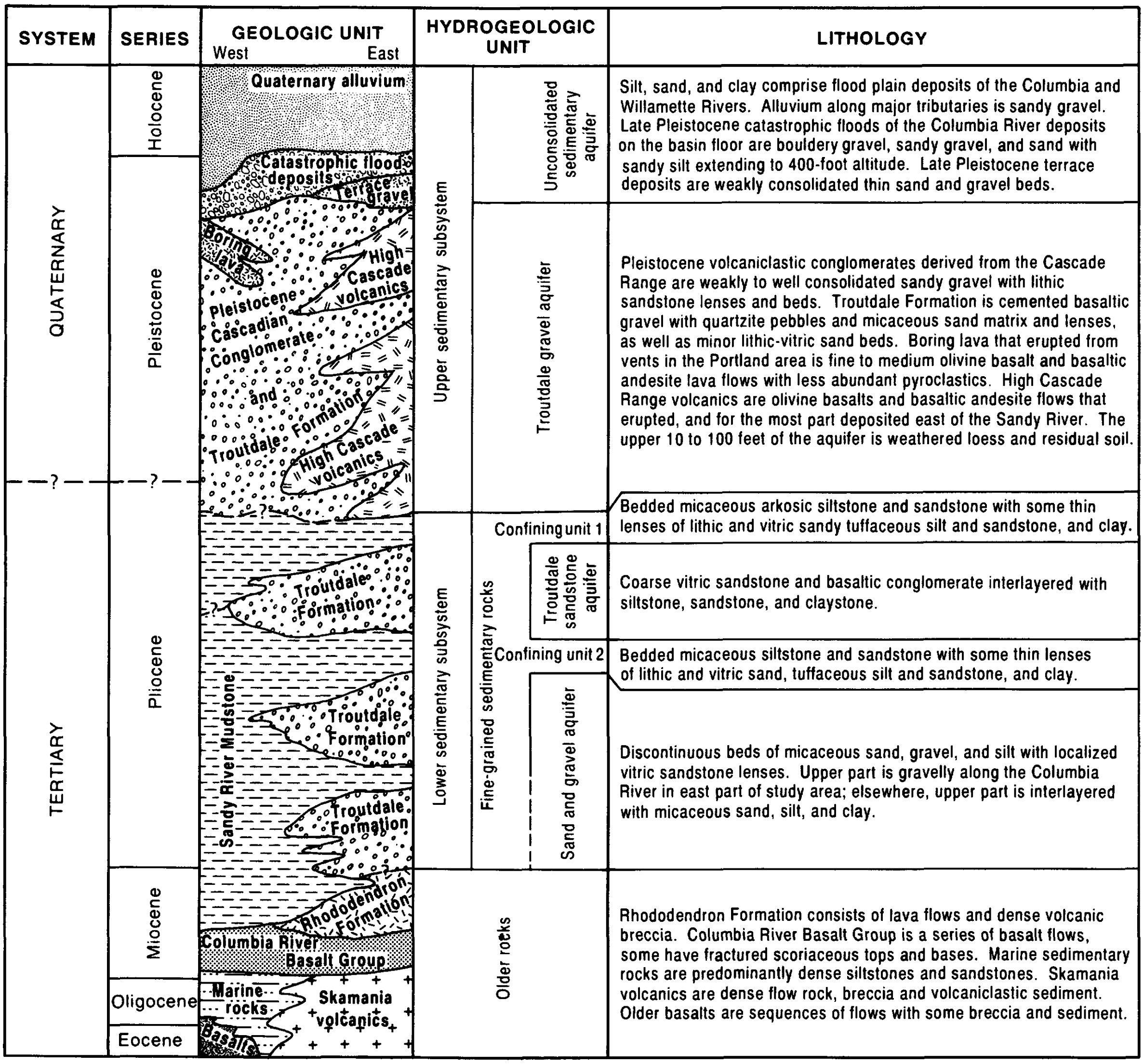

Figure 3.—Summary of geologic and hydrogeologic units.

sandstone and a lower part consisting of siltstone and sandstone, both believed to have been deposited by an ancestral Columbia River. The lower siltstone and sandstone were separated from the Troutdale Formation and mapped as the Sandy River Mudstone by Trimble (1963). However, other studies continued to use the Troutdale Formation to refer to the entire post Columbia River Basalt Group consolidated sedimentary rock section. Mundorff (1964) used informal upper and lower members to separate upper gravelly rock from lower sandy and silty rock of the Troutdale Formation in Clark County, but did not map them as separate units. Another usage for upper and lower members of the Troutdale Formation was coined by Tolan and Beeson (1984) in the lower Columbia River Gorge. They informally divided the Troutdale Formation into upper and lower members based on a gradual transition from a Columbia River source marked by quartzite pebble and cobble-bearing basaltic conglomerate to locally derived vitric sandstone and volcaniclastic conglomerate primarily composed of olivine basalt.

The term "Troutdale Formation" as used in this report refers strictly to the Columbia River drainage-basin-derived quartzite pebble-bearing and cobble-bearing basaltic conglomerate and interbedded fluvial vitric sandstone of the Troutdale Formation type area.

The Troutdale Formation ranges in thickness from between 75 and 400 feet. Vitric sandstone and gravels interfinger with the Sandy River Mudstone throughout much of the Portland Basin. The conglomerate beds are probably channel deposits deposited along the course of an ancestral Columbia River in a subsiding Portland Basin. The vitric sandstone beds overlie the channel gravel in some areas and are more sheet-like in their distribution. The vitric sandstone beds are thickest in the southeastern part of the basin and thin toward the center. Well data indicate that these sandstones pinch out in the westernmost parts of the basin.

Trimble (1963) assigned a Pliocene age to the Troutdale Formation on the basis of fossil-plant assemblages taken from the upper part of the Sandy River Mudstone and fine-grained beds in the lower part of the Troutdale Formation. Although this is the accepted age for much of the Troutdale Formation in the Portland Basin, the age of the unit probably ranges from late Miocene to late Pliocene or early Pleistocene on the basis of K-Ar (potassium-argon) rock ages of volcanic rocks that underlie, interlayer with, or overlie the Troutdale Formation (Tolan and Beeson (1984). Troutdale Formation conglomerates fill an ancestral Columbia River canyon cut into middle Miocene, Columbia River Basalt Group flows. Troutdale Formation conglomerates are interlayered with lahar beds correlated with the late Miocene Rhododendron Formation (Tolan and Beeson, 1984). Cascade volcanic lava flows overlying the Troutdale Formation have been K-Ar dated at less than 1.5 million years (Hammond and Korossec, 1983).

Cascade Range Volcanics and Boring Lava

The Cascade Range volcanics (fig. 2) and Boring Lava are compositionally similar and genetically related Pliocene and Quaternary basalt and basaltic andesite flows and breccias. The Cascade volcanics form a platform along the crest of the Cascade Range (High Cascades) in Oregon and southern Washington with thicknesses over 3,000 feet (Peck and others, 1964; Walsh and others, 1987). The Boring Lava is considered a western outlier of Cascade Range volcanics in the Portland Basin and Tualatin Mountains (Peck and others, 1964) and is the westernmost extent of Cascade Range volcanics in Oregon and Washington. In this report, the term Boring Lava (Treasher, 1942) refers to localized accumulations (in some areas more than 400 feet thick) of Cascade volcanics erupted from vents in the greater Portland area and in Clark County. Cascade volcanics form a wedge of Pliocene and Quaternary basalt and basaltic andesite that thickens east of the Sandy River. The source of the fluvial vitric sandstones in the Troutdale Formation was Cascade volcanics basalt erupted into surface waters and redeposited by the ancestral Columbia River system (Tolan and Beeson, 1984; Swanson, 1986).

Late Pliocene to Holocene Sediments

Cascadian volcaniclastic conglomerate, loess, terrace deposits, catastrophic flood deposits, and alluvium of late Pliocene to Holocene age mantle much of the Portland Basin.

Volcaniclastic conglomerate derived from the Cascade Range and sandstone overlie the Troutdale Formation and Sandy River Mudstone, and interlayer with and overlie the Boring Lava in Multnomah and northern Clackamas Counties. These volcaniclastic conglomerates have been mapped as Troutdale Formation in some parts of the basin. In eastern Clark County, Mundorff (1964) mapped similar rocks that cap hills as Troutdale Formation. In Oregon, Trimble (1963) mapped similar units as the Walters Hill, Springwater, and Gresham Formations. These conglomerates are 100 to 200 feet thick and consist of cemented, pebble-cobble gravel with bouldery areas and lenses. Volcanic tuff and breccia are locally interbedded with these conglomerates and sandstones. In some places, there is a thick, weathered zone on the volcaniclastic conglomerates derived from the Cascade Range up to 100 feet thick.

Loess deposits (Trimble, 1963), also referred to as the Portland Hills Silt (Lowrey and Baldwin, 1952), are brown, micaceous, clayey, eolian silt of Pleistocene age (Lentz, 1981). These deposits are thickest (40 to 120 feet) where they mantle the Tualatin Mountains and parts of the Boring Lava southeast of Portland (Trimble, 1963; Lentz, 1981); however, thinner deposits (5 to 20 feet thick) probably mantle much of the study area. These loess deposits interlayer and overlie Boring Lava in the Tualatin Mountains (Lentz, 1981) and overlie the Cascadian volcaniclastic conglomerate. Below 300 to 400 feet altitude, the loess deposits are removed or covered by the fine-grained facies of the catastrophic flood deposits of the Columbia River.

Terrace deposits along most major rivers in the Portland area are of limited extent and consist of Pleistocene volcanic gravels, felsic lithic sand, and Cascades Range volcanic derived debris flows. These deposits are lithologically similar to the volcaniclastic conglomerate unit that overlies the Troutdale Formation. The terrace deposits are usually not more than 50 to 75 feet thick. Many exposures consist of thin veneers on valley walls with little lateral extent.

In northern Clark County, late Pleistocene and Holocene mudflow and pyroclastic debris deposits from Mount St. Helens' eruptions cover parts of the Lewis River valley floor and walls (Major and Scott, 1988). Unique to northern Clark County are small isolated basins of upper Pleistocene glacial outwash deposits (Mundorff, 1964). For example, in Chelatchie Prairie and the Yacolt Basin as much as 250 feet or more of predominately sand and gravel deposits underlie the valley floors (Mundorff, 1964).

Large quantities of Pleistocene sediments were deposited by catastrophic floods of the Columbia River that occurred in the late Pleistocene. Periodic failure of ice dams impounding huge lakes in Idaho and Montana caused a series of as many as 40 colossal floods of the Columbia River (Bretz and others, 1956; Waitt, 1985). A constriction in the Columbia River valley at the the north end of the Portland Basin caused the flood waters to fill the Willamette Valley and

Portland area to an altitude of about 400 feet. These episodes of flooding deposited bouldery gravel, gravely sand, sand, and sandy silts that mantle the Willamette Valley and Portland Basin to altitudes of 350 to 400 feet (Trimble, 1963). In addition to depositing significant quantities of sediment, catastrophic flood waters eroded large parts of exposed rock units.

The catastrophic flood deposits can be grouped into two easily discernable lithologic units. A basaltic sand and gravel unit with varied amounts of cobbles and boulders (some to over 12 feet in diameter) and a finer, stratified, micaceous arkosic sand, silt, and clay. The coarse unit is found near the present channel of the Columbia River in southern Clark County and the Portland area. There also appears to be similar coarse flood deposits beneath Sauvie Island. Thickness of the gravel ranges from a few feet to more than 200 feet in local areas. These coarse-grained flood deposits constitute the most permeable aquifer in the Portland Basin. Away from the Columbia River flood plain, the coarse-grained flood deposits tend to be largely unsaturated where they are present. The finer unit exists at an altitude of about 250 feet throughout the study area and ranges in thickness from 20 feet to about 100 feet.

Alluvium exists along all major streams in the Portland Basin with the most extensive deposits along the Columbia and Willamette Rivers. The Columbia and Willamette River alluvium is chiefly sand and silt, whereas alluvium of the major tributaries is mostly cobble gravel. The Lewis River and Sandy River valleys include finer mudflow and reworked mudflow deposits from Mount St. Helens and Mount Hood respectively (Major and Scott, 1988; Crandell, 1980). Mount St. Helens is located north of the study area and Mount Hood is east of the study area (fig. 2).

GEOLOGIC STRUCTURE

Northwest and northeast trending topographic lineations, faults, and folds are present throughout the Portland Basin (sheet 1). One of these structures is the northwest trending Portland Hills-Clackamas River fault zone, described by Beeson and others (1985), that bounds the Portland Basin on the west and south. Eocene to Miocene volcanic and sedimentary rocks form topographic highs that predate deposition of the Columbia River Basalt Group and younger sediments. The older volcanic rocks, marine rocks, and Columbia River basalts underlie the basin-fill sediments and are offset downward into the basin by poorly defined faults. Basin-filling sedimentary rocks were deposited as a broad, shallow basin formed. Small faults and folds deform these sediments, appearing to be both contemporaneous with and subsequent to deposition of the basin-filling sediment. Major geologic structures mapped in the basin are shown on sheet 1.

Geologic structure is difficult to map in most of the older volcanic and marine rocks because they are thickly bedded and lack distinctive marker beds or, in the case of marine beds, are subject to landsliding. However, some major faults have been identified. The oldest volcanic rocks, the basalts of Waverly Heights, Goble Volcanics, and Skamania Volcanics, form topographic and structural highs that younger units lap up against or drape over. Prune Hill in southeastern Clark County, and the Tryon Creek area near Lake Oswego are examples of older rock highs.

Mundorff (1964) and Phillips (1987b) mapped several major faults that form linear fault-bounded valleys within the Skamania Volcanics in Clark County. One of the most prominent in the northeast Clark County area is the Chelatchie Prairie fault zone which trends north, 70 degrees east, and bounds the south end of Chelatchie Prairie. Another in the same area is the Yacolt Basin fault. The Yacolt Basin fault trends north, 35 degrees west, intercepts the Chelatchie fault zone and appears to extend 10 or more miles to the southeast as a lineation (sheet 1).

The Skamania Volcanics are also displaced by major faults in the Camas and Washougal areas of Clark County. Along Lacamas Lake and lowermost Lacamas Creek, vitric sandstone in the Troutdale Formation appears to be in fault contact with Skamania Volcanics to the northeast. Along the southwest side of Prune Hill, the Skamania Volcanics appear to be displaced more than 1,600 feet by a significant northwest trending fault zone. This structure also offsets vitric sandstone in the Troutdale Formation by as much as 500 feet. Several studies using gravity geophysical investigations have identified areas of structural deformation at the margins of the Portland Basin. Geophysical models indicate a sharp density change between older rocks and the basin filling sediments (Beeson and others, 1975; Perttu, 1980; Davis, 1987).

The stratigraphy and structure of the Columbia River Basalt Group has been mapped in detail along the Tualatin Mountains (locally referred to as the Portland Hills) [Beeson and others, 1989] on the basis of variation of rock geochemistry, magnetic stratigraphy, and lithology. The Tualatin Mountains are a complexly-faulted anticlinal fold. Similar structures also may be present within the basin, but are unknown because of basin-filling sediments. Lithologic records and drill cuttings from several wells just north of the Clackamas River reveal two anticlinal structures in the Columbia River Basalt Group. One anticline is just southeast of Damascus and the other, the Tickle Creek anticline, is a northwest trending anticlinal ridge between Tickle Creek and Deep Creek.

Some geologic structures in the Sandy River Mudstone, Troutdale Formation, Boring Lava, and volcaniclastic conglomerate were identified from stratigraphic relations and lithologic data from wells; however, data are too sparse to identify all folds and faults in these units. In general, the Sandy River Mudstone, Troutdale Formation, and volcaniclastic conglomerate dip gently toward the center of the basin, suggesting that sediments accumulated as the basin subsided. Geologic structures observed in the older rocks are carried through into the overlying Sandy River Mudstone, Troutdale Formation, and volcaniclastic gravel. Younger rocks thin over structural highs of older rocks and in some cases show small amounts of displacement upward through the section, suggesting that these structures were active while the basin-filling sediments were being deposited. Prune Hill, Tickle Creek anticline, a Boring Lava capped ridge southeast of Damascus (sheet 1) and an unnamed series of low ridges in western Clark County are examples.

Structural deformation appears to have taken place at the time of emplacement of the basalt and pyroclastic rocks of the Boring Lava. The volcaniclastic conglomerates underlying, interlayering, and overlying the Boring Lava are uplifted and downdropped slightly as fault bounded blocks southeast of Portland. Eruptive vents formed along a northeast trending fault along the west margin of the Boring Lava north of Carver, Oregon. The lavas were intruded and extruded in the downdropped block that underlies Pleasant Valley.

HYDROGEOLOGIC UNITS

The flow of ground water through an aquifer system and, therefore, the availability of ground water is dependent largely on the extent and thickness of relatively good water-bearing units, or aquifers, and of relatively poor water-bearing units, called confining units. These aquifers and confining units are referred to as "hydrogeologic units" in this report because they are mapped on the basis of their geologic and water-bearing characteristics. A hydrogeologic unit may include several geologic units or formations with similar water-bearing characteristics or may include a single part of a geologic unit with a distinct water-bearing characteristic.

In this study, the hydrogeologic units described by Hartford and McFarland (1989) and older hydrogeologic units were mapped throughout the basin on the bais of geologic mapping, lithologic descriptions by drillers, geophysical data, examination of drill cuttings, specific-capacity tests, and water levels in wells. Comparisons of hydrogeologic units with geologic units described earlier in this report are shown in figure 3. A chart comparing hydrogeologic units mapped in this study with other workers' stratigraphic and hydrogeologic units is shown in figure 4.

In previous regional scale ground-water studies in the Portland Basin (Mundorff, 1964; Hogenson and Foxworthy, 1965), water-bearing characteristics of each geologic formation were described. However, more recent studies have used a significant amount of new well data to map multiple hydrogeologic units in the Troutdale Formation and the Sandy River Mudstone (Willis, 1977; Willis, 1978; Hoffstetter, 1984; Hartford and McFarland, 1989). Late Pleistocene to Holocene Columbia River sediments also have been mapped by water-bearing characteristics locally, but it is not practical to separate these localized units in a regional study.

Eight major hydrogeologic units form the Portland Basin aquifer system. From oldest to youngest they include: older rocks, sand and gravel aquifer, confining unit 2, Troutdale sandstone aquifer, confining unit 1, consolidated gravel aquifer, and the unconsolidated sedimentary rock aquifer. The eighth unit (undifferentiated fine-grained sediments) exists in areas of the basin where the Troutdale sandstone aquifer and the sand and gravel aquifer pinch out or there is insufficient information to characterize the aquifer units within the fine-grained Sandy River Mudstone (or lower member of the Troutdale Formation of Mundorff, 1964). In those areas, confining units 1 and 2 cannot be separated and therefore are mapped singly as undifferentiated fine-grained sediments. The location of hydrogeologic units that are exposed at land surface is shown on plate 1, and hydrogeologic sections in the basin are shown on plate 2.

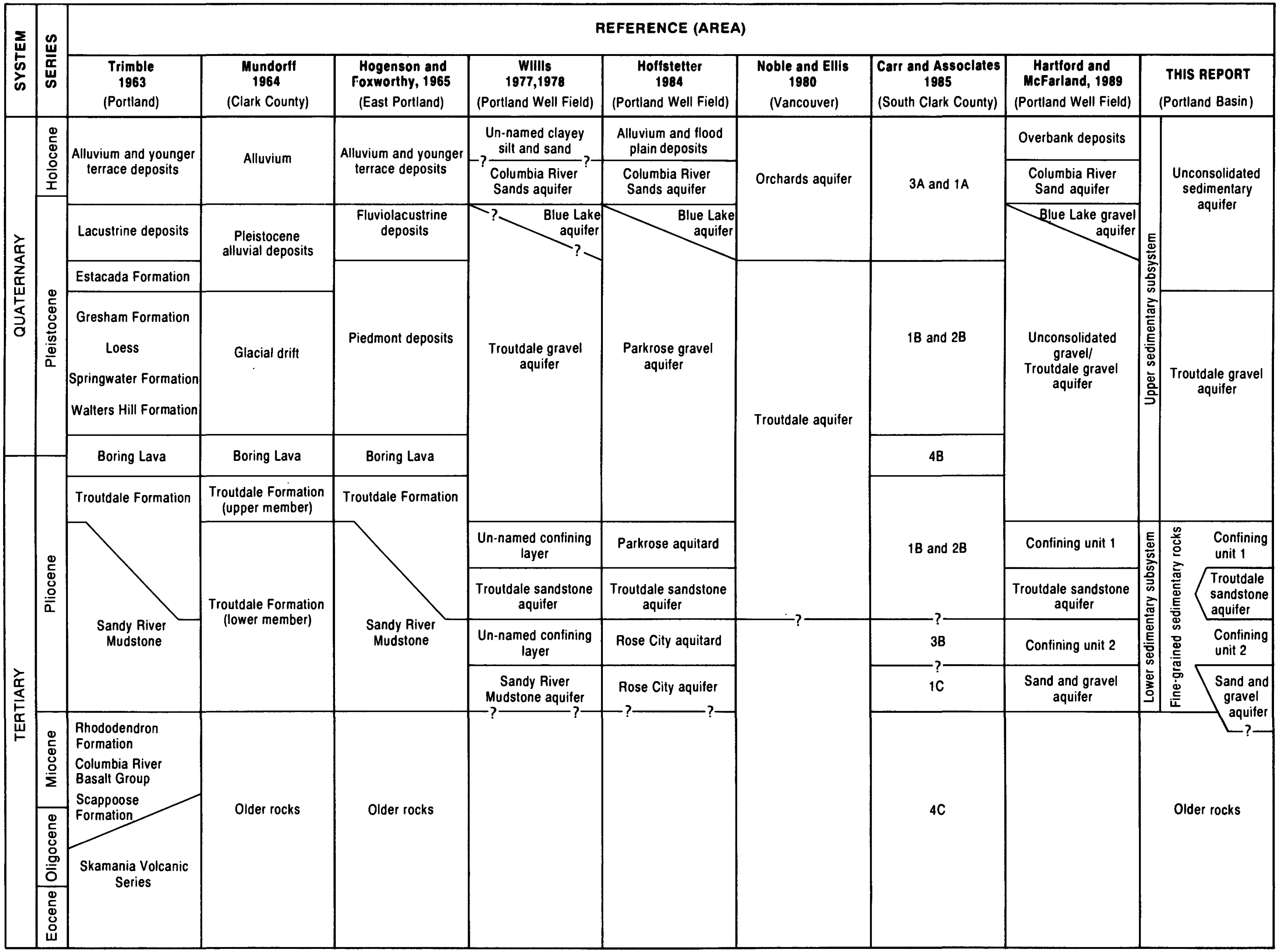

Figure 4.—Comparison of hydrogeologic unit terminology for the Portland Basin.

For discussion purposes, the aquifer system can be grouped into three major subsystems (fig. 3) on the basis of regionally continuous contacts between units or groups of units of distinctly different lithologic and hydrogeologic characteristics. These aquifer subsystems are the older rocks, the lower sedimentary rocks, and the upper sedimentary rocks.

A series of maps (pls. 3-10) show the altitude of the top and thickness of the hydrogeologic units in the basin. These maps are discussed in the following descriptions for each unit. Interpretations of hydrogeologic units in individual wells are listed in table 1 at the back of the report. These data can be cross-referenced to well data from well-drillers' reports (McCarthy and Anderson, 1990).

Older Rocks Subsystem

The older rocks subsystem includes Miocene and older volcanic and marine sedimentary rocks of generally low permeability that underlie and bound the basin-filling sediments in the Portland Basin. The contact between the older rocks and basin-filling sediments can be easily interpreted in many wells that penetrate both units. With the exception of the Columbia River Basalt Group and the Rhododendron Formation, these older rocks are poor aquifers and, in most areas, only supply water adequate for domestic uses. These rocks are not a primary source of water in many parts of the study area. Much of the area, where the older rocks are exposed at land surface, is sparsely populated forest uplands with some farmland or urbanized areas served by public water supplies. Where they are covered by basin-filling sediments, the older rocks generally are too deep to be used as a water supply under the current demand for water.

The Skamania Volcanics, Goble Volcanics, and basalts of Waverly Heights Formation are all dense altered volcanic rocks with little capacity to store or transmit water. Wells in these units yield about 5 to 10 gallons per minute. The Skamania Volcanics and, to a lesser degree, the Goble Volcanics increasingly are being used as residential development moves into the foothills of the Cascade Range. Wells drilled into the fractured zones and to the soil/rock interface may be the best producers.

Marine sedimentary rocks such as the Scappoose Formation also have limited water-bearing capabilities and in some areas contain saline water. In the Tualatin Valley, ground water derived from marine sedimentary rocks underlying the Columbia River Basalt Group have chloride contents of more than 1,800 milligrams per liter (hart and Newcomb, 1965). Most wells in these older rocks generally have yields from 5 to 10 gallons per minute.

The Columbia River Basalt Group is used as an aquifer along the western and, to a lesser extent, southern boundaries of the Portland Basin where it crops out or is not overlain by thick sedimentary rock aquifers. Large capacity wells in the Columbia River Basalt Group typically are open to several hundred feet of the unit in order to penetrate one or more productive interflow zones. Within the study area, several wells completed in the Columbia River Basalt Group are capable of producing over 1,000 gallons per minute.

Although the Columbia River Basalt Group has the capability in places to produce large quantities of ground-water, its limited capacity to store water is evident in many parts of western Oregon. Water-level declines have occurred in several upland areas of the Willamette Valley in Oregon as a result of overdevelopment of aquifers in the basalts.

The Rhododendron Formation underlies the extreme southeastern part of the study area and produces ground water for domestic use and small-scale irrigation. The Rhododendron Formation is principally lava flows and consolidated volcanic debris. Leonard and Collins (1983) report that the most productive wells were completed in material described as lava or rock by drillers. Well yields of 5 to 25 gallons per minute are typical for the Rhododendron Formation.

Older rocks in the Portland Basin (pls. 2 and 3) form a broad northwest trending depression with a maximum depth of about 1,600 feet. The altitude of the top of the older rocks, where overlain by basin-filling sediments, is shown on plate 3. The contour map of altitude of the top of the older rocks are based primarily on available well data and geological mapping in the basin. Most of the wells that penetrate the older rocks are along the edge of the basin where the older rocks are shallow and the overlying sediments are thin. Only a few wells penetrate the older rocks where overlying sediments are more than 500 feet thick. Wells that do not penetrate the older rocks also give control points for the top of the unit by identifying the minimum thickness of sediments above older rocks. The altitude of the top of the unit, in this case, is known to be less than the altitude of the bottom of the well.

Several geophysical studies have been conducted in the Portland Basin (Perttu, 1980; Davis, 1987; and Beeson and others, 1975). Interpretations from those studies were used to assist with mapping the altitude of the top of the older rocks.

Plate 3 shows that the center of the basin is approximately located beneath Vancouver, Washington, at an altitude of about minus 1,600 feet. This estimate of the top of the older rocks is based largely on wells that do not penetrate bedrock. Projection of the approximate dip of the older rock/basin-filling sediment contact, as indicated in wells close to the contact near the margin of the basin, was assumed to be less steep toward the center of the basin .

Areas of the basin with the best control on the altitude of the older rocks beneath the basin-fill sediments include: downtown Portland, Milwaukie/Lake Oswego, Damascus, Tickle Creek, and the area near Blue Lake. In these areas, sufficient well data allow somewhat detailed mapping of the subsurface structure. In the Damascus and Tickle Creek areas, structural highs in the Columbia River Basalt Group were located with well data that were not available in earlier studies. Near Blue Lake, wells have been drilled to depths greater than 1,000 feet below sea level and did not penetrate the older rocks; however, Skamania Volcanics outcrop approximately 1.5 miles northeast of the Blue Lake area. Although the wells in that area do not penetrate the older rocks, their depth and proximity to outcrops give reasonable control on the altitude of the older rock/basin-filling sediment contact.

In the southeastern part of the study area, outcrops in canyons and few field-located wells provide reasonable control on the altitude of the top of the older rocks.

A few small isolated, sediment-filled subbasins occur in the study area which are not part of the main structural basin. These basins are in the Chelatchie Prairie/Yacolt area of northeastern Clark County, the Bear Prairie area of southeastern Clark County, and a basin just northwest of St. Helens, Oregon. These basins are relatively shallow and are generally related to geologic structures in the older rocks.

Lower Sedimentary Subsystem

The lower sedimentary subsystem extends basin wide and overlies the older rocks. It is composed of: (1) interbedded consolidated silt, sand, and clay which are characteristic of Trimble's (1963) Sandy River Mudstone and Mundorff's (1964) lower member of the Troutdale Formation, and (2) interlayered vitric sandstone and quartzite pebble-bearing basaltic conglomerate that characterize the Troutdale Formation in its type area in the lower Sandy River canyon. The lower sedimentary subsystem was divided into two aquifers and two confining units in the southeastern part of the basin where the vitric sandstone and channel gravel deposits of the ancestral Columbia River are interlayered with the Sandy River Mudstone. Where data permit, the lower sedimentary subsystem is mapped into a sand and gravel aquifer, a lower confining unit 2, the Troutdale sandstone aquifer, and an upper confining unit 1. Toward the western side of the basin, the Troutdale sandstone and the sand and gravel aquifer become finer grained and apparently pinch out. In these areas, confining unit 2 and confining unit 1 are not distinguishable from each other and the lower sedimentary subsystem is mapped as undifferentiated fine-grained sedimentary rocks. Throughout most of the basin, the contact between confining unit 1 or the undifferentiated fine-grained sediments and the overlying consolidated gravels is easily mapped.

Sand and Gravel Aquifer

The sand and gravel aquifer is the lowermost hydrogeologic unit within the lower sedimentary subsystem (pls. 2 and 4). Where it is present, this aquifer is defined by the total sediment thickness between the top of the aquifer and the top of the older rocks. This sediment interval consists of principally sandy gravel, silty sand, sand, and clay. Where it is described in the Portland well field (Hartford and McFarland, 1989), the sand and gravel aquifer has a relatively coarse-grained upper subunit and a predominately fine-grained lower subunit that extends to the base of the sedimentary rock section. This hydrogeologic unit is considered a relatively coarse-grained facies of the Sandy River Mudstone and Mundorff's (1964) lower member of the Troutdale Formation.

The upper subunit consists of micaceous arkosic sand, vitric-lithic sand, sandy gravel, and silt. In the eastern part of the Portland well field, the upper subunit is a conglomerate with basaltic clasts in a sandy matrix overlain by vitric sandstone. The subunit is more than 200 feet thick and tends to become more sandy upward and toward the western part of the Portland well field. Outside the Portland well field and

Troutdale areas, the vitric sand upper part of the subunit cannot be recognized. The lower subunit is predominantly fine- to medium-grained micaceous quartzose sand with silt and clayey silt interbedded with minor lenses of basaltic sand mixed with micaceous arkosic sand.

In general, available well data suggest that the sand and gravel aquifer is coarsest near the present Columbia River channel. Sand and sandy gravel beds were probably deposited by an ancestral Columbia River.

Although the sand and gravel aquifer is well defined along the south shore of the Columbia River east of Portland by Hartford and McFarland (1989), its extent is poorly defined elsewhere because few deep wells penetrate the unit. The top and thickness of the sand and gravel aquifer are shown on plate 4.

The sand and gravel aquifer exists near the present Columbia River channel and extends from the Columbia River Gorge area (fig. 2) on the east to western edge of 1N/2E (pl. 4). Although most of the aquifer is identified in Oregon, two areas of Clark County, Washington are underlain by this unit. One area is along the north shore of the Columbia River, east of Vancouver, in the Prune Hill/Lacamas Lake area, and the second area includes sandy gravels that underlie the Mount Norway area.

The altitude of the top of the sand and gravel aquifer is highest in the Prune Hill/Lacamas Lake and the Mount Norway areas. In those areas, the top of the unit reaches altitudes of about 400 and 700 feet, respectively. Areas east of the Sandy River in Oregon also are underlain by the sand and gravel aquifer at a relatively high altitude of 500 feet.

In these upland areas of Clark and Multnomah Counties, the sand and gravel aquifer is tapped only by a few domestic water supply wells. At the higher altitudes, these sands and gravels may not be saturated.

From upland areas to the north and east, the top of the unit generally dips westward and is at its lowest altitude of about minus 600 feet northwest of Gresham. In the Portland well field, where the unit is best defined and described, the altitude of the top of the sand and gravel aquifer ranges from about minus 100 feet near Blue Lake to approximately minus 500 feet beneath the Portland International Airport.

The contours on the top of the sand and gravel aquifer, in areas such as those beneath the Columbia River, may represent an erosional and structural surface; however, this surface may represent only a structural surface in other areas. Between the Gresham and Blue Lake area, for example, the contours may indicate the presence of anticlinal and synclinal structure in the sand and gravel aquifer.

The thickness of the sand and gravel aquifer is generally least where the unit laps up against the older rocks in the upland areas and thickest near the center of the basin where it exceeds 800 feet.

The areal extent of the coarse-grained deposits in the unit is shown in plate 4. Hydrogeologic sections in plate 2 illustrate the facies changes that apparently limit the extent of the sand and gravel aquifer. Future deep well drilling in the basin may help refine the subsurface mapping of the unit.

The sand and gravel aquifer is developed chiefly by public-supply systems along the south shore of the Columbia River between Interstate 5 and the Sandy River Portland Bureau of Water Works supply wells, which are open solely to the sand and gravel aquifer, can yield 2,000 to 3,000 gallons per minute. One Troutdale public-supply well, open only to the sand and gravel aquifer, was tested at a discharge of 590 gallons per minute with 52 feet of drawdown after 24 hours. Several domestic wells, in the low hills between the Washougal River and Columbia River, draw water from a sandy conglomerate which is included in the sand and gravel aquifer. These wells yield 5 to 30 gallons per minute.

Confining Unit 2

Confining unit 2 overlies the sand and gravel aquifer and underlies the Troutdale sandstone aquifer where the two aquifers are present (pl. 2). Hartford and McFarland (1989) describe confining unit 2 in the Portland well field as greyish olive-green clay and silt with lenses of silt and fine-to-medium-grained basaltic sand. Outcrops of this unit are limited to the southeastern part of the basin along the Clackamas and Sandy Rivers in Oregon.

The altitude of the top and thickness of confining unit 2, where the Troutdale sandstone aquifer is present and where the sand and gravel aquifer may or may not be present, is shown in plate 5. The altitude of the top of confining unit 2 is highest just east of the Sandy River and in the Tickle Creek area in Oregon. In these areas, the top of the unit is at altitudes of about 900 feet. From the southeastern part of the basin, the top of the unit generally dips toward the center of the basin to an altitude of about minus 500 feet. In Clark County, Washington, the altitude of the top of the unit is about 500 feet in the Prune Hill area, but is generally between sea level and about minus 400 feet toward the center of the basin. Geologic structures, as well as erosional features, are evident from contours on the top of and the extent of confining unit 2 (pl. 5). For example, a high in the unit is shown on the Tickle Creek anticline and an erosional east-facing "v-shaped" outcrop is mapped where the Columbia River cuts across the updip edge of the unit.

Where the Troutdale sandstone aquifer is present, but the sand and gravel aquifer is not mapped, the thickness of confining unit 2 is much greater. An abrupt change in thickness is shown on sheet 5 outside the extent of the sand and gravel. This is because the fine-grained facies equivalent to the sand and gravel aquifer has been included in confining unit 2 in that area. The thickness of confining unit 2 ranges from approximately 200 feet in the southeastern part of the basin to more than 800 feet toward the center of the basin. Around the basin margin, the unit ends where it thins against older rocks. Near the Columbia River, confining unit 2 is generally less than 200 feet thick and average thickness is between 40 and 100 feet.

Confining unit 2 is used for a water supply only where more permeable units are not present. Lenses of silt and fine-grained sand 2 to 6 feet thick in the unit can supply water for domestic uses. Confining unit 2 limits vertical flow in the aquifer system and partly confines the sand and gravel aquifer.

Troutdale Sandstone Aquifer

The Troutdale sandstone aquifer (pls. 2 and 6) consists of coarse-grained vitric sandstone and conglomerate with lenses and beds of fine to medium sand and silt. The aquifer is underlain by confining unit 2 and overlain by confining unit 1 throughout much of its extent. Where the aquifer is not present, the two confining units cannot be differentiated.

The Troutdale sandstone aquifer was first described in the Portland well field by Willis (1977, 1978). Hartford and McFarland (1989) described the lithology and mapped the extent of the unit in the Portland well field and nearby area, and correlated the vitric sandstone outcrops south of Blue Lake with the aquifer. Swanson (1986, 1988) correlated the unit with fluvial deposits in the Troutdale Formation along the Sandy River and lower Columbia River Gorge on the basis of the chemistry and lithology of the vitric sand grains.

The Portland well field area was considered the type area for the Troutdale sandstone aquifer. Geologic mapping and correlation of lithologic records from water wells indicate that the Troutdale sandstone aquifer mapped by Hartford and McFarland (1989) extends to the type area of the Troutdale Formation near Troutdale, Oregon. Further geologic mapping and correlation of well records indicate that the vitric sandstone and the vitric sandstone-bearing conglomerate of the Troutdale Formation form a distinct, discernable unit throughout most of the southeastern and south central Portland Basin.

Hartford and McFarland (1989) described the Troutdale sandstone aquifer as consisting of two lithologic subunits; the upper two-thirds is chiefly vitric sandstone and the lower one-third is conglomerate. The upper vitric sandstone consists of moderately- to well-sorted angular to subround coarse sand of black to dark-brown olivine basalt glass and dark-gray olivine basalt. Lenses of sandy silt and clay are interlayered with the vitric sandstone. The lower conglomerate consists of quartzite-bearing basaltic conglomerate with a matrix of vitric sand and micaceous lithic arkose.

In outcrops, samples of the Troutdale sandstone aquifer usually appear much more weathered and, in some cases, more cemented than those encountered in well cuttings in the Portland Basin. Outcrops range in color from nearly black to deep reddish brown to orange, indicating increasing degrees of weathering. Weathering from basaltic glass to clays, zeolites, and opal is probably most rapid above the water table (Hay and Iijima, 1968). The unweathered glassy appearance of most well cuttings of vitric sand suggests that the sands were buried and saturated before appreciable weathering took place.

Locally, the Troutdale sandstone aquifer in the basin contains channel conglomerates and sequences of 20- to 30-foot thick vitric sandstone beds that grade upward into medium-grained feldspar, quartz sand, and siltstone.

The Troutdale sandstone aquifer is most extensive in the southeastern part of the basin and crops out along streams in that area. Streams near the towns of Troutdale, Sandy, and Boring, Oregon cut through the aquifer, and in some areas significant seepage occurs from the aquifer to the streams. The aquifer also crops out just north of the City of Camas, in Clark County, Washington. The altitude of the top and thickness of the Troutdale sandstone aquifer are shown in plate 6.

The altitude of the top of the aquifer is about 1,000 feet in the area east of the Sandy River and dips westward to an altitude of about minus 400 feet just a few miles east of downtown Portland. The contours on the top of the unit show structure and erosional features similar to those described for confining unit 2.

The thickness of the Troutdale sandstone aquifer is generally from 100 to 200 feet but may reach 400 feet in the southeastern part of the basin. The thickest part of the aquifer is east of the Sandy River, close to the source area for the sediments that comprise the unit. The aquifer is generally thinner to the west and northwest and interfingers with undifferentiated fine-grained sediments near the center of the basin (pl. 2).

Sandstones and conglomerates of the Troutdale sandstone aquifer are excellent water-bearing units just west of the mouth of the Columbia River Gorge and, to a lesser degree, in the Damascus and Boring, Oregon areas. Large-capacity wells in the Portland well field have been tested at up to 2,500 gallons per minute. Other smaller-capacity municipal, industrial, and irrigation wells open to the Troutdale sandstone aquifer may yield more than 500 gallons per minute.

Confining Unit 1

Confining unit 1 (pls. 2 and 7) is the uppermost unit in the lower sedimentary subsystem. The contact between this unit and the overlying consolidated gravel aquifer is recognizable throughout the basin where adequate well data or outcrop data are available. Confining unit 1 consists of medium-to-fine grained arkosic sand, silt, and clay, with some vitric sand beds. A comparison of plate 7 with maps of the top of the Sandy River Mudstone (Trimble, 1963, p. 29) and the top of the lower member of the Troutdale Formation (Mundorff, 1964, p. 29) suggests that the top of confining unit 1 is the unit mapped by previous workers.

Confining unit 1 is defined as an individual unit only where the Troutdale sandstone aquifer is present. Outside that area, the unit is part of a thick sequence of undifferentiated fine-grained sediments from the top of the confining unit to the top of the older rocks. The confining unit does not exist in all areas where the Troutdale sandstone aquifer is present and, therefore, the aquifer may be in direct contact with overlying aquifers in some areas of the basin.

The altitude of the top of confining unit 1 is about 900 feet in the area south of the City of Sandy and generally dips toward the center of the basin to an altitude of about minus 300 feet. The structural trends in the top of the unit are similar to those in the previously described units.

Confining unit 1 is generally less than 200 feet thick, but is more than 260 feet thick in well 3N/2E-30bbd. In the Portland well field area, the updip edge of the confining unit has been eroded by the Columbia River.

Although confining unit 1 is generally a poor water-bearing unit, local sand lenses may provide adequate water for domestic uses. The unit is not used as a source of water throughout most of the basin.

Undifferentiated Fine-grained Sediments

The undifferentiated fine-grained sediments are mapped where aquifers in the lower sedimentary subsystem are not present or well information is insufficient to map them (pls. 2 and 8). Where the unit is mapped, it generally overlies the older rocks and underlies the consolidated gravel aquifer. These fine-grained sediments are lithologically similar to confining unit 1 and confining unit 2. The unit may include some sedimentary rocks older than Mundorff's (1964) lower member of the Troutdale Formation in northern Clark County.

The fine-grained unit is most extensive in the northwestern part of the basin, whereas individually mapped aquifers and confining units in the lower sedimentary subsystem generally exist in the southeastern part of the basin (pls. 4-7). The altitude of the top and the thickness of the undifferentiated fine-grained sediments are shown on plate 8.

Altitude of the top of the undifferentiated fine-grained unit is highest in the southeastern basin, east of Sandy, Oregon. In that area, the altitude of the top of the unit is about 1,200 feet. The altitude of the top of the unit is also relatively high in the Mount Norway area northeast of Washougal, Washington where it is about 700 feet. The top of the unit generally dips toward the center of the basin to an altitude of about minus 300 feet.

Thickness of the unit exceeds 1,200 feet in the central part of the basin. Elsewhere, the unit generally thins outward from the basin center toward the older rocks/basin-fill contact.

The unit is generally a poor water-bearing formation. However, in northern Clark County it is an important local source of water. Where the unit contains extensive sand beds, its capacity to yield water may be equivalent to that of the sand and gravel aquifer.

Upper Sedimentary Subsystem

The upper sedimentary subsystem overlies the lower sedimentary subsystem throughout most of the basin. It is composed of consolidated gravel of the Troutdale Formation and Cascade Range derived volcaniclastic conglomerate, but also locally includes thick deposits of

Pliocene and Quaternary High Cascade volcanics and Boring Lava. The consolidated gravel and volcanic rock are grouped into a consolidated gravel aquifer, and the late Pleistocene sediments and alluvium are grouped into an unconsolidated sedimentary aquifer.

Troutdale Gravel Aquifer

The consolidated gravel aquifer (pls. 2 and 9) generally overlies confining unit 1 or the undifferentiated sedimentary rock aquifer and underlies the unconsolidated sedimentary aquifer. The contact between this unit and confining unit 1 marks a distinct change in depositional environment in the basin.

The consolidated gravel aquifer is composed of several geologic formations of poorly- to moderately-cemented conglomerate and sandy conglomerate, but also includes thick local accumulations of lavas and a mantling soil horizon. The conglomerate part of the aquifer extends basin wide and includes the upper member of the Troutdale Formation of Trimble (1963) and Mundorff (1964); Cascade Range derived volcaniclastic conglomerate chiefly mapped as Springwater Formation, Walters Hill Formation, and Gresham Formation by Trimble (1963); and the informal upper member of the Troutdale Formation of Mundorff (1964). Within the basin, local accumulations of Boring Lava underlie, interlayer, and overlie the Cascade Range derived volcaniclastic conglomerate and are included in the consolidated gravel aquifer. East of the Sandy River an eastward-thickening sheet of Cascade Volcanic lavas also is included in the consolidated gravel aquifer. In many areas, the upper part of the consolidated gravel aquifer is weathered to a thick clayey soil. In upland areas above an altitude of 300 feet, the weathered upper part may be up to 100 feet thick. Weathered loess deposits of clay and silt also occur in the upper part of the consolidated gravel aquifer and may be 10 to 20 feet thick.

Troutdale Formation conglomerate derived from the ancestral Columbia-River- and the Cascade-Range-derived volcanic conglomerate and sandstone are the primary sedimentary rocks of the consolidated gravel aquifer. The ancestral Columbia River gravel is quartzite bearing and is found throughout the basin, but is thickest in the center of the basin. The conglomerate derived from the Cascade Range volcaniclastics usually overlies conglomerate derived from the Columbia River and extends farther east into the Cascade Range than does the Columbia River conglomerate.

Conglomerate derived from the ancestral Columbia River consists of pebble and cobble gravel with some boulder-size clasts and a matrix of primarily medium-grained micaceous arkosic sand with varying amounts of coarse-to-granule-sized lithic clasts. Gravel clasts are predominately basalt (derived from Columbia River Basalt Group) with a wide variety of lithologies reflecting the diversity of rock types in the Columbia River drainage basin. Gravel lenses composed of pebbles and small cobbles usually contain a higher percentage of exotic clasts, which are predominately quartzite. Lenses of sand, silt, and clay are common in the lower part of the unit where the gravels grade into underlying sand and silt beds that are included in the lower sedimentary subsystem.

Conglomerate derived from the Cascade Range and sandstone form a continuous unit in the southern part of the study area, extending from the Clackamas River to northeast Portland. They underlie the gently rolling slope from Eagle Creek and the Clackamas River northwest to Gresham and Troutdale, where Trimble (1963) mapped them as Springwater and Gresham Formations. The conglomerate underlies, interlayers, and overlies Boring Lava flows and pyroclastic deposits in the Boring Lava vent areas southeast of Portland. In Clark County, Washington, unnamed hills between Salmon Creek and Ridgefield, a bench along the east and northern margin of the Portland Basin from 400 to 600 feet in altitude, and Mount Norway are at least partly underlain by weathered volcaniclastic conglomerates with felsic lithic sand matrix. However, it is uncertain if the Clark County gravels are directly equivalent to those exposed in the Clackamas River drainage.

Boring Lava and vent rocks are included in the consolidated gravel aquifer. Boring Lava is dark-gray to light-gray, and commonly forms columnar and platy joints. Some flows are similar in appearance to Columbia River Basalt Group rocks but often they can be distinguished by their coarser or less dense texture. These rocks are most extensive in Oregon, east of Portland near the City of Boring. Boring Lava also exists locally in Clark County at Prune Hill, at Mount Norway, Bear Prairie, Green Mountain, and Battle Ground Lake. In many areas of the basin, Boring Lava caps hills and may not be saturated; however, one exception is in the Mount Norway area, where the Boring Lava supplies sufficient water to domestic wells. Boring Lava vents intrude basin-fill sediments and may influence ground-water flow where they are present.

The consolidated gravel aquifer crops out extensively in the eastern and southern parts of the basin, with less extensive outcrops in the central and western basin (pl. 1). The altitude of the top of the unit is more than 1,400 feet where Cascade volcanics are included east of the Sandy River in Oregon. Throughout most of the basin, however, the top of the unit is between altitudes of 100 and 200 feet (pl. 9). Where the unit has been eroded by the Willamette and Columbia Rivers, the altitude of the top of the unit is about minus 200 feet. In the Portland well field area, results of test drilling indicated a former channel of the Columbia River that cuts through the consolidated gravel aquifer (McFarland and others, 1982).

The consolidated gravel aquifer is generally thickest where the Boring Lava or the Cascade volcanics are included in the unit. These areas are generally in the southern and southeastern parts of the basin (pl. 9) where unit is more than 800 feet thick. Throughout much of the basin, however, the aquifer varies from 100 feet to 400 feet thick.

The Sandy River, Little Sandy River, Bull Run River, and much of the Clackamas and East Fork Lewis Rivers have cut completely through the consolidated gravel aquifer, exposing underlying units along their canyon walls. The Columbia River has eroded the consolidated gravel aquifer from the east boundary of the study area to the vicinity of Rocky Butte and then from about 2 miles north of the confluence of the Willamette and Columbia Rivers to the northern boundary of the study area.

The consolidated gravel aquifer is an important and productive source of ground water in the Portland Basin. Many public supply, industrial, and domestic wells in the basin are completed in this aquifer. Most wells will yield a minimum of 50 gallons per minute and, if they are carefully designed, can yield more than 1,000 gallons per minute.

Unconsolidated Sedimentary Aquifer

The unconsolidated sedimentary aquifer (pls. 2 and 10) is the uppermost hydrogeologic unit in the Portland Basin. The aquifer consists mostly of catastrophic flood deposits of late Pleistocene age mantling the central part of the basin and Holocene Columbia River alluvium. The aquifer also includes water-bearing alluvial deposits that exists along smaller streams in the basin. Additionally, the aquifer includes flood-plain deposits, terrace deposits along major tributaries, and glacial outwash in small basins in northern Clark County.

The bottom of the unconsolidated sedimentary aquifer was mapped principally using data from drillers' reports and outcrop contacts. In drillers' reports, the base of the unconsolidated sedimentary aquifer can most commonly be identified by the transition to the underlying conglomerate or weathered gravel of the consolidated gravel aquifer. Most drillers note the transition as the presence of cemented or clayey gravels. Although the lithology of the aquifer varies from bouldery gravel to silt, it can usually be recognized in outcrop by a lack of weathering beneath the oxidized upper 6 feet and the limited cementation between grains.

The extent and thickness of the unconsolidated sedimentary aquifer are shown on plate 10. The aquifer is thickest under the Columbia River flood plain at Sauvie Island and adjacent areas in Clark County, Washington. A survey of drillers' reports in that area indicate that, except for a few wells along the west edge of the study area, all wells were completed in unconsolidated sand and sandy gravel. The deepest wells on Sauvie Island are from 250 to 300 feet deep. Elsewhere in the basin, the aquifer is usually between 50 and 100 feet thick with local accumulations of catastrophic flood deposits more than 250 feet. Locally, stream alluvium and low terrace deposits are usually from 20 to 60 feet thick. Unconsolidated glacial outwash deposits underlying Chelatchie Prairie and the Yacolt Basin in Washington are up to 200 feet and approximately 100 feet thick, respectively. Because the unconsolidated sedimentary aquifer occurs at land surface throughout the basin, top-of-unit contours are not shown on plate 10.

In some parts of the basin, deposits mapped as the unconsolidated sedimentary aquifer are unsaturated; otherwise, the unit consists of alluvium or coarse-grained catastrophic flood deposits, and it is the most productive aquifer in the Portland Basin. Mundorff (1964) described a major alluvial aquifer adjacent to the Columbia River near Washougal, Camas, and Vancouver, Washington. In those areas public-supply and industrial wells generally yield from 1,000 to 6,000 gallons per minute with less than 10 feet of drawdown. The City of Portland has developed wells in similar deposits in Oregon just north of Blue Lake for municipal water supply. In that area, public-supply wells have been tested at rates of up to 10,000 gallons per minute with less than 25 feet of drawdown.

Similar, highly productive, coarse-grained catastrophic flood deposits in the unconsolidated sedimentary aquifer that have not yet been developed may also be present beneath Sauvie Island. Wells completed in finer-grained catastrophic flood deposits typically yield up to 150 gallons per minute (Mundorff, 1964).

The unconsolidated sedimentary aquifer is less productive in other areas of the basin, but nonetheless, is an important water-bearing unit. In Chelatchie Prairie and the Yacolt Basin in northern Clark County, wells completed in fluvial and glacial outwash gravels yield up to 600 gallons per minute. Along the Clackamas, Sandy, East Fork of Lewis, and Lewis Rivers, wells in poorly consolidated terrace gravels yield from 10 to 40 gallons per minute. Holocene alluvium underlying the Columbia River and Willamette River flood plains are principally clayey silt and sand that yield from 5 to 40 gallons per minute. Coarser-grained deposits can yield 100 to 200 gallons per minute.

SUMMARY

Eight major hydrogeologic units were mapped in the Portland Basin using data from water, cathodic protection, geothermal, and oil and gas wells. Borehole samples, geophysical logs, and surficial geologic mapping also were used to assist mapping the units. From oldest to youngest these units are: (1) older rocks, (2) sand and gravel aquifer, (3) confining unit 2, (4) Troutdale sandstone aquifer, (5) confining unit 1, (6) consolidated gravel aquifer, (7) unconsolidated sedimentary rock aquifer, and (8) an undifferentiated fine-grained unit that is lithologically similar to the confining units.

The older rocks unit includes generally low permeability, Miocene and older volcanic and marine sedimentary rock that underlie and bound the basin-filling sediments. The altitude of the top of the unit ranges from land surface in the exposed areas to minus 1,600 feet beneath Vancouver, Washington.

The sand and gravel aquifer consists principally of sandy gravel, silty sand, sand, and clay. The altitude of the top of the unit ranges from about 700 feet in the Prune Hill area to minus 600 feet northwest of Gresham. The maximum thickness of this unit is about 800 feet and well yields are as large as 3,000 gallons per minute in some areas.

Confining unit 2 is a grayish olive-green clay and silt with lenses of silt and fine-to-medium-grained sand. The altitude of the top of the unit ranges from about 900 feet in the Tickle Creek area to about minus 500 feet toward the center of the basin. The thickness of the unit ranges from about 200 feet in the southeastern part of the basin to about 800 feet toward the center of the basin.

The Troutdale sandstone aquifer consists of coarse sandstone and conglomerate with lenses and beds of fine-to-medium sand and silt. The altitude of the top of the aquifer is about 1,000 feet in the area east of the Sandy River and dips westward to about minus 400 feet near downtown Portland. The thickness of the aquifer ranges from 100 to 200 feet but is about 400 feet in the southeastern part of the basin. Wells completed in this unit yield up to 2,500 gallons per minute.

Confining unit 1 is lithologically similar to confining unit 2. The altitude of the unit ranges from about 900 feet in the area south of the City of Sandy to about minus 300 feet near the center of the basin. The thickness is generally less than about 200 feet.

The undifferentiated fine-grained sediments are lithologically similar to confining units 1 and 2. This unit includes all the sediments overlying the older rocks and underlying the consolidated gravel aquifer wherever individual units can not be discerned either because the individual units are not present or because information is insufficient to map them. Altitude of top of the unit ranges from about 1,200 feet east of Sandy, Oregon to minus 300 feet near the center of the basin, where its thickness is about 1,200. The unit is generally a poor water-bearing formation.

The consolidated gravel aquifer is composed of a poorly- to moderately-cemented sandy conglomerate and includes local accumulations of lavas and a mantling soil horizon. The altitude of the top of the unit is about 1,400 feet east of the Sandy River; however, the top of the unit is between altitudes of 100 and 200 feet throughout most of the basin, and its thickness ranges from 100 to 400 feet in most of the area. Wells completed in this unit can yield about 1,000 gallons per minute.

The unconsolidated sedimentary aquifer is consists primarily of flood deposits of late Pleistocene age varying from bouldery gravel to silt. It includes flood plain and terrace deposits along major tributaries, and glacial outwash in some areas. The top of the unit is land surface, and its thickness is mostly between 50 and 100 feet. Local deposits range from 150 to 300 feet thick near Sauvie Island. Well completed in these deposits have maximum yields between 1,000 and 6,000 gallons per minute near Washougal, Camas, and Vancouver, Washington, and up to 10,000 gallons per minute north of Blue Lake in Oregon.

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ALTITUDE OF TOP OF HYDROGEOLOGIC UNITS FOR SELECTED WELLS

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
7037	01N/01E-02BCD	20	-132	--	--	--	--	--	--
7036	01N/01E-02DAB	12	--	--	--	--	--	--	--
7034	01N/01E-02DBC1	10	--	--	--	--	--	--	--
7035	01N/01E-02DBC2	10	--	--	--	--	--	--	--
5935	01N/01E-03BBDD	20	-160	--	--	--	--	--	--
7038	01N/01E-03BCC1	5	-163	--	--	--	--	--	--
7039	01N/01E-03DBD1	10	--	--	--	--	--	--	--
7040	01N/01E-04BAA	13	--	--	--	--	--	--	--
7041	01N/01E-05CBA	25	--	--	--	--	--	--	--
7043	01N/01E-05DCB1	20	-79	--	--	--	--	--	--
7044	01N/01E-05DCB2	20	-67	--	--	--	--	--	--
900292	01N/01E-05DDB1	15	--	--	--	--	--	--	--
7045	01N/01E-05DDB2	15	--	--	--	--	--	--	--
7079	01N/01E-06ACB1	20	--	--	--	--	--	--	--
900334	01N/01E-07BBCA	138	-24	--	--	--	--	-235	--
7046	01N/01E-07BDB1	143	-74	--	--	--	--	--	--
900335	01N/01E-07CBDA	150	-74	--	--	--	--	-208	--
900290	01N/01E-07CCA1	38	-67	--	--	--	--	--	--
7048	01N/01E-07CCA2	38	--	--	--	--	--	--	--
7050	01N/01E-09ABC1	35	--	--	--	--	--	--	--
900294	01N/01E-09ABC2	32	--	--	--	--	--	--	--
900293	01N/01E-09ACC	42	--	--	--	--	--	--	--
900295	01N/01E-09ACD1	45	--	--	--	--	--	--	--
900296	01N/01E-09ACD2	49	-24	--	--	--	--	--	--
7049	01N/01E-09BAB1	30	--	--	--	--	--	--	--
900297	01N/01E-09BBA	31	-47	--	--	--	--	--	--
900298	01N/01E-10AAB1	15	--	--	--	--	--	--	--
900299	01N/01E-10DDB1	48	--	--	--	--	--	--	--
5943	01N/01E-11CCA	48	--	--	--	--	--	--	--
900302	01N/01E-11DAC1	15	-103	--	--	--	--	-292	--
900291	01N/01E-12CBB	10	-131	--	--	--	--	--	--
900336	01N/01E-13ACBC	68	40	--	--	--	--	-142	--
7052	01N/01E-13DDD1	145	60	--	--	--	--	-127	--
7051	01N/01E-13DDD2	151	51	--	--	--	--	--	--
7053	01N/01E-17CAD1	22	--	--	--	--	--	--	--
900338	01N/01E-17DDBC	18	-107	--	--	--	--	-280	--
7054	01N/01E-18ADB1	172	-64	--	--	--	--	--	--
900339	01N/01E-18CCAD	35	--	--	--	--	--	--	-53
900340	01N/01E-19ACBA	35	--	--	--	--	--	--	-30
7055	01N/01E-21CAB1	22	-105	--	--	--	--	--	--
5957	01N/01E-22BDAA	208	-52	--	--	--	--	--	--
7056	01N/01E-23BBB1	203	-3	--	--	--	--	--	--
900341	01N/01E-27ACDC	167	-38	--	--	--	--	--	-93
900676	01N/01E-28CAB1	32	-163	--	--	--	--	--	-258
5963	01N/01E-29AAB	30	-177	--	--	--	--	--	-213
900081	01N/01E-29ABA	35	--	--	--	--	--	--	-160
900310	01N/01E-33CDA	125	9	--	--	--	--	--	-103
5994	01N/01E-34ABC1	70	40	--	--	--	--	--	--
5978	01N/01E-34ADDD	75	-5	--	--	--	--	-295	--
5977	01N/01E-34CAAD	38	-27	--	--	--	--	-292	-412
900088	01N/01E-34CC	38	-14	--	--	--	--	-125	-332
5990	01N/01E-34CCAB	49	16	--	--	--	--	-134	-302
5975	01N/01E-34CCB	60	-3	--	--	--	--	-155	-182
5985	01N/01E-34CCBC	60	-15	--	--	--	--	-193	-325
5987	01N/01E-34CCDA1	38	-14	--	--	--	--	-102	--
900089	01N/01E-34CCDA3	38	-17	--	--	--	--	-124	--
5989	01N/01E-34CCDD1	37	-38	--	--	--	--	--	--
900094	01N/01E-34CDCB	38	-22	--	--	--	--	--	--
7059	01N/01E-35ADC	138	17	--	--	--	--	-68	--
7057	01N/01E-35BAC1	133	-3	--	--	--	--	--	--
7060	01N/01E-35BAC2	133	-1	--	--	--	--	--	--
900304	01N/01E-35CAB	112	-9	--	--	--	--	--	--
7058	01N/01E-35DBA	130	13	--	--	--	--	--	--
900312	01N/01E-36ADC2	220	46	--	--	--	--	--	--
900305	01N/01E-36ADCD1	215	75	--	--	--	-505	-190	-1085
5999	01N/01E-36BCBD	150	65	--	--	--	--	-50	--
900353	01N/01W-01BCCC	105	-37	--	--	--	--	-174	--
6108	01N/01W-12CDCD	26	--	--	--	--	--	--	-24
900100	01N/02E-01DBB1	257	179	--	--	--	--	--	--
900101	01N/02E-02DAC	160	125	-69	--	--	--	--	--
900102	01N/02E-03AAB	211	170	--	--	--	--	--	--
900103	01N/02E-03ACD	--	55	-73	--	--	--	--	--
900104	01N/02E-04ABC	--	90	--	--	--	--	--	--
900404	01N/02E-05CDA	15	-88	-135	--	--	--	--	--
900275	01N/02E-09DBDB1	19	-116	-186	-283	-390	--	--	--
900280	01N/02E-09DDDC1	31	-156	-179	--	--	--	--	--
900105	01N/02E-11AAA	--	75	-72	--	--	--	--	--
500058	01N/02E-12AAC	145	96	--	--	--	--	--	--
6165	01N/02E-13CDCC1	20	-37	-154	-259	-349	-449	--	--
6166	01N/02E-13CDCC1	20	-38	-154	-240	-348	-448	--	--
6164	01N/02E-13CDCC2	20	-37	-154	-259	-349	-449	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
900056	01N/02E-14CCCD	20	-63	-188	-310	--	--	--	--
6170	01N/02E-14DDDB2	20	-50	-144	-267	-382	-456	--	--
6175	01N/02E-15BADD2	23	--	-205	--	--	--	--	--
900276	01N/02E-15BADD4	24	--	-200	-321	-377	-440	--	--
6179	01N/02E-15BBAC1	22	-267	-301	-339	--	--	--	--
6180	01N/02E-15BCAC1	25	--	-298	--	--	--	--	--
900281	01N/02E-15CAAC1	16	-60	--	--	--	--	--	--
6182	01N/02E-15CBAA1	16	-60	-214	-322	-421	--	--	--
900283	01N/02E-15CBAC1	17	-155	-205	-316	-403	-466	--	--
6181	01N/02E-15CBAC3	17	-56	-211	--	--	--	--	--
6184	01N/02E-15CDAA1	22	-10	-228	-315	-420	--	--	--
6174	01N/02E-15DAAA1	23	-201	-208	-290	-392	--	--	--
6172	01N/02E-15DAAA2	22	--	-239	--	--	--	--	--
6173	01N/02E-15DAAD1	22	--	-211	-296	-393	--	--	--
900277	01N/02E-15DBCB1	20	-35	-207	-315	--	--	--	--
900284	01N/02E-15DBDB1	22	-40	--	--	--	--	--	--
6185	01N/02E-16ABAC1	23	-177	-185	-311	--	--	--	--
6186	01N/02E-16ACAC1	7	--	-243	-294	-388	--	--	--
6187	01N/02E-16ADBC1	15	--	-286	-330	-373	--	--	--
500205	01N/02E-17CAD1	65	--	--	--	--	--	--	--
500204	01N/02E-17CAD2	60	--	--	--	--	--	--	--
6190	01N/02E-17DAA	21	--	--	--	--	--	--	--
500206	01N/02E-20AAB	20	--	--	--	--	--	--	--
900057	01N/02E-20DAAD	157	127	--	--	--	--	--	--
900058	01N/02E-21BBCC	114	49	--	--	--	--	--	--
900285	01N/02E-21CCCD1	239	206	-348	--	--	--	--	--
500207	01N/02E-22CDA	148	--	--	--	--	--	--	--
500212	01N/02E-23AACB1	20	-14	-136	-220	-328	--	--	--
500208	01N/02E-23BCB1	30	-30	--	--	--	--	--	--
500209	01N/02E-23BCB2	28	--	--	--	--	--	--	--
500210	01N/02E-23BCC	31	-34	--	--	--	--	--	--
500211	01N/02E-23BCDB1	35	-21	--	--	--	--	--	--
6194	01N/02E-24AABC2	25	-29	-89	-199	-310	-387	--	--
6199	01N/02E-24AABC2	25	-29	-89	-199	-310	-387	--	--
6198	01N/02E-24AACC1	25	-26	-107	-193	-316	-390	--	--
6205	01N/02E-24ADCB1	17	4	-88	-203	-303	--	--	--
6206	01N/02E-24BDBD2	15	-27	-133	-225	-355	--	--	--
6213	01N/02E-24CACA1	39	29	-127	-227	-362	-394	--	--
6214	01N/02E-24CACA2	39	-32	-128	-229	-362	-393	--	--
900286	01N/02E-24DABB1	18	-34	-81	-228	-321	-346	--	--
6204	01N/02E-24DB	17	11	-113	-208	-318	-390	--	--
500213	01N/02E-25ABD	145	118	--	--	--	--	--	--
900059	01N/02E-25BABA	95	68	-170	-200	--	--	--	--
500214	01N/02E-25CBCC1	251	185	-159	--	--	--	--	--
500218	01N/02E-26CBA	272	226	-140	--	--	--	--	--
500215	01N/02E-26CBC	245	190	-125	--	--	--	--	--
500216	01N/02E-26DDB	255	212	--	--	--	--	--	--
500217	01N/02E-26DDD1	258	198	-182	--	--	--	--	--
500219	01N/02E-27BBA	210	-28	--	--	--	--	--	--
900288	01N/02E-27DCCC1	292	116	-256	-281	-364	-395	--	--
500221	01N/02E-29CAA	--	180	--	--	--	--	--	--
500222	01N/02E-29CAB	182	150	--	--	--	--	--	--
900289	01N/02E-29DABD1	204	130	-321	-387	-458	-482	--	--
500220	01N/02E-29DBA	204	129	--	--	--	--	--	--
900060	01N/02E-29DCBC	225	120	--	--	--	--	--	--
500223	01N/02E-31BDB	210	160	--	--	--	--	--	--
500224	01N/02E-32BCD	240	180	--	--	--	--	--	--
900061	01N/02E-33ABCB	240	-20	--	--	--	--	--	--
500226	01N/02E-33DAA	294	104	--	--	--	--	--	--
500225	01N/02E-33DAB	292	105	--	--	--	--	--	--
500227	01N/02E-34ABD1	291	162	--	--	--	--	--	--
500228	01N/02E-34ABD2	288	178	--	--	--	--	--	--
900062	01N/02E-34DCC	283	105	--	--	--	--	--	--
900063	01N/02E-35ABBB	283	213	--	--	--	--	--	--
6229	01N/02E-35ACC2	298	272	-189	--	--	--	--	--
500229	01N/02E-35CDD	305	263	--	--	--	--	--	--
500035	01N/03E-01BAB	--	--	--	--	--	--	--	356
500061	01N/03E-02BACA	--	--	--	185	55	--	--	-15
500036	01N/03E-03AAD	--	--	--	230	--	--	--	102
500038	01N/03E-04AAA	--	380	272	238	143	--	--	--
500039	01N/03E-04ABD	--	415	290	240	118	--	--	29
900480	01N/03E-04BAB1	295	265	--	147	27	8	--	--
500040	01N/03E-06CDC	228	88	--	--	--	--	--	--
500041	01N/03E-06DCCC1	235	189	-40	-119	-245	--	--	--
500042	01N/03E-07ACA	--	210	-3	--	--	--	--	--
500043	01N/03E-08ABC	--	435	--	--	--	--	--	--
11600	01N/03E-08ACC	--	280	--	--	--	--	--	--
500044	01N/03E-08DBAD1	--	200	--	--	--	--	--	--
500037	01N/03E-10BAA	--	615	--	578	482	435	--	--
900723	01N/03E-11DAA01	13	--	--	--	--	--	--	--
900721	01N/03E-11DAB01	13	--	--	-42	--	--	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
900722	01N/03E-11DAB02	15	--	--	--	--	--	--	--
900724	01N/03E-11DAB03	13	--	--	--	--	--	--	--
900725	01N/03E-11DAB04	13	--	--	--	--	--	--	--
900707	01N/03E-11DAC01	48	--	--	--	--	--	--	-80
900708	01N/03E-11DAC02	48	--	--	--	--	--	--	--
900709	01N/03E-11DAC03	48	--	--	--	--	--	--	--
900710	01N/03E-11DAC04	46	--	--	--	--	--	--	-76
900711	01N/03E-11DAC05	49	--	--	--	--	--	--	-66
900712	01N/03E-11DAC06	50	--	--	--	--	--	--	--
900713	01N/03E-11DAC07	38	--	--	--	--	--	--	--
900714	01N/03E-11DAC08	16	--	--	--	--	--	--	--
900715	01N/03E-11DAC09	35	--	--	--	--	--	--	-85
900716	01N/03E-11DAC10	29	--	--	--	--	--	--	-83
900717	01N/03E-11DAC11	16	--	--	--	--	--	--	--
900718	01N/03E-11DAC12	16	--	--	--	--	--	--	--
900719	01N/03E-11DAD01	15	--	--	--	--	--	--	--
900394	01N/03E-12BCB1	52	--	--	--	--	--	--	--
11602	01N/03E-12CAB1	33	--	--	--	--	--	--	-48
11601	01N/03E-12CAB2	34	--	--	--	--	--	--	-48
11603	01N/03E-12CAD1	50	--	--	--	--	--	--	-30
900395	01N/03E-12CBA3	45	-25	--	--	--	--	--	--
11604	01N/03E-12CDA1	38	--	--	--	--	--	--	--
900391	01N/03E-12DBD1	50	--	--	--	--	--	--	--
900392	01N/03E-12DBD2	50	--	--	--	--	-44	--	--
900393	01N/03E-12DBD3	50	--	--	--	--	-49	--	--
11598	01N/03E-12DBD4	50	--	--	--	--	--	--	--
500060	01N/03E-12DCB	45	--	--	--	--	-70	--	-210
900196	01N/03E-19ADBB1	25	-3	-70	-140	-253	--	--	--
6236	01N/03E-19ADBB2	24	-31	-81	-145	-265	--	--	--
6237	01N/03E-19BACD1	23	-43	-87	-159	-272	-327	--	--
6238	01N/03E-19BACD2	23	-46	-87	-159	-272	-327	--	--
6244	01N/03E-19BBCB1	24	-24	-96	-190	-287	--	--	--
6239	01N/03E-19BBCB2	18	--	-102	-196	-293	--	--	--
6234	01N/03E-19BDDC1	24	6	-71	-166	-278	-343	--	--
6233	01N/03E-19BDDC2	24	-31	-97	-191	-279	-347	--	--
6240	01N/03E-19CBBA1	17	5	-87	-181	-311	--	--	--
6241	01N/03E-19CBBA2	17	5	-87	-217	-311	--	--	--
6243	01N/03E-19CBBA3	17	5	-87	-217	-311	--	--	--
900193	01N/03E-20ADCB1	23	--	--	--	--	-109	-62	--
6245	01N/03E-20ADCB2	22	--	--	--	--	-101	-54	--
6251	01N/03E-20BDBB1	26	--	-29	-40	-150	-212	--	--
6259	01N/03E-20BDBB2	26	--	-24	-39	-147	-212	--	--
500059	01N/03E-20CBDC1	20	-27	-67	-120	-252	-312	--	--
6254	01N/03E-20CC1	15	-5	-95	-168	-275	-344	--	--
6252	01N/03E-20CCAB1	25	-30	-59	-125	-253	-314	--	--
900195	01N/03E-20CCAB3	20	-36	-70	-115	-254	-312	--	--
6255	01N/03E-20CCCD2	18	-2	-85	-160	-271	-332	--	--
6265	01N/03E-21ACBB1	25	--	--	--	--	--	--	--
900259	01N/03E-21ACC	16	--	--	--	--	--	--	--
6270	01N/03E-21ACCA2	16	--	--	--	--	--	--	--
900260	01N/03E-21ADAA1	25	--	--	--	--	--	--	--
6262	01N/03E-21ADBC2	17	--	--	--	--	--	--	--
900261	01N/03E-21ADDC1	19	--	--	--	--	--	--	--
6272	01N/03E-21BCBC1	27	--	--	--	--	-189	-93	--
6263	01N/03E-21BCBC2	6	--	--	--	--	--	-92	--
6271	01N/03E-21BDBA1	28	--	--	--	--	-150	-142	--
6264	01N/03E-21BDBA2	28	--	--	--	--	-141	--	--
900263	01N/03E-21BDC	22	--	--	--	--	--	--	--
6273	01N/03E-21CBCD1	--	--	--	21	-84	-164	--	--
900267	01N/03E-21DABB1	21	--	--	--	--	--	--	--
6268	01N/03E-21DBBB1	30	--	--	--	--	-119	--	--
6274	01N/03E-21DBCC2	--	--	--	14	-64	-100	--	--
900460	01N/03E-23ACCA1	26	--	--	--	--	-207	--	--
900461	01N/03E-23ACDA1	28	--	--	--	--	-167	--	--
900467	01N/03E-23ACDC1	28	--	--	--	--	-165	--	--
900468	01N/03E-23ACDC2	28	--	--	--	--	-154	--	--
900469	01N/03E-23ACDD1	28	--	--	--	--	-155	--	--
900462	01N/03E-23ADCA1	28	--	--	--	--	--	--	--
900466	01N/03E-23ADCA2	28	--	--	--	--	-207	--	--
900463	01N/03E-23ADCB1	28	--	--	--	--	-192	--	--
900464	01N/03E-23ADCB2	28	--	--	--	--	-177	--	--
900465	01N/03E-23ADCD1	28	--	--	--	--	-187	--	--
6282	01N/03E-23BDCA	22	--	--	--	--	-247	--	--
900459	01N/03E-23BDDA1	25	--	--	--	--	-253	--	--
6284	01N/03E-23CAAD1	20	--	--	--	--	--	--	--
900473	01N/03E-23DABA1	27	--	--	--	--	--	--	--
6283	01N/03E-23DABC1	28	--	--	--	--	-232	--	--
900470	01N/03E-23DBAB1	26	--	--	--	--	-169	--	--
900471	01N/03E-23DBAD1	27	--	--	--	--	--	--	--
900472	01N/03E-23DBAD2	28	--	--	--	--	-164	--	--
500015	01N/03E-25ADCB	48	--	--	--	--	-10	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
500014	01N/03E-25CBC1	135	--	--	126	41	-83	--	--
500016	01N/03E-26BDDA	78	--	--	68	--	--	--	--
500062	01N/03E-27BBCC	20	--	--	11	-189	-202	--	--
500019	01N/03E-27CBAA	110	65	20	-50	-250	--	--	--
500021	01N/03E-27CBB1	120	95	28	-5	--	--	--	--
500020	01N/03E-27CBB2	120	100	37	-5	-240	-380	--	--
500017	01N/03E-27DACC1	133	117	--	23	-137	--	--	--
500027	01N/03E-28ABCD1	51	--	34	-13	--	--	--	--
500028	01N/03E-28BBCC1	--	80	--	50	-229	-237	--	--
500029	01N/03E-28CBAB1	110	--	80	9	--	--	--	--
500022	01N/03E-28DCDD	185	96	-32	-104	--	--	--	--
6321	01N/03E-29AADA	--	--	--	75	--	--	--	--
6325	01N/03E-29DAC1	145	134	98	27	-78	--	--	--
500031	01N/03E-29DCDD1	190	144	68	-4	-193	--	--	--
6256	01N/03E-29DCDD2	195	177	74	-2	-188	-231	--	--
500034	01N/03E-30CCAC1	205	129	-173	-270	-415	--	--	--
500033	01N/03E-30DADD1	184	143	-115	--	--	--	--	--
500073	01N/03E-31CDCD1	253	186	-196	-282	-422	-603	--	--
500063	01N/03E-31DDAB	248	187	-139	--	--	--	--	--
500070	01N/03E-33ADDA1	197	144	-109	-117	-251	-351	--	--
500026	01N/03E-33BBCA1	200	190	-37	-95	--	--	--	--
500018	01N/03E-34AAB	170	87	--	-124	--	--	--	--
500023	01N/03E-34BBDD1	176	150	-75	-100	-200	--	--	--
500024	01N/03E-34CCCC1	325	280	--	--	--	--	--	--
500002	01N/03E-35ACAD1	312	300	--	87	-57	-184	--	--
500013	01N/03E-35BDB	340	289	--	61	-110	--	--	--
500001	01N/03E-35CCD1	357	313	--	73	--	--	--	--
500006	01N/03E-36BBCB1	292	271	95	85	-14	-133	--	--
500004	01N/03E-36CBA1	250	--	--	--	--	--	--	--
500000	01N/03E-36CCA1	225	178	112	72	-44	--	--	--
500003	01N/03E-36CCA2	230	179	117	75	-39	-193	--	--
500005	01N/03E-36DDBB1	--	190	--	154	13	-168	--	--
6568	01N/04E-01AAC	--	1008	--	--	--	--	--	--
900064	01N/04E-01BDD	--	910	--	--	--	--	--	--
6569	01N/04E-02AAA	--	1077	--	--	--	--	--	--
900116	01N/04E-02DDD	--	807	--	--	--	607	623	--
900117	01N/04E-03ACC	--	705	--	--	--	--	--	--
900118	01N/04E-04ACD	--	610	--	--	--	352	383	--
900119	01N/04E-05DAD	--	--	--	--	--	--	--	450
900120	01N/04E-06BAA	--	465	--	--	--	--	331	286
900121	01N/04E-06DDC	--	--	--	--	--	--	--	323
900122	01N/04E-07BAD	70	--	--	--	--	--	--	51
900123	01N/04E-08ABB	205	--	--	--	--	--	--	121
11596	01N/04E-08CAD1	85	--	--	--	--	0	--	--
900390	01N/04E-08DBC1	90	80	--	--	--	--	--	--
11597	01N/04E-08DBC5	85	--	--	--	--	--	--	--
900124	01N/04E-09CCA	102	--	--	--	--	40	--	--
6670	01N/04E-10ABD	--	597	--	--	--	512	--	--
900125	01N/04E-10BDD	--	--	--	--	--	358	--	--
6671	01N/04E-11DCB	--	523	--	--	--	403	--	--
6672	01N/04E-12CBA	--	708	--	--	--	533	--	--
900187	01N/04E-13ABA	--	707	--	--	--	569	--	--
6673	01N/04E-13ABC1	--	562	--	--	--	484	--	--
900107	01N/04E-14DBC	--	500	--	--	--	--	--	--
6674	01N/04E-14DBD	--	495	--	--	--	435	--	--
6675	01N/04E-15AAC	--	420	--	--	--	--	--	--
6676	01N/04E-15ADA	--	--	--	--	--	380	--	--
6677	01N/04E-16BDA	25	--	--	--	--	-29	--	--
6678	01N/04E-17ACD	18	--	--	--	--	--	--	--
6579	01N/04E-24BAA	--	517	--	--	--	427	--	--
7065	01S/01E-01ABC	151	14	--	--	--	--	--	--
7066	01S/01E-01BAA	152	--	--	--	--	--	--	--
7064	01S/01E-01CCD	120	-39	--	--	--	--	--	--
7061	01S/01E-02ABD	111	23	--	--	--	--	--	--
900342	01S/01E-02BCAD	40	-85	--	--	--	--	-240	--
900252	01S/01E-02BCC	52	-71	--	--	--	--	-177	--
6465	01S/01E-03BBAC	58	-25	--	--	--	--	-179	-294
900451	01S/01E-03BBAD	50	-1	--	--	--	--	-165	-329
900083	01S/01E-03BBD	70	-50	--	--	--	--	--	-178
6467	01S/01E-03BCBD	85	2	--	--	--	--	--	-134
6468	01S/01E-03BCBD	80	-4	--	--	--	--	-148	-277
6469	01S/01E-03CBCA	130	41	--	--	--	--	--	-93
900343	01S/01E-03CCAD	118	40	--	--	--	--	-84	--
6474	01S/01E-04AAA1	110	51	--	--	--	--	--	-158
6482	01S/01E-04AAA2	110	48	--	--	--	--	--	--
6477	01S/01E-04ADDD	140	27	--	--	--	--	--	-92
900344	01S/01E-06CDDA	--	775	--	--	--	--	--	595

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Uncon-solidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
900345	01S/01E-11ABAC	55	-45	--	--	--	--	-307	--
7069	01S/01E-11BAB	52	37	--	--	--	--	-246	--
7068	01S/01E-11BBA	51	-7	--	--	--	--	--	--
7070	01S/01E-11BBB	55	12	--	--	--	--	-203	--
7067	01S/01E-11BBD	51	-62	--	--	--	--	--	--
900349	01S/01E-11DCC	140	80	--	--	--	--	-203	--
900346	01S/01E-12ABAD	148	-8	--	--	--	--	--	--
7071	01S/01E-13BDB	115	--	--	--	--	--	--	--
6499	01S/01E-16DCD	--	--	--	--	--	--	--	553
900350	01S/01E-22ADC	25	--	--	--	--	--	--	-70
900348	01S/01E-23BDCC	115	30	--	--	--	--	-185	--
7072	01S/01E-23CCC	79	-13	--	--	--	--	-18	--
7075	01S/01E-24CCC	50	-3	--	--	--	--	--	--
7074	01S/01E-25CBD	50	41	--	--	--	--	-25	-90
500312	01S/01E-25DAC	170	63	--	--	--	--	--	--
500311	01S/01E-25DAD2	168	126	--	--	--	--	--	-208
500313	01S/01E-25DDBA	172	116	--	--	--	--	--	--
500301	01S/01E-25DDDC	183	48	--	--	--	--	--	--
7073	01S/01E-26CAB	35	12	--	--	--	--	--	-52
7062	01S/01E-26CAD	59	--	--	--	--	--	--	33
900351	01S/01E-28AADA	--	--	--	--	--	--	--	445
900352	01S/01E-33DABB	--	370	--	--	--	--	--	281
500314	01S/01E-36ABB	100	39	--	--	--	--	--	--
500316	01S/01E-36ACCD	105	65	--	--	--	--	--	-222
500230	01S/02E-01AAC	251	--	--	--	--	--	--	--
500231	01S/02E-02CAA	289	165	--	--	--	--	--	--
500234	01S/02E-02CDCD	268	176	--	--	--	--	--	--
500232	01S/02E-03BAC	261	87	--	--	--	--	--	--
900486	01S/02E-05CCA	--	315	--	--	--	--	--	--
900485	01S/02E-05DBA	282	191	--	--	--	--	--	--
500235	01S/02E-07AACC	223	115	--	--	--	--	--	--
900477	01S/02E-08ADC	238	97	--	--	--	--	--	--
900487	01S/02E-08DAB	232	67	--	--	--	--	--	--
900488	01S/02E-09DAB	295	262	--	--	--	--	--	--
500233	01S/02E-10BAC	--	485	99	-35	-142	--	--	--
500238	01S/02E-11CAA	228	--	--	--	--	--	--	--
500236	01S/02E-11DAC1	222	--	--	--	--	--	--	--
500237	01S/02E-11DAC2	222	111	--	--	--	--	--	--
500239	01S/02E-11DDC	205	--	--	--	--	--	--	--
500240	01S/02E-12ACB	238	151	--	--	--	--	--	--
900489	01S/02E-12BDD	228	188	--	--	--	--	--	--
900490	01S/02E-12DAA	255	213	--	--	--	--	--	--
500241	01S/02E-13DDB	255	159	--	--	--	--	--	--
500243	01S/02E-14ABC	220	186	--	--	--	--	--	--
500251	01S/02E-14CBCB	211	176	--	--	--	--	--	--
500242	01S/02E-14DDA	255	--	--	--	--	--	--	--
500244	01S/02E-15DBD	211	--	--	--	--	--	--	--
500245	01S/02E-18DCD	249	199	--	--	--	--	--	--
500252	01S/02E-19CCDD	95	38	--	--	--	--	--	--
500246	01S/02E-19CDC1	100	70	--	--	--	--	--	--
500247	01S/02E-19CDC2	100	67	--	--	--	--	-93	--
500248	01S/02E-19CDC3	100	73	--	--	--	--	--	--
900357	01S/02E-21ACC	200	112	--	--	--	--	--	--
500255	01S/02E-21CCA1	195	--	--	--	--	--	--	--
500250	01S/02E-22ABC	235	165	--	--	--	--	--	--
500249	01S/02E-22CCC	--	400	--	--	--	--	--	--
500253	01S/02E-22DDD	--	800	275	137	-30	--	--	--
500254	01S/02E-23DBB	--	400	--	--	--	--	--	--
500257	01S/02E-25ABD	--	545	--	--	--	--	--	--
900366	01S/02E-25BBA	--	730	--	--	--	--	--	--
500258	01S/02E-25DBA	--	745	--	--	--	--	--	--
900371	01S/02E-26DCA1	--	470	--	--	--	--	--	--
500259	01S/02E-27AAB	--	735	96	-26	--	--	--	--
900367	01S/02E-27CCC1	--	625	--	--	--	--	--	--
500260	01S/02E-28BBD	208	150	--	--	--	--	--	--
500261	01S/02E-29BCA1	150	80	--	--	--	--	--	--
500262	01S/02E-29BCA2	151	69	--	--	--	--	--	--
500265	01S/02E-29CDD	215	124	--	--	--	--	--	--
500263	01S/02E-29DCC	190	155	--	--	--	--	--	--
500266	01S/02E-30AAA1	245	192	--	--	--	--	--	--
500267	01S/02E-31CDA1	85	56	--	--	--	--	--	--
500268	01S/02E-31CDA2	85	5	--	--	--	--	--	--
500315	01S/02E-31DAC	155	132	--	--	--	--	--	--
500269	01S/02E-32CAA1	185	151	--	--	--	--	--	--
500270	01S/02E-33DAC1	--	290	--	--	--	--	--	--
900372	01S/02E-33DCB1	--	205	-92	-200	--	--	--	--
500271	01S/02E-34CBB1	--	395	-88	-150	-330	--	--	--
500272	01S/02E-34CDB1	--	375	--	--	--	--	--	--
900437	01S/02E-35DAA1	--	770	--	--	--	--	--	--
500007	01S/03E-01ABC	--	235	137	133	-23	-164	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Uncon-solidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
500064	01S/03E-01BDC	--	280	130	95	-45	--	--	--
500008	01S/03E-01DAC	--	270	--	130	-18	--	--	--
500009	01S/03E-01DBA	--	283	162	132	-24	--	--	--
500012	01S/03E-02CAB	--	318	31	--	--	--	--	--
500025	01S/03E-03CCA	--	310	--	--	--	--	--	--
500065	01S/03E-03DDDD	--	333	--	--	--	--	--	--
500106	01S/03E-04BAB	248	207	--	--	--	--	--	--
500107	01S/03E-04DDA	--	296	--	--	--	--	--	--
500066	01S/03E-04DDCC	--	308	--	--	--	--	--	--
6628	01S/03E-05ADB	255	215	--	--	--	--	--	--
500106	01S/03E-05BDD	255	208	--	--	--	--	--	--
500067	01S/03E-06CCA	245	229	--	--	--	--	--	--
500111	01S/03E-07CBC	275	205	--	--	--	--	--	--
500110	01S/03E-07CCA	288	266	--	--	--	--	--	--
500112	01S/03E-08CCBC	310	295	--	--	--	--	--	--
900491	01S/03E-08DAA	--	325	--	--	--	--	--	--
6634	01S/03E-08DAB1	310	258	--	--	--	--	--	--
500109	01S/03E-09BAD	--	415	--	--	--	--	--	--
900492	01S/03E-09CBA	--	368	-51	--	--	--	--	--
900493	01S/03E-09DBB	--	358	-26	--	--	--	--	--
500113	01S/03E-10CCA	--	355	-12	-210	-342	--	--	--
900494	01S/03E-11CDA	--	395	81	-65	--	--	--	--
500114	01S/03E-11DDB	--	440	149	--	--	--	--	--
500115	01S/03E-12CDD	--	493	211	--	--	--	--	--
900497	01S/03E-13ADA	--	495	234	106	--	--	--	--
900496	01S/03E-13BAC	--	422	158	-23	--	--	--	--
900495	01S/03E-13BBB	--	425	150	19	--	--	--	--
500116	01S/03E-13BDC	--	472	--	--	--	--	--	--
500117	01S/03E-14BAC	--	400	150	--	--	--	--	--
500118	01S/03E-14CBC	--	365	--	--	--	--	--	--
500119	01S/03E-14CCB	--	385	--	--	--	--	--	--
500120	01S/03E-14CCC	--	425	--	--	--	--	--	--
900253	01S/03E-15ACBA	--	322	--	--	--	--	--	--
500122	01S/03E-16CDA	--	595	221	180	--	--	--	--
500121	01S/03E-16DCC	--	820	440	--	--	--	--	--
900254	01S/03E-17AADD	--	311	52	36	--	--	--	--
900251	01S/03E-16BDC	265	261	--	--	--	--	--	--
500123	01S/03E-19CAD	--	345	44	-54	--	--	--	--
500125	01S/03E-20BCD	--	382	--	--	--	--	--	--
6719	01S/03E-20CAD	--	390	--	--	--	--	--	--
500126	01S/03E-21DDC	--	830	--	--	--	--	--	--
500127	01S/03E-22DAB	--	575	161	105	--	--	--	--
6779	01S/03E-23BBB1	--	440	--	--	--	--	--	--
500129	01S/03E-24BBA	--	480	--	--	--	--	--	--
500128	01S/03E-24BCCD	--	442	--	--	--	--	--	--
500130	01S/03E-24BDB	--	475	--	--	--	--	--	--
500131	01S/03E-24DDC	--	435	173	140	--	--	--	--
7521	01S/03E-25ADD	--	586	--	--	--	--	--	--
7587	01S/03E-26ABA	--	411	--	--	--	--	--	--
7565	01S/03E-26ABC	--	611	--	--	--	--	--	--
7569	01S/03E-26CAD	--	530	--	--	--	--	--	--
7562	01S/03E-26CDB	--	490	--	--	--	--	--	--
500133	01S/03E-27CAA	--	650	--	--	--	--	--	--
500132	01S/03E-27DDC	--	460	180	--	--	--	--	--
500134	01S/03E-28ACDA	--	825	--	--	--	--	--	--
500135	01S/03E-28ACDC	--	770	--	--	--	--	--	--
9407	01S/03E-29ADB1	--	890	--	--	--	--	--	--
900373	01S/03E-29BDD	--	548	--	--	--	--	--	--
9427	01S/03E-29DAD1	--	620	--	--	--	--	--	--
500136	01S/03E-30BAB	--	392	--	--	--	--	--	--
900374	01S/03E-31CCA	--	365	65	5	--	--	--	--
900378	01S/03E-32ACB	--	776	428	--	--	--	--	--
500140	01S/03E-32DAC	--	415	105	--	--	--	--	--
500139	01S/03E-33DCA	--	600	356	295	--	--	--	--
500138	01S/03E-33DDA	--	628	363	338	--	--	--	--
900726	01S/03E-34ABC	--	490	--	--	--	--	--	--
500137	01S/03E-34BDD	--	552	340	282	--	--	--	--
7650	01S/03E-35BAD	--	530	--	--	--	--	--	--
8132	01S/03E-36ABA	--	572	--	--	--	--	--	--
7677	01S/03E-36BDB	--	620	--	--	--	--	--	--
7695	01S/03E-36DBB	--	535	--	--	--	--	--	--
900358	01S/04E-01BDA	--	--	--	570	520	--	--	307
10769	01S/04E-05CCD	--	448	--	318	161	48	--	--
10770	01S/04E-06DCB	--	295	--	237	58	--	--	--
10771	01S/04E-07ADA	--	364	278	214	72	41	--	--
7077	01S/04E-07BCD	--	375	--	204	--	--	--	--
7076	01S/04E-07DBC	--	388	--	267	--	--	--	--
10772	01S/04E-09CBC	--	650	--	362	162	92	--	--
10773	01S/04E-10BAC2	120	--	--	--	--	33	--	--
900308	01S/04E-10BDB	110	--	--	--	--	--	70	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
900306	01S/04E-11ACC	150	--	--	--	--	--	110	20
10774	01S/04E-14CBB	112	--	--	--	--	91	--	--
10775	01S/04E-14CCC	140	--	--	--	--	--	125	-205
10776	01S/04E-15BAB	80	--	--	--	--	--	45	--
10777	01S/04E-15CBC	--	648	--	416	333	258	--	--
10778	01S/04E-16ADB	--	672	--	469	87	--	--	-341
10779	01S/04E-16ADC	--	672	422	367	--	--	--	--
900324	01S/04E-17ACB	--	573	330	286	--	--	--	--
10780	01S/04E-17BAD	--	515	332	207	113	41	--	--
900500	01S/04E-17DCB	--	528	284	164	--	--	--	--
900498	01S/04E-18ACD	--	495	285	130	--	--	--	--
900325	01S/04E-18ADC1	--	525	235	164	-16	--	--	--
900326	01S/04E-18ADC2	--	523	213	163	-16	--	--	--
900327	01S/04E-18DAA	--	549	255	194	--	--	--	--
900499	01S/04E-18DAA2	--	550	225	142	--	--	--	--
900328	01S/04E-18DDC	--	550	253	--	--	--	--	--
10781	01S/04E-19BBD	--	533	202	--	--	--	--	--
900359	01S/04E-19BCBB	--	520	203	--	--	--	--	--
10782	01S/04E-20BCB	--	573	273	--	--	--	--	--
900329	01S/04E-20DAA	--	612	332	266	--	--	--	--
10783	01S/04E-21DDC	--	612	--	450	220	--	--	--
900501	01S/04E-22BAB	--	673	551	544	--	--	--	--
900330	01S/04E-22BDC	--	653	--	473	--	--	--	--
9182	01S/04E-22DCC	--	650	--	443	232	--	--	--
900331	01S/04E-23CDC	--	475	--	410	--	--	--	--
7115	01S/04E-26ACB	--	537	--	--	--	--	--	--
7091	01S/04E-26BAA	--	500	--	467	--	--	--	--
7101	01S/04E-26CCB	--	730	--	--	--	--	--	--
7459	01S/04E-26CCC	--	746	446	416	--	--	--	--
7135	01S/04E-28ABC	--	603	--	--	--	--	--	--
7129	01S/04E-28ADA	--	646	--	358	--	--	--	--
900309	01S/04E-28ADD1	--	660	337	316	220	--	--	-434
7139	01S/04E-28BAC	--	589	--	--	--	--	--	--
7128	01S/04E-28DDB	--	663	352	315	--	--	--	--
900447	01S/04E-29AAA	--	560	--	--	--	--	--	--
7146	01S/04E-29BDA	--	566	--	326	--	--	--	--
7143	01S/04E-29CAA	--	592	381	335	117	--	--	--
7152	01S/04E-29CAA	--	585	--	--	--	--	--	--
900444	01S/04E-29DCC	--	580	399	335	124	--	--	--
7209	01S/04E-30ADB	--	611	--	--	--	--	--	--
7164	01S/04E-30ADD	--	615	--	--	--	--	--	--
7192	01S/04E-30BDA	--	540	--	--	--	--	--	--
7183	01S/04E-30CBB	--	581	--	294	--	--	--	--
7244	01S/04E-30CCB	--	601	--	--	--	--	--	--
7236	01S/04E-30DCD	--	605	--	--	--	--	--	--
900448	01S/04E-31CBB	--	571	282	241	78	48	--	--
7239	01S/04E-31CCD	--	535	279	249	--	--	--	--
7277	01S/04E-32CAD	--	538	--	--	--	--	--	--
7253	01S/04E-32DAB	--	576	--	--	--	--	--	--
7312	01S/04E-33DBA	--	625	--	--	--	--	--	--
7343	01S/04E-33DBA	--	625	--	--	--	--	--	--
7368	01S/04E-34ABB	--	710	--	--	--	--	--	--
7356	01S/04E-34CBA	--	675	--	--	--	--	--	--
7394	01S/04E-34DBD	--	705	575	513	--	--	--	--
7460	01S/04E-35BAA	--	717	--	568	402	--	--	--
900443	01S/04E-35BCB	--	740	--	450	--	--	--	--
900502	01S/05E-31ACA	--	--	--	--	--	502	590	340
5098	02N/01E-01AAD	270	--	--	--	--	--	--	--
5095	02N/01E-01DAB1	273	109	--	--	--	--	--	--
900680	02N/01E-02BAA	200	90	--	--	--	--	-212	--
900679	02N/01E-02CAB	220	100	--	--	--	--	-230	--
900320	02N/01E-02DDCC	243	100	--	--	--	--	--	--
5103	02N/01E-03CCB1	218	85	--	--	--	--	--	--
11571	02N/01E-04BAD1	215	70	--	--	--	--	--	--
5105	02N/01E-07BCB	20	--	--	--	--	--	--	--
5107	02N/01E-07CBB1	20	--	--	--	--	--	--	--
5108	02N/01E-09CAD1	30	-48	--	--	--	--	--	--
5109	02N/01E-09DBB1	50	-83	--	--	--	--	--	--
5116	02N/01E-10AAD1	195	78	--	--	--	--	--	--
900321	02N/01E-10CBCC	153	102	--	--	--	--	-230	--
900381	02N/01E-11AAB1	238	114	--	--	--	--	--	--
900227	02N/01E-11ABC1	258	79	--	--	--	--	--	--
900383	02N/01E-11BAB1	225	85	--	--	--	--	--	--
11575	02N/01E-11BAB2	226	85	--	--	--	--	--	--
11574	02N/01E-11BAB3	227	84	--	--	--	--	--	--
900382	02N/01E-11BAB4	250	103	--	--	--	--	--	--
11563	02N/01E-11BAB5	230	85	--	--	--	--	-359	--
11572	02N/01E-11BAC1	230	81	--	--	--	--	--	--
5118	02N/01E-11CDC1	220	--	--	--	--	--	--	--
5120	02N/01E-12AAA1	281	165	--	--	--	--	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
5119	02N/01E-12DAD1	265	--	--	--	--	--	--	--
5127	02N/01E-13CAC1	255	61	--	--	--	--	--	--
5129	02N/01E-13DB	265	--	--	--	--	--	--	--
5134	02N/01E-15AAD1	173	15	--	--	--	--	--	--
900322	02N/01E-15CDDB	218	-117	--	--	--	--	--	--
900405	02N/01E-15DCB1	215	-52	--	--	--	--	--	--
900407	02N/01E-15DCB3	214	-36	--	--	--	--	--	--
5136	02N/01E-16CAB1	25	--	--	--	--	--	--	--
900684	02N/01E-18CDD1	28	--	--	--	--	--	--	--
900689	02N/01E-18CDD2	28	--	--	--	--	--	--	--
900690	02N/01E-18DCC1	28	--	--	--	--	--	--	--
900693	02N/01E-18DCC2	31	--	--	--	--	--	--	--
900694	02N/01E-18DCC3	33	--	--	--	--	--	--	--
900699	02N/01E-18DCC4	32	--	--	--	--	--	--	--
900700	02N/01E-18DCC5	33	--	--	--	--	--	--	--
900701	02N/01E-18DCC5	33	--	--	--	--	--	--	--
900687	02N/01E-19AAB1	28	--	--	--	--	--	--	--
900691	02N/01E-19AAB1	30	--	--	--	--	--	--	--
900697	02N/01E-19AAB2	34	--	--	--	--	--	--	--
900698	02N/01E-19AAC1	33	--	--	--	--	--	--	--
900702	02N/01E-19AAC3	30	--	--	--	--	--	--	--
900703	02N/01E-19AAC4	32	--	--	--	--	--	--	--
900704	02N/01E-19AAC5	32	--	--	--	--	--	--	--
900705	02N/01E-19AAC6	30	--	--	--	--	--	--	--
900695	02N/01E-19ABA1	29	--	--	--	--	--	--	--
900696	02N/01E-19ABA2	32	--	--	--	--	--	--	--
900686	02N/01E-19ABC1	30	--	--	--	--	--	--	--
900685	02N/01E-19ABD1	30	--	--	--	--	--	--	--
900692	02N/01E-19ABD3	30	--	--	--	--	--	--	--
900228	02N/01E-21AAB1	65	-38	--	--	--	--	--	--
5139	02N/01E-21BBC1	21	--	--	--	--	--	--	--
900528	02N/01E-21CCD1	33	--	--	--	--	--	--	--
900529	02N/01E-21CCD2	33	--	--	--	--	--	--	--
5142	02N/01E-22ABD1	210	94	--	--	--	--	--	--
5148	02N/01E-23CBA1	211	121	--	--	--	--	--	--
5145	02N/01E-23CDC1	185	137	--	--	--	--	--	--
11583	02N/01E-23DCA1	177	-65	--	--	--	--	--	--
11584	02N/01E-23DCA2	188	-55	--	--	--	--	--	--
900323	02N/01E-23DCAD	175	-117	--	--	--	--	--	--
5147	02N/01E-23DCC1	210	--	--	--	--	--	--	--
5146	02N/01E-23DCD1	210	-42	--	--	--	--	--	--
900408	02N/01E-23DCD1	222	-51	--	--	--	--	--	--
900409	02N/01E-23DCD2	187	-47	--	--	--	--	--	--
900410	02N/01E-23DCD3	185	-47	--	--	--	--	--	--
900411	02N/01E-23DCD4	185	-49	--	--	--	--	--	--
900412	02N/01E-23DCD5	182	-49	--	--	--	--	--	--
900413	02N/01E-23DDB1	178	-42	--	--	--	--	--	--
11585	02N/01E-23DDB2	174	-82	--	--	--	--	--	--
11586	02N/01E-23DDB3	178	-87	--	--	--	--	--	--
900229	02N/01E-24ACD1	170	75	--	--	--	--	--	--
5150	02N/01E-24DCD1	175	-11	--	--	--	--	--	--
5153	02N/01E-25CDA1	135	--	--	--	--	--	--	--
5154	02N/01E-25CDA2	135	--	--	--	--	--	--	--
5158	02N/01E-26ABB1	175	-40	--	--	--	--	--	--
5157	02N/01E-26ABB2	191	-48	--	--	--	--	--	--
5156	02N/01E-26BDB1	130	65	--	--	--	--	--	--
5159	02N/01E-26CAC1	85	19	--	--	--	--	--	--
900234	02N/01E-27ACB1	100	--	--	--	--	--	--	--
900230	02N/01E-27CBC1	42	--	--	--	--	--	--	--
900231	02N/01E-27CBC2	42	-70	--	--	--	--	--	--
900232	02N/01E-27CBC3	35	-78	--	--	--	--	--	--
900233	02N/01E-27CDB1	35	-67	--	--	--	--	--	--
5163	02N/01E-27CDDB	28	-106	--	--	--	--	-329	--
900235	02N/01E-28ACA1	28	--	--	--	--	--	--	--
900243	02N/01E-28ACA2	28	--	--	--	--	--	--	--
900238	02N/01E-28ACB1	28	--	--	--	--	--	--	--
900236	02N/01E-28ACB2	28	--	--	--	--	--	--	--
900237	02N/01E-28ACB3	28	--	--	--	--	--	--	--
900239	02N/01E-28ACB4	30	--	--	--	--	--	--	--
900240	02N/01E-28ACB5	30	--	--	--	--	--	--	--
5167	02N/01E-28ACB6	28	--	--	--	--	--	--	--
5166	02N/01E-28ACB7	28	--	--	--	--	--	--	--
5164	02N/01E-28BAA	28	-110	--	--	--	--	-274	--
900375	02N/01E-28BAA1	28	--	--	--	--	--	--	--
5165	02N/01E-28DAAB	48	-92	--	--	--	--	-307	--
900244	02N/01E-35BDA1	31	--	--	--	--	--	--	--
900245	02N/01E-35BDA2	31	--	--	--	--	--	--	--
900246	02N/01E-35BDA3	31	-64	--	--	--	--	--	--
900415	02N/01E-36ABA1	50	--	--	--	--	--	--	--
900414	02N/01E-36ABA12	50	--	--	--	--	--	--	--
900417	02N/01E-36ABA13	55	-51	--	--	--	--	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Uncon-solidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
900418	02N/01E-36ABA14	50	--	--	--	--	--	--	--
900419	02N/01E-36ABA15	60	--	--	--	--	--	--	--
900416	02N/01E-36ABA6	55	--	--	--	--	--	--	--
900420	02N/01E-36ABA9	55	--	--	--	--	--	--	--
5170	02N/01E-36ADA1	39	-51	--	--	--	--	-198	--
5169	02N/01E-36ADA2	38	-80	--	--	--	--	--	--
5721	02N/01W-07ADD1	35	--	--	--	--	--	--	--
5740	02N/01W-14CAD1	20	--	--	--	--	--	--	--
5773	02N/01W-16BCC1	30	--	--	--	--	--	--	--
5763	02N/01W-17DAD1	30	--	--	--	--	--	--	--
5775	02N/01W-17DDB1	20	--	--	--	--	--	--	--
5826	02N/01W-27CAC1	20	--	--	--	--	--	--	--
5829	02N/01W-27CDC1	30	--	--	--	--	--	-96	-166
900567	02N/01W-35DAC	30	--	--	--	--	--	--	--
900571	02N/01W-35DDB	40	--	--	--	--	--	--	--
900568	02N/01W-35DDBB	40	--	--	--	--	--	--	--
900569	02N/01W-35DDBD	40	--	--	--	--	--	--	--
900570	02N/01W-35DDCA	44	--	--	--	--	--	--	--
900572	02N/01W-36BCC1	45	--	--	--	--	--	--	--
500167	02N/02E-01CAD	258	208	103	99	--	--	--	--
3391	02N/02E-02ADC	270	220	--	--	--	--	--	--
500168	02N/02E-02CBA	263	221	--	--	--	--	--	--
500169	02N/02E-03CAC	240	--	--	--	--	--	--	--
500170	02N/02E-04DBB	230	175	--	--	--	--	--	--
500171	02N/02E-05ADB	205	126	--	--	--	--	--	--
500172	02N/02E-06BBD	260	--	--	--	--	--	--	--
3424	02N/02E-06CDC	269	--	--	--	--	--	--	--
900426	02N/02E-07AAB1	270	142	--	--	--	--	--	--
900427	02N/02E-07AAB2	270	146	--	--	--	--	--	--
500173	02N/02E-07CAA	300	140	--	--	--	--	--	--
500174	02N/02E-08BAB	253	128	--	--	--	--	--	--
500175	02N/02E-09DAD	235	189	--	--	--	--	--	--
900422	02N/02E-10CCB1	220	180	--	--	--	--	--	--
900423	02N/02E-10CCB2	220	171	--	--	--	--	--	--
500203	02N/02E-10CCB3	220	167	--	--	--	--	--	--
500176	02N/02E-11BCDD	218	188	--	68	--	--	--	--
500177	02N/02E-11BDB	235	155	--	83	--	--	--	--
500166	02N/02E-12ADC	215	211	--	--	--	--	--	--
500165	02N/02E-13DDB	--	235	--	--	--	--	--	--
500199	02N/02E-14DDC1	239	143	--	--	--	--	--	--
500200	02N/02E-14DDC2	266	188	--	--	--	--	--	--
900424	02N/02E-14DDC3	266	190	--	--	--	--	--	--
900425	02N/02E-14DDC4	239	164	--	--	--	--	--	--
500178	02N/02E-15CCA	205	117	--	--	--	--	--	--
500179	02N/02E-16CBD	200	80	--	--	--	--	--	--
500180	02N/02E-17BBB	285	125	--	--	--	--	--	--
500202	02N/02E-18ACB1	304	206	-158	--	--	--	--	--
900421	02N/02E-18ACB3	302	235	--	--	--	--	--	--
500181	02N/02E-20AAA	210	167	--	--	--	--	--	--
500195	02N/02E-20DBB1	210	113	--	--	--	--	--	--
500196	02N/02E-20DBB2	208	111	--	--	--	--	--	--
500197	02N/02E-20DBB3	209	115	--	--	--	--	--	--
500198	02N/02E-20DBB4	207	119	--	--	--	--	--	--
3555	02N/02E-21CBC	185	--	--	--	--	--	--	--
500182	02N/02E-21CBC	185	155	--	--	--	--	--	--
500183	02N/02E-22BCB	218	187	--	--	--	--	--	--
500185	02N/02E-23CAA	231	171	--	--	--	--	--	--
3588	02N/02E-23CAB	235	157	--	--	--	--	--	--
500184	02N/02E-23CDC	308	186	--	--	--	--	--	--
500187	02N/02E-23DCA	311	206	--	--	--	--	--	--
500186	02N/02E-23DCC	315	167	--	--	--	--	--	--
500188	02N/02E-24BDB	235	190	--	--	--	--	--	--
900200	02N/02E-24BDB	235	190	--	--	--	--	--	--
500189	02N/02E-25BBD	305	--	--	--	--	--	--	--
500201	02N/02E-27BBC1	314	180	-188	--	--	--	--	--
500191	02N/02E-27BCB	315	180	--	--	--	--	--	--
900453	02N/02E-27BDA	318	184	--	--	--	--	--	--
500190	02N/02E-27CAA	312	201	--	--	--	--	--	--
500192	02N/02E-28BDA	305	133	--	--	--	--	--	--
500193	02N/02E-29CBDB	296	146	--	--	--	--	--	--
500194	02N/02E-30CAA	295	133	--	--	--	--	--	--
900065	02N/02E-30DCC	295	195	--	--	--	--	--	--
900109	02N/02E-31ADD	190	132	--	--	--	--	--	--
900110	02N/02E-32CAC	--	110	--	--	--	--	-182	--
900111	02N/02E-33ADB	304	183	--	--	--	--	--	--
900068	02N/02E-33CDA	--	180	-187	-319	-372	--	--	--
900112	02N/02E-34ADD	303	201	--	--	--	--	--	--
900069	02N/02E-34BCAD	302	193	--	--	--	--	--	--
900115	02N/02E-35CBA	302	209	--	--	--	--	--	--
900113	02N/02E-35DAB	300	225	--	--	--	--	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Uncon-solidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
900114	02N/02E-36DDB	277	237	--	--	--	--	--	--
5568	02N/02W-13ACC1	--	--	--	--	--	--	--	320
500104	02N/03E-03BBA	--	465	--	--	--	--	--	175
500103	02N/03E-04AAC	--	385	--	--	--	--	329	92
500068	02N/03E-04ABCD	--	310	--	--	--	--	278	--
500102	02N/03E-04BBA	--	407	--	--	--	--	--	--
500101	02N/03E-05CDB	283	256	--	--	--	--	--	--
500100	02N/03E-06CBB	245	226	--	--	--	--	--	--
500099	02N/03E-06DDB	275	236	--	--	--	--	--	--
500098	02N/03E-07DAB	232	200	--	135	--	--	--	--
500097	02N/03E-08CAB	289	257	--	--	--	--	--	--
500096	02N/03E-09CDD	--	346	--	--	--	--	--	--
500095	02N/03E-09DCA	350	336	--	--	--	--	--	--
500094	02N/03E-10DBB	--	--	--	--	--	--	--	423
500093	02N/03E-11DCB1	--	--	--	--	--	--	--	790
500092	02N/03E-12CDC	--	--	--	--	--	--	--	958
500091	02N/03E-13BBC	--	--	--	--	--	--	--	910
500090	02N/03E-14CCC	--	379	--	--	--	--	--	--
500089	02N/03E-15CDD	--	475	--	--	--	--	--	--
500088	02N/03E-16BBC	341	283	--	--	--	--	--	--
500087	02N/03E-17ABA	319	224	--	--	--	--	--	--
500086	02N/03E-18ABA	202	181	--	--	--	--	--	--
500085	02N/03E-19ADC	225	--	--	--	--	--	--	--
500164	02N/03E-19CCA	292	189	--	--	--	--	--	--
500084	02N/03E-20DDD	189	168	--	184	--	--	--	--
500069	02N/03E-21CBD	--	--	--	198	-45	--	--	--
900475	02N/03E-21DCA	--	260	150	70	--	--	--	10
500083	02N/03E-21DDB	--	286	--	--	--	--	--	--
500071	02N/03E-22BAC	--	495	--	--	--	--	--	--
500072	02N/03E-23ABD	--	502	--	--	--	--	--	--
500074	02N/03E-23CAD	--	512	--	--	--	--	--	--
500075	02N/03E-24DBC	--	665	--	--	--	--	629	315
500076	02N/03E-25ABB	--	430	--	--	--	--	--	295
500077	02N/03E-26BBC	--	422	--	--	--	--	--	--
500078	02N/03E-27AAC	--	420	--	--	--	--	--	--
500057	02N/03E-27CDB	--	--	--	264	189	--	--	7
500056	02N/03E-28DCC	--	265	--	156	--	--	--	--
500079	02N/03E-29CDA	257	232	152	97	--	--	--	--
500080	02N/03E-29DBC	248	209	--	74	--	--	--	--
500081	02N/03E-30ACB	287	192	--	87	--	--	--	--
500082	02N/03E-30DBA	235	204	--	--	--	--	--	--
500055	02N/03E-30DCC	287	179	104	70	--	--	--	--
500054	02N/03E-30DCD	285	150	48	48	-100	--	--	--
500053	02N/03E-31AAB	282	194	67	--	--	--	--	--
500052	02N/03E-31ADD	277	158	--	44	--	--	--	--
500051	02N/03E-31DBA	277	199	--	--	--	--	--	--
500050	02N/03E-31DBD	275	140	92	65	--	--	--	--
500049	02N/03E-32CAA	255	--	--	--	--	--	--	--
500048	02N/03E-33DAC	--	355	--	230	--	--	--	--
500047	02N/03E-34CCA	--	390	--	--	--	--	--	--
500046	02N/03E-35AAA	--	410	--	231	--	--	--	--
500045	02N/03E-36ABC	--	438	--	--	--	276	--	--
6551	02N/04E-26DBA	--	--	--	--	--	--	--	340
6550	02N/04E-26DDB	230	--	197	--	--	--	--	124
6552	02N/04E-27CCA	182	--	--	--	--	--	--	156
6553	02N/04E-28DCD	--	715	--	--	--	--	--	522
6554	02N/04E-29BBB	--	--	--	--	--	--	--	678
900189	02N/04E-29BBD	--	--	--	--	--	--	--	635
6555	02N/04E-30ADC	--	--	--	--	--	--	--	483
6556	02N/04E-31ACB	140	--	--	--	--	--	119	20
6557	02N/04E-32BBA	--	--	--	--	--	--	300	217
900188	02N/04E-32BBC	--	370	--	--	--	--	294	219
6558	02N/04E-32BCA	--	362	--	--	--	--	287	222
6559	02N/04E-32DAA	--	515	--	--	--	--	420	385
6560	02N/04E-33AAA	--	703	--	--	--	--	--	--
6561	02N/04E-33AAC	--	708	--	--	--	--	487	466
6562	02N/04E-33CAC	--	550	--	--	--	--	--	--
6563	02N/04E-34BDC	--	725	--	--	--	--	--	--
900201	02N/04E-35DDB	--	1030	--	--	--	--	--	--
6565	02N/04E-36ADC	300	--	288	--	--	--	--	60
6566	02N/04E-36CCA1	--	1040	--	--	--	--	--	--
6567	02N/04E-36CCA2	--	1050	--	--	--	--	--	--
500302	02S/01E-01BCD	--	200	--	--	--	--	--	159
500304	02S/01E-02DBB	--	--	--	--	--	--	--	110
7836	02S/01E-11AABC	--	175	--	--	--	--	--	165
500305	02S/01E-12DDA	--	--	--	--	--	--	--	180
500306	02S/01E-13ABD	72	--	--	--	--	--	--	55
500307	02S/01E-13DDB	55	--	--	--	--	--	--	8
500308	02S/01E-14DCAA	175	--	--	--	--	--	--	160
500309	02S/01E-24CDC	257	--	--	--	--	--	--	237
500273	02S/02E-01ADA	--	348	58	--	--	--	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
500274	02S/02E-02DBC1	--	355	121	--	--	--	--	--
500275	02S/02E-02DBC2	--	352	70	4	-2	--	--	--
500277	02S/02E-03DBC	--	380	-33	-196	-220	--	--	--
500276	02S/02E-03DDD	--	312	--	--	--	--	--	--
500278	02S/02E-04DCC	95	45	--	--	--	--	--	--
500279	02S/02E-05CBD	100	71	--	--	--	--	--	--
500317	02S/02E-06ABDA	125	59	--	--	--	--	--	-354
500280	02S/02E-07DDD	--	--	--	--	--	--	--	306
500292	02S/02E-08ABAD	151	1	--	--	--	--	-135	--
500281	02S/02E-08CCC	--	265	--	--	--	--	--	222
500282	02S/02E-09CCB	135	39	--	--	--	--	--	--
500283	02S/02E-10BDD	122	77	--	--	--	--	-103	--
500284	02S/02E-11DAA	148	--	--	--	--	--	109	--
500285	02S/02E-11DDB	132	--	--	--	--	--	65	--
500286	02S/02E-12ADA	--	338	106	3	-57	--	--	--
500287	02S/02E-13ABA	158	--	--	--	--	--	118	--
11526	02S/02E-13DAC	115	--	--	--	99	--	--	--
11527	02S/02E-14ADD	75	--	--	--	38	--	--	--
500288	02S/02E-14BAA	125	--	--	--	--	--	78	--
500289	02S/02E-15ADC	65	--	--	--	--	--	34	--
500290	02S/02E-15BBB	104	54	--	--	--	--	-9	--
500291	02S/02E-16BBB	112	89	--	--	--	--	--	--
500293	02S/02E-16BDDB	118	81	--	--	--	--	-52	--
500294	02S/02E-17BDA	--	320	--	--	--	--	--	307
500295	02S/02E-17CBBB	--	211	--	--	--	--	--	138
500296	02S/02E-18ACB	--	--	--	--	--	--	--	154
500297	02S/02E-18BDA	--	--	--	--	--	--	--	132
500298	02S/02E-19ACB	98	--	--	--	--	--	56	-15
500299	02S/02E-19DAC	55	32	--	--	--	--	--	-31
500300	02S/02E-20BBD	88	--	--	--	--	--	--	67
900479	02S/02E-30BDD	95	--	--	--	--	--	--	74
900474	02S/03E-01CCC	--	597	522	427	301	--	--	--
8142	02S/03E-01DCA	--	551	--	436	--	--	--	--
900370	02S/03E-03DCC	--	615	515	425	375	--	--	--
500147	02S/03E-04ADB	--	762	--	--	380	--	--	--
8201	02S/03E-05CBC1	--	590	--	--	--	--	--	--
500141	02S/03E-05DDBC	--	548	--	245	196	--	--	-285
500148	02S/03E-06BDB	--	333	--	--	--	--	--	--
500142	02S/03E-06BDD	--	362	61	2	-18	--	--	--
500149	02S/03E-07BAC	--	418	--	--	--	--	--	--
900376	02S/03E-07BDDA	--	407	--	--	--	--	205	--
500150	02S/03E-08BAD	--	528	--	--	--	--	--	--
500151	02S/03E-08DCB	--	422	272	257	--	--	--	--
500145	02S/03E-09AAB	--	590	--	419	356	--	--	-9
500143	02S/03E-09ACA1	--	522	--	402	317	--	--	-10
500144	02S/03E-09ACA2	--	522	--	416	314	--	--	--
8278	02S/03E-09CDC	--	628	--	--	--	--	328	127
500152	02S/03E-09CDD	--	640	--	--	--	--	319	1
500155	02S/03E-10AAA	--	575	485	447	405	--	--	--
500153	02S/03E-10BAC	--	618	498	413	321	--	--	--
500154	02S/03E-10BAC	--	618	498	413	321	--	--	--
8339	02S/03E-11AAD	--	565	--	475	--	--	--	--
8311	02S/03E-11ACC	--	565	--	470	--	--	--	--
900446	02S/03E-11ACC	--	542	465	364	--	--	--	--
900445	02S/03E-11BDA	--	541	--	469	--	--	--	--
8332	02S/03E-12CDC	--	580	--	404	--	--	--	--
8340	02S/03E-12DBD	--	613	--	493	386	--	--	--
900431	02S/03E-13AAC	--	601	--	509	417	--	--	--
8369	02S/03E-13ABC	--	586	--	528	409	--	--	--
9100	02S/03E-13ADC	--	--	--	--	--	--	382	--
11452	02S/03E-13CDC	285	--	--	--	--	--	280	--
8297	02S/03E-14BCC	--	490	--	470	290	--	--	--
900503	02S/03E-14CBC	190	--	--	--	--	--	181	-380
11453	02S/03E-14CDC	260	--	--	--	--	--	222	--
500156	02S/03E-15CAD	248	--	--	--	--	--	229	--
500157	02S/03E-15CCD	182	--	--	--	--	--	170	-238
500158	02S/03E-16ABB	--	655	--	--	--	--	--	--
900478	02S/03E-16BDC	--	642	--	--	--	--	256	--
900377	02S/03E-17ABA	--	365	--	--	--	--	270	75
500159	02S/03E-17ACD	--	250	--	--	--	--	187	--
500160	02S/03E-17BAD	--	312	--	--	--	--	277	4
500161	02S/03E-18CBC	--	115	--	--	--	--	61	--
11454	02S/03E-18CDD	175	--	--	--	--	--	151	--
500162	02S/03E-20BAC	120	--	--	--	--	--	55	--
500163	02S/03E-21BBC	--	172	--	--	--	--	112	--
11456	02S/03E-23AAC	265	--	--	--	--	--	244	--
11459	02S/03E-23BDB	250	--	--	--	--	--	222	--
900532	02S/03E-24AAA	--	--	--	590	395	--	--	--
11464	02S/03E-24BCB	257	--	--	--	--	--	--	--
11465	02S/03E-24DBC	295	--	--	--	--	--	259	--
8555	02S/04E-01CBA1	--	585	--	--	--	--	541	132

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
8577	02S/04E-02BAD	--	781	--	576	--	--	--	--
8687	02S/04E-02BDB	--	779	--	589	419	--	--	--
8686	02S/04E-02CDA1	--	830	--	618	534	465	--	--
300978	02S/04E-02CDD1	--	825	--	559	439	--	--	--
8684	02S/04E-02CDD2	--	814	--	599	474	--	--	--
8631	02S/04E-03ACB	--	716	--	501	--	--	--	--
8640	02S/04E-03DCB	--	755	591	561	--	--	--	--
8654	02S/04E-04ACB	--	642	512	427	--	--	--	--
900316	02S/04E-04BDD	--	625	516	385	--	--	--	--
900432	02S/04E-04DBD	--	673	--	--	--	--	--	--
301669	02S/04E-04DCC1	--	655	--	555	--	--	--	--
900433	02S/04E-04DDA	--	692	578	464	298	--	--	--
8683	02S/04E-04DDD	--	694	618	469	--	--	--	--
900434	02S/04E-05CBB	--	541	461	382	--	--	--	--
8744	02S/04E-05CCC	--	563	410	365	--	--	--	--
8709	02S/04E-05DAA	--	591	--	--	--	--	--	--
8710	02S/04E-05DAB	--	591	--	--	--	--	--	--
900442	02S/04E-05DDA	--	599	349	324	--	--	--	--
8742	02S/04E-06ABB	--	545	--	--	--	--	--	--
8767	02S/04E-06ACB	--	530	--	--	--	--	--	--
8777	02S/04E-06CCD	--	594	458	429	--	--	--	--
8775	02S/04E-06CDD	--	575	420	380	--	--	--	--
8787	02S/04E-07ABA	--	598	--	--	--	--	--	--
8806	02S/04E-07ACA	--	624	485	457	--	--	--	--
8782	02S/04E-07BAA	--	608	490	411	233	--	--	--
8791	02S/04E-07BAA	--	608	490	411	--	--	--	--
8799	02S/04E-07BAA	--	600	470	394	--	--	--	--
900428	02S/04E-07BAA	--	608	--	350	--	--	--	--
8789	02S/04E-07BAD	--	611	--	416	--	--	--	--
8785	02S/04E-07CAB	--	684	--	--	--	--	--	--
8350	02S/04E-07CBA	--	641	536	413	--	--	--	--
8330	02S/04E-07CBC	--	642	--	540	407	--	--	--
8784	02S/04E-07DBA	--	600	514	418	369	--	--	--
900435	02S/04E-07DCB	--	--	--	485	410	--	--	--
8825	02S/04E-08ABB	--	592	454	387	--	--	--	--
8815	02S/04E-08ADC	--	660	425	385	263	--	--	--
900439	02S/04E-08BAA	--	578	428	368	--	--	--	--
8810	02S/04E-08BAC	--	591	441	386	--	--	--	--
8830	02S/04E-08BDD	--	640	535	485	325	--	--	--
8816	02S/04E-08DAA	--	645	508	--	--	--	--	--
8856	02S/04E-09ABB	--	665	562	470	--	--	--	--
8846	02S/04E-09BBB	--	622	477	417	--	--	--	--
8854	02S/04E-09CAA	--	650	--	479	--	--	--	--
8837	02S/04E-09DAA	--	702	595	505	--	--	--	--
8847	02S/04E-09DCB	--	--	535	441	--	--	--	--
8913	02S/04E-10ADD	--	--	778	583	--	--	--	--
8882	02S/04E-10BBB	--	700	643	540	--	--	--	--
8889	02S/04E-10BBD	--	692	609	532	--	--	--	--
8836	02S/04E-10BCB	--	676	--	502	--	--	--	--
8884	02S/04E-10BDB	--	693	655	501	--	--	--	--
8933	02S/04E-11ACB	--	841	691	--	--	--	--	--
8929	02S/04E-11BBB	--	791	709	564	--	--	--	--
8942	02S/04E-11CCC	--	810	695	598	556	--	--	--
900360	02S/04E-13BDDD	--	981	826	621	--	--	--	--
8998	02S/04E-15CBD	--	696	673	631	--	--	--	--
11472	02S/04E-15DAD	--	770	738	676	--	--	--	--
9062	02S/04E-16BDB	--	675	594	535	--	--	--	--
11474	02S/04E-16DAD	--	--	765	675	--	--	--	--
9048	02S/04E-16DDA	--	792	691	616	598	--	--	--
9075	02S/04E-17BAC	--	--	--	586	445	--	700	--
9071	02S/04E-17CBB	--	700	--	651	--	--	--	--
9097	02S/04E-17CBC	--	692	--	--	578	--	--	--
900440	02S/04E-17CCB	--	--	--	700	682	--	--	270
11478	02S/04E-18ACC	--	645	--	565	--	--	--	--
9090	02S/04E-18ACD	--	611	--	544	440	--	--	--
9093	02S/04E-18ADD	--	665	--	605	555	--	--	23
8797	02S/04E-18BAC	--	--	--	--	--	--	375	--
11479	02S/04E-19ACD	--	635	--	615	--	--	--	--
11480	02S/04E-19CCC	305	--	--	--	--	--	--	--
9130	02S/04E-20ACB	--	--	--	648	609	--	--	--
11481	02S/04E-20ADB	--	--	--	780	650	--	--	--
9166	02S/04E-21BCD	--	710	--	700	552	--	--	--
9133	02S/04E-21CCA	--	700	669	662	607	--	--	--
9006	02S/04E-22ABC	--	--	869	675	539	--	--	--
11482	02S/04E-22BBD	--	810	720	666	--	--	--	--
900441	02S/04E-22CBC	--	--	--	811	644	--	--	-74
9183	02S/04E-22DAD	--	937	817	747	727	--	--	--
11485	02S/04E-23AAD	--	960	862	--	--	--	--	--
8996	02S/04E-23BBC	--	901	727	700	631	--	--	--
9222	02S/04E-23BCC	--	896	--	746	--	--	--	--
9270	02S/04E-24CBB	--	1023	830	723	--	--	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Uncon-solidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
9280	02S/04E-24DAA	--	1078	--	942	--	--	--	--
11491	02S/04E-24DBA	--	1075	951	870	--	--	--	--
9213	02S/04E-25ABA	--	1095	--	--	--	--	--	--
11492	02S/04E-25BDC	--	1105	--	--	--	--	--	--
900598	02S/04E-26ACD	--	1070	1041	934	849	--	--	--
900599	02S/04E-26BBC	--	920	836	775	725	--	--	--
11494	02S/04E-26BCD	--	1015	--	--	--	--	885	--
10452	02S/04E-26DAB	--	1030	994	887	863	--	--	--
11496	02S/04E-27BAB	--	905	855	705	645	--	--	--
11497	02S/04E-27BDA	--	920	--	--	675	--	--	--
900601	02S/04E-28BDB	--	645	--	--	--	--	605	105
11500	02S/04E-28CDA	--	772	--	721	663	--	--	--
11502	02S/04E-29DAA	--	725	--	650	563	--	--	--
900364	02S/04E-29DAD	--	712	--	640	564	--	--	--
11503	02S/04E-29DDA	--	685	--	661	--	--	--	--
11504	02S/04E-30BAA	310	--	--	--	--	--	275	--
11507	02S/04E-30CBD	320	--	--	--	--	--	--	--
900674	02S/04E-30DCB	325	--	--	--	--	--	277	--
11517	02S/04E-32BAB	--	420	--	--	--	--	352	--
11519	02S/04E-32DAB	--	432	--	--	--	--	--	--
11520	02S/04E-33BCD	--	--	--	--	--	--	535	--
11522	02S/04E-34BCC	--	802	--	--	--	--	--	--
900600	02S/04E-34DAD	--	--	--	--	--	--	779	394
900602	02S/04E-34DBA	--	862	--	--	--	--	763	512
11523	02S/04E-36DCA	--	1200	--	--	--	--	1121	--
900603	02S/04E-36DCA	--	1202	--	--	--	--	1111	672
900037	03N/01E-01DAC	262	187	--	--	--	--	--	--
900038	03N/01E-02CCB	235	142	--	--	--	--	--	--
900040	03N/01E-03ABB	215	136	--	--	--	--	73	--
900039	03N/01E-03CBD	300	233	--	--	--	--	--	--
900041	03N/01E-04AAA	--	371	--	--	--	--	199	--
900042	03N/01E-04CAA	--	360	--	--	--	--	183	--
900043	03N/01E-05ACD	242	117	--	--	--	--	-30	--
900044	03N/01E-06ADA	215	87	--	--	--	--	--	--
900047	03N/01E-07ADB	220	102	--	--	--	--	--	--
900046	03N/01E-07BBC	95	10	--	--	--	--	-127	--
900048	03N/01E-08CBA	179	92	--	--	--	--	-79	--
6526	03N/01E-08DCB1	172	59	--	--	--	--	--	--
6527	03N/01E-08DCB2	171	63	--	--	--	--	--	--
6528	03N/01E-09CBD	232	112	--	--	--	--	--	--
900070	03N/01E-10BAC	--	303	--	--	--	--	--	--
6529	03N/01E-10CAD	--	321	--	--	--	--	101	--
6530	03N/01E-11BBA	270	208	--	--	--	--	--	--
900071	03N/01E-12DCD	272	197	63	--	--	--	--	--
6531	03N/01E-13DB	213	173	--	--	--	--	88	--
6532	03N/01E-13DBC	213	156	--	--	--	--	123	--
6533	03N/01E-14CAC	280	212	--	--	--	--	--	--
6534	03N/01E-15CBD	201	112	--	--	--	--	4	--
6535	03N/01E-16BAD	196	126	--	--	--	--	--	--
6536	03N/01E-17BAD	151	58	--	--	--	--	--	--
6537	03N/01E-17CA	179	59	--	--	--	--	--	--
6538	03N/01E-17CDD	174	82	--	--	--	--	--	--
6539	03N/01E-18DBC	127	37	--	--	--	--	--	--
900073	03N/01E-18DDB	148	48	--	--	--	--	--	--
900074	03N/01E-20BAD	173	67	--	--	--	--	--	--
6541	03N/01E-20CDD	190	48	--	--	--	--	--	--
11564	03N/01E-21CDA1	180	67	--	--	--	--	-128	--
6542	03N/01E-21CDC	125	63	--	--	--	--	--	--
6543	03N/01E-22BBB	191	86	--	--	--	--	--	--
900075	03N/01E-23CBD	206	119	--	--	--	--	--	--
900076	03N/01E-23DCA	--	302	--	--	--	--	160	--
900077	03N/01E-24CAA	147	--	--	--	--	--	127	--
900078	03N/01E-24DBB	127	122	--	--	--	--	101	--
6544	03N/01E-25ACB	219	126	--	--	--	--	--	--
6545	03N/01E-26BAC	201	120	--	--	--	--	--	--
6548	03N/01E-27BCB	171	91	--	--	--	--	--	--
900379	03N/01E-27CDA1	25	-41	--	--	--	--	--	--
900380	03N/01E-27DDD1	40	-5	--	--	--	--	--	--
6549	03N/01E-28AAB	171	47	--	--	--	--	--	--
11566	03N/01E-28CCD1	215	85	--	--	--	--	--	--
900455	03N/01E-28CCD2	215	78	--	--	--	--	-219	--
900128	03N/01E-29ADD	205	70	--	--	--	--	--	--
900313	03N/01E-30CCD	10	-195	--	--	--	--	-340	--
900129	03N/01E-30DAD	135	42	--	--	--	--	--	--
900130	03N/01E-32DAB	199	87	--	--	--	--	--	--
900131	03N/01E-33ACB	213	72	--	--	--	--	--	--
3957	03N/01E-33BCB	210	--	--	--	--	--	--	--
11568	03N/01E-33DCC1	215	77	--	--	--	--	--	--
900132	03N/01E-34CCD	197	129	--	--	--	--	--	--
11573	03N/01E-34DDD1	210	100	--	--	--	--	--	--
11570	03N/01E-35ABA1	110	32	--	--	--	--	-56	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
11561	03N/01E-35ABA2	110	29	--	--	--	--	-53	--
11562	03N/01E-35ABA3	110	37	--	--	--	--	--	--
3282	03N/01E-36AAD1	250	97	-24	--	--	--	--	--
11565	03N/01E-36AAD1	250	97	-24	--	--	--	--	--
900133	03N/01E-36ABD	244	126	--	--	--	--	--	--
6521	03N/01W-01ADD	144	19	--	--	--	--	--	--
900045	03N/01W-01DAA	132	5	--	--	--	--	-41	--
9613	03N/01W-06BAA1	42	--	--	--	--	--	--	--
6522	03N/01W-25BDC	18	--	--	--	--	--	--	--
6523	03N/01W-25DBA	13	-239	--	--	--	--	--	--
6524	03N/01W-25DCB	21	--	--	--	--	--	-243	--
6525	03N/01W-36ADA	11	--	--	--	--	--	--	--
2708	03N/02E-01BAB	--	345	--	--	--	--	--	324
900134	03N/02E-02BBB	292	280	--	--	--	--	132	--
900333	03N/02E-03AADD	287	277	--	--	--	--	162	--
900389	03N/02E-03ABA1	290	258	--	--	--	--	148	--
900388	03N/02E-03ABA2	290	223	--	--	--	--	146	--
11594	03N/02E-03DBA1	280	232	--	--	--	--	140	--
11593	03N/02E-03DBA2	280	246	--	--	--	--	144	--
2719	03N/02E-04ABD	269	226	--	--	--	--	--	--
2722	03N/02E-05BCC	223	187	--	--	--	--	110	--
900135	03N/02E-05CCB	215	200	--	--	--	--	93	--
2734	03N/02E-06AAD	212	185	--	--	--	--	106	--
900157	03N/02E-06CBB	264	234	--	--	--	--	--	--
900136	03N/02E-07ACB	193	185	68	-35	-56	--	--	--
900158	03N/02E-07DBC	200	171	101	--	--	--	--	--
900137	03N/02E-07DCB	200	171	101	--	--	--	--	--
900138	03N/02E-08AAC	275	200	--	--	--	--	--	--
900139	03N/02E-08BBB	225	200	--	--	--	--	--	--
2745	03N/02E-08BCA	230	190	--	--	--	--	108	--
900140	03N/02E-08CBC	230	165	--	--	--	--	--	--
900141	03N/02E-09ADD1	282	202	--	--	--	--	123	--
900142	03N/02E-09ADD2	283	203	--	--	--	--	--	--
2754	03N/02E-09CAD	280	204	--	--	--	--	99	--
2766	03N/02E-10DDB	273	199	158	32	12	--	--	--
2771	03N/02E-11BCD	281	243	--	--	--	--	--	--
2773	03N/02E-12DBB	258	200	--	--	--	--	--	--
2780	03N/02E-13ACB	203	193	--	--	--	--	--	--
2814	03N/02E-14CBC	291	202	--	--	--	--	--	--
2830	03N/02E-15DAC	276	195	--	--	--	--	--	--
2832	03N/02E-15DAD	283	207	--	--	--	--	--	--
2841	03N/02E-16BBC	273	200	--	--	--	--	--	--
900143	03N/02E-17DCC	245	177	125	--	--	--	--	--
2847	03N/02E-17DDC	261	188	--	--	--	--	--	--
2881	03N/02E-18BAA	209	170	--	--	--	--	--	--
900144	03N/02E-18BBB	220	177	122	--	--	--	--	--
2905	03N/02E-19BBA	214	159	102	--	--	--	--	--
2926	03N/02E-20ADA	256	211	112	--	--	--	--	--
900145	03N/02E-21AAB	258	158	--	--	--	--	--	--
900146	03N/02E-21AAC	264	181	--	--	--	--	--	--
900147	03N/02E-21DAB	290	187	105	--	--	37	--	--
2965	03N/02E-22AAD	295	217	--	112	--	--	--	--
900148	03N/02E-23ABB	285	212	--	--	--	--	--	--
900149	03N/02E-23ADA	295	194	--	--	--	--	--	--
11577	03N/02E-23BAB1	280	195	103	--	--	--	--	--
11576	03N/02E-23BAB2	280	212	--	--	--	--	--	--
900150	03N/02E-23BBA	290	212	--	--	--	--	--	--
2997	03N/02E-23CAB	293	202	93	59	-15	--	--	--
2989	03N/02E-23CBC	298	199	--	88	--	--	--	--
900151	03N/02E-23DAD	295	190	--	--	--	--	--	--
900152	03N/02E-24CDC	280	200	--	--	--	--	--	--
900219	03N/02E-25CAC	275	169	--	--	--	--	127	--
3005	03N/02E-25CBD	275	188	145	--	--	--	--	--
3017	03N/02E-26CDC	283	183	--	--	--	--	--	--
3022	03N/02E-26DDD	280	214	--	--	--	--	--	--
900153	03N/02E-27BDB	287	224	134	36	--	--	--	--
900154	03N/02E-27BDC	295	199	125	38	-7	--	--	--
3030	03N/02E-27CCD	283	166	103	-7	-32	--	--	--
900319	03N/02E-28AAB	285	--	--	--	--	--	--	--
3064	03N/02E-28ADD	288	147	111	--	--	--	--	--
900220	03N/02E-28BAB	278	155	33	--	--	--	--	--
3083	03N/02E-29DBD	195	--	--	--	--	--	--	--
3111	03N/02E-30AAA	198	144	--	--	--	--	--	--
900221	03N/02E-30BAB	232	142	--	--	--	--	--	--
900155	03N/02E-30BBD	231	138	-65	-330	-431	--	--	--
3094	03N/02E-30CDA	240	115	--	--	--	--	--	--
11569	03N/02E-31CBC1	252	154	-45	--	--	--	--	--
3141	03N/02E-31DBB	268	156	--	--	--	--	--	--
3166	03N/02E-32BDC	220	120	--	--	--	--	--	--
3188	03N/02E-33BAB	215	--	--	--	--	--	--	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
3203	03N/02E-34CBA	269	131	77	--	--	--	--	--
900222	03N/02E-35ADA	271	188	--	--	--	--	--	--
11580	03N/02E-35BBB	280	212	87	19	-17	--	--	--
3238	03N/02E-35DDD	279	184	--	--	--	--	--	--
3283	03N/02E-36BAD	268	199	--	--	--	--	--	--
900156	03N/02E-36BCA	269	204	123	103	--	--	--	--
3685	03N/02E-36CAD	270	--	--	--	--	--	--	--
900578	03N/02W-12DA	36	32	--	--	--	--	--	--
9799	03N/02W-12DCB1	62	17	--	--	--	--	--	--
9796	03N/02W-13ABD1	30	16	--	--	--	--	--	--
9811	03N/02W-13CAC1	70	47	--	--	--	--	--	--
9924	03N/02W-24CCB1	250	--	--	--	--	--	235	62
9934	03N/02W-24CDA1	85	60	--	--	--	--	--	--
11582	03N/03E-03CDC	--	--	--	--	--	--	--	420
2091	03N/03E-04ADA	--	--	--	--	--	--	--	442
900604	03N/03E-05BDD	--	530	--	--	--	--	489	106
2127	03N/03E-06CDB	--	368	--	--	--	--	323	150
2165	03N/03E-07CAA	--	322	--	--	--	--	260	113
2191	03N/03E-08BDB	--	400	--	--	--	--	376	223
2296	03N/03E-08DCC	--	535	--	--	--	--	387	--
2301	03N/03E-17AAB	--	415	--	--	--	--	367	202
2298	03N/03E-17DAD	--	510	--	--	--	--	410	355
2309	03N/03E-18AAD	--	483	--	--	--	--	--	319
2303	03N/03E-18ABC	--	353	--	--	--	--	--	--
2323	03N/03E-19DCD	--	337	--	--	--	--	--	--
2368	03N/03E-20ABD	--	480	--	--	--	--	397	305
900566	03N/03E-20BAA	--	511	--	--	--	--	397	--
2386	03N/03E-21DAB1	--	--	--	--	--	--	--	830
2385	03N/03E-21DAB2	--	--	--	--	--	--	--	830
900384	03N/03E-28BBB1	--	491	--	--	--	--	--	416
2585	03N/03E-30BAB	281	256	--	--	--	--	--	--
2584	03N/03E-30BCC	262	219	--	--	--	--	106	--
2586	03N/03E-31CBB	266	204	--	--	--	--	--	--
500105	03N/03E-34DDD	--	--	--	--	--	--	--	341
900612	03S/04E-01CBD	--	1165	--	--	--	--	--	--
900613	03S/04E-02BBC	--	1040	--	--	--	--	909	--
900614	03S/04E-02DCB	--	1090	--	--	--	--	--	--
900615	03S/04E-02DDC	--	1100	--	--	--	--	946	--
900616	03S/04E-03ACA1	--	930	--	--	--	--	--	--
900617	03S/04E-03BAD1	--	815	--	--	--	--	743	--
900618	03S/04E-03BDD	--	865	--	--	--	--	--	--
900621	03S/04E-04ADB	--	510	--	--	--	--	--	--
900620	03S/04E-04BBC	--	465	--	--	--	--	--	--
900619	03S/04E-04DAA	--	--	--	--	--	--	510	--
900622	03S/04E-05ABC	--	445	--	--	--	--	384	--
900623	03S/04E-05BDC	380	--	--	--	323	--	--	21
900625	03S/04E-05CAC	385	--	--	--	333	--	--	--
900624	03S/04E-05CAC2	385	--	--	--	342	--	--	--
900626	03S/04E-06BCC	355	--	--	--	--	--	--	--
900627	03S/04E-06DBA	362	--	--	--	295	--	--	--
900628	03S/04E-07CDC	390	--	--	--	--	--	--	--
900629	03S/04E-08AAB	--	450	--	--	418	--	--	--
900630	03S/04E-09CAB	--	670	--	--	650	--	--	--
900631	03S/04E-10CCB	--	832	--	--	--	--	--	--
900632	03S/04E-10CDB	--	810	--	--	724	--	--	650
900633	03S/04E-11ACB	--	--	--	--	--	--	--	565
900634	03S/04E-12AAC	--	1235	--	--	--	--	1147	--
900635	03S/04E-12BCB	--	--	--	--	--	--	930	759
900636	03S/04E-13CCD	--	--	--	--	--	--	--	635
900637	03S/04E-14CAC	--	960	--	--	--	--	--	908
900638	03S/04E-15ACC	--	890	--	--	817	--	--	--
900639	03S/04E-15ADD	--	880	--	--	854	--	--	709
900640	03S/04E-15BAD	--	887	--	--	813	--	--	712
900641	03S/04E-15BCB1	--	850	--	--	790	--	--	--
900642	03S/04E-16CBC	--	490	--	--	--	--	--	--
900643	03S/04E-17ACC	--	462	--	--	--	--	--	--
900644	03S/04E-18BBA	382	--	--	--	337	--	--	--
900645	03S/04E-19BDD	305	--	--	--	277	--	--	--
900646	03S/04E-21ADC	--	755	--	--	730	--	--	685
900647	03S/04E-22BDA	--	880	--	--	--	--	--	--
900648	03S/04E-23ABC	--	--	--	--	985	--	--	--
900649	03S/04E-23BBD	--	1095	--	--	1025	--	--	891
900650	03S/04E-23BCC	--	1070	--	--	--	--	--	--
900651	03S/04E-23DCA	--	1115	--	--	--	--	--	1046
900652	03S/04E-25BBB	--	1090	--	--	--	--	--	--
900653	03S/04E-25BDC1	--	1110	--	--	--	--	--	1072
900654	03S/04E-25BDC2	--	1100	--	--	--	--	--	1057
900655	03S/04E-26ABD	--	1150	--	--	--	--	--	--
900656	03S/04E-26CDA	--	1120	--	--	1060	--	--	--
900657	03S/04E-27ADD	--	1020	--	--	976	--	--	--
900658	03S/04E-27CDB	--	900	--	--	--	--	--	816

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Uncon-solidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
900659	03S/04E-28ADD	--	813	--	--	--	--	--	--
900660	03S/04E-26BDD	--	720	--	--	--	--	--	710
900661	03S/04E-29CCA3	--	--	--	--	750	--	--	712
900662	03S/04E-29DAB	--	535	--	--	448	--	--	--
900663	03S/04E-29DBD	--	--	--	--	690	--	--	515
900664	03S/04E-30BCA	--	855	--	--	807	--	--	--
900665	03S/04E-30CAA	--	885	--	--	852	--	--	574
900666	03S/04E-32ACD	--	1045	--	--	860	--	--	--
900667	03S/04E-32BAA	--	990	--	--	880	--	--	--
900668	03S/04E-32CBB	--	992	--	--	--	--	--	--
900669	03S/04E-33CDB	--	1105	--	--	--	--	--	--
900670	03S/04E-34ADA	--	1160	--	--	--	--	--	--
900671	03S/04E-34ADD	--	1165	--	--	1110	--	--	1075
900672	03S/04E-35DBC	--	1180	--	--	--	--	--	1134
900673	03S/04E-36DDB	--	--	--	--	--	--	--	1230
794	04N/01E-01BAD	--	350	--	--	--	--	250	--
802	04N/01E-02BCA	139	114	--	--	--	--	82	--
806	04N/01E-03CDC	145	70	--	--	--	--	37	--
812	04N/01E-04BAC1	120	75	--	--	--	--	--	63
819	04N/01E-05ACC	248	193	--	--	--	--	117	--
823	04N/01E-06ABD	130	69	--	--	--	--	39	--
841	04N/01E-07ADD	247	200	--	--	--	--	75	--
832	04N/01E-07CBC	--	175	--	--	--	--	121	--
846	04N/01E-08CBA	242	141	--	--	--	--	74	--
854	04N/01E-09BCA	263	191	--	--	--	--	51	--
866	04N/01E-10BCB	279	214	--	--	--	--	149	--
869	04N/01E-11CCC	287	221	--	--	--	--	142	--
883	04N/01E-12DBB	200	192	--	--	--	--	158	--
897	04N/01E-13ABA	165	141	--	--	--	--	115	--
906	04N/01E-14BDC	298	197	--	--	--	--	80	--
916	04N/01E-15ADD	280	207	--	--	--	--	108	--
919	04N/01E-16CCD	252	182	--	--	--	--	127	--
931	04N/01E-17ACC	261	185	--	--	--	--	122	--
939	04N/01E-18DAD	250	216	--	--	--	--	33	10
959	04N/01E-19ADDC	105	70	--	--	--	--	15	-200
952	04N/01E-19BDA1	40	36	--	--	--	--	-4	--
950	04N/01E-19BDA2	40	19	--	--	--	--	-74	-195
960	04N/01E-19BDB2	35	26	--	--	--	--	-54	--
900398	04N/01E-19BDB3	35	25	--	--	--	--	-31	--
951	04N/01E-19BDB4	40	38	--	--	--	--	-54	-300
974	04N/01E-20AAA	213	124	--	--	--	--	--	--
979	04N/01E-21DBA1	260	198	--	--	--	--	89	--
900476	04N/01E-21DBC	270	184	--	--	--	--	10	-457
985	04N/01E-22ACD	273	182	--	--	--	--	44	--
988	04N/01E-22DDD	257	188	--	--	--	--	28	--
996	04N/01E-23CDC	267	179	--	--	--	--	85	--
1005	04N/01E-24CCD	246	152	--	--	--	--	64	--
1035	04N/01E-25CAC	261	179	--	--	--	--	99	--
1053	04N/01E-26BCB	262	168	--	--	--	--	--	--
900438	04N/01E-26CBC	263	181	--	--	--	--	101	--
987	04N/01E-27ABB	268	160	--	--	--	--	--	--
1064	04N/01E-27BBC	265	187	--	--	--	--	--	--
1063	04N/01E-27DAD	280	181	--	--	--	--	111	--
1069	04N/01E-28DAA	225	166	--	--	--	--	49	--
1092	04N/01E-29CDA	280	178	--	--	--	--	53	--
1096	04N/01E-30DDB	246	168	--	--	--	--	--	--
1100	04N/01E-31DAA	248	166	--	--	--	--	--	--
1104	04N/01E-32CBB	263	175	--	--	--	--	--	--
1107	04N/01E-33ABC	229	179	--	--	--	--	93	--
1124	04N/01E-34AAA	250	175	--	--	--	--	--	--
1138	04N/01E-35AAD	272	255	--	--	--	--	--	--
1145	04N/01E-36ABA	233	209	--	--	--	--	43	--
900580	04N/01W-05DDB1	--	--	--	--	--	--	--	105
9991	04N/01W-07BCBB	253	158	--	--	--	--	--	113
9990	04N/01W-07CCA1	160	--	--	--	--	--	--	69
9989	04N/01W-07CCA2	160	--	--	--	--	--	--	69
900399	04N/01W-13DCA1	40	38	--	--	--	--	--	--
900582	04N/01W-17BDD1	28	--	--	--	--	--	--	1
900581	04N/01W-17CAA1	25	--	--	--	--	--	--	-22
900579	04N/01W-19CBC1	118	--	--	--	--	--	--	--
269	04N/01W-24ABA1	55	16	--	--	--	--	--	--
270	04N/01W-24ABA2	55	23	--	--	--	--	--	--
1157	04N/02E-01DBD	--	--	--	--	--	--	--	682
1165	04N/02E-02AAAD	--	--	--	--	--	--	--	498
1166	04N/02E-03BDA	--	580	--	--	--	--	--	--
1167	04N/02E-04BBB1	--	561	--	--	--	--	--	--
1177	04N/02E-05CCC	--	495	--	--	--	--	374	--
1222	04N/02E-06DBCD	--	502	--	--	--	--	387	--
1234	04N/02E-07CDA	--	258	--	--	--	--	143	--
900223	04N/02E-07DBC	--	258	--	--	--	--	106	--

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Uncon-solidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
1239	04N/02E-08CBB	290	268	--	--	--	--	236	--
1254	04N/02E-09CAC	--	423	--	--	--	--	379	--
900482	04N/02E-10ABC	--	720	--	--	--	--	511	--
1271	04N/02E-10CCB	--	525	--	--	--	--	452	--
1272	04N/02E-11ACC	--	385	--	--	--	--	295	--
1280	04N/02E-12DDC	--	--	--	--	--	--	--	676
1296	04N/02E-13ADB	--	--	--	--	--	--	--	485
1304	04N/02E-14BAD	--	305	--	--	--	--	243	-248
1312	04N/02E-14DCD	--	420	--	--	--	--	200	--
1329	04N/02E-15CDC	--	365	--	--	--	--	239	--
1330	04N/02E-16DAA	340	322	--	--	--	--	235	--
1341	04N/02E-17CAD	265	156	--	--	--	--	129	--
1365	04N/02E-18DCA	200	178	--	--	--	--	140	--
1390	04N/02E-19DCB	--	195	--	--	--	--	80	--
1421	04N/02E-20CBD	69	--	--	--	--	--	44	--
1453	04N/02E-21AAA	--	318	--	--	--	--	176	--
1489	04N/02E-22CAD	--	227	--	--	--	--	195	--
1516	04N/02E-23ABA	--	442	--	--	--	--	195	--
11581	04N/02E-23DBA	--	442	--	--	--	--	295	--
1538	04N/02E-24BBD	--	505	--	--	--	--	366	--
1564	04N/02E-25CBA	--	455	--	--	--	--	323	--
1613	04N/02E-26CBD	--	352	--	--	--	--	--	--
1681	04N/02E-27AAD	--	395	--	--	--	--	221	--
1697	04N/02E-28CCC	270	247	--	--	--	--	163	--
1708	04N/02E-29AAD	100	--	--	--	--	--	60	--
1727	04N/02E-30CDA	201	168	--	--	--	--	133	--
1784	04N/02E-31CBB	230	189	--	--	--	--	119	--
1795	04N/02E-32BBA	232	187	--	--	--	--	72	--
900362	04N/02E-32DDCC	260	236	--	--	--	--	114	--
1807	04N/02E-33DCC	319	296	--	--	--	--	186	--
1811	04N/02E-35BAD	319	313	--	--	--	--	273	-129
1832	04N/02E-36DDC	--	484	--	--	--	--	453	176
10177	04N/02W-12DCC1	--	360	--	--	--	--	--	273
10191	04N/02W-13BDC	240	--	--	--	--	--	--	--
10301	04N/02W-24ABB1	135	71	-25	--	--	--	--	-92
10419	04N/02W-36DAB1	40	--	--	--	--	--	--	--
1855	04N/03E-02BBC1	680	--	--	--	--	--	--	678
900012	04N/03E-02BBD1	680	--	--	--	--	--	--	564
900401	04N/03E-02BBD2	700	--	--	--	--	--	--	--
1917	04N/03E-17BBC	--	373	--	--	--	--	--	325
11578	04N/03E-28DDB1	--	--	--	--	--	--	--	635
11579	04N/03E-28DDB2	--	--	--	--	--	--	--	662
1989	04N/03E-29CAC	--	--	--	--	--	--	545	--
1981	04N/03E-29CCB	--	561	--	--	--	--	556	--
2001	04N/03E-32BBD	--	623	--	--	--	--	586	--
2	05N/01E-08DCA	45	--	--	--	--	--	--	--
110	05N/01E-08DCA	45	--	--	--	--	--	--	--
900126	05N/01E-09ADC	51	--	--	--	--	--	--	--
10	05N/01E-09CDB	43	-142	--	--	--	--	--	--
12	05N/01E-10BDC	56	--	--	--	--	--	--	--
19	05N/01E-11DAB	185	52	--	--	--	--	--	--
16	05N/01E-11DCD	222	--	--	--	--	--	--	--
28	05N/01E-13CCA	--	623	--	--	--	--	602	563
31	05N/01E-14CDD	--	--	--	--	--	--	330	--
36	05N/01E-15BCB	--	495	--	--	--	--	--	--
33	05N/01E-15CCC	--	588	--	--	--	--	551	--
45	05N/01E-16DAC	--	--	--	--	--	--	403	243
47	05N/01E-16DDA	--	--	--	--	--	--	505	142
52	05N/01E-17BCD1	92	--	--	--	--	--	--	4
56	05N/01E-18DCD	--	250	--	--	--	--	208	180
63	05N/01E-19DBC	--	--	--	--	--	--	--	150
77	05N/01E-20AAD	--	--	--	--	--	--	--	860
92	05N/01E-21ADC	--	661	--	--	--	--	608	571
88	05N/01E-21CBB	--	--	--	--	--	--	--	805
109	05N/01E-22ACC	--	673	--	--	--	--	515	--
96	05N/01E-22DCA	--	460	--	--	--	--	420	--
117	05N/01E-23CDD	--	663	--	--	--	--	--	--
131	05N/01E-24AAB	--	799	--	--	--	--	--	--
127	05N/01E-24DBC	--	743	--	--	--	--	--	--
136	05N/01E-25CCB1	--	638	--	--	--	--	--	--
134	05N/01E-25CCB2	--	615	--	--	--	--	469	--
161	05N/01E-26BCA	--	632	--	--	--	--	--	--
170	05N/01E-27ABB	--	480	--	--	--	--	456	210
175	05N/01E-27DCD	--	595	--	--	--	--	--	--
275	05N/01E-28BDA	--	516	--	--	--	--	--	462
280	05N/01E-29ADA	--	635	--	--	--	--	545	405
281	05N/01E-30ACD	120	--	--	--	--	--	--	58
900000	05N/01E-31DCD	123	--	--	--	--	--	--	--
292	05N/01E-32ABB	--	496	--	--	--	--	344	240
291	05N/01E-32CAD	13	--	--	--	--	--	--	-120
309	05N/01E-33BDD	--	253	--	--	--	--	--	154

Table 1.--Altitude of top of hydrogeologic units for selected wells, in feet above or below (-) sea level--Continued

Log-ID	Location number	Unconsolidated sedimentary rocks	Troutdale gravel	Confining unit 1	Troutdale sandstone	Confining unit 2	Sand and gravel	Undifferentiated fine-grained sediments	Older rocks
304	05N/01E-33CAA	--	250	--	--	--	--	184	147
900361	05N/01E-33CABB	165	--	--	--	--	--	--	125
807	05N/01E-33CDA	168	136	--	--	--	--	126	21
327	05N/01E-34ABA	--	575	--	--	--	--	--	404
900400	05N/01E-34ACD1	--	--	--	--	--	--	400	--
325	05N/01E-34ACD2	--	--	--	--	--	--	410	160
318	05N/01E-34ACD3	--	410	--	--	--	--	392	131
335	05N/01E-35DBC	293	275	--	--	--	--	207	--
343	05N/01E-36DCD	--	541	--	--	--	--	493	--
372	05N/02E-08ABA	--	183	--	--	--	--	--	162
377	05N/02E-09DAA	--	435	--	--	--	--	--	307
411	05N/02E-15DBA	--	741	581	--	--	--	--	--
564	05N/02E-19ABA	--	--	--	--	--	--	821	721
594	05N/02E-21DDB	--	835	--	--	--	--	--	809
626	05N/02E-23CCA	--	--	--	--	--	--	--	820
691	05N/02E-27CDD	--	735	--	--	--	--	657	--
716	05N/02E-30BCB	--	690	--	--	--	--	543	--
763	05N/02E-34ACC	--	712	--	--	--	--	679	628
764	05N/02E-34ACC	--	712	--	--	--	--	679	628
900481	05N/03E-12CDD	497	--	--	--	--	--	--	--
450	05N/03E-14BCA	450	--	--	--	--	--	--	--
456	05N/03E-15ABB	435	--	--	--	--	--	--	--
451	05N/03E-15ABD	439	--	--	--	--	--	--	--
452	05N/03E-15CAA	428	--	--	--	--	--	--	--
453	05N/03E-15DBA	430	--	--	--	--	--	--	--
472	05N/03E-16CDB	437	--	--	--	--	--	--	414
470	05N/03E-16CDC	407	--	--	--	--	--	--	382
510	05N/03E-21CAD	--	510	--	--	--	--	--	494
511	05N/03E-21CCD	--	625	--	--	--	--	--	560
547	05N/03E-27CCB	--	838	--	--	--	--	--	763
196	05N/03E-28ABB	--	620	--	--	--	--	--	542
900436	05N/03E-35CCA1	710	--	--	--	--	--	--	--
900402	05N/03E-35CCB1	--	710	--	--	--	--	--	621
900403	05N/03E-35CCB2	--	713	--	--	--	--	--	637
260	05N/04E-07ACA	558	--	--	--	--	--	--	--
900527	05N/04E-07CBC	530	--	--	--	--	--	--	313
262	06N/03E-34ADD	--	--	--	--	--	--	--	1155
267	06N/03E-35BBB	--	--	--	--	--	--	--	400