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STATE OF WASHINGTON

DANIEL J. EVANS, Governor

DEPARTMENT OF ECOLOGY

JOHN A. BIGGS, Director

Water-Supply Bulletin No. 32

RECONNAISSANCE OF SEA-WATER INTRUSION ALONG COASTAL WASHINGTON, 1966-68

By

Kenneth I Walters

Prepared in cooperation with

UNITED STATES GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

1971

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FOREWORD

Following the conclusion of World War Two, the marine coastlands of Washington State experienced a tremendous growth in popularity as residential, park and recreational areas and with the rapid encroachment on those limited areas came the problem of providing the public utilities, (water, power and sanitary facilities) required to serve the people occupying and using the salt water coastlands. Not least of their needs was a reliable source of fresh, potable water.

Although many coastal areas receive their domestic water supplies from local springs and streams, most individuals and recent land developments obtain their fresh water supplies from wells tapping local ground-water sources. Because of the delicate balance between the fresh-water-salt-water interface, special knowledge is required and certain procedures must be followed to prevent destruction of the coastal aquifers by sea-water encroachment.

Individuals and agencies responsible for developing ground-water supplies along marine coast-lines should obtain professional assistance from experts with experience in the field. Two fundamental points should be remembered when selecting a well site along a marine coast-line: 1. Locate the well as far inland as is reasonable to do, and 2. Retain the pumping level above sea level when the well is used for extended periods of time.

Geologists with the Department of Ecology, Olympia, and the U.S. Geological Survey, Tacoma, are available to discuss the contents of W.S. Bulletin No. 32 with parties interested in the problems associated with sea-water encroachment along Washington's marine coast.

ROBERT H. RUSSELL, Geologist

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RECONNAISSANCE OF SEA-WATER INTRUSION ALONG COASTAL WASHINGTON, 1966-68

By Kenneth L. Walters

ABSTRACT

Some of the most rapidly developing areas of the State are immediately adjacent to the marine shorelines of western Washington. In some of these areas, large demands are being placed on ground-water supplies that were totally undeveloped only a few years ago. The objectives of this reconnaissance were to determine the present occurrence and general extent of salt-water intrusion into the ground-water reservoirs, and to delineate areas of possible future sea-water intrusion. Collection of data was generally limited to areas within 1 mile of the shoreline, and the chloride content of ground water was used as the principal criterion for the recognition of sea-water intrusion.

Uncontaminated ground water in most coastal areas of Washington contains less than 10 mg/l (milligrams per liter) of chloride. Most wells tapping aquifers intruded by sea water yield water having chloride concentrations of less than about 750 mg/l, but a few have concentrations of more than 5,000 mg/l.

Near the Pacific Ocean and along most of the shoreline of the Strait of Juan de Fuca, present development of ground-water supplies is localized, and only in a few cases are aquifers intruded by sea water to the extent that more than one or two wells are affected at any one locality. Intrusion along marine shorelines of the Puget Sound lowland is more pronounced than elsewhere, because of the moderately intensive development of ground-water supplies on the many islands and long, narrow peninsulas that are susceptible to intrusion by adjacent salt water. Although it has not reached serious proportions sea-water intrusion has

occurred near Olympia, at Tacoma, in Northern Kitsap and northeastern Jefferson Counties, and in Island County. Small areas of additional intrusion are expected to develop with increased local pumping, and some intrusion may become more pronounced where it is now only incipient.

INTRODUCTION

PURPOSE AND SCOPE OF THE INVESTIGATION

Some of the most rapidly developing areas of the State are immediately adjacent to the marine shorelines of western Washington (fig. 3). In some of these areas, surface water is the principal source of supply. In other areas, however, large demands are being placed on ground-water supplies that were totally undeveloped only a few years ago. Planning for efficient development and management of this ground-water resource requires more detailed imformation about the present and potential threat of sea-water intrusion into coastal aquifers of Washington. The objectives of this study were to rapidly gather information about nearshore wells and the salt content of the well water and, from those data, to (1) determine in general the extent of any indicated intrusion of salty water into coastal aquifers, and (2) identify areas where problems of sea-water intrusion are likely in the future.

The investigation was made by the U.S. Geological Survey in cooperation with the Washington Department of Ecology as part of a continuing program for the collection and interpretation of data concerned with the water resources of the State. The data presented herein, collected during 1966-68, should be usefull in identifying existing sea-water-intrusion problems and in the detection of future problems early in their development.

METHODS OF INVESTIGATION

The chloride content of water was used as the principal criterion for the recognition of sea-water intrusion. Most samples collected as part of this study were analyzed in the laboratory for both chloride content and specific conductance.

Collection of data was limited mostly to areas within 1 mile of the marine coast. The islands of San Juan County were not included in this study because of the relative remoteness and the resultant time requirements and cost of travel to and among the islands. Water samples for chemical analysis were collected primarily from wells whose producing zones were below sea level. However, some wells producing from zones that are above sea level, and thus unlikely to be intruded, also were sampled locally to provide comparative information on the quality of native ground water.

Most wells were sampled only once as part of this reconnaissance, and no attempt was made to relate variations in chloride content to pumpage, tidal fluctuations, or changes in water levels. Where analyses had been made in connection with earlier studies, the earlier results are presented for comparison with more recent analyses.

The chloride content and specific conductance of water in each area were evaluated in relation to geologic and hydrologic conditions. Geologic information in this report is from earlier studies or from reconnaissance observations where no earlier studies were made. Geologic considerations were limited to an evaluation of the extent to which productive or potentially productive aquifers are in hydraulic contact with sea water or with other geologic units that contain large amounts of saline water.

The potential for sea-water intrusion was interpreted largely on the basis of theoretical considerations because in many areas wells and ground-water data are scarce. That is, the general physical relationships between fresh and salty ground water (discussed below) were assumed to apply within the framework of the local subsurface geologic and hydrologic situation, insofar as it could be discerned.

WELL-NUMBERING SYSTEM

The well and test-hole numbers listed in this report indicate their locations according to the rectangular-grid system of land subdivision. The number shows the location by township, range, section, and position within the section. An illustration of this method of location is shown in figure 1.

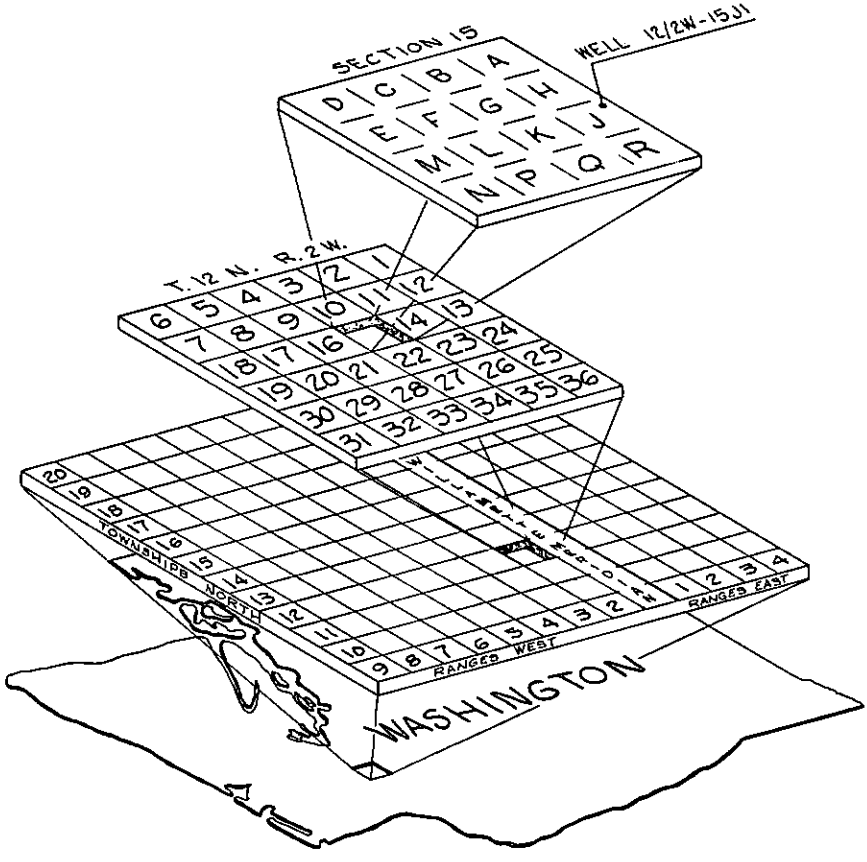


FIGURE 1.--Sketch showing well-numbering system.

The well number 12/2W-15J1 is used as an example. The two numbers preceding the hyphen indicate the township north and the range west (T. 12 N., R. 2 W.) of the Willamette base line and meridian, respectively. Because the entire State is north of the Willamette base line, the letter "N" to denote north is omitted. Most of the State is east of the Willamette meridian, and the letter "E" is omitted for locations east of the meridian, but the letter "W" is included for locations west of the meridian. The first number after the hyphen indicates the section (sec. 15), and the letter "J" gives the 40-acre subdivision of the section as shown in figure 1. The last number (1) is the sequence number of the well as recorded within a particular 40-acre tract. Well 12/2W-15J1 is the first well recorded in the northeast quarter of the southeast quarter of Section 15, Township 12 North, Range 2 West. Springs are designated by small "s" following the serial number.

ACKNOWLEDGMENTS

Appreciation is expressed to the many people who supplied information about their wells. Special acknowledgment is due the many well drillers who supplied information on individual wells and on areas where water-quality problems exist.

The investigation was made under the general supervision of L. B. Laird, district chief in charge of the Geological Survey's water-resources program in Washington.

Constructive suggestions for improvement of this report were supplied by F. A. Kohout and G. F. Worts of the Geological Survey.

PHYSICAL CONDITIONS OF SEA-WATER INTRUSION

The interrelations of fresh and salty ground water have been intensively studied in other areas, and are well defined in the scientific literature. Therefore, these relationships are only briefly described in this report to serve as a foundation for discussion of specific areas.

PHYSICAL CONDITIONS OF SEA-WATER INTRUSION

Sea water contains about 19,000 mg/l chloride, whereas uncontaminated ground water in most coastal areas of Washington contains less than 10 mg/l of chloride. High chloride concentrations do not always indicate current sea-water intrusion; they may be due to contamination from sewage or industrial waste, to lateral or upward migration of saline water from adjacent formations, or to relict sea water in the aquifer--either residual salty water dating from the time of former higher levels of the sea, or connate water that has been trapped in the formation since the time of its deposition.

GEOLOGIC CONDITIONS

The water-bearing materials that underlie an area obviously must be in hydraulic continuity with the sea to some degree before these materials can be intruded by sea water. The fact that many coastal aquifers that are below sea level are not in good hydraulic continuity with the sea has allowed major ground-water withdrawal from some of them without discernable sea-water intrusion. Most aquifers of economic importance have at least moderate permeability in the area where wells are located, but the seaward margin of the aquifer may be sufficiently sealed to impede sea-water intrusion, or other impermeable barriers may occur between the wells and the sea water. On the other hand, some materials that are above present sea level, but that were saturated with sea water during a higher former position of the sea (p. 9), may yield salty water because they have not been completely flushed out by fresher ground water.

Artesian (confined) aquifers may extend seaward beyond the shoreline and be in contact with sea water only at a considerable distance seaward. Also, they may extend under a shallow bay or arm of the sea without direct contact with the overlying bodies of sea water. Examples are the aquifers that occur as sand and gravel fillings of ancient channels now buried by clay. Some of these undersea aquifers yield large amounts of fresh water to nearshore wells, while sea water is intruding the seaward extensions of the aquifers undetected; many years may elapse before the salty water reaches the wells.

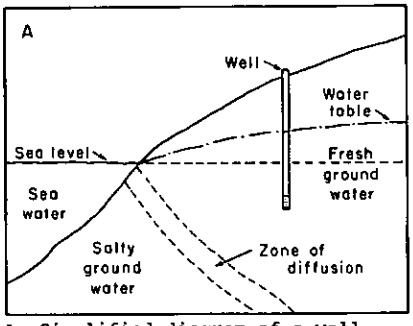
HYDROLOGIC CONDITIONS

The other basic condition requisite to sea-water intrusion is a reduction of the hydraulic head of the fresh ground water relative to that of the sea water. When the fresh-water hydraulic gradient in a coastal aquifer is seaward, as it is under natural (predevelopment) conditions, fresh ground water moves seaward under a condition of general equilibrium with the salt water. Under natural conditions the hydraulic gradient is landward only during high tides and only near the shore. When the fresh-water gradient is reversed, or even decreased, by pumping of nearshore wells, the front of the salty water begins to move landward (fig. 2, B and D).

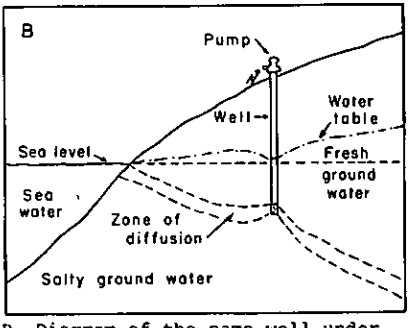
Where fresh water and sea water are in contact within an aquifer, they mix only within a zone of diffusion which may be fairly narrow. Otherwise, they remain separate with the fresh water overriding or "floating" on the heavier salty water (fig. 2). Sea water is only slightly heavier than fresh water (about 1.025 times heavier), and Archimedies' principle of buoyancy dictates that a floating object will displace its own weight of the fluid in which it floats. Therefore, the bottom of a fresh-water body that is floating on sea water within an aquifer is theoretically about 40 times as far below sea level as the top (the water table or potentiometric surface) is above sea level. Stated another way, when fresh water overlies sea water in a porous rock material about 40 feet of fresh water theoretically will occur below sea level for each foot of fresh water that occurs above sea level. This 40-to-1 relationship is based on an assumed condition of hydrostatic balance in an unconfined aquifer of uniform composition and it may not apply in areas of appreciable ground-water movement or confined conditions. Because the water table for the fresh ground water almost invariably increases in altitude landward from the shore, the interface between the fresh and salt water has a slope inland approximately 40 times the slope of the water table. Therefore, when an unconfined body of fresh ground water is subjected to pumping, the underlying salt water tends to rise 40 feet for every foot that the water table is depressed (fig. 2B).

Within and near the zone of diffusion the movement of water is very complex, and in some cases results in the salt-water front being significantly seaward of where it would be expected to occur on the

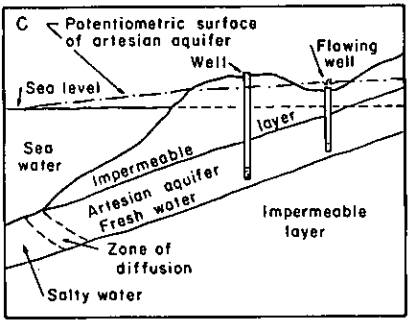
PHYSICAL CONDITIONS OF SEA-WATER INTRUSION



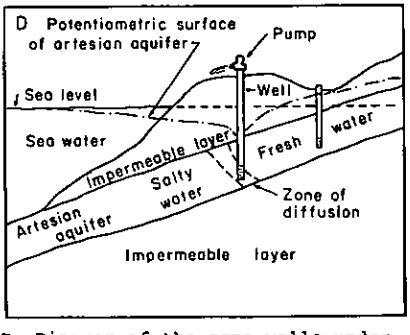
A. Simplified diagram of a well tapping an unconfined near-shore aquifer under conditions of equilibrium--no intrusion has occurred.



B. Diagram of the same well under conditions of intensive pumping--intrusion has reached the well.



C. Simplified diagram of two wells tapping a confined (artesian) aquifer under conditions of equilibrium--no intrusion has occurred.



D. Diagram of the same wells under conditions of intensive pumping--intrusion has reached the well nearest to the shoreline, flow in shallow well has ceased.

Figure 2.--Schematic sections showing nearshore confined and unconfined aquifers before and after sea-water intrusion.

basis of Archimedes' principle. Cooper and others (1964, p. 1-11) show that salt water flows from the floor of the sea into the zone of diffusion in the aquifer, where it moves upward and returns to the sea. This circulation of salty water tends to lessen the extent to which the salty water occupies the aquifer.

Most aquifers are more permeable to water moving laterally through them than to water moving nearly vertically across the aquifer layers. This difference between the lateral and vertical permeabilities has a fundamental influence on sea-water intrusion. For example, low vertical permeability may significantly reduce the upwelling of salt water beneath a pumping well. Conversely, high lateral permeability in the direction of the sea may allow the rapid intrusion of a tongue of sea water toward a pumping well that taps the highly permeable layer. The net result of lateral permeability being greater than vertical permeability often is a tendency to retard intrusion. In this study, the possible "safety factor" provided by limited vertical permeability is ignored, unless a particular aquifer system is known to be well confined, because: (1) the degree of difference between lateral and vertical permeability is seldom known, and (2) a conservative evaluation of potential sea-water intrusion was desired.

Sea level along the Washington coastline has not remained stationary since deposition of most of the geologic units from which water supplies are obtained. Armstrong and Brown (1954, p. 361) state that in the lower Fraser Valley of British Columbia relative sea level was at least 750 feet higher during a late stage of glaciation of the area. Armstrong and others (1965, p. 327) present evidence that relative sea level in northwestern Washington was at least 600 feet higher than at present. Sea level along the entire Washington coastline at certain times during the Pleistocene Epoch doubtless was somewhat higher than now, and the interface between fresh and salty ground water was correspondingly farther inland. Many occurrences of saline ground water in Washington coastal areas are probably due to incomplete flushing of sea water from rock materials following the latest relative decline of sea level. The term "relict sea water" is used throughout this report to include both the incompletely flushed salty water from an ancient intrusion and true connate water that has been in the aquifer since its deposition.

The saltiness of ground water resulting from contamination by relict sea water is much less predictable than that resulting from intrusion by modern sea water. For example, in the latter case, the chloride content of water from a well can be expected to vary directly with the amount of water pumped from the aquifer, or to increase progressively as pumping proceeds at a given rate. Conversely, where contamination is by relict sea water (or from land-surface sources), the chloride content may decrease, increase, or remain the same with time, largely independent of the amount pumped from the aquifer.

PRESENT AND POTENTIAL SEA-WATER INTRUSION

For the purpose of discussion, the coastal areas of the State are divided into eight regions, by counties or groups of counties (fig. 3), that have similarities in the present or potential status of sea-water intrusion, or in the geologic or hydrologic conditions that govern intrusion.

GRAYS HARBOR AND PACIFIC COUNTIES

That part of the area investigated in Grays Harbor and Pacific Counties extends from the mouth of the Columbia River northward about to the mouth of the Queets River (pls. 1, 2)-- to within a few miles of the west-coast strip of Olympic National Park. It includes Washington's two principal Pacific Ocean harbors--Willapa Bay and Grays Harbor--as well as all of the State's developed recreational Pacific beaches. In addition to tourism and processing of seafoods, industries of the area include growing of cranberries and processing of forest products, all of which are moderate to large users of fresh water.

Occurrence of Ground Water

Ground-water supplies in coastal Grays Harbor and Pacific Counties are obtained principally from upland terrace deposits consisting of alternating layers of clay, sand, and gravel, and from beach deposits of sand, silt, peat, and minor amounts of gravel. Locally, along some of the major streams, a few wells produce water from alluvium. The bedrock of the area produces very little water.

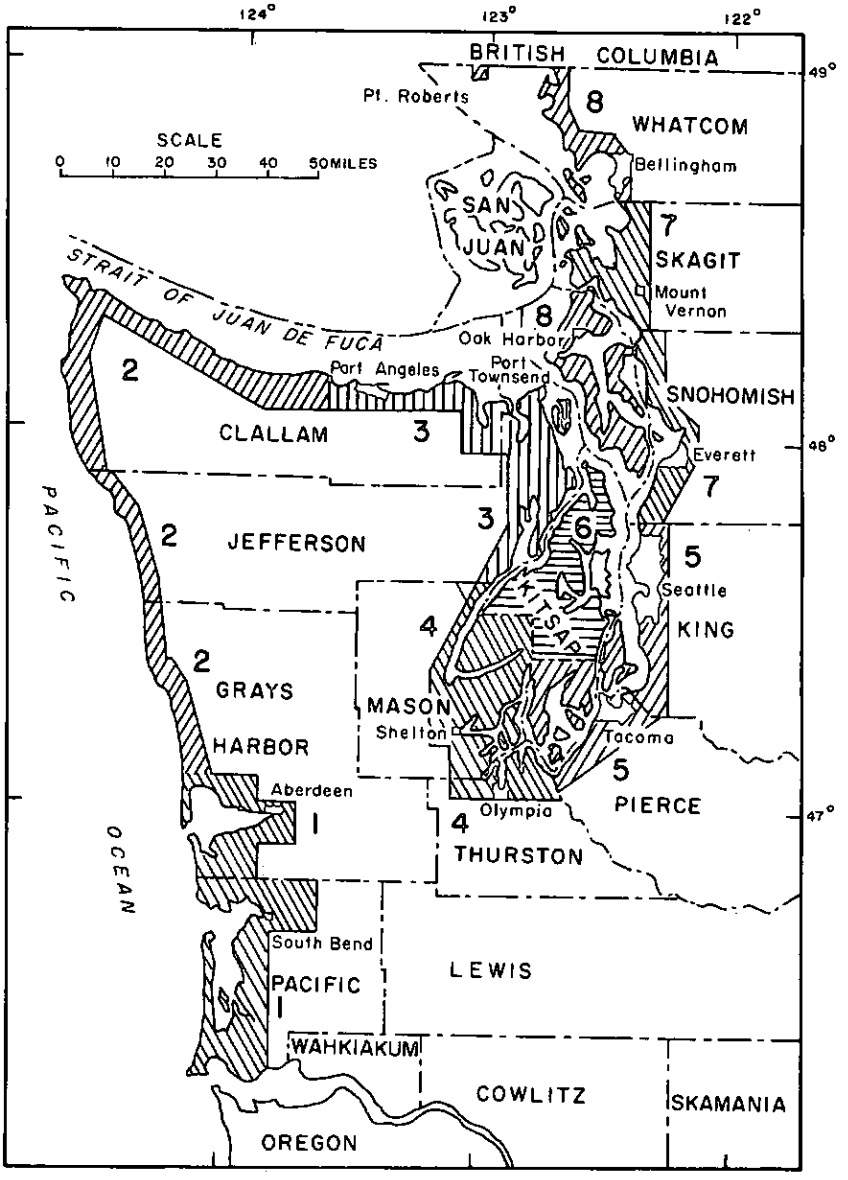


Figure 3.--Western Washington, showing coastal regions studied and as indexed in plates 1-8.

GRAYS HARBOR AND PACIFIC COUNTIES

Development of ground-water supplies in coastal Grays Harbor and Pacific Counties is limited chiefly to North Beach Peninsula, to the area between Tokeland and Westport, and to the district between Point Brown and Moclips. Moderately large quantities of ground water are used by cranberry growers on the North Beach Peninsula, and in the area between Tokeland and Westport. Nearshore wells are pumped intensively at times when the berry bogs are sprinkled for irrigation, for frost control, and to control heat damage. Little ground water is available along the east shore of Willapa Bay, and not much ground-water development has been undertaken on the Quinault Indian Reservation.

Status of Sea-Water Intrustion

The chloride content of seven water samples collected from wells along the mouth of the Columbia River between Chinook and Fort Canby State Park (pl. 1, table 1), ranged from 9.6 to 64 mg/l. The two samples with the greatest chloride content, 64 mg/l from well 10/11W-26P2 and 27 mg/l from well 10/11W-34M1, were from very shallow wells whose method of construction might permit contamination from land surface. Also, the latter well bottoms about 4 feet above mean sea level. For these reasons, the writer concluded that sea-water intrusion was not indicated in this area. However, few wells in the area are deep enough to provide adequate information, and the potential for intrusion of the aquifers cannot be determined.

The chloride concentration in about 125 samples collected from wells on the North Beach Peninsula (pl. 1) ranged from less than 5 to 566 mg/l. The greatest chloride concentration was from the deepest well sampled (11/11W-34P1), which produces water from a zone 139 to 149 feet below mean sea level. The depth of the producing zone in this well is sufficient that, according to the buoyancy effect (p. 7), sea water theoretically could reach the well any time the pumping level declined to within about 3½ feet above sea level. About a mile north, near Ocean Park, wells 12/11W-28G1 and 33B1 produce water from about 57 and 78 feet below mean sea level, respectively, and samples from them contained only 20 and 8.6 mg/l of chloride, respectively. Both wells are near the center of the peninsula, and have static water levels ranging from 10 to 12 feet above mean sea level. Thus, considerable drawdown could occur before sea water is drawn into

these wells. Nearly all the other wells on the peninsula produce water from sandy beach deposits at depths ranging from 4 feet above to about 20 feet below mean sea level. No relationship between depth and chloride content appears to exist in the shallower wells.

Only chloride concentrations in excess of 50 mg/l have been considered as indicating sea-water intrusion on the peninsula because several wells that do not extend to sea level produce water with concentrations of 25 to 50 mg/l. Contamination from septic tanks may be the source of some chloride in the shallow ground water, but a more likely source is infiltration of salt spray from the ocean. This is suggested by the chloride concentrations which are generally greatest in wells on the west side of the peninsula, closer to the ocean.

Chloride concentrations of more than 50 mg/l--probably due to sea-water intrusion--were determined in samples from the following wells tapping shallow aquifers on the North Beach Peninsula:

Well Number	Altitude of producing zone [ft above or below (-) mean sea level]	Chloride concentration (mg/l)
10/11W-9N1	4	94
9N2	0	124
28D3	-11	73
29J1	2	149
11/11W-4D1	-4	70
4E1	-14	108
9D2	-10	80
9E1	-3	66
9N2	-6	51
33N1	-1	66
12/11W-3N2	-8	135
21E1	0	62
21N1	-2	210
27N1	-8	76
33N1	-4	72

At most places on the North Beach Peninsula where intrusion has occurred, only one or two wells are affected. The greatest concentration of affected wells is in the Ocean Park-Nahcotta area. Although intrusion is not yet serious here, the peninsula is highly susceptible to intrusion because it is exposed to sea water on three sides. Intrusion could occur to a serious degree locally with the addition of perhaps only a few heavily pumped wells.

East of Willapa Bay, bedrock is exposed or near the surface in most places, and little ground water is available. The greatest concentration of wells is in the Bay Center area (pl. 1) where wells as deep as 600 feet have yielded as much as several hundred gallons per minute from alluvial deposits. Sixteen wells were sampled in the area east of Willapa Bay (table 1), and none contained enough chloride to indicate definite intrusion. Samples from wells 14/9W-18L1 and 23P1 contained 81 and 32 mg/l of chloride, respectively, but may represent dilute relict sea water. A sample from well 12/10W-15J1, which produces water from bedrock, contained 46 mg/l of chloride and almost certainly represents dilute relict sea water. The chloride content of water from five wells in the Bay Center area was low, ranging from 8.0 to 8.8 mg/l.

Water supplies on the peninsula at Tokeland (pl. 1) are chiefly from an artesian alluvial aquifer that extends from about 150 to 300 feet below the surface. Ten flowing wells on the peninsula were sampled, and the chloride content ranged from 5.8 to 9.7 mg/l. No detectable intrusion of sea water has occurred in the artesian aquifer. Well 14/11W-11C2 is only 13 feet deep and does not flow. It produces water containing 57 mg/l of chloride, which may be derived from a source at or near land surface or from local sea-water intrusion of the shallow aquifer.

Wells along the coast between North Cove and Westport (pl. 1) range in depth from about 20 to more than 300 feet; most are in the range of 70 to 170 feet. Nearly all ground water in this area is from Holocene beach deposits, but a few of the deeper wells may extend into the underlying older terrace deposits.

Locally in this district, salinity of ground water is a problem, but probably not because of sea-water intrusion. In a strip about half a mile wide and extending northward for about 3 miles from North Cove--through the center of sec. 5, T. 14 N., R. 11 W., and

the W½ secs. 29 and 32, T. 15 N., R. 11 W.-- chloride concentrations as great as 380 mg/l were obtained. This strip lies between a beach ridge on the west and the foot of a terrace escarpment on the east and probably is a filled ancient lagoon. Much of the surficial material is peat, used for cranberry growing, and the materials at depth probably are less permeable than elsewhere in the North Cove-Westport district. The saline or brackish water in the area probably is due to incomplete flushing of relict sea water. According to W. A. Davie, local well driller, the ground water there has been brackish since the earliest development and is getting no worse. In fact, the chloride content in several wells (for example 14/11W-5H1, 15/11W-32E1 and 32E3) has decreased as much as 100 mg/l in the past 5 to 12 years. Several zones that reportedly contain highly saline water were cased off in well 14/11W-5B1 above the depth of 165 feet, which suggests incomplete flushing of relict sea water rather than intrusion. Well 15/11W-31H1 was originally 327 feet deep, and a sample collected from it in 1956 contained 710 mg/l of chloride. It has now been plugged back to a depth of 200 feet and a sample collected in 1968 contained only 14 mg/l of chloride. The salty water at the original depth might result from incomplete flushing of relict sea water from that zone, or more likely, it may represent the zone of diffusion between the shallow fresh and brackish ground water and the sea water which presumably underlies the fresh water all along the beach between North Cove and Westport.

In Westport, at the northern end of the peninsula, some wells (now destroyed) reportedly produced salty water. The area now is served by water from the Town of Westport wells farther south, in the SW¼ sec. 18, T. 16 N., R. 11 W., where there has been no intrusion to date. Slightly greater-than-normal concentrations of chloride were found in samples from wells 15/11W-7R1 and 16/12W-25A1, but these probably do not indicate progressive intrusion as in 1956 both wells produced water having even greater chloride concentrations.

Although some pertinent data are available from wells at various depths and distances inland from the shore on the Westport peninsula, the present positions and movement of the salt-water fronts in the aquifers there are not known. Pumping to date (1968) from existing wells in the middle part of the peninsula has not induced noticeable intrusion. However, any additional large-scale ground-water development in parts of the district between North Cove and Westport could lead

to serious intrusion, and should be preceded by, and guided by, studies to define and monitor relations between the fresh and salty ground-water interface.

Of 38 wells sampled along the north and south shores of Grays Harbor, only well 17/10W-3Q1 indicated intrusion of possible serious magnitude. This well was drilled for a heat-pump installation and produces several hundred gallons per minute with only a few feet of drawdown, from a coarse gravel zone 163 to 190 feet below the surface. In use for only a short time when sampled in October 1968, the well contained water with 305 mg/l of chloride. More samples should be collected periodically to determine whether the chloride content is increasing.

Other examples of wells with water having above-normal chloride content in the Grays Harbor area are:

1. Well 18/11W-16L1, which produced water containing 200 mg/l of chloride, but, as it is within a few feet of a salt-water slough, it has very limited use. Intrusion at this well would affect only a very small area.

2. Well 16/11W-21E2, which reportedly encountered very salty water at a depth of 110 feet when the well was drilled. This water was cased off and the well was finished at a depth of 162 feet and produces water containing only 37 mg/l of chloride. The salty water encountered in this well is believed to be relict sea water, as production from that depth zone has been insufficient to cause intrusion.

3. Well 18/11W-17P2, which has water with a chloride content of 44 mg/l, possibly indicating incipient local intrusion.

The Ocean Shores peninsula, which extends southward to Point Brown and lies between North Bay (pl. 1) and the ocean is a rapidly developing residential and recreational area served by wells. The community of Oyhut at the north end of the peninsula is served with water from well 18/12W-27F1 which is 358 feet deep. Another well, 18/12W-26M1, near the north end of the peninsula, which is more than 600 feet deep, supplies three families. The central part of the peninsula--the northern part of the community of Ocean Shores--is presently (1968) served by well 17/12W-3R1 which is 513 feet deep, while the southern part of the peninsula is

served by individual jetted wells, all of which are similar in construction and about 20 feet deep. Additional water lines were being installed in 1968 so that eventually all of the Ocean Shores community will be served by wells 17/12W-3R1 and R2 (also 513 feet deep).

Problems with sea-water intrusion on the peninsula are more likely to occur when supplies are obtained from a few closely spaced large wells, rather than from many scattered shallow wells.

Of three deep wells on the Ocean Shores peninsula that are in use for water supplies, none has water with sufficient chloride content to suggest intrusion. However, oil-test well 17/12W-10R1, of unknown depth and plugged back and perforated at about the 700-foot depth in an unsuccessful attempt to convert it to a fresh-water well, reportedly produced very salty water. This chloride content doubtless reflects the natural presence of deep salty water underlying the fresh water rather than being due to sea-water intrusion.

Of the many shallow wells sampled on the peninsula, only wells 17/12W-15L3 and P1 seem to be intruded by sea water. Nearly all of the other shallow wells that contained more than the normal concentration of chloride are in groups alined parallel to the ridge just west of Duck Lake. These areas probably were occupied by lagoons during higher stages of sea level, and now are filled with material that is less permeable than materials constituting the remainder of the peninsula; they probably also were not as completely flushed of the relict sea water.

At Ocean City, north of Oyhut in Grays Harbor County is a small area of sea-water intrusion. Wells 18/12W-3N1, 3P6, and 10C1 (pl. 1), all producing from zones 35 to 45 feet below mean sea level, have water containing 140, 68, and 78 mg/l of chloride, respectively. North of Ocean City about 3 and 6 miles respectively, wells 19/12W-28A1 and 4N1 (pl. 2), have water with 53 and 77 mg/l respectively, of chloride, while 2 miles south of Ocean City well 18/12W-22K2 (pl. 2), has water with 100 mg/l of chloride. If intrusion has occurred it has not become extensive enough to affect neighboring wells.

Summary of Potential Sea-Water-Intrusion Problems

No serious problems of sea-water intrusion affecting substantial areas of Grays Harbor and Pacific Counties are likely to occur under the 1968 pattern of development. However, if appreciably expanded development should occur, problems may be expected (1) on the North Beach peninsula, (2) near Cohassett and Westport, and (3) on the Ocean Shores peninsula. Average annual recharge to the ground-water reservoir in these areas may be as much as 50 percent of the average annual precipitation, or on the order of 2,000 acre-feet (650 million gallons) per square mile. Because some natural discharge of the fresh ground water is unavoidable, pumping withdrawal at the above rate (about 1 3/4 million gallons per day per square mile) could be expected to lower the water table sufficiently in time to induce serious intrusion, and withdrawal at a considerably lower rate would cause some landward migration of sea water. However, areas that are bordered on at least one side by permeable materials at higher elevations would receive additional recharge by lateral movement of ground water and could sustain a larger pumpage than could the isolated barrier-bars or narrow peninsulas.

Sea-water intrusion has not been observed in wells in the Tokeland area, but some landward advancement of the salt-water fronts probably has resulted from pumpage to date. The extent to which intrusion may proceed in the future cannot be predicted from the available information but will depend largely on the rate of ground-water withdrawal and the accompanying reduction of head in the artesian aquifer.

CLALLAM AND JEFFERSON COUNTIES

The areas investigated in Clallam and Jefferson Counties (pls. 2, 3) include the northern part of the Pacific coast, all of the southern shoreline of the Strait of Juan de Fuca, the west shoreline of Admiralty Inlet, and the west shoreline of northern Hood Canal. In all, more than 250 miles of shoreline are involved. Most of the Pacific coast in these counties is within Olympic National Park, and the ground water of this coastal strip is largely undeveloped.

Occurrence of Ground Water

Marine sedimentary bedrock is at or near the surface in much of the Pacific coastal area of Clallam and Jefferson Counties, and ground-water supplies there are very small. Locally, along the Pacific coast in Jefferson County and southern Clallam County, small ground-water supplies can be obtained from terrace deposits that overlie bedrock. In the vicinity of Ozette Lake (pl. 2) in coastal west-central Clallam County thin glacial deposits, which may be capable of yielding small amounts of fresh water to wells, overlie the bedrock. Locally, along the shoreline between Port Angeles and Quilcene and on the Toandos Peninsula (pl. 3) are moderately thick glacial deposits that may be capable of moderate ground-water yields. Locally in the Sequim-Dungeness area (pl. 3), extensive alluvial deposits yield large quantities of water to wells. Large yields also are available from alluvial deposits of limited areal extent at the mouths of several major streams. The Sequim-Dungeness area, where sizeable acreages are irrigated from wells, is the only part of Clallam and Jefferson Counties where ground-water development has been extensive.

Status of Sea-Water Intrusion

Because the ground-water resources of the Pacific coast in Clallam and Jefferson Counties are almost entirely undeveloped, no sea-water intrusion has been noted to date (1968). Since 1966, wells or test holes have been drilled near Kalaloch, near the mouth of the Hoh River, and near the mouth of the Quillayute River at La Push (pl. 2). Test hole 28/15W-22P1 drilled in 1966 into the alluvium of the Quillayute River about half a mile from the ocean, contained water with 78 mg/l of chloride; this is the only known case of greater-than-normal chloride in ground water from the Pacific coast districts of these counties. However, because there has been no pumping of ground water in the area, this concentration is assumed to represent a natural condition in the aquifer.

Along the shoreline of Strait of Juan de Fuca west of Siebert Creek (pl. 3) present (1968) development of ground-water supplies is limited chiefly to wells that do not extend to sea level and to springs. Only a few wells at Neah Bay (pl. 2) and Angeles Point (pl. 3)

extend below sea level.

Test well 33/15W-15B1, drilled at Neah Bay in 1967, yielded water containing 3,320 mg/l of chloride from gravel lying 164 feet below mean sea level (pl.2). The well was drilled in the low valley that extends from Neah Bay southwestward to the Pacific Ocean, and probably produced from the natural zone of diffusion.

Two wells, 55 and 67 feet deep and in 1968 yielding water containing respectively 17 and 6.5 mg/l of chloride, are the source of supply for the village of Neah Bay. Well 33/15W-12L1, about 25 feet deep at the Makah Tribal Center about a mile east of Neah Bay, contained water with 28 mg/l of chloride. This concentration might indicate slight intrusion. Former wells (now destroyed), drilled within a few feet of the beach to supply fish-processing plants in Neah Bay, reportedly produced salty water from the time they were drilled.

Large ground-water supplies probably cannot be developed in the area of Neah Bay and the Makah Tribal Center without accompanying problems of sea-water intrusion or the pumping of saline water from the zone of diffusion.

In the area between Makah Tribal Center and Siebert Creek, no evidence of intrusion was observed. However, the sampling may have been inadequate. Very few wells were available for analysis; most residents of this area are supplied with water from springs, shallow wells, or public supplies derived from small streams.

The Sequim-Dungeness area, between Siebert Creek and Sequim Bay, is primarily an agriculture area served chiefly by individual wells tapping alluvial materials. Water samples were obtained from 20 wells near the shore and with bottom altitudes ranging from 12 feet above to 534 feet below mean sea level (pl. 3). Wells in the district southeast of Dungeness are generally somewhat deeper than in the district southwest of the town. In the latter area, slightly greater chloride concentrations were found in the well water but were not great enough to suggest sea-water intrusion. Well 31/3W-18G1, on Dungeness Spit, reportedly penetrated salty water to a depth of about 315 feet, where it entered fresh water. The well was finished

at a depth of 667 feet and originally flowed at a rate of about 80 gpm (gallons per minute). The artesian aquifer tapped by this well apparently is recharged at higher altitudes to the south, and as of 1968 contamination by the overlying salty ground water has been prevented by intervening clay layers.

Greater-than-normal chloride concentrations occur in water from deep wells locally on both shores of Sequim Bay. A sample from well 29/3W-2K1, on the west shore of the bay, contained 150 mg/l of chloride, and well 29/3W-2Q1 is reported to yield salty water of unspecified chloride content. Well 30/3W-36F1 (depth unknown), on the east shore, produced water containing 56 mg/l of chloride. The kinds of materials penetrated by these wells are not known, but in part may be bedrock. The fact that there has been little ground-water development in the area suggests that the occurrence of salty water may be natural rather than due to sea-water intrusion.

Samples were collected from wells 30/2W-15L1 and 16G1, near Diamond Point at the northeast tip of Miller Peninsula (pl. 3), and both contained enough chloride (145 and 313 mg/l, respectively) to suggest sea-water intrusion. If the aquifer tapped by these wells has been intruded by sea water, the areal extent of the intrusion probably is small, because no other deep wells exist nearby. On the basis of conditions near Gardiner, the high chloride content may be due to relict sea water. Water from wells 30/2W-34H1 and 35E1 near Gardiner contained 70 and 665 mg/l of chloride, respectively, when sampled in 1968. Both wells flow at altitudes higher than 100 feet above sea level. Well 34H1 taps a sandstone aquifer; the aquifer for 35E1 is not known. The aquifers in both wells are below mean sea level. Well 30/2W-34C1, which taps a gravel aquifer, contained water having 820 mg/l of chloride in 1968, and was reported to be salty when first drilled. The occurrence of salty ground water near Gardiner suggests that the salinity in the ground water in these areas is due to incomplete flushing of relict sea water from the aquifers rather than to pumping. A similar situation may exist near Diamond Point.

Developers of large ground-water supplies from nearshore wells west of Sequim Bay and on Miller Peninsula should expect salinity problems related either to sea-water intrusion or to relict sea water.

Apparent intrusion of unknown areal extent is indicated on the west shore, and near the head, of Port Discovery Bay (pl. 3). Well 29/1W-18E1, bottoming 18 feet below mean sea level, produced water containing 390 mg/l of chloride, and well 29/2W-23J1, bottoming 35 feet below mean sea level, produced water containing 329 mg/l of chloride. Yet, well 29/2W-13P1, bottoming at about the same altitude and midway between the two wells, contained only 7.0 mg/l of chloride.

On the Quimper Peninsula north of Chimacum (pl. 3), chloride concentrations were slightly greater than normal (which is generally less than 25 mg/l) in samples from wells that bottom both above and below sea level. Well 29/1-7D1 contained 74 mg/l of chloride when sampled in 1968. It was originally drilled to a depth of 125 feet (85 feet below mean sea level) and yielded salty water. The well was finished at a depth of 60 feet, and the 74 mg/l of chloride probably is due to upward leakage from the deeper zone rather than to lateral sea-water intrusion. Not enough wells are available for sampling to evaluate adequately the potential intrusion hazard on Quimper Peninsula.

In the northern half of Marrowstone Island (pl. 3), several wells that extend below mean sea level produced water moderately high in chloride content. Well 30/1-17J1 (not listed in table 3 nor shown on pl. 3) at Fort Flagler State Park, reportedly penetrated only salty water (probably relict sea water) to a depth of at least 186 feet and possibly to 310 feet. It was drilled to a depth of 1,462 feet and reportedly at 1,456 feet penetrated a fresh-water zone of small yield; the well was later destroyed. Wells 30/1-29C1 and 29K1 respectively produced water containing 358 and 141 mg/l of chloride from altitudes of 7 and 5 feet below mean sea level. Well 30/1-28E1 produced fresh water from sand and gravel 14 feet below mean sea level until about 1965, but a sample in 1968 contained 357 mg/l of chloride.

In the southern part of Marrowstone Island, well 29/1-5H2, is unusable as a source of fresh water because of the high chloride content of the water (1,150 mg/l in 1968). The well taps sandstone about 68 feet below mean sea level in a small area of sea-water intrusion. Several shallow wells on the island, which lack several tens of feet of extending to sea level and thus could not be affected by sea-water intrusion, contain more than 50 mg/l of chloride.

Some additional withdrawal of ground water from individual domestic wells on Marrowstone Island probably would not seriously increase the problem of sea-water intrusion. However, greatly increased total withdrawal, or intensive localized pumping anywhere on the island, would require careful planning and management to avoid serious long-term problems of salt-water contamination.

Indian Island has no wells in use. The Navy installation there is supplied with water from the Port Townsend surface-water source.

Near the head of Port Ludlow Bay (pl. 3), a bedrock aquifer which yields water to several wells is intruded by sea water. Wells 28/1-16M1 and 16P1 respectively produced water containing 241 and 66 mg/l of chloride. Elsewhere in eastern Jefferson County south of Hadlock, intrusion is limited to individual wells. Some yield water with greater-than-normal chloride content near Oak Bay, Mats Mats Bay, Shine, South Point, Jackson Cove, and Lackawanna Beach (pl. 3). The aquifer supplying well 26/2W-13G1 at Jackson Cove is so badly intruded--chloride concentration 915 mg/l--that the well can no longer be used.

Summary of Potential Sea-Water-Intrusion Problems

At Neah Bay, where sea-water intrusion is not now (1968) a serious problem, appreciably larger ground-water supplies probably could not be developed without causing additional salt-water problems. Pumping levels in the existing wells are below sea level, and test drilling has indicated that deeper aquifers contain salty water.

Along the west side of Port Discovery Bay and on Marrowstone Island, salinity of well water could become a serious problem with increased development, and the well water should be monitored to detect increasing chloride concentrations. Increased withdrawal from existing wells or from additional wells in these districts would cause definite deterioration of the quality of water in zones that are now intruded, and would cause the areas of intrusion to grow in size. In wells that now have moderate chloride concentrations because of incomplete flushing of relict sea water, future change in water quality due to increased pumping

probably would be less noticeable because the pumping possibly would resume the flushing process.

MASON AND THURSTON COUNTIES

Occurrence of Ground Water

Ground-water supplies in nearshore districts of Mason and Thurston Counties (pl. 4) are obtained chiefly from glacial deposits. Locally in major stream valleys, alluvial deposits furnish some ground water. Bedrock is at or near the surface at only a few places along the shoreline, except in northern Mason County where it is extensively exposed along the west shore of Hood Canal. Ground-water development has been principally for the purpose of supplying rural homes and small public-supply systems. A number of wells also supply water for use in oyster-processing plants.

Status of Sea-Water Intrusion

The chloride content of water from most wells near Hood Canal in Mason County is very low--generally less that 3 mg/l. Locally some intrusion has occurred --at Triton Head well 24/2W-6D1 (pl. 4) yielded water containing 870 mg/l of chloride.

On both sides of the canal in T. 22 N., R. 3 W., four wells yielded water ranging in chloride content from 18 to 55 mg/l, and may indicate intrusion. These wells tap glacial deposits at altitudes of from 7 to 85 feet below mean sea level, and all are within a few tens of feet of Hood Canal. They represent isolated cases of intrusion, inasmuch as water from neighboring wells at similar depths had very low chloride concentrations.

Salty water in wells along the channels and inlets of Puget Sound in Mason County (pl. 4), is known to be significant at only two points, both on northern Totten Inlet. In 1967, well 20/2W-28B1 produced water containing 355 mg/l of chloride, and water from well 19/2W-5C1 contained 345 mg/l. Well 20/2W-28B1 extends to 157 feet below mean sea level and the static water level is only about 1 foot above mean sea level. This well may tap the zone of diffusion that exists under natural conditions rather than a part of the aquifer

that had been intruded as a result of pumping. The chloride content of the well water has decreased by about 12 percent since 1963.

The salinity of water from well 19/2W-5C1 probably is due to lateral movement of sea water to the well through a zone that is restricted in the vertical direction, because nearby well 19/2W-5C3, which extends to a greater depth below sea level, reflects only incipient intrusion.

Aquifers extending below sea level near the shore between Hammersley and Totten Inlets seem to be more vulnerable to intrusion than aquifers elsewhere in Mason County. Intrusion could be minimized by locating wells as far inland as possible and by allowing sufficient spacing between wells.

The alluvial deposits at the head of Skookum Inlet (pl. 4) yield water with above-normal chloride content to several wells. The quality of water from well 19/4W-24P1 (not shown on pl.4), which is about 2 miles from the coast, is probably affected by incomplete flushing of relict sea water, whereas the high chloride content of water from wells 19/3W-20D1 and D2 (table 5) could be due to intrusion by sea water.

Intrusion probably is indicated on Hartstene Island at wells 19/2W-1A1, 20/2W-3P1, and 21/1W-31D2, and near the south end of Totten Inlet at well 19/3W-23E1 (pl. 4). In 1964, water from well 20/2W-21B1 on Pickering Passage contained 670 mg/l of chloride; the well is now unused and a sample collected from it in 1967 contained only 62 mg/l. The 1967 sample may have been diluted by surface drainage into the open well.

Aquifers that are capable of supplying yields reportedly as great as 2,000 gpm or more to individual wells are available locally in the Shelton district (pl. 4). However, pumpage in 1968 and for several preceding years was small, and no recent instances of salt-water intrusion in that district are known. Intensive pumping at the rates possible from the existing municipal and industrial wells probably would cause serious problems of intrusion.

According to Molenaar and Noble (1970), wells 20/3W-19H1, 20M1, and 20M2 yielded water that doubled in chloride content between 1947 winter and summer rates of pumping--8.5-17, 21-41, and 17-32 mg/l, respectively. These wells were not in use and were not sampled during this study.

Development of ground-water supplies along the inlets and channels of southern Puget Sound in Thurston County is more advanced than in Mason County, and sea-water intrusion is somewhat more widespread.

Significant intrusion has occurred in the northernmost mile of the peninsula between Totten and Eld Inlets (pl. 4). Although the depths of some of the sampled wells are not known, intrusion probably is limited to aquifers less than about 200 feet below sea level. Well 20/2W-33L1, which bottoms at 105 feet below mean sea level on the east side of Totten Inlet near its entrance, yielded water containing 677 mg/l of chloride in 1960 and 570 mg/l of chloride in 1967. Yet, wells 20/2W-28P1 and 33L2, which bottom at altitudes of 415 and 400 feet below sea level, yielded water containing only 2 and 10 mg/l of chloride, respectively. Locally, at least in this area, the severity of intrusion has not increased in the past 7 years. Several wells on the west side of Budd Inlet, near its entrance and about 1½ miles southeast of well 20/2W-33L1, yielded water containing from about 100 to 200 mg/l of chloride when sampled in 1967.

Chloride concentrations as great as 200 mg/l were obtained in samples from wells tapping alluvial deposits south of Mud Bay at the south end of Eld Inlet. The highest concentrations were from flowing wells that extend from about 100 to 200 feet below sea level, and the above-normal chloride apparently results from incomplete flushing of relict sea water. The salinity of water from most wells in this area, from which more than one sample has been collected, has not changed appreciably in the past 7 years.

Wells 19/2W-15M2, 16P1, 21L1, and 27D1 on the peninsula between Eld and Budd Inlets produce water that is high enough in chloride (78 to 205 mg/l) to suggest at least some sea-water intrusion. Three of the four wells bottom at altitudes of 20 to 40 feet below mean sea level; two other wells that were finished at greater depths reportedly encountered salty water just below mean sea level. The affected wells are located among other wells of comparable depth that tap unintruded zones, suggesting that, rather than one large area of intrusion, there are either several tongues of intrusion in small areas or several strata of intrusion or of incompletely flushed relict sea water. Pumping of additional wells or increased pumping from existing wells could cause a coalescing

of the contaminated areas, with the result that several wells could start to produce salty water with little or no forewarning.

Most wells within about 1,000 feet of Dana Passage near Big Fishtrap and Little Fishtrap in sec. 6, T. 19 N., R. 1 W., and secs. 1 and 12, T. 19 N., R. 2 W. (pl. 4), show some salt-water contamination. Well 19/1W-5M1, near the entrance to Henderson Inlet, also is affected. The affected wells tap aquifers in glacial deposits lying from a few feet to more than 500 feet below sea level, but the saltiest water occurs in aquifers that are just below mean sea level. Well 19/1W-6M2 yielded water containing 1,795 mg/l of chloride in 1960 from an aquifer only about 20 feet below mean sea level. The well has since been deepened, the upper zone sealed off, and its casing has been extended; in 1967 it produced water containing 145 mg/l of chloride from 223 feet below sea level.

Along the east shore of Henderson Inlet, only three small areas with wells containing water of above-normal chloride content are known. Well 19/1W-17K1, which taps an aquifer in glacial deposits 30 feet below mean sea level, produced water containing 620 mg/l of chloride. This well flows at an altitude of only a few feet above mean sea level, and taps a zone of diffusion that may have been at or near its present position even under natural conditions. Wells 19/1W-5J3 and 20G1, which extend to 110 and 43 feet below sea level, respectively, show some intrusion.

Several wells along Nisqually Reach, in secs. 4 and 10, T. 19 N., R. 1 W., produce water that ranges in chloride content from about 25 to more than 400 mg/l--the higher values indicate intrusion by sea water. Intrusion here probably is not restricted to a particular depth zone, but depends principally upon the distance from the shoreline and the amount of pumping from the wells.

Summary of Potential Sea-Water-Intrusion Problems

Unless ground-water withdrawal is greatly increased near Hood Canal, intrusion problems are likely to be restricted to a few isolated wells which are on points of land or which tap aquifers especially susceptible to intrusion.

In the vicinity of Hammersley Inlet and adjacent marine channels, increased pumping could result in sea-water intrusion. Wells on both sides of the entrance to Hammersley Inlet (east end) apparently would be susceptible to intrusion if pumping were intensified, as would be wells along most of the west shoreline of Totten Inlet for about 2 miles south of the entrance to Hammersley Inlet. In the Shelton area, at the head of Hammersley Inlet, renewal of intensive pumping doubtless would cause intrusion to increase to at least the extent of that existing prior to 1947. A more detailed study of the potential for sea-water intrusion should precede any major increase in pumpage in that area.

Drilling more wells and increased pumping from existing wells near the tips of the peninsulas north of Olympia could result in enlargement of the intruded areas and increased salinity in the zones already intruded. Selection of well sites farther inland to supply these problem areas would, in most cases, require increased well depths to supply the needed yields. Such alternate sources of fresh ground water generally could be found, and would help to reduce pumping in the nearshore areas.

PIERCE COUNTY

Occurrence of Ground Water

Nearly all ground water pumped from nearshore districts in Pierce County (pl. 5) is from aquifers in glacial deposits. Near Puget Sound the maximum thickness of these deposits is not known, but several wells more than 1,000 feet deep do not completely penetrate them. The largest yields are obtained from wells tapping glacial deposits in the mainland part of Pierce County, but equally productive aquifers may exist in peninsular parts of the county at depths greater than those explored to date.

Extensive alluvial deposits occur near the mouths of Nisqually and Puyallup Rivers, but the ground water developed in these areas comes chiefly from deeper glacial deposits.

Status of Sea-Water Intrusion

Sea-water intrusion in the mainland part of Pierce County is limited largely to the tidal flats at the mouth of the Puyallup River in Tacoma and a small area near Browns Point, northeast of Tacoma. One of the greatest chloride concentrations (6,450 mg/l) was found in ground water from 25-foot deep well 21/3-34C1 on the tidal flats at Tacoma. This well was drilled near Commencement Bay in artificial fill for the purpose of dewatering a construction site and has since been destroyed. Well 21/3-34C2 was a similar dewatering well and also had a very high chloride content (5,740 mg/l).

The tidal flats at the lower end of the Puyallup valley are underlain by about 100 feet of alluvium, which in turn is underlain by several hundred feet of marine deposits consisting chiefly of clay but containing lenses of sand and gravel. Glacial deposits of unknown thickness underlie the marine deposits at depths as great as 500 feet in the center of the valley floor. The alluvial and marine deposits are thinner on the edges of the valley floor than in the center. The glacial deposits include highly permeable sand and gravel layers containing fresh water under sufficient head to cause wells to flow at land surface. Most ground-water supplies in the Tacoma tidal flats are from aquifers in these glacial deposits.

A wedge of salty ground water in the alluvium and marine deposits extends up the valley about 1½ miles; only minor quantities of ground water is pumped from these units, mostly along the edges of the valley. This wedge has increased in thickness and salinity in recent years and may be affecting the quality of water in the underlying glacial deposits, as shown by a comparison of chloride concentrations of water obtained during the drilling of two wells about 40 feet apart (fig. 4).

Well 20/3-4J3, drilled in 1958, yielded water with a maximum chloride concentration of about 400 mg/l from a depth of about 350 feet. Well 20/3-4J4, drilled in 1965, produces water from approximately the same depth, but the chloride concentration had increased to nearly 3,900 mg/l in the intervening years (fig. 4). Salt water also was found at greater depths in 1965 than in 1958.

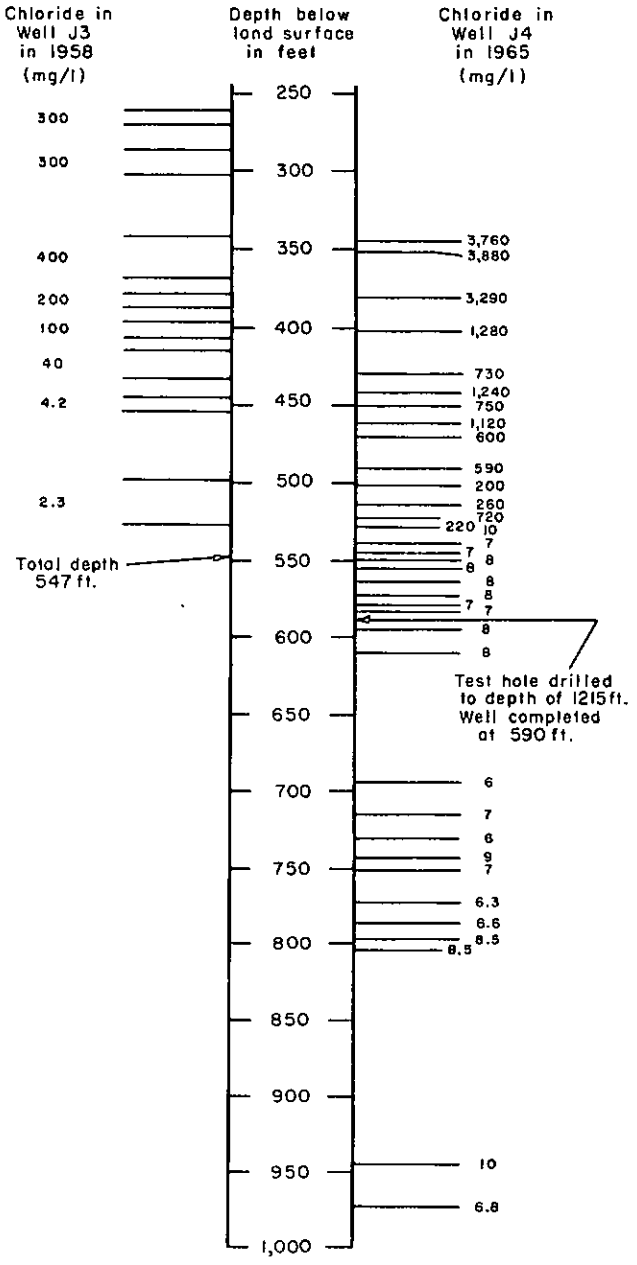


Figure 4.--Chloride concentrations in ground water at various depths, obtained during drilling of adjacent wells in Tacoma, 20/3-4J3 in 1958 and 20/3-4J4 in 1965.

The increased thickness, salinity, and areal extent of the salt-water wedge in the alluvial and marine deposits probably is not due entirely to the pumping of wells that are finished in these units. When the hydrostatic head in the glacial deposits is reduced by the pumping of deep wells, saline water from the alluvial and marine deposits may enter some wells through damaged or improperly installed casings. The saline water may be discharged from the well where the contamination took place, or it may be drawn laterally into a neighboring well; the amount of water withdrawn from shallow aquifers through the leaking casings of deeper wells on the Tacoma tidal flats may exceed the amount withdrawn by shallow wells. This leakage between shallow and deep zones could account for much of the growth of the salt-water wedge in the shallow deposits, and also could cause intrusion in the deeper glacial deposits.

The chloride content of several deep wells on the Tacoma tidal flats is known to increase when the hydrostatic head is reduced. For example, well 20/3-4J3 contained 279 mg/l of chloride on February 19, 1966, when nearby well 20/3-4J4 was being pumped and only 5.4 mg/l on March 22, 1966, when 4J4 was not being pumped. Also, the chloride content of well 21/3-26Q1 is reported to have risen greatly when an accumulation of sand in the bottom of the well stopped the flow. When the well was later cleaned out and the casing replaced the flow resumed and the chloride content decreased.

Well 21/3-27J1, the farthest seaward of all the tidal-flat wells for which records are available, reportedly entered brackish water at a depth of about 550 feet when it was drilled in 1938. The brackish water supposedly was sealed off by casing and the well was finished at the 1,216-foot depth. However, water from the well proved to be too brackish for use and the well was destroyed.

Several public-supply wells at Hyada Park, northeast of Tacoma, show marked sea-water intrusion. The wells tap aquifers in glacial deposits at altitudes ranging from about 90 to 329 feet below sea level. When the wells were sampled in 1966, the highest chloride concentration was 230 mg/l, from well 21/3-16L2, but higher concentrations have occurred at times in five other wells in the area. The highest known chloride concentration in this district was 1,050 mg/l, from well 21/3-16N1 in June 1960. Kimmel (1963) made a detailed study of intrusion in this area, and

found that the chloride concentrations increase with prolonged pumping, when water levels are drawn down below sea level.

Isolated cases of sea-water intrusion affecting individual wells only a few tens of feet from the beach line have been detected on the mainland of Pierce County. For example, well 20/2-20Q1, which is a large infiltration trench extending to about 5 feet below mean sea level and which produces water used for washing gravel, yielded water containing 7,660 mg/l of chloride in 1966.

Incipient sea-water intrusion may be indicated in the Dupont area by a chloride concentration of 27 mg/l in water from industrial well 19/1-27C1 in 1966, as compared to 12 mg/l in 1961. Nearby, well 19/1-22P2 contained 15 mg/l in 1966 as compared to 9 mg/l in 1961. Another adjacent well, 19/1-22P1, was not sampled in 1966, but the 1961 chloride concentration was 8 mg/l compared to 20 mg/l in 1942. These wells extend from 44 to as much as 115 feet below sea level and have static water levels only a few feet above mean sea level. The chloride concentrations in these wells probably varies directly with pumpage.

Water from public-supply wells 20/2-9C1 and C2 on Day Island, a few hundred feet west of the mainland at Tacoma, have increased slightly in chloride content during the past 5 years, and may be very slightly contaminated by salt water.

Of the four islands in Puget Sound between the mainland and peninsular parts of Pierce County (pl. 5), only Anderson and Fox Islands were visited as part of this study. No wells are in use on McNeil Island, a Federal penitentiary, and one deep well supplies the entire needs of the residents of Ketron Island. Many of the ground-water supplies for domestic use on Anderson and Fox Islands are from springs or shallow dug wells.

Information on the quality of ground water from deep aquifers on Anderson Island is limited to data on six wells. Of these, wells 19/1-9M1 and 17J1 yielded water containing 561 and 504 mg/l of chloride, respectively, and doubtless are contaminated by sea water. Well 20/1-29Q1 was finished at an altitude of 77 feet below mean sea level and reportedly yielded water of good quality when drilled. However, the water became

increasingly salty with use and the well was destroyed. Well 20/1-29Q3, about 750 feet southeast of Q1 and finished at 7 feet below mean sea level, contained 64 mg/l of chloride which probably represents intrusion. Incipient intrusion also may be indicated at 19/1-6P1 (depth unknown) by a chloride concentration of 27 mg/l. Increased pumping in the parts of the island that are already intruded, or the development of appreciably larger ground-water supplies for the island as a whole, probably would greatly increase the rate of sea-water intrusion. However, small to moderate additional supplies might be obtained safely from widely spaced wells in areas that are now developed.

On Fox Island, seven wells bottoming at altitudes ranging from 13 to 333 feet below sea level were sampled. The chloride concentration of water from these wells ranged from 2.4 to 6.5 mg/l, and no indication of sea-water contamination was obtained.

Except for well 20/1-6P2 near Lake Bay, which shows some intrusion, sea-water intrusion on the Longbranch peninsula of Pierce County is limited to the southern 3 miles of the peninsula. Most wells in this area tap aquifers in glacial deposits lying between sea level and about 125 feet below sea level, and have static water levels ranging from 20 feet above sea level to reportedly as much as 34 feet below sea level. Chloride concentrations in water from wells on the Longbranch peninsula range from only 2.7 mg/l in well 20/1W-25F2 to 1,020 mg/l in well 20/1W-24L3, but most are within the range of about 20 to 125 mg/l and probably represent only the edge of the zone of diffusion. No relationship between depth below sea level and degree of intrusion is evident; the degree to which salty water has reached individual wells probably depends largely on their distance from shore and on the quantity pumped from them.

Intrusion on the small peninsula south and west of Horsehead Bay is indicated by the chloride concentrations in most wells sampled. Of six wells sampled on the peninsula, five yielded water with chloride concentrations ranging from 13 to 329 mg/l. These wells bottom at altitudes ranging from 3 to 107 feet below mean sea level. The depth of the sixth well, which yielded water containing only 1.4 mg/l of chloride, is not known.

In the rest of peninsular Pierce County, intrusion is indicated at only two places. Well 21/1-16L2 at Kopachuck State Park produced water containing 190 mg/l of chloride, and wells 21/1-3D1 and D2 on Allen Point produced samples containing 360 and 401 mg/l of chloride, respectively.

Summary of Potential Sea-Water-Intrusion Problems

Intrusion by sea water in the Tacoma tidal flats probably will increase in magnitude at the present rate of pumping from deep aquifers, and would be greatly accelerated if pumpage were increased. If the theory that intrusion is taking place by movement of saline water from shallow aquifers to deep aquifers through faulty casings is correct, the problem could be alleviated by proper repairs to existing wells and plugging of abandoned test holes. Wells that penetrate a great thickness of alluvial materials, many with casings that are very old, are especially subject to casing damage by earthquakes, and in the event of an earthquake in this area salt-water contamination at some wells could occur abruptly.

Withdrawal of ground water at Hyada Park, on Anderson Island, and at the south end of the Longbranch peninsula is now about equal to or greater than the natural recharge that takes place through the poorly permeable till cover in the very limited recharge areas. Increased localized withdrawal in these areas would result in further lowering of the water table and increased sea-water intrusion.

KITSAP COUNTY

Occurrence of Ground Water

Ground-water supplies in Kitsap County (pl. 6) are developed almost entirely from aquifers in glacial deposits. Pumping yields as great as 1,000 gpm are obtained at several localities, and deep wells in the Port Orchard-Manchester area flow at rates of several hundred gallons per minute. At other places, wells penetrate principally fine-grained materials, and yields are barely adequate for individual domestic supplies.

Little or no development of ground-water supplies has been attempted in parts of northern and western Kitsap County, and the amount of ground water that may be available is unknown. Locally, near Bremerton and Manchester and on Bainbridge Island, bedrock is exposed at the surface and very little ground water is available.

Status of Sea-Water Intrusion

The greatest known chloride concentration in ground water in Kitsap County was 897 mg/l, from well 24/2-9L1 (table 8) which was drilled in bedrock for public supply. Water from this well was salty when the well was drilled, and the well consequently was never used. Nearby domestic wells 24/2-9J2 and J3 produced water containing 210 and 41 mg/l of chloride, respectively, also from bedrock. The high chloride content of water from bedrock in this area probably is due to relict sea water. Water from well 24/2-16F4 in the same general area, which taps a very shallow alluvial aquifer and ends above sea level, contained 413 mg/l of chloride. The high chloride content in this well probably is due to contamination from surface sources.

The areal extent of sea-water intrusion in the extreme northern part of Kitsap County (pl. 6) is not known, but all the wells sampled near Foulweather Bluff contained considerably more than 10 mg/l of chloride. The chloride content of nine wells tapping aquifers in glacial deposits at altitudes between 2 feet above and 53 feet below sea level, ranged from 20 to 590 mg/l. Recharge to these aquifers from local precipitation is impeded by the overlying, nearly impermeable glacial till and clay.

Sea water affects the quality of water from wells in a small area south of Foulweather Bluff. Several wells reportedly have been abandoned because they produced brackish water. Brackish water also has been reported in the nearby Hansville and Point No Point areas; these areas are now served by a public-supply system obtaining water from a surface source and most wells formerly used for domestic supply have been destroyed.

Increased development in the Foulweather Bluff area, or renewed ground-water pumpage at Hansville and Point No Point probably would result in the intrusion becoming more pronounced.

At Keyport, well 26/1-36P4, which is 1,036 feet deep and which produces water from several glacial-deposit aquifers from 158 to 1,001 feet below sea level, flows at land surface and, when sampled in 1967, its water contained 26 mg/l of chloride. This chloride concentration is not high enough to suggest intrusion of the principal aquifers tapped by the well but, when it is pumped, some salty water from shallow zones may enter the well by way of the gravel pack that reportedly extends the full depth of the well. In the same township, well 26/1-35F1, about three-fourths of a mile northwest of 36P4, and several wells in sec. 25 yield water containing from 11 to 18 mg/l of chloride from zones ranging from 2 to 145 feet below mean sea level.

On Bainbridge Island, well 24/2-13D1 yielded water containing 150 mg/l of chloride. The well is only a few tens of feet from the beach near the southeast tip of the island, and the intrusion that affects it probably is localized. In about 1945, several wells that were drilled in the SW¼ sec. 26, T. 25 N., R. 2 E., for a Federal housing project reportedly produced brackish water and were later destroyed. Several other wells on the island yield water with chloride concentrations of 11 to 30 mg/l; all are near the beach and the high chloride values indicate local intrusion.

Widely scattered small areas of localized intrusion in Kitsap County may be indicated by chloride concentrations of 41, 36, and 20 mg/l, respectively, from wells 23/2-22Q1 at Fragaria, 24/1-4C1 at Erlands Point, and 25/1W-19M1 near Seabeck on Hood Canal.

Summary of Potential Sea-Water-Intrusion Problems

A large part of the present ground-water withdrawal in Kitsap County is in areas where fresh-water aquifers are under artesian pressure, and pumpage to date has not significantly reduced the pressure. At most places the salt-water front probably is in an offshore extension of the aquifers. Sea-water intrusion is not likely to be a problem in these areas until

withdrawals are increased substantially and the artesian heads are reduced.

Continued ground-water withdrawal near Foulweather Bluff probably will result in increased salinity in well waters that already are contaminated by sea water and it also could cause enlargement of the intruded area.

Static water levels in the Winslow area are above sea level and some wells flow at land surface. No known intrusion has occurred in this area. However, prolonged heavy pumping in such an area of closely spaced wells could bring about sea-water intrusion.

KING AND SNOHOMISH COUNTIES

The areas investigated in King and Snohomish Counties include the mainland shorelines and Vashon and Maury Islands. Most of the area, except the islands, is heavily populated and much is industrialized.

Occurrence of Ground Water

Nearly all the ground-water supplies in King and Snohomish Counties are derived from aquifers in glacial deposits. Although nearly saturated alluvial deposits occur along the Duwamish River in Seattle, the Snohomish River at Everett, and the Stillaguamish River near Stanwood (pl. 7), few wells obtain water from them.

In King County (pl.5) and Snohomish County (pl. 7), considerably less ground water is being pumped now than in the past, from wells near the coast, and many former wells have been abandoned or destroyed. Much of the area now receives water from public-supply systems that obtain water from surface sources, or from wells that are several miles inland, where aquifers are more productive than those near the coast. Many industries that formerly obtained water from their own wells now use water from public supplies. Springs and shallow wells provide most of the water used in those parts of Vashon and Maury Islands (pl. 5) not served by public water-supply systems.

Status of Sea-Water Intrusion

On the mainland of King County, south of Elliott Bay, only one well yielded water containing more than 10 mg/l of chloride when sampled as part of this study. The chloride content of 14 samples of water from wells in this area ranged from 4 to 14 mg/l. All the wells tap aquifers in glacial deposits at altitudes ranging from 235 feet above sea level to 784 feet below sea level. None of the chloride concentrations was high enough to indicate sea-water intrusion.

Well 22/4-17Q4, in the Zenith district, now maintained as a standby public-supply well, contained water with 300 mg/l of chloride when sampled in 1961, and was definitely contaminated by sea water. The contamination at that well, however, did not affect the quality of water from shallower wells in the same area.

Near the Duwamish River in south Seattle wells 23/4-4A1 and 24/4-19H1 (not listed in table 9 or shown on pl. 5) formerly produced water containing 348 and 990 mg/l of chloride, respectively, from depths of more than 600 feet. It is not known whether the chloride content of water from these wells change appreciably during the period of use. Both wells are now destroyed.

Of five water samples collected from wells north of Elliott Bay in Seattle, one was high enough in chloride content to indicate definite intrusion. This sample, a composite of water from interconnected flowing wells 25/4-31E1 and E2, contained 520 mg/l of chloride. The wells are 120 and 785 feet deep, respectively, and in 1941 the deeper well reportedly yielded brackish water whereas the shallower well yielded potable water. The wells are only a few tens of feet from Elliott Bay, and the deeper one probably extends into a zone of diffusion between fresh and saline ground water. Wells about 150 to 200 feet deep near the head of Elliott Bay reportedly produced brackish water as early as 1922. Wells 25/3-11R1, near Salmon Bay, and 25/3-23Q1, near Elliott Bay, suggest intrusion, having chloride concentrations of 60 and 38 mg/l, respectively.

Sparse sampling of water from wells on Maury Island revealed no sea-water intrusion; all samples contained less than 10 mg/l of chloride. Also, in the south half of Vashon Island, all well waters sampled contained less than 15 mg/l of chloride, and only two

wells yielded water containing more than 10 mg/l. These were wells 21/2-2Q1, which produced water containing 14 mg/l, and 22/3-17C1, where 11 mg/l was found. Both wells are shallow and are within a few feet of the beach.

Along the shorelines of northern Vashon Island, several wells show the effects of intrusion. Of samples from seven wells in the northern part of the island, two had less than 10 mg/l of chloride, three had from 83 to 156 mg/l of chloride, suggesting intrusion, and two had 345 and 658 mg/l, showing definite intrusion. Not enough deep wells were available for sampling to determine the extent of intrusion. Static water levels generally are not far above mean sea level in the north part of the island, and little drawdown of water levels by pumping is necessary before landward movement of salty ground water could occur.

Along the shoreline of Puget Sound north of Salmon Bay in King County and in southern Snohomish County, a body of clay extends from about sea level to several hundred feet below sea level, and deep wells penetrating it generally have been unproductive. Most of this part of the area is supplied with domestic and industrial water by public-supply systems which use surface-water sources. No wells deep enough to be intruded were available for sampling.

In that part of Snohomish County lying north of the mouth of the Snohomish River (pl. 7) known, definite intrusion by sea water is limited to a small district at Priest Point, northwest of Everett, and to a district near the Stillaguamish River, southeast of Stanwood. Some saline ground water probably occurs near the slough and tidal reaches of the mouth of the Snohomish River, but no wells are known to have been drilled there.

The Priest Point Beach Water Company has abandoned a 174-foot well which taps aquifers in glacial deposits about 45 feet below sea level because of high salinity (210 mg/l of chloride in 1961). The company's second well in the vicinity (pl. 7), 30 feet shallower than the abandoned well, contained water with only 22 mg/l of chloride in 1967. A privately owned well just west of the company's wells, and tapping a glacial-deposit aquifer at about the same depth below sea level as the abandoned well, contained water with 120 mg/l of chloride in 1967. Water from wells on the

southernmost tip of the point shows no significant change in chloride content since 1947, indicating that intrusion is not advancing from the south. The direction of movement of the intruding salt water probably has been from the northeast to the southwest.

Two wells on Gedney (Hat) Island produced saline water from glacial-deposit aquifers 30 to 40 feet below sea level. The static water level reportedly was about 2 feet above mean sea level in one of these wells, and about 3 feet below sea level in the other. In that depth range, these wells probably tap water in the zone of diffusion where fresh water is floating on saline water, and probably did not reflect active sea-water intrusion. The wells then were finished for production at depths of 20 and 24 feet below sea level and produced usable water. However, only a few feet of lowering of the water level would cause a rise of salt water into the wells.

Data on the quality of ground water beneath the delta at the mouth of the Stillaguamish River is limited to that from two wells of the Stanwood Water Company. These wells were drilled on the north bank of the river, south of Jorgenson Slough. Well 32/4-30L1 (table 10) was drilled to a depth of 145 feet, all in alluvial material, and reportedly produced very salty water from the lower 30 feet. An attempt was made to backfill the well to a depth of about 95 feet and obtain water of better quality from a gravel layer 70 to 95 feet below the surface. The well was later abandoned because of brackish water. Well 32/4-30K1 was drilled to a depth of about 67 feet, also in alluvium, but it also was abandoned because of salinity. Although saline ground water may occur only in the lowlands that border the river, its upriver extent is unknown. About 700 feet north of the Stillaguamish, well 31/4-4C1 produces water that is low in chloride. However, it taps deeper zones than do the aforementioned wells and saline water in the overlying alluvium may have been penetrated and sealed off by the casing.

Summary of Potential Sea-Water-Intrusion Problems

Problems of sea-water intrusion in mainland King and southern Snohomish Counties are likely to occur only where pumpage of ground water is greatly increased.

Because Vashon and Maury Islands have practically no surface-water sources, any increased water supply for these islands probably will be from ground-water sources, and intrusion could become a serious problem. The most serious problems are likely to develop in the northern part of Vashon Island, where some intrusion already has occurred.

ISLAND COUNTY

Occurrence of Ground Water

All ground water obtained from existing wells in Island County (pl. 8) occurs in aquifers in glacial or interglacial deposits. These aquifers are only moderately permeable, and yields of more than about 250 gpm are rare. More than half the wells for which information is available tap aquifers between sea level and 75 feet below (Anderson, 1968, p. 12). Wells that tap aquifers below sea level generally have static water levels only a few feet above mean sea level. A few flowing wells occur where land-surface altitudes are near sea level.

Status of Sea-Water Intrusion

The chloride content of nearly all ground water in Island County is higher than in most parts of Washington. Some wells that lack as much as 50 feet of reaching sea level yield water containing more than 100 mg/l of chloride. According to Van Denburgh (1968, p. 26), many of the fine-grained sediments that underlie the surface of Island County accumulated in a marine or brackish-water environment when the land surface was several hundred feet lower relative to sea level. For purposes of discussion, ground water from wells in Island County is not considered to be intruded unless the chloride content is more than about 100 mg/l.

Sea-water intrusion in Island County is not limited to any particular shoreline area, except that there is little evidence of intrusion in the southeast and northeast extremities of Whidbey Island. Intrusion seems to be more pronounced in the southeast and northeast extremities of Camano Island, and in the

Coupeville-Oak Harbor and Double Bluff areas of Whidbey Island, but even within these areas intrusion seems random.

Sea-water intrusion occurs in shoreline areas at almost all depths below sea level, but the greatest number of intruded wells tap aquifers at less than 50 feet below sea level. However, some of the highest chloride concentrations are from wells that extend to more than 200 feet below sea level. Well 32/1W-25F2 was drilled to a depth of 245 feet. The water was salty, and the well was plugged back to 190 feet. Water that was too saline for use reportedly has been found during the drilling of water wells that extend as much as 444 feet below sea level. The saline water at these great depths probably occurs naturally, but substantial pumping of shallow wells could cause intrusion by upwelling of the deep saline water.

Van Denburgh (1968, p. 37-43) showed that, at least in some wells, there is considerable variation in chloride content with time and pumpage, and that changes in concentration may be due to variations in recharge. Water from well 31/1-9A1, which extends to about 42 feet above sea level, has ranged from 80 to 129 mg/l of chloride. At the U. S. Naval Air Station, the chloride content of water from well 33/1-22C1, whose bottom is about 42 feet below mean sea level, increases abruptly from about 30 to about 100 mg/l when the well is pumped continuously; when pumping is discontinued the chloride content slowly returns to about 30 mg/l. Proper spacing of wells that are to be intensively pumped, and generally good ground-water-management practices are required under these conditions.

The highest known chloride concentration (14,000 mg/l) in ground water in Island County was from industrial well 32/1-32N1 near Coupeville. Twelve wells in that district have produced water containing more than 250 mg/l, the maximum concentration recommended for drinking water by the U. S. Public Health Service (1962).

Summary of Potential Sea-Water-Intrusion Problems

Aquifers lying below sea level in practically all shoreline areas of Island County are susceptible to contamination by lateral movement of sea water toward pumping wells, and deep wells inland are subject to contamination by upwelling saline water from greater depths. The amount of pumping that is necessary to cause contamination of either type varies with local conditions. Wells for additional supplies or to replace those yielding salty water should be moved inland as far as possible and be widely spaced to minimize drawdown of water levels at any locality.

WHATCOM AND SKAGIT COUNTIES

The area investigated in Whatcom and Skagit Counties comprises the nearshore districts extending northward from the Snohomish County line to the international boundary (pls. 7, 8), some small offshore islands, and Point Roberts, the southern part of a peninsula extending across the international boundary from Canada.

Occurrence of Ground Water

Ground water in the uplands of this area occurs almost exclusively in glacial deposits, or in stream or lake deposits laid down between periods of glaciation. Areas beneath which bedrock is at or very near the surface can be regarded as almost devoid of ground water. Although many wells in the uplands extend to depths of 500 feet or more without encountering it, generally the bedrock is closer to the surface in Whatcom and Skagit Counties than it is in other parts of the Puget Sound region. Where the bedrock consists of igneous and metamorphic rocks it limits only the availability of ground water, but locally in Whatcom County sedimentary bedrock contains enough saline water to contaminate the water in overlying unconsolidated aquifers. However, a thick section of clay or other fine-grained unconsolidated deposits overlies the bedrock in much of the area, so that the upward movement of saline water into surficial deposits is limited. Contamination by relict

sea water from the bedrock, rather than sea-water intrusion, probably occurs in fairly shallow unconsolidated deposits north and northwest of Bellingham.

Deltas or flood plains bordering the estuaries of the larger rivers comprise the major lowlands of Skagit and Whatcom Counties that are bordered by sea water. The most notable of these deltas are formed by the Skagit River southwest of Mount Vernon (pl. 7), and by the Nooksack near Marietta (pl. 8). The thickness of deposits beneath these lowlands is unknown. Most wells have encountered only fine-grained materials below depths of about 100 feet. Near the seaward edges, coarse-grained materials are almost completely lacking and small yields of saline or brackish water are all that can be obtained from shallow fine-grained materials.

Status of Sea-Water Intrusion

Virtually no sea-water intrusion of the fresh ground-water body has occurred on the mainland of Skagit County. The absence of intrusion is due largely to the lack of development of ground-water supplies along the coastline, which in turn is due mainly to low well yields.

In the mainland part of Skagit County, only well 35/3-11R1 has produced water with moderate chloride content (114 mg/l). Although the chloride content is great enough to suggest advanced sea-water intrusion, the well is about 3 miles from the coastline. This well taps water in a sand and gravel aquifer 177 feet below mean sea level; in contrast a nearby well produces low-chloride water from 48 feet below sea level. The moderate chloride content of water from well 35/3-11R1 may be due to incomplete flushing of relict sea water rather than to active intrusion. Well 35/3-19C1, on the mainland about one-quarter mile from the coastline, produced water containing 39 mg/l of chloride from 55 feet below sea level. This chloride content may indicate some intrusion and it may represent dilute relict sea water.

The two principal areas of Fidalgo Island served by local wells are the west shore district and the Swinomish Indian Reservation. Of the wells sampled in the west shore district, only well 35/1-27Q1 had water

with enough chloride content (120 mg/l) to suggest sea-water intrusion. That this well might more likely be producing dilute relict sea water is suggested by the fact that nearby well 35/1-34H1 yielded water containing 42 mg/l chloride from a zone 19 feet above mean sea level. Samples from wells on the Swinomish Indian Reservation ranged in chloride content from 16 to 55 mg/l. Although these concentrations are somewhat higher than normal for coastal ground water in Washington, sea-water intrusion is not necessarily indicated because some of the wells do not extend to sea level.

Guemes Island is an area of farms and summer homes and is served entirely from private wells. Of five widely scattered wells from which samples were collected, only well 36/1-36C1 contained water with enough chloride concentration (315 mg/l) to suggest sea-water intrusion or relict sea water. Chloride concentrations in the other four samples ranged from 17 to 39 mg/l and also may indicate either intrusion or dilute relict sea water. A well in the N½ sec. 35, T. 36 N., R. 1 E., was not sampled but was reported to produce water too brackish for household use. This well is about 300 feet deep and was completed at an unknown depth between 150 and 200 feet below sea level.

In comparison with many other areas of coastal Washington, the development of ground-water supplies in coastal Whatcom County (pl. 8) is minor, being limited mostly to use for individual domestic and small public supplies.

Many wells in Whatcom County produce water somewhat greater in chloride content than normal ground water, and some produce water that is definitely saline. However, more water-quality problems probably are related to relict sea water than to present-day sea-water intrusion.

On the nearshore mainland of Whatcom County, there is a definite relationship between well depth and water quality. Of 29 sampled wells that bottom at depths of less than 100 feet below sea level, only two had chloride concentrations of more than 50 mg/l (pl. 8). In contrast, of 10 that bottom at depths of more than 100 feet below sea level, only one had a chloride concentration of less than 50 mg/l, and most were in the range of 50 to 230 mg/l.

On the peninsula of the Lummi Indian Reservation and on the coastal mainland of Whatcom County to the southeast no intrusion is indicated by the water from existing wells. However, a sample collected in 1948 from well 38/2-19L2 contained 1,160 mg/l of chloride, and probably represents local intrusion. This well was reportedly damaged several years ago by an earthquake and has been destroyed. Another well, drilled by the U. S. Navy to a depth of 150 feet near the center of the SW¼ sec. 11, T. 38 N., R. 1 E., reportedly also yielded salty water and was destroyed. Many wells on the Lummi Indian Reservation yield water that ranges in chloride content from 25 to 40 mg/l; however, this probably does not indicate intrusion, because well 38/2-19L5, which bottoms 28 feet above mean sea level, produces water containing 33 mg/l of chloride. Further evidence that the above-normal chloride content of ground water beneath the reservation is due to some cause other than active sea-water intrusion is furnished by well 39/2-30L1 (not shown on maps). This flowing well, which is about 4 miles from the coastline, produces water having a chloride concentration of 162 mg/l.

At Point Whitehorn, well 39/1W-2P1 yielded water with 230 mg/l of chloride and probably taps an aquifer intruded by sea water. Several wells east of Point Whitehorn also produce brackish or saline water, but because they flow with substantial artesian head they may not tap a recently intruded aquifer. Wells 40/1-17P1 and 20D1 produced water containing 495 and 120 mg/l of chloride respectively, but they also flow with sufficient head to preclude the likelihood of the chloride coming from recent sea-water intrusion. Development of additional ground-water supplies at or near Point Whitehorn may require extensive test drilling and water-quality monitoring to avoid the pumping of relict sea water or the inducement of modern-day intrusion.

On Lummi Island, sea-water intrusion is presently (1968) a problem only along the northeast shoreline between the northernmost point of the island and the community of Lummi Island, and for about half a mile east of Village Point (pl. 8). The highest chloride concentration (355 mg/l) sampled was from well 37/1-4J1, which is 55 feet deep and taps a sandstone aquifer. No wells are now in use in the intruded area east of Village Point. Chloride concentrations of 15 to 30 mg/l are common on the island and do not indicate intrusion, as some of the concentrations in that range

are from wells that do not extend to sea level. However, substantial increases in ground-water withdrawal on the island without danger of intrusion probably could be accomplished by means of widely spaced wells, each of fairly low yield.

On the Point Roberts peninsula (pl. 8), sea-water intrusion is limited to a small district along the west shore, south of the community of Point Roberts. Here ground-water development to supply summer homes is by individual driven wells about 10 to 15 feet deep. Intrusion is most pronounced at well 40/3W-9A1 which in September 1968 yielded water with a chloride content of 285 mg/l. The high chloride may be due to greater aggregate pumpage in this vicinity during the summer months. Other wells to the south are of about the same depth, but the intrusion has been very slight.

Summary of Potential Sea-Water-Intrusion Problems

Problems of sea-water intrusion on the mainland parts of Whatcom and Skagit Counties probably will continue to be restricted to isolated shoreline wells on points and peninsulas. Expansion of existing public supplies from ground-water sources is likely to involve drilling at inland locations where more productive aquifers are found. Also, industries in these counties that require large quantities of water are likely to develop supplies from surface sources, and may supply the surrounding residential communities. Points of land, such as Point Whitehorn, that are especially susceptible to sea-water intrusion and are occupied by year-round residents, will most likely continue to have contamination of the fresh ground water. Barring increased pumping to supply additional residents, intrusion is not expected to advance much beyond its present state in areas of predominately summer residents, such as Point Roberts, where pumping is highly seasonal.

SUMMARY AND CONCLUSIONS

The status of sea-water intrusion along Washington's more than 1,000 miles of marine coastline is evaluated in this reconnaissance on the basis of data from about 1,800 wells. There has been no development

of the ground-water resources along many miles of coastline, and other large segments of the coastline are not subject to sea-water intrusion because of local geologic and hydrologic conditions.

As of 1968, sea-water intrusion is a problem of very localized concern in the State, although it is already pronounced at some places; in some small localities, most of the deep wells tap aquifers that are contaminated to some degree. Most wells that tap intruded zones are close to the shoreline and, in may cases, adequate replacement by wells farther from the shoreline is possible with less danger of intrusion. Very few large-yield wells have been abandoned or have had their water seriously degraded because of intrusion. Except for the tidal flats at the mouth of the Puyallup River at Tacoma, most sizable areas of intrusion are on islands and peninsulas where fresh-water recharge is small in relation to withdrawals.

The amount of ground water that can be pumped from aquifers underlying peninsulas and offshore islands without causing excessive sea-water intrusion is largely controlled by the amount of local recharge to the fresh ground-water bodies. Knowledge of the size and character of the fresh ground-water reservoir, the amount of precipitation that recharges the aquifers, and the natural ground-water losses is a requisite for determining a water budget that would adequately guide water-management decisions such as the amount of pumpage that could be permitted before other sources of fresh water are to be developed.

Because of the abundance of precipitation and favorable recharge conditions in much of coastal Washington, intrusion of substantial areas is likely to occur only where large, intensively pumped well fields are near the shorelines. To date (1968), the larger cities and industries that require large water supplies depend primarily on surface-water sources. Ground water is used only supplementally by large nearshore cities, and is develped mostly for smaller public-supply systems, small industries, and individual domestic supplies.

Small areas of additional intrusion are expected to develop with increased local pumping, and some intrusion may become more pronounced where it is now only incipient. However, where serious intrusion is present in the mainland nearshore areas, it may now be about at

its maximum because increased water use and early awareness of water-quality problems tend to cause a gradual shift by major users from coastal ground-water supplies to surface water or to ground-water supplies farther inland. Major water users in coastal areas of Washington who now rely largely on surface-water supplies, or on ground water that is not subject to intrusion, include Hoquiam, Aberdeen, Port Angeles, Port Townsend, Bremerton, Seattle, Tacoma, and several large industries in northern Whatcom County.

Areas that may experience increased intrusion without greatly increasing ground-water withdrawals include Neah Bay in Clallam County; parts of the Miller Peninsula and Marrowstone Island in Jefferson County; the Foulweather Bluff area of Kitsap County; parts of Anderson Island, the Tacoma tidal flats and Hyada Park near Tacoma in Pierce County; and much of the shorelines of Island County. A program should be established to monitor changes in ground-water quality and water levels in these areas.

Areas such as Shelton and Winslow, that have had problems with intrusion when more water was pumped, should have further study before pumpage is again appreciably increased. The North Beach peninsula, the peninsulas that enclose Grays Harbor, the southeast part of Mason County, the peninsulas of northern Thurston County, and perhaps the Bremerton-Port Orchard area should be reinvestigated in about 10 years to ascertain the state of sea-water intrusion.

To minimize the chance of sea-water intrusion, new wells (or replacement wells) in nearshore areas should be widely spaced and located as far away from the shoreline as is feasible, and should be designed from the best information obtainable. For much of coastal Washington, hydrologic data of use during the planning of well-water supplies are available at the State of Washington Department of Ecology in Olympia and (or) the U. S. Geological Survey in Tacoma.

REFERENCES

Anderson, H. W., Jr., 1968, Ground-water resources of Island County: Part II of Washington Div. Water Resources Water Supply Bull. 25.

Armstrong, J. E., and Brown, W. L., 1954, Late Wisconsin marine drift and associated sediments of the lower Fraser Valley, British Columbia, Canada: Geol. Soc. American Bull. v. 65, p. 349-364.

Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., and Nobel, J. B., 1965, Late Pleistocene stratigraphy and chronology of southwestern British Columbia and northwestern Washington: Geol. Soc. American Bull., v. 76, p. 321-330.

Cooper, H. H., Jr., Kohout, F. A., Henry, H. R., and Glover, R. E., 1964, Sea water in coastal aquifers: U. S. Geol. Survey Water-Supply Paper 1613-C, 84 p.

Kimmel, G. E., 1963, Contamination of ground water by sea-water intrusion along Puget Sound, Washington. An area having abundant precipitation: U. S. Geol. Survey Prof. Paper 475-B.

Molenaar, Dee, and Noble, J. B., 1970, Geology and related ground-water occurrence, southeastern Mason County, Washington: Washington Div. Water Resources Water-Supply Bull. 29, 145 p.

U. S. Public Health Service, 1962, Drinking water standards, 1962: U. S. Public Health Service Pub. 956.

Van Denburgh, A. S., 1968, Chemical quality of the ground water, in Anderson, H. W., Jr., Part II, Ground-water resources of Island County: Washington Div. Water Resources Water Supply Bull. 25, p. 22-47.

APPENDIX

Tables 1-8.--Quality of ground water in coastal areas.

EXPLANATION

* - Indicates well has been destroyed

** - Indicates well not shown on plates 1-8.

a - Water not sampled, but reportedly brackish or saline.

b - Composite sample from two or more wells.

c - Water level or flow affected noticeably by tide.

TABLE 1.-- Quality of ground water in coastal areas, Pacific County.

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 9 N., R. 10 W.								
17J1	Oscar Ablesen	10	22	2	8- 8-68	14	274	8-15-68
T. 10 N., R. 11 W.								
3H1	Al Winter	10	20	--	--	23	217	9-11-68
3H2	E. W. Meriwether	15	19	5	--	12	103	9-11-68
4D1	Reuben Anderson	25	28	--	--	[b]18	143	8-16-68
4D2	J. B. Bigelow	25	25	--	--	18	131	8-16-68
4E1	Robert Wright	20	30	--	--	17	108	8-15-68
4M1	Florence Stanley	20	13	13	--	21	135	8-15-68
4N1	C. J. Underwood	20	19	10	--	19	127	8-15-68
9D1	Don Thompson	20	20	--	--	20	201	8- 9-68
9D2	Paul Hackett	20	21	--	--	18	120	8-15-68
9E1	G. G. Knott	25	21	--	--	14	106	8- 9-68
9M1	Clair Vaughn	25	22	15	--	24	139	8- 9-68
9M2	Oceanview Nursing Home	25	25	--	--	13	128	8- 9-68

9N1	Sid Snyder	20	16	--	--	94	439	8- 9-68
9N2	D. M. Cox	20	20	15	--	124	512	8- 9-68
16D1	Ruth Brattebo	30	24	--	--	18	125	8- 9-68
16D2	W. F. Monnes	30	28	--	--	13	86	8-15-68
16E1	T. A. Precht	25	20	21	--	42	226	8- 8-68
16E2	Frances Madison	25	25	--	--	11	107	8- 9-68
16M1	Ted Lentz	20	18	12	--	16	214	8- 8-68
16M2	Walter Christensen	20	24	18	--	42	243	8- 8-68
21D1	William Hill	10	18	8	--	[b]22	184	8- 8-68
21D2	--do--	10	18	5	--	18	223	8- 8-68
21E1	Peter Brown	10	20	0	--	17	134	8- 8-68
21E2	Joseph Traynor	10	22	8	--	25	217	8- 8-68
21M1	Forrest Christner	15	22	--	--	[b]35	285	8- 7-68
21N1	William Elliot	15	12	10	--	13	151	8- 7-68
21N2	Mrs. Della DeMuth	15	20	--	--	16	132	8- 8-68
26P1	Mrs. Evelyn Christensen	10	15	5	--	15	194	8-14-68
26P2	Dr. Ben Brattebo	10	14	5	--	64	413	8-14-68
28D1	Herbert Zahl	10	9	--	--	32	178	8- 7-68
28D2	Constance W. Kamm	15	24	--	--	[b]25	176	8- 7-68

TABLE 1.--Quality of ground water in coastal areas, Pacific County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 10 N., R. 11 W. - Continued								
28D3	E. W. Neale	10	21	7	--	73	328	8- 8-68
28E1	S. T. Eide	15	18	10	8- -67	31	155	8- 7-68
29J1	Bonney Henderson	10	8	--	--	149	702	8- 6-68
32K1	William Weinburg	10	21	0	--	50	434	8- 6-68
34M1	A. E. McMullen	10	6	6	8- 6-68	27	238	8- 6-68
36F1	Cecil Timmen	5	9	3	--	22	236	8-14-68
36K1	Eldred Gilpin	10	14	8	--	15	144	8-14-68
T. 10 N., R. 10 W.								
31N1	Washington Mineral Products Inc.	10	14	3	8- -68	9.6	189	8-14-68
T. 11 N., R. 11 W.								
3C1	Jack Weigardt	10	15	--	--	6.8	95	9- 9-68
4D1	Conservative Baptist Church	20	24	--	--	[b]70	335	8-22-68

4E1	A. P. Schmidt	20	34	--	--	108	457	8-22-68
4M1	J. H. & Jean Wirtz	15	29	5	--	46	242	8-21-68
4N1	W. E. Lynn	15	20	--	--	28	226	8-21-68
4N2	K. O. Hammer	15	23	--	--	39	207	8-21-68
5A1	Lloyd Hagen	15	25	2	--	22	174	8-22-68
5J1	N. F. Chambers	15	24	--	--	48	261	8-22-68
5J2	E. A. Thomas	15	27	--	--	47	279	8-22-68
9D1	W. J. Emschede	20	26	8	--	16	114	8-21-68
9D2	Ray Lewis	20	30	--	--	80	423	8-21-68
9E1	C. E. Smith	20	23	--	--	66	294	8-21-68
9M1	P. L. Shepler	20	24	6	8- -56	21	151	8-21-68
9M2	George Nance	20	24	8	--	16	123	8-21-68
9N1	Louis Meier	20	26	7	--	24	130	8-20-68
9N2	Mrs. Wm. (Clara) Hulett	20	26	--	--	51	245	8-21-68
10D1	Oswald Steiner	20	28	12	1967	10	84	9-10-68
10D2	--do--	15	22	9	9-10-68	--	--	--
10L1	H. L. Dennis	12	18	8	--	28	135	9- 9-68
10P1	R. E. Gillespie	12	20	--	--	14	85	9-12-68
15C1	H. J. Smith	13	25	3	7- -68	9.3	80	9-10-68

TABLE 1.--Quality of ground water in coastal areas, Pacific County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 11 N., R. 11 W. - Continued								
15G1	T. L. Greenwood	13	24	--	--	8.1	120	9-10-68
15K1	J. L. Petersen	10	20	--	--	7.0	58	9-10-68
16D1	O. L. Snodgrass	20	25	--	--	40	201	8-20-68
16D2	W. F. Kleinschmidt	20	22	13	--	18	103	8-20-68
16M1	Ray Roark	15	32	--	--	33	174	8-20-68
16M2	J. S. Fulford	20	30	--	--	21	138	8-20-68
16N1	Ann Hopson	15	30	--	--	21	147	8-20-68
21D1	A. J. Skoubo	20	31	9	--	16	174	8-20-68
21D2	Norvel Sawyer	20	28	--	--	16	159	8-20-68
21M1	Lorraine Lange	20	28	10	--	25	279	8-19-68
21M2	William Rohleder	15	26	-1	--	19	131	8-20-68
21N1	George Scott	20	25	--	--	36	224	8-19-68
22B1	W. J. Pierson	15	25	--	--	9.6	90	9-10-68
22B2	G. L. Hansen	10	20	3	--	12	84	9-11-68

22K1	Edward Flatt	13	24	--	--	8.9	85	9-11-68
22R1	Henry Huppenbauer	12	20	--	--	13	217	9-11-68
22R2	Nellie Pares	15	21	--	--	24	142	9-11-68
27A1	J. L. Peoples	15	15	--	--	6.8	75	9-12-68
27H1	P. E. Clarke	17	25	10	--	14	100	9-11-68
27J1	Mel Stratton	17	30	7	--	10	90	9-12-68
27R1	P. E. Clarke	15	24	--	--	13	157	9-12-68
28E1	A. F. Walser	20	24	--	--	16	134	8-19-68
28E2	Harvey Pegg	25	30	--	--	15	109	8-19-68
28M1	Russell Templin	25	21	--	--	22	201	8-19-68
28N1	F. S. Provo	15	22	14	--	18	124	8-19-68
33D1	J. D. Foley	20	30	--	--	16	130	8-16-68
33D2	Frank Mohns	25	24	--	--	14	94	8-16-68
33E1	W. Conway	25	25	--	--	26	168	8-16-68
33E2	S. R. Finley	20	22	--	--	31	174	8-16-68
33M1	Ray Millner	20	25	18	--	11	102	8-16-68
33N1	N. M. Parkin	20	21	--	--	66	372	8-16-68
33N2	Martin Korhonen	25	18	--	--	31	226	8-16-68
34B1	Bert Harrison	20	29	--	--	31	159	9-12-68

TABLE 1.--Quality of ground water in coastal areas, Pacific County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 11 N., R. 11 W. - Continued								
34P1	Ocean Spray Cranberries, Inc.	15	164	8	9-12-68	566	2,070	9-12-68
34Q1	Lawrence Tetz	15	15	--	--	8.7	99	9-11-68
T. 11 N., R. 10 W.								
15P1	Harvey Sedy	10	11	4	9-13-68	9.7	72	9-13-68
T. 12 N., R. 11 W.								
3N1	Edwin Freshley	10	18	2	--	9.6	81	9- 4-68
3N2	Richard Sheldon	10	18	2	--	[b]135	689	9- 4-68
4A1	Fred Biggs	20	30	--	--	8.5	86	9- 5-68
4R1	Oysterville Water Works	15	23	--	--	[b]23	142	9- 4-68
8A1	Carl Spichalsky	30	29	7	--	38	247	8-30-68
10D1	Theodore Holway	10	12	3	--	13	184	9- 4-68
10M1	Espy Estate	15	21	--	--	8.6	81	9- 4-68

15D1	G. A. Wiegardt, Jr.	20	23	5	4- -68	15	96	9- 4-68
15M1	Max Casey	10	15	--	--	7.7	70	9- 4-68
17A1	Surfside Estates	15	25	12	--	[b]27	218	8-30-68
17J1	D. M. Jackson	20	20	--	--	37	230	8-29-68
20A1	Calvin Pearson	15	26	--	--	27	116	8-29-68
21E1	W. S. Sovey	20	20	--	--	62	297	9- 4-68
21M1	Methodist Church	20	27	--	--	[b]19	135	8-29-68
21M2	--do--	20	27	--	--	[b]22	143	8-29-68
21N1	H. C. Rosenkranz	25	27	--	--	210	686	8-29-68
22E1	Edward Kelly	17	25	--	--	8.5	89	9- 5-68
22N1	R. M. Smith	10	14	--	--	26	140	9- 5-68
27D1	E. H. Gebert	17	20	--	--	7.8	92	9- 5-68
27D2	--do--	10	22	--	--	11	79	9- 5-68
27E1	J. L. Wiegardt	15	28	--	--	[b]20	133	9- 5-68
27M1	Wash. Dept. of Fisheries	18	25	12	--	18	112	9- 6-68
27N1	Mrs. Cecil Paris and Walter Jacobus	12	20	--	--	76	496	9- 9-68
28G1	Ocean Park Water Company, Inc.	20	77	13	8-28-68	20	150	8-28-68
28G2	--do--	20	253	14	8-28-68	--	--	--

TABLE 1.--Quality of ground water in coastal areas, Pacific County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 12 N., R. 11 W. - Continued								
28N1	Richard Sheldon	20	25	--	--	[b]19	155	9-10-68
29A1	Carl Keith	15	18	--	--	19	163	8-29-68
32J1	Edward Haskell	14	24	--	--	31	176	8-28-68
33B1	Jerry Martin	20	98	10	8-30-68	8.6	140	8-30-68
33E1	Frank Hilton	10	30	5	--	17	144	8-23-68
33H1	Jerry Martin	15	55	4	8-30-68	--	--	--
33H2	--do--	15	92	10	8-30-68	--	--	--
33M1	Paul Lowden	25	30	--	--	50	255	8-23-68
33N1	N. C. McPhail	20	24	12	--	72	397	8-22-68
34D1	O. Biddulph	12	15	--	--	46	198	9- 9-68
34N1	K. W. Kissell	19	24	4	--	4.6	90	9- 5-68
T. 12 N., R. 10 W.								
15J1	Jean L'Hommedieu	10	190	--	--	46	720	10-21-68
22H1	Mrs. Earl Crawford	45	68	--	--	6.5	260	10-21-68

27C1	New Washington Oyster Co.	10	105	--	--	16	171	10-21-68
			T. 13 N., R. 10 W.					
8G1	Palix Oyster Co.	8	585	Flow	10-22-68	8.1	182	10-22-68
8G2	Pacific County PUD 2	15	500	--	--	8.6	191	10-22-68
8R1	Harbor Bell, Inc.	5	455	--	--	8.8	187	10-22-68
9A1	Wilson Oyster Farms	15	96	--	--	8.2	255	10-22-68
21F1	Richard Pearson	50	180	20	1968	8.0	360	10-21-68
			T. 14 N., R. 11 W.					
4L1	E. Stegmiller	10	100	--	--	27	254	10-31-68
4M1	W. F. Haynes	15	41	--	--	62	--	5-10-56
						46	275	10-31-68
4M2	H. S. Summers	12	20	0	1968	15	118	10-31-68
5B1	R. Jacobsen	12	165	4	1968	335	1,148	10-31-68
5H1	Wash. Dept. of Highways	16	76	12	12-13-63	125	--	12-13-63
						60	466	10-31-68
11C1	Dexter by the Sea	10	198	Flow	10-31-68	9.0	164	10-31-68
11C2	C. T. Burger	10	13	2	1968	57	401	10-31-68

TABLE 1.--Quality of ground water in coastal areas, Pacific County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 14 N., R. 11 W. - Continued								
11F1	Trade Winds Motel	10	290	Flow	10-31-68	9.7	168	10-31-68
11G1	Ron Tucker	8	200	Flow	10-31-68	9.0	197	10-31-68
11J1	David Hawthorne	10	200	Flow	10-31-68	9.5	219	10-31-68
12P1	Harold Johnson	10	200	Flow	10-31-68	9.7	239	10-31-68
12Q1	Kenneth Widders	10	210	Flow	10-31-68	7.6	188	10-31-68
13A1	School District	10	172	Flow	10-31-68	5.8	185	10-31-68
13A2	Nelson Crab Co.	10	200	Flow	10-31-68	5.9	185	10-31-68
T. 14 N., R. 10 W.								
18C3	Port of Willapa Harbor	15	30	Flow	10-23-68	7.1	197	10-23-68
18D1	Jack Brockhoff	10	200	Flow	10-31-68	8.3	231	10-31-68
24G1	Mrs. Joe Aust	20	16	16	10-22-68	9.6	260	10-22-68
28H1	Lynn McKee	10	90	Flow	10-22-68	10	208	10-22-68

				T. 14 N., R. 9 W.				
18L1	Boyd Keller	10	75	--	--	81	680	10-22-68
22H1	Harry Johnson	45	73	30	1968	8.7	166	10-22-68
23P1	Louis Dokter	40	75	--	--	32	247	10-22-68
29Q1	Leonard Lloyd	290	460	10	7- -68	12	374	10-23-68
				T. 14 N., R. 8 W.				
20G1	Marie Hunter	15	18	0	1968	7.3	145	10-23-68
				T. 15 N., R. 11 W.				
18G1	O. W. Pollari	14	72	4	1968	17	280	10-30-68
18R1	Arnold Richards	15	80	7	1968	23	196	10-30-68
20M1	Twin Harbor Community	15	304	Flow	10-30-68	26	--	5-10-56
						15	177	--
20N2	M. Congelose	17	97	16	10-30-68	86	--	5- 9-56
						44	397	10-30-68
20N3	William Jurgens	17	76	--	--	532	--	5- 9-56
						380	2,220	10-30-68

TABLE 1.--Quality of ground water in coastal areas, Pacific County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 15 N., R. 11 W. - Continued								
20N5	Sigurd West	18	127	17	10-30-68	220	--	5- 9-56
						168	896	10-30-68
20N6	E. Walkowsky	15	90	3	10-30-68	54	423	10-30-68
30A2	J. A. Hudson	20	208	--	--	28	--	5-11-56
						17	193	10-30-68
30A3	Mrs. Lester Bowman	20	210	--	--	60	--	5-11-56
						24	205	10-30-68
30A5	L. C. Mullins	20	165	--	--	18	--	5-11-56
						171	828	10-30-68
30H2	Mrs. Lewis Fletcher	20	166	18	10-30-68	28	184	10-30-68
31H1	Fred Danielson	18	200	13	5-10-56	710	--	5-10-56
						14	417	10-30-68
31K1	Craig	10	24	2	10-30-68	21	514	10-30-68
31Q1	--	10	60	2	10-30-68	14	220	10-30-68

31R1	Murphy	10	24	2	10-30-68	20	226	10-30-68
32E1	William Crossman	20	146	11	5-20-56	160	--	5-10-56
						120	685	10-30-68
32E3	Gunnar Sigurdson	15	75	--	--	230	--	5-10-56
						116	735	10-30-68
32L1	E. R. Smith	15	75	--	--	410	--	5-10-56
						278	1,180	10-30-68
32M1	F. J. Roeser	20	124	--	--	52	--	5-10-56
						37	517	10-30-68
32N1	U. S. Army	15	--	--	--	18	307	10-30-68

TABLE 2.--Quality of ground water in coastal areas, Grays Harbor County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 15 N., R. 11 W.								
6G1	Dale Richards	17	130	--	--	16	--	5- 9-56
						11	278	10-29-68
7R1	Ivonen Market	17	80	14	1953	80	--	5-11-56
						64	638	10-29-68
T. 16 N., R. 12 W.								
12H1	Marvin Roberts	12	42	--	--	27	359	10-29-68
25A1	Allen Slenes	15	?	2	10-29-68	66	--	5- 9-56
						55	367	10-29-68
T. 16 N., R. 11 W.								
1M1	Wash. Dept. of Game	50	168	--	--	6.6	183	10-25-68
2A1	Coast Oyster Co.	10	150	Flow	10-25-68	8.3	210	10-25-68
2H1	Ocean Spray Cranberries, Inc.	10	100	--	--	5.5	178	10-25-68
2H2	--do--	10	150	--	--	8.0	188	10-25-68

2J1	Associated Seafoods, Inc.	10	121	Flow	10-25-68	8.0	190	10-25-68
7E1	Charles Kaatz	12	70	Flow	10-28-68	37	456	10-28-68
9G1	Bud Harrow	12	90	--	--	6.4	185	10-25-68
9J1	Mrs. M. Lowe	27	25	--	--	9.3	71	10-25-68
9J2	Jack Hatton	26	148	12	10-25-68	7.7	205	10-25-68
10A1	Wildwood Trailer Court	50	117	8	10-25-68	7.7	176	10-25-68
10F1	John Grossman	24	30	-2	1968	7.0	98	10-25-68
18M1	Town of Westport, well 3	22	70	-3	1968	31	279	10-28-68
18N1	Town of Westport, well 1	22	70	-3	1968	22	234	10-28-68
18N2	Town of Westport, well 2	22	70	-3	10-28-68	37	352	10-28-68
19K1	C. H. Roberts	6	180	Flow	10-29-68	8	--	11-20-47
						14	160	10-29-68
20E1	Mangan	10	24	--	--	13	119	10-28-68
20F1	Wash. Dept. of Highways	12	20	2	1968	20	138	10-28-68
21D1	Parks Country Store	20	20	8	1968	15	130	10-25-68
21E1	Floyd Kite	2	525	Flow	10-25-68	12	--	10-20-47
						16	185	10-25-68
21E2	William Casanova	25	162	-5	1966	37	231	10-25-68
31D1	E. W. Rowley	17	58	11	1968	33	303	10-29-68

TABLE 2.--Quality of ground water in coastal areas, Grays Harbor County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 17 N., R. 12 W.								
3R1	Grays Harbor County Water Dist. 3	10	513	0	1968	11	329	10- 9-68
3R2	--do--	10	513	--	--	--	--	--
10B1	--	10	20	2	--	28	419	10-11-68
10B2	Croft	10	20	2	--	10	251	10-22-68
10C1	M. Mulvihill	10	20	2	--	44	406	10-11-68
10C2	B. Morrow	10	20	2	--	25	348	10-22-68
10C3	--	10	20	2	--	34	373	10-22-68
10F2	Neil Smith	10	20	2	--	19	280	10-11-68
10G1	K. I. Snider	10	20	2	--	18	517	10-11-68
10G2	--	10	20	2	--	12	244	10-22-68
10G3	Warner	10	20	2	--	16	291	10-22-68
10J1	--	10	20	2	--	38	332	10-11-68
10K1	--	10	20	2	--	19	413	10-22-68
10K2	S. A. Potts	10	20	2	--	20	756	10-22-68
10L1	--	10	20	2	--	23	283	10-22-68

10L2	Community Park	10	20	2	--	23	346	10-22-68
10L3	--	10	20	2	--	15	317	10-22-68
10P1	--	10	20	2	--	17	207	10-11-68
10P2	--	10	20	2	--	21	344	10-22-68
10Q1	Yohe	10	20	2	--	25	399	10-22-68
10Q2	Mrs. Robert Orr	10	20	2	--	18	316	10-22-68
10Q3	--	10	20	2	--	15	445	10-22-68
10Q4	--	10	20	2	--	19	490	10-22-68
10R1	Minard oil test 1	10	--	1	10-10-68	120	1,130	10-10-68
10R2	H. Hafer	10	20	2	--	11	494	10-11-68
10R3	William Morgan	10	20	2	--	22	398	10-22-68
11M1	Coleman Steele	10	20	2	--	35	472	10-11-68
11M2	Flath	10	20	2	--	73	498	10-11-68
11M3	Foss	10	20	2	--	31	551	10-11-68
11M4	--	10	20	2	--	28	276	10-11-68
11M5	Arner	20	20	2	--	7.8	79	10-11-68
11M6	Frank Stevens	12	20	2	--	36	430	10-11-68
11N1	R. S. Chase	10	20	2	--	16	204	10-10-68
11N2	--	12	20	4	--	15	285	10-11-68

TABLE 2:--Quality of ground water in coastal areas, Grays Harbor County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 17 N., R. 12 W. - Continued								
11N3	--	10	20	2	--	6.4	303	10-11-68
14C1	Stowell	25	30	10	--	7.1	154	10-10-68
14D1	Dunton	10	20	2	--	11	429	10-11-68
14D2	--	12	20	4	--	34	339	10-22-68
14E1	J. J. Parante	10	20	2	--	14	418	10-23-68
14E2	Joseph Stevens	10	20	2	--	9.5	259	10-10-68
14F1	--	10	20	2	--	82	425	10-10-68
14F2	O'Brien	10	20	2	--	16	125	10-10-68
14F3	--	10	20	2	--	7.7	100	10-10-68
14F4	Lyle St. Louis	10	20	2	--	74	367	10-10-68
14K1	--	12	20	2	--	84	413	10-10-68
14M1	--	10	20	2	--	24	817	10-23-68
14N1	Walter Marble	12	28	4	--	18	479	10-23-68
14Q1	R. L. Newcomer	10	20	2	--	28	278	10-10-68

14Q2	--	10	20	2	--	26	307	10-10-68
14Q3	Paul Roeder	10	20	2	--	31	183	10-10-68
14Q4	Harris Realty	10	20	2	--	11	325	10-10-68
14Q5	R. P. Johnson	10	20	2	--	11	372	10-10-68
14R1	Krippaehne	10	20	3	--	37	238	10- 9-68
14R2	--	10	20	2	--	26	228	10-10-68
15A1	J. E. Hardman	12	20	4	--	212	962	10-22-68
15A2	Carter	12	20	4	--	54	522	10-23-68
15B1	--	12	20	4	--	24	366	10-22-68
15C1	--	10	20	2	--	33	343	10-22-68
15C2	Richard Hagar	10	20	2	--	17	331	10-22-68
15C3	--	10	20	2	--	8.5	233	10-22-68
15F1	Miller	10	20	2	--	17	235	10-22-68
15F2	--	10	20	2	--	11	163	10-23-68
15F3	--	10	20	2	--	62	794	10-23-68
15F4	Grove	10	20	2	--	12	354	10-23-68
15H1	--	10	20	2	--	16	654	10-23-68
15J1	--	12	20	4	--	29	358	10-23-68
15L1	--	10	20	2	--	37	533	10-23-68

TABLE 2.--Quality of ground water in coastal areas, Grays Harbor County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 17 N., R. 12 W. - Continued								
15L2	--	10	14	2	--	17	335	10-23-68
15L3	A. E. Balmer	10	14	2	--	100	776	10-23-68
15N1	--	10	14	2	--	28	449	10-23-68
15P1	Parker	10	20	2	--	132	670	10-23-68
15P2	--	10	20	2	--	30	445	10-23-68
15Q1	--	10	20	2	--	9.6	281	10-23-68
15R1	--	10	20	2	--	10	110	10-23-68
22D1	--	10	14	2	--	23	287	10-23-68
22D2	--	10	14	2	--	14	273	10-23-68
22M1	J. A. Kommer	10	20	2	--	11	191	10-23-68
23A1	--	11	20	2	--	69	354	10- 9-68
23C1	Shelley Apts	10	20	2	--	32	240	10-23-68
23D1	--	10	20	2	--	19	424	10-23-68
23G1	Benson	10	20	2	--	10	134	10-23-68
24D1	Ocean Shores Marina	20	25	--	--	[b]32	226	10- 9-68

3Q1	Hoquiam School District	8	190	0	3- 4-66	305	1,410	10-24-68
5P1	--	20	31	12	10-24-68	9.3	202	10-24-68
6R1	Kenneth Kristom	40	107	--	--	16	213	10-24-68
24J1	Fred James	20	65	Flow	1968	5.9	106	10-24-68
31C1	Fred Danene	20	138	--	--	9.5	166	10-24-68
32F1	Robert Tucker	20	28	--	--	7.8	179	10-25-68
	T. 18 N., R. 12 W.							
3D1	Harry Hoagland	15	126	13	10- 8-68	6.9	425	10- 8-68
3F1	Robert Smith	15	278	Flow	10- 8-68	5.9	450	10- 8-68
3L1	George Petrosik	15	155	Flow	10- 8-68	9.3	255	10- 8-68
3L2	Emil Matson	15	140	Flow	10- 8-68	11	186	10- 8-68
3L3	--do--	15	40	--	--	26	265	10- 8-68
3N1	Wash. State Parks	5	45	1	10- 8-68	140	662	10- 8-68
3P1	Don McDonald	20	156	14	1968	21	273	10- 8-68
3P2	James Green	20	187	Flow	10- 8-68	6.7	154	10- 8-68
3P3	Ocean City Economic Club	25	55	0	1967	23	238	10- 8-68
3P4	Seaside Land, Inc.	8	400	Flow	10- 8-68	11	197	10- 8-68

TABLE 2.--Quality of ground water in coastal areas, Grays Harbor County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 18 N., R. 12 W. - Continued								
3P5	Ocean City Variety Store	10	400	Flow	10- 8-68	9.5	173	10- 8-68
3P6	R. Erickson	15	60	--	--	68	522	10- 8-68
10C1	Ray Belles	18	55	Flow	1968	78	515	10- 8-68
10F1	Alfred Jezek	18	100	13	10- 8-68	18	198	10- 8-68
10L1	Rodney Hall	15	23	--	--	32	294	10- 8-68
13L1	Chas. Pennington	15	50	5	--	13	106	10-24-68
15F1	Walter Allen	10	25	--	--	20	278	10- 8-68
15P1	--	10	20	--	--	13	488	10- 9-68
15R1	Giles Hogan	45	45	5	1968	37	248	10-10-68
22A1	Father Dominick	45	85	0	1968	28	248	10-10-68
22A2	Giles Hogan	35	85	0	1968	20	182	10-10-68
22A3	H. E. Romagosa	33	85	3	1968	27	216	10-10-68
22A4	V. B. Lucash	30	120	0	1968	20	192	10-10-68
22A5	Giles Hogan	43	125	3	1968	27	216	10-10-68
22A6	--do--	50	55	5	1968	32	221	10-10-68

22A7	--do--	45	65	5	1968	28	236	10-10-68
22C1	Milford Green	10	14	0	1968	11	136	10- 9-68
22K1	Wash. State Parks	20	605	Flow	10- 9-68	31	354	10- 9-68
22K2	--do--	20	42	17	6-27-61	100	--	6-27-61
						51	450	10- 9-68
26M1	Ralph Minard Est.	10	600	8	10- 9-68	8.1	162	10- 9-68
27F1	Illahee Water Co.	10	358	Flow	10- 9-68	9.6	158	10- 9-68
	T. 18 N., R. 11 W.							
16L1	M. A. Bloom	7	42	4	10-21-68	200	739	10-21-68
16N1	--do--	10	13	1	1968	6.1	71	10-21-68
17L1	O. C. Sangder	10	139	0	--	10	169	10-24-68
17M1	Albert Coppin	15	40	0	--	14	160	10-24-68
17P1	Ray Stullick	10	170	5	--	13	283	10-24-68
17P2	J. A. Ramiskey	10	48	7	7-23-66	44	413	10-24-68
17R1	Hogan	10	90	--	--	13	187	10-21-68
17R2	K. J. Bratt	12	30	2	--	13	210	10-24-68
17R3	D. E. Arnold	12	75	4	--	18	238	10-24-68
22E1	Henry Morley	21	325	--	--	5.5	151	10-21-68

TABLE 2.--Quality of ground water in coastal areas, Grays Harbor County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 18 N., R. 11 W. - Continued								
22H1	Henry Morley	17	300+	8	10-21-68	9.6	178	10-21-68
26R1	James Baker	10	90	4	1968	6.2	128	10-21-68
36E1	John Andrews	40	60	15	--	8.6	74	10-21-68
36M1	J. A. Paulsen	12	13	--	--	7.5	75	10-21-68
36P1	Alice Lamb	15	100	Flow	10-21-68	7.0	142	10-21-68
T. 19 N., R. 12 W.								
4N1	Iron Springs Resort	20	125	--	--	77	388	10- 3-68
9D1	Iron Springs Park	140	160	7	10- 3-68	27	234	10- 3-68
22M1	Driftwood Acres Court	10	80	4	10- 4-68	10	170	10- 4-68
22N1	Walter Plumb	10	93	2	--	8.8	162	10- 4-68
22N2	Richard Wheeler	10	85	Flow	10- 4-68	8.6	167	10- 4-68
22N3	Lawrence Plumb	10	86	Flow	10- 4-68	8.6	155	10- 4-68
22P1	John Pink	10	105	Flow	10- 4-68	11	163	10- 4-68
22P2	Al Dipko	20	42	--	--	20	218	10- 4-68

27D1	--	25	51	-1	10- 4-68	18	223	10- 4-68
27D2	Wallace Holz	20	143	5	1968	14	177	10- 4-68
27D3	Copalis Community Church	6	100	Flow	10- 4-68	14	171	10- 4-68
28A1	John Rozeman	12	39	0	10- 4-68	53	375	10- 4-68
28A2	Robert Ryan	10	120	--	--	15	187	10- 4-68
28A3	Copalis Beach Water Dist.	10	100+	3	10- 4-68	22	240	10- 4-68
28A4	Quigg and Close	10	130	--	--	12	162	10- 4-68
28H1	Haven by Sea Water Co.	15	111	Flow	10- 4-68	15	198	10- 4-68
28H2	Earl Thomas	12	140	--	--	15	210	10- 4-68
28J1	George Garka	12	--	Flow	10- 7-68	17	198	10- 7-68
28J2	Beachwood Resort	12	109	Flow	10- 7-68	18	226	10- 7-68
28R1	John Rod	12	120	Flow	10- 7-68	19	202	10- 7-68
34M1	Sea View Estates	18	171	Flow	10- 7-68	15	204	10- 7-68
34N1	R. M. Donahoe	15	51	--	--	8.5	388	10- 7-68
34R1	George Cleaver	50	158	19	1947	11	297	10- 7-68
	T. 20 N., R. 12 W.							
8P1	North Beach School Dist.	60	234	--	--	12	172	10- 3-68
20B1	Pacific Beach Water Co.	110	250	10	1965	7.6	168	10- 3-68

TABLE 2.--Quality of ground water in coastal areas, Grays Harbor County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 20 N., R. 12 W. - Continued								
32H1	Gordon Vanderslice	10	150	Flow	10- 3-68	13	149	10- 3-68
32H2	Theodore Backstrom	40	320	--	--	6.9	165	10- 3-68
T. 21 N., R. 12 W.								
18K1	Point Grenville Estates	120	50	102	10- 3-68	17	131	10- 3-68
20F1	Santiago Beach Development Co.	120	264	Flow	10- 3-68	15	210	10- 3-68

PARTIAL CHEMICAL ANALASIS
OF
GROUND WATER
CLALLAM COUNTY

TABLE 3.--Quality of ground water in coastal areas, Clallam County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 28 N., R. 15 W.								
22P1	National Park Service	10	55	1	9-15-67	66	372	1-18-67
						78	420	9-15-67
23N1	--do--	17	48	2	9-19-67	12	167	9-19-67
23N2	--do--	17	28	2	9-19-67	12	126	1-17-67
						13	113	9-19-67
23N3	--do--	17	91	2	5-20-68	11	182	5-21-68
T. 29 N., R. 3 W.								
2K1	Rodney Erickson	110	150	41	7-22-68	150	1,300	7-22-68
2Q1	Roy Olson	120	300	90	7-21-68	(a)	--	--
12A1	Daniel Bellis	40	12	Flow	10- 1-68	3.6	106	10- 1-68
12D1	Cascade Pole Co.	15	25	--	--	9.6	339	7-23-68
12E1	Peter Joppe	20	30	-6	--	6.6	307	7-23-68

T. 30 N., R. 5 W.								
2R1	Mrs. Gerhke	140	142	--	--	7.7	321	7-30-68
12A1	Donald Corlett	140	152	10	--	21	321	7-30-68
12C1	Weinzerl & Douglas	140	144	--	--	7.0	315	7-30-68
T. 30 N., R. 4 W.								
5L1	A. N. Brambach	110	126	-6	1964	18	484	7-26-68
5L2	Austin Post	80	92	8	--	13	430	7-26-68
5M1	Louis Huber	120	108	25	8- 2-68	7.9	325	8- 2-68
T. 30 N., R. 3 W.								
5B1	Bureau of Indian Affairs	5	265	Flow	7-24-68	2.2	250	7-24-68
5B2	William Alton	5	10	1	7-24-68	5.0	366	7-24-68
5H1	Dr. Wilcox	6	30	0	7-24-68	4.3	352	7-24-68
10N1	Mrs. James Gates	70	310	63	--	5.4	401	7-24-68
15G1	Sequim Valley Land Co.	20	574	Flow	8- 2-68	3.8	328	8- 2-68
22K1	Battelle Research Lab.	10	355	6	1966	6.0	358	7-24-68
23H1	Langdon Simons, Jr.	40	107	10	--	8.0	499	7-23-68

TABLE 3.--Quality of ground water in coastal areas, Clallam County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 30 N., R. 3 W. - Continued								
25F1	Chester Steeby	100	186	--	--	10	1,050	7-23-68
27B2	Eugene Forest	40	64	15	8- 8-60	3.2	409	7-24-68
27Q1	Phillip Schenck	5	15	1	7-23-68	14	367	7-23-68
35M1	R. H. Mulder	80	108	-13	7-23-68	20	607	7-23-68
36F1	Charles Gunstone	40	--	--	--	56	601	7-23-68
T. 30 N., R. 2 W.								
15L1	Diamond Point Water Co.	75	90	10	--	145	1,300	10- 1-68
16G1	Sunshine Acres	240	421	--	--	313	1,340	10- 1-68
T. 31 N., R. 11 W.								
9H1	Merrill and Ring	12	85	--	--	(a)	--	--
10E1	Irving Fernandez	15	11	9	8- 1-68	11	198	8- 1-68

T. 31 N., R. 7 W.								
26N1	Ben Phillips	15	8	--	--	3.8	147	8- 2-68
27J1	Martin Hopie	15	14	7	7-31-68	.7	107	7-31-68
27J2	Laverne Hepfer	15	12	(c)	--	1.8	130	7-31-68
33A1	Archie Hooper	10	13	-1	--	12	210	7-31-68
33F1	Robert Boice	10	14	2	--	27	370	7-31-68
T. 31 N., R. 4 W.								
25M1	Port of Port Angeles	5	300	Flow	7-25-68	5.1	294	7-25-68
26G1	San Juan Farm	5	98	Flow	7-25-68	7.3	291	7-25-68
27N1	Roy Dawes	90	118	7	--	11	340	7-25-68
27R1	F. D. Bode	35	53	1	7-25-68	13	377	7-25-68
T. 31 N., R. 3 W.								
18G1	U. S. Coast Guard	10	667	Flow	7-26-68	3.6	293	7-26-68
30M1	Ernest Marshall	8	48	3	7-25-68	4.3	298	7-25-68
30Q1	Harvey Pettitt	10	250	Flow	7-25-68	2.5	225	7-25-68
31H1	C. H. Fitzgerald	10	44	Flow	7-25-68	3.6	277	7-25-68

TABLE 3.--Quality of ground water in coastal areas, Clallam County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 32 N., R. 14 W.								
1A1	Edward Bell	4	32	2	10- 2-68	2.7	147	10- 2-68
T. 33 N., R. 15 W.								
12L1	Makah Tribal Center (south well)	15	25	12	10- 2-68	28	474	10- 2-68
15A1	Town of Neah Bay (east well)	25	55	--	--	17	199	10- 2-68
15A2	Town of Neah Bay (center well)	25	67	--	--	6.5	560	10- 2-68
15B1	Town of Neah Bay	25	211	--	--	3,320	11,500	4- 7-67

PARTIAL CHEMICAL ANALASIS
OF
GROUND WATER
JEFFERSON COUNTY

TABLE 4.--Quality of ground water in coastal areas, Jefferson County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 24 N., R. 13 W.								
3M1	National Park Service, Kalaloch Campground, well 1	50	66	36	7-26-66	6.9	278	7-25-66
						14	218	7-26-66
						12	198	7-28-66
3M2	National Park Service, Kalaloch Campground, well 2	50	--	35	9-12-67	12	290	9-12-67
T. 25 N., R. 2 W.								
2E1	Wash. State Parks	20	60	10	8-14-68	1.0	75	8-14-68
11E1	N. Leibly	80	84	10	8-13-68	31	277	8-13-68
14N1	G. R. Cooper	5	15	-3	1963	92	471	8- 9-68
15B1	F. M. Millard	15	47	--	--	1.3	85	8- 9-68
21K1	Hood Canal Development Co.	20	70	--	--	1.9	213	8- 9-68
21P1	G. C. Small	30	39	12	8- 9-68	1.0	77	8- 9-68
29L1	Paradise Cove	10	40	0	8- 8-68	1.0	82	8- 8-68

T. 26 N., R. 13 W.								
19C1	National Park Service	10	21	3	9-14-67	24	159	1-18-67
						8.5	149	9-14-67
T. 26 N., R. 2 W.								
13G1	Camp Parsons	55	--	31	8-14-68	915	2,960	8-14-68
26J1	Vern Cox	15	40	--	--	.9	103	8-14-68
35P1	Mel Thompson	10	28	--	--	.2	97	8-14-68
T. 26 N., R. 1 W.								
7K1	Wash. Dept. of Fisheries	70	150	35	1952	1.8	127	8-14-68
18M1	Ray Lindeke	50	130	1	8-14-68	6.9	165	8-14-68
29R1	U. S. Navy, Zelatched Point well	183	300	-7	9-29-64	18	--	9-29-64
						31	260	8-14-68
T. 27 N., R. 2 W.								
24H1	Dan Newman	10	20	5	8-14-68	14	141	8-14-68

TABLE 4.--Quality of ground water in coastal areas, Jefferson County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 27 N., R. 1 W.								
18P1	M. W. Maberry	5	30	--	--	6.2	188	8-14-68
19K1	Henretta Button	15	48	6	8-14-68	2.3	161	8-14-68
36B1	Earl Naylor	40	183	--	--	6.8	365	8-15-68
T. 27 N., R. 1 E.								
5A1	H. Afflaibach	30	97	Flow	8-15-68	4.1	183	8-15-68
9P1	Bridgehaven	5	--	--	--	26	293	8-15-68
16E1	C. E. Strand	5	92	--	--	301	1,190	8-15-68
T. 28 N., R. 1 E.								
4B1	Basalt Beach Water Dist.	50	92	0	7- 9-68	11	390	7- 9-68
16M1	Eugene White	30	125	--	--	241	947	7- 9-68
16P1	Cecil Midkiff	35	100	--	--	66	369	7- 9-68
16Q1	Ray Garney	50	48	5	1960	4.0	185	7- 9-68
16Q2	George Heinrich	50	83	5	1962	3.3	219	7- 9-68

22A1	John Parker	80	92	45	1965	6.8	167	7- 9-68
22G1	Jack Plaskett	80	90	67	1967	6.7	263	7- 9-68
33M1	W. K. Merideth	40	73	Flow	8-16-68	3.9	223	8-16-68
33Q1	M. J. Churchill	25	30	--	--	22	415	8-16-68
34P1	George Thomas	20	65	--	--	45	517	8-16-68
	T. 29 N., R. 2 W.							
13P1	Harold Hubert	40	60	--	--	7.0	283	10- 1-68
23J1	William Thomas	8	43	6	10- 1-68	329	1,190	10- 1-68
24H1	H. C. Reid	20	14	9	9-30-68	5.8	271	9-30-68
24N1	Walter Moa	7	6	5	9-30-68	14	308	9-30-68
	T. 29 N., R. 1 W.							
1Q1	W. J. Wolfe	70	65	65	--	16	333	7-24-68
18E1	H. F. Barrett	40	58	-3	10- 1-68	390	1,750	10- 1-68
	T. 29 N., R. 1 E.							
4G1	Stockton and Kruegel	70	135	--	--	22	453	7-24-68
5H1	Don Sweeney	14	88	7	--	11	367	7-24-68

TABLE 4.--Quality of ground water in coastal areas, Jefferson County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 29 N., R. 1 E. - Continued								
5H2	K. H. Stoops	12	80	-8	--	1,150	4,090	7-24-68
6M1	--	45	63	12	7-24-68	28	584	7-24-68
7D1	Lyle Albrecht	40	60	0	--	74	665	7-11-68
7E1	Mike Sedlak	25	22	Flow	7-11-68	8.1	348	7-11-68
7M1	M. V. Colling	20	30	3	7-10-68	18	273	7-10-68
7M2	Mrs. A. D'Jarnett	20	24	4	7-10-68	14	301	7-10-68
7M3	A. L. Clogston	45	56	Flow	7-10-68	9.2	327	7-10-68
8Q2	Hanson and Bailey	10	20	0	7-24-68	44	425	7-24-68
9J1	M. A. Turner	90	47	50	7-24-68	56	488	7-24-68
28P1	Harrier and Anderson	40	100	5	--	12	321	7-10-68
29E1	--	60	135	37	7-10-68	(a)	--	--
33M1	--	20	41	16	7-10-68	290	1,170	7-10-68
T. 30 N., R. 2 W.								
12Q2	Cape George Colony	230	208	--	--	32	493	7-25-68

13J1	Cape George Village	320	315	--	--	29	542	7-25-68
24G1	Ocean Grove Estates	340	268	104	9-30-68	14	580	9-30-68
24M1s	Cape George Fishermen, Inc.	7	--	7	9-30-68	24	626	9-30-68
27M1	C. J. Messer	80	128	15	1954	24	1,000	9-30-68
34C1	J. D. Swarthout	20	77	1	10- 1-68	820	2,900	10- 1-68
34H1	H. L. Drake	155	400	Flow	10- 1-68	70	469	10- 1-68
34L1	W. V. Norton	240	360	Flow	10- 1-68	28	389	10- 1-68
35E1	C. A. Johnson	130	175	Flow	10- 1-68	665	2,300	10- 1-68
36P1	Chas. Gunstone	20	93	--	--	30	440	10- 1-68
	T. 30 N., R. 1 W.							
16K1	Guy Whiteman	30	31	7	--	27	515	7-25-68
16K2	M. W. Hart	50	80	20	--	11	349	7-25-68
16R1	Crown Zellerbach Corp.	25	35	--	--	13	391	7-25-68
22P1	Wash. State Parks	180	270	-10	1956	12	436	7-25-68
29E1	P. Bailey	75	290	5	7-18-63	16	525	9-30-68
32J1	James Jensen	120	145	--	--	7.0	314	9-30-68
32K1	R. E. Trautman	44	47	2	--	2.0	422	9-30-68

TABLE 4.--Quality of ground water in coastal areas, Jefferson County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 30 N., R. 1 E.								
28E1	Norman Smith	110	124	3	7-11-68	357	1,790	7-11-68
28L1	Mrs. A. E. Kroon	40	60	5	--	55	609	7-11-68
28L2	H. L. Johnson	55	63	0	1967	46	599	7-11-68
29C1	R. E. Lowrie	25	32	0	--	358	1,680	7-11-69
29K1	George Tracey	30	35	-2	1968	141	834	7-11-68
33C1	Allen McCoy	60	56	9	--	51	496	7-24-68
33E1	Stanley Lybeck	20	35	-5	7-24-68	66	790	7-24-68

PARTIAL CHEMICAL ANALASIS
OF
GROUND WATER
MASON COUNTY

TABLE 5.--Quality of ground water in coastal areas, Mason County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 4 W.								
24P1**	Wes Whitener	120	147	89	11- 1-62	13	242	5-11-67
T. 19 N., R. 3 W.								
1A1	Darrel Barnes	25	200	0	--	--	157	5-11-67
1C1	F. W. Silva	120	252	--	--	--	159	5-11-67
1L1	K. N. Anthony	80	138	--	--	--	180	5-11-67
1N1	Larry Oliver	110	179	5	7-24-64	--	154	5-11-67
3Q1	Edwin Braz	80	195	--	--	--	169	5-12-67
3Q2	Ira Stansbury	40	107	20	--	--	172	5-12-67
9E1	H. H. Leonard	180	200	136	5-29-64	--	168	5-12-67
10A1	L. A. Moore	30	91	--	--	--	174	5-12-67
10B1	H. G. Nelson	30	42	--	--	--	176	5-12-67
10B2	Ira Stansbury	30	87	--	--	3.0	224	5-12-67
10F2	Jack Hisata	40	135	Flow	--	3.5	221	5-12-67
10H1	J. R. Bralley	80	--	--	--	3.5	269	5-12-67

11A1	Robert Marcy	60	83	1	7-24-64	--	145	5-12-67
11B1	R. F. Wallin	15	100	0	10-30-62	--	125	5-12-67
11D2	Dave McMillin	40	100	--	--	--	169	5-12-67
11G1	O. R. Taylor	40	105	9	10-23-62	--	135	5-12-67
11G3	A. M. Taylor	25	105	10	--	--	158	5-12-67
11G4	W. R. Carlson	20	98	--	--	--	128	5-12-67
14B1	E. A. Dahman	15	87	7	5-27-64	3.5	281	5-12-67
14L1	A. H. Fagergren	40	45	--	--	--	125	5-12-67
14L2	C. A. Fagergren	40	60	10	--	--	124	5-12-67
17R1	Edward Sigo	15	18	3	--	--	80	5-12-67
20D1	C. F. Blackwelder	75	200	25	10-29-62	24	240	5-11-67
20D2	Ellison Bros.	20	300	20	--	145	673	5-12-67
21H2	Olympia Oyster Co.	60	75	35	1964	--	145	5-11-67
21L1	J. J. Brenner Oyster Co.	20	110	-12	9- 8-55	--	112	5-11-67
23E1	Nat Waldrip	25	51	-5	--	70	443	5-12-67
30B1	Max Waldburger	100	117	Flow	11- 2-62	--	179	5-11-67

TABLE 5.--Quality of ground water in coastal areas, Mason County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 2 W.								
1A1	Harry Croft	32	67	4	8-29-63	17	225	4- 8-68
5C1	Earl Isaacson	100	103	30	1962	345	1,370	5-15-67
5C2	R. W. Bogrand	140	212	--	--	3.5	254	5-15-67
5C3	R. E. Noble	70	87	--	--	80	492	5-15-67
6A1	H. H. Unger	120	170	0	--	5.0	241	5-15-67
6B2	H. Eigenman	15	37	5	--	--	162	5-15-67
6D1	Helen McCann	80	128	40	1959	4.5	207	5-15-67
T. 20 N., R. 3 W.								
3A1	R. J. Kratcha	25	78	Flow	5-16-67	--	118	5-16-67
3A2	F. Minor	25	110	Flow	5-16-67	--	120	5-16-67
3H1	Leo Bishop	20	89	[c]9	5-25-65	--	124	5-16-67
3K1	Bayshore Water Co.	25	254	Flow	5-16-67	--	122	5-16-67
9Q1	Andy Thomas	20	81	Flow	5-16-67	--	118	5-16-67
10A1	Peninsula Development Co.	105	233	3	6- 6-63	--	120	5-16-67

10E1	Martin Stevens	18	97	6	--	--	109	5-16-67
15E1	S. S. Waterman	35	66	--	--	4.5	275	5-16-67
15E2	G. M. Brewer, Jr.	35	50	10	5-17-67	4.0	270	5-17-67
15F1	M. E. Abbott	16	45	1	6- 6-63	--	180	5-16-67
15F2	Oscar Berntsen	25	39	0	7- 1-65	--	184	5-16-67
15Q1	C. A. Robb	120	148	7	6- 6-63	--	164	5-17-67
15Q2	Dean Doyle	95	112	5	9- 2-63	--	162	5-17-67
16C3	W. J. White	15	50	Flow	5-17-67	--	105	5-17-67
19H1	Simpson Timber Co.	19	750	Flow	1968	293	--	1937
						15	--	6-30-47
20M1	Rayonier, Inc.	40	600	Flow	1935	21	--	1-27-47
						41	--	6-30-47
20M2	--do--	56	770	--	--	17	--	1-27-47
						32	--	6-30-47
21B1	Shorecrest, Inc.	245	249	40	6- 4-64	4.5	236	5-17-67
21L1	O. J. Ashford	10	60	--	--	--	127	5-16-67
21M1	H. L. Smith	36	58	0	1948	--	157	5-16-67
21Q2	G. R. Quimby	15	50	--	--	--	133	5-16-67
21Q3	C. Swenson	25	42	5	7-21-65	--	154	5-16-67
21R1	Bert Hurst	23	76	4	7-17-64	--	154	5-16-67

TABLE 5.--Quality of ground water in coastal areas, Mason County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 20 N., R. 3 W. - Continued								
22K1	G. H. Butter	16	40	13	--	--	150	5-16-67
22N1	R. H. Ferris	32	100	--	--	--	127	5-16-67
23E1	J. D. Goodro	20	89	--	--	--	159	5-17-67
23F1	C. H. Grunert	15	48	--	--	--	195	5-17-67
23F2	Jack Shero	35	51	5	8- 1-63	--	186	5-17-67
23H1	Mrs. Harry Westland	30	86	18	3- 8-63	--	154	5-17-67
23M1	A. D. Bakke	47	54	8	7-13-65	--	128	5-16-67
23M2	E. J. Mell	23	70	7	7-13-65	--	130	5-16-67
23P1	H. L. Sutherland	35	70	--	--	--	142	5-16-67
23Q1	Joe Gruver	47	93	--	--	--	173	5-16-67
24F1	J. W. Fadden	15	70	5	3-18-64	--	97	5-17-67
24G1	Ray Drebis	10	30	5	--	--	95	5-17-67
24K1	R. W. Young	45	83	16	6- 7-63	--	167	5-17-67
24K2	B. D. Stroud	25	80	13	--	4.5	220	5-17-67
24L1	Russell Hovind	55	76	1	1959	3.5	231	5-16-67

24M1	E. L. Irwin	41	84	--	--	5.0	219	5-16-67
24M2	C. V. Derosier	20	178	5	--	--	132	5-16-67
25B1	R. C. Brigham	20	151	--	--	--	159	5-16-67
25B2	Paul Dunbar	75	98	10	--	--	156	5-16-67
			T. 20 N., R. 2 W.					
3P1	G. B. Howard	22	61	1	8-28-63	37	246	5-16-67
4A1	Besse Anderson	30	90	14	6-21-63	--	157	5-19-67
9B1	DGTGOC Water Co.	40	144	5	6-11-63	1.6	141	4- 8-68
9B2	Werberger Winery	12	68	--	--	.4	188	4- 8-68
9J1	Myron Massey	15	113	--	--	2.0	117	4- 8-68
9Q2	James Cameron	18	59	9	9- 5-63	1.2	213	4- 8-68
10P1	S. M. Baunsgard	20	24	--	--	2.2	115	4- 8-68
10P2	Nels Baunsgard	12	12	2	--	3.4	68	4- 8-68
12A1	Hugo Glaser	10	22	--	--	2.1	160	4- 8-68
14N1	L. Saeger	20	53	--	--	3.2	126	4- 8-68
15C1	Gordon Simmons	18	20	--	--	3.2	88	4- 8-68
16B2	G. R. Anderson	30	43	3	7-22-65	4.2	186	4- 8-68
19N1	Waterfront Realty Co.	30	100	--	--	--	154	5-17-67

TABLE 5.--Quality of ground water in coastal areas, Mason County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 20 N., R. 2 W. - Continued								
21B1	Irwin McArthur	25	60	-25	5-17-67	670	2,100	1-23-64
						62	246	5-17-67
21P1	Arkada Park	50	183	-22	--	--	160	5-16-67
25M1	M. A. Olson	10	38	0	8-28-63	6.6	147	4- 8-68
28B1	B. N. Collier	15	172	1	2-21-63	400	--	12- 9-63
						355	1,320	5-16-67
28B2	L. A. Carlson	25	--	--	--	33	336	5-16-67
28C1	C. H. Woodcook	25	60	--	--	7.5	283	5-16-67
28C2	C. W. Teagle	60	96	4	2-21-63	--	165	5-16-67
28C3	L. J. Munson	27	65	--	--	10	358	5-16-67
28F1	A. R. Stewart	30	76	--	--	60	397	5-16-67
29J1	H. W. McClary	175	210	--	--	--	169	5-16-67
32G1	W. H. Bowen	110	120	--	--	4.0	236	5-16-67
32G2	W. J. McCleary	112	132	8	7-23-64	4.5	237	5-16-67
32P1	D. R. Beal	25	80	--	--	9.5	289	5-15-67

32Q3	K. A. Kelley	90	100	--	--	3.5	261	5-15-67
32Q4	William Brown	60	63	--	--	--	172	5-15-67
			T. 20 N., R. 1 W.					
19A1	J. J. Lohrer	20	56	1	7-14-65	2.1	90	4- 8-68
19R1	Mary Adams	50	75	--	--	2.2	101	4- 8-68
20E3	Paul Chaffee	30	59	--	--	2.2	91	4- 8-68
30M1	Dorothy Smith	240	419	5	8-29-63	2.6	112	4- 8-68
			T. 21 N., R. 3 W.					
35J1	Lawrence Gosser	25	92	Flow	5-16-67	--	118	5-16-67
36C1	D. A. Johnson	50	56	31	9-10-63	--	95	5-16-67
36C2	J. O. Okonek	50	101	Flow	5-16-67	--	100	5-16-67
36E2	R. E. Nation	50	83	Flow	5-16-67	--	114	5-16-67
36G1	Bruce Pagel	40	64	Flow	5-16-67	--	128	5-16-67
36G2	R. L. Fitchett	15	87	3	6- 9-68	--	112	5-16-67
36M1	Vern Savage	10	53	8	9-10-63	--	110	5-16-67
36N1	Glen Pettijohn	25	67	Flow	5-16-67	--	138	5-16-67

TABLE 5.--Quality of ground water in coastal areas, Mason County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 21 N., R. 2 W.								
13F1	Emmett Johnson	160	203	--	--	--	144	5-19-67
13H1	J. Britton	45	60	6	7-10-63	--	122	5-19-67
13J1	E. T. Petterson	78	95	8	12-17-48	--	145	5-19-67
13R1	E. H. Fredricks	28	89	--	--	--	139	5-19-67
22Q1	Madings, Inc.	35	72	--	--	--	140	5-19-67
23M1	K. Morton	40	65	--	--	--	120	5-19-67
23M3	Bruhakn	60	121	20	--	--	154	5-19-67
24C2	R. W. Weymouth	40	68	25	--	--	129	5-19-67
24E1	M. A. Polk	46	85	1	--	--	134	5-19-67
24E2	Winifred Fox	30	67	--	--	--	165	5-19-67
24P1	Irvie Wingert	78	101	3	9-13-63	2.0	207	4- 8-68
25M1	G. Johnson	55	80	15	--	2.6	142	4- 8-68
25M2	M. Goetsch	55	168	-5	--	1.6	290	4- 8-68
25M3	Hartstene Island Comm. Center	60	99	17	--	2.4	274	4- 8-68

33H1	R. O. Yeager	40	53	Flow	5-19-67	--	106	5-19-67
33H2	Leander Giest	12	65	11	5-19-67	--	87	5-19-67
35D1	J. Meeks	98	102	29	2-14-63	2.4	227	4- 8-68
			T. 21 N., R. 1 W.					
5A1	Treasure Island Comm. Club	50	227	3	--	--	127	5-19-67
5B1	L. E. Soule	10	352	Flow	5-19-67	.70	127	5-19-67
5B2	R. O. Edington	13	60	11	--	--	120	5-19-67
5G1	C. J. Baulig	15	39	12	5-28-65	--	120	5-19-67
5H1	Treasure Island Comm. Club	15	168	7	--	--	133	5-19-67
5K2	H. E. Somers	40	60	0	1961	--	116	5-19-67
5P1	Spooner-Stock-Burkhart	40	64	4	7-11-63	--	161	5-19-67
8B1	I. F. Rowe	15	67	1	7-11-63	--	157	5-19-67
8B3	Leslie Rice	5	120.	(c)	--	--	128	5-19-67
8C1	Grapeview Store	47	67	--	--	--	151	5-19-67
8C2	E. R. Park	12	300	Flow	5-19-67	--	133	5-19-67
8C3	Grapeview Fire Station	45	277	43	1965	--	151	5-19-67
8E1	H. J. Engen	60	67	25	7-11-63	--	180	5-19-67

TABLE 5.--Quality of ground water in coastal areas, Mason County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 21 N., R. 1 W. - Continued								
8E2	I. B. Palms	30	41	--	--	--	137	5-19-67
8G1	Orville Kager	30	150	--	--	--	153	5-19-67
8G2	--do--	28	50	--	--	--	103	5-19-67
8G3	St. Charles Winery	8	65	--	--	--	133	5-19-67
8H1	O. R. Buckingham	60	165	22	2-20-51	--	198	5-19-67
8J1	Lloyd Richey	60	550	--	--	--	150	5-19-67
8M1	Robert Lorentz	100	142	24	--	--	128	5-19-67
8Q1	J. E. Carlson	70	225	10	--	--	140	5-19-67
8Q2	Vinyard Cove Corp.	50	161	--	--	--	122	5-19-67
8R1	R. G. Wells	60	610	20	1962	--	138	5-19-67
18D1	R. W. Henz	30	37	0	7-10-63	--	125	5-19-67
31D1	D. D. Peugh	15	39	1	--	3.7	135	4- 8-68
31D2	Stieg Gabrielson	18	81	2	--	21	227	4- 8-68

T. 22 N., R. 4 W.								
1Q1	Starr White	30	120	--	--	.8	71	8- 7-68
12N1	Howard Lockwood	15	--	--	--	1.7	117	8- 7-68
14H1	William Wolf	50	52	[c]0	--	1.2	85	8- 7-68
26P1	R. L. Hays	10	75	--	--	1.0	91	8- 6-68
T. 22 N., R. 3 W.								
18L1	C. M. James	10	67	--	--	.8	97	7-18-68
19F1	Kenneth Rothline	20	40	--	--	1.2	102	7-18-68
19P1	T. N. Carlson	5	35	--	--	3.8	116	7-18-68
20P1	Ed Pohl	10	20	4	7-18-68	18	182	7-18-68
21N1	George Andrew	25	32	5	7-22-68	22	169	7-22-68
24F1	W. M. Brown	15	65	2	7-31-68	1.3	113	7-31-68
26G1	R. L. McDonald	40	61	6	7-31-68	1.4	130	7-31-68
27D1	Grayums Water Works	20	44	14	7-22-68	.9	116	7-22-68
27F1	R. C. Mitchell	20	31	3	1967	1.7	131	7-22-68
27R1	Madrona Morningside Beach Water Assoc., Inc.	45	92	13	7-22-68	2.3	123	7-22-68
31A1	Dick Buechel	30	197	[c]0	--	1.0	97	--

TABLE 5.--Quality of ground water in coastal areas, Mason County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 22 N., R. 3 W. - Continued								
31Q1	C. T. Wright	15	39	5	--	53	294	8- 6-68
32H1	Madrona Private Homes	75	275	41	8- 6-68	.8	91	8- 6-68
33M1	Dr. Calhoun	10	--	--	--	1.4	152	8- 5-68
33R1	V. A. Nyman	20	70	--	--	.9	84	8- 5-68
34R1	Eric Bergquist	20	105	11	8- 5-68	55	292	8- 5-68
T. 22 N., R. 2 W.								
1B1	John Sutherland	15	35	--	--	1.2	112	8- 1-68
1E1	Lynnwood Beach Estates	20	96	4	8- 1-68	1.5	114	8- 1-68
1R1	Louis Baccetti	30	218	Flow	8- 2-68	1.0	138	8- 2-68
2L1	Boyd Hunter	10	100	4	8- 1-68	1.0	112	8- 1-68
9J1	John Clappe	15	18	--	--	1.5	105	8- 1-68
10F1	Peter Fedts	10	38	-3	8- 1-68	2.4	95	8- 1-68
11D1	Walter Scott, Jr.	15	36	3	1958	1.5	96	8- 1-68
12M1	F. J. Donovan	15	--	--	--	1.1	97	8- 2-68

14B1	E. R. Tiffin	15	60	--	--	1.0	107	8- 2-68
17A1	J. O. Burkman	10	37	--	--	1.4	89	7-31-68
18G1	A. Skaret	15	43	8	7-31-68	.9	116	7-31-68
18N1	S. J. Wilson	15	49	6	7-31-68	.8	114	7-31-68
21A1	Kenneth McCaw	10	34	--	--	1.1	102	8- 2-68
21F1	Vic Frielin	10	40	Flow	8- 5-68	1.0	68	8- 5-68
22B1	E. R. Hosher	5	33	-5	8- 2-68	1.5	117	8- 2-68
	T. 22 N., R. 1 W.							
6B1	Sara Tschida	10	263	Flow	8- 2-68	1.0	120	8- 2-68
17B1	L. A. Allen	10	28	Flow	5-18-67	--	110	5-18-67
17B2	W. M. Baker	55	230	--	--	--	108	5-18-67
17H1	Sargent Oyster Co.	10	91	Flow	5-18-67	--	103	5-18-67
20G1	Fred Stock	12	169	0	--	--	116	5-18-67
20H1	G. R. Kirk Co.	8	288	Flow	5-18-67	--	92	5-18-67
20K1	John Mead	8	110	Flow	5-18-67	--	122	5-18-67
20N1	D. W. Beeson	20	46	10	--	--	122	5-18-67
20P1	Fred Stock	12	70	4	4-17-61	--	116	5-18-67
20Q1	Mrs. Chris Zietner	25	66	1	7-17-63	--	120	5-18-67

TABLE 5.--Quality of ground water in coastal areas, Mason County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 22 N., R. 1 W. - Continued								
29B1	John Glenn	10	31	6	--	--	176	5-18-67
29B2	William Payette	10	72	2	7-23-65	--	143	5-18-67
29H1	R. A. Benson	15	273	Flow	5-18-67	--	156	5-18-67
32A1	M. O. Barnard	20	71	6	7- 3-63	--	143	5-18-67
32A3	Wally Waugh	20	58	--	--	--	161	5-18-67
32G1	C. J. Holl	40	75	10	7-11-63	--	104	5-18-67
32H1	E. A. Middleton	38	84	4	7-11-63	--	130	5-18-67
32J1	A. V. Richards	30	66	--	--	--	106	5-18-67
32J2	J. E. Milner	34	61	2	6- 2-65	--	110	5-18-67
32Q1	W. G. Clayton	25	38	2	6- 2-65	--	120	5-18-67
T. 23 N., R. 3 W.								
3N1	Ayock Beach Improvement Club	50	90	31	8- 8-68	1.4	107	8- 8-68
20G1	Ed Gunkel	15	58	--	--	2.9	99	8- 7-68

30G1	Starr White	35	--	Flow	8- 7-68	0.8	79	8- 7-68
31F1	--do--	20	90	--	--	1.1	95	8- 7-68
T. 24 N., R. 2 W.								
6D1	Fred Martin	20	64	4	8- 8-68	870	2,970	8- 8-68

TABLE 6.--Quality of ground water in coastal areas, Thurston County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 18 N., R. 3 W.								
1C1	J. W. McKnight	5	50	Flow	5- 2-67	6.0	113	6-30-60
						--	122	5- 2-67
1D1	Grant Valentine	10	12	$^{c}3$	7- 1-59	--	130	5- 2-67
1D2	L. C. Voigt	10	65	Flow	5- 2-67	--	124	5- 2-67
2H2	L. W. Sexton	6	71	Flow	5- 2-67	7.0	116	6-30-60
						--	129	5- 2-67
2H3	Eugene Beck	10	45	2	--	--	116	5- 2-67
2H4	R. A. Bain	25	95	--	--	--	192	5- 1-67
2J1	W. E. Kaer	35	55	--	--	--	167	5- 1-67
12F1	--	40	--	--	--	--	137	5- 1-67
12N1	M. B. Juhl	20	49	5	--	--	130	5- 1-67
12P2	G. V. Kanda	15	30	13	4- 5-60	--	73	5- 1-67
12R1	A. F. Osborne	12	27	Flow	7-16-59	--	123	5- 1-67
13B1	Stacey Thompson	15	--	--	--	100	496	5- 1-67
13G1	Weatherhead	22	54	18	--	--	72	5- 1-67

13G2	L. R. Dorsett	20	90	Flow	5- 1-67	--	87	5- 1-67
13G3	R. W. Haskell	20	90	Flow	5- 1-67	--	87	5- 1-67
13G4	Frances Dickison	25	--	Flow	5- 1-67	--	87	5- 1-67
13G5	W. M. Anderson	20	45	--	--	--	113	5- 1-67
13H1	Mobbs Nursery	10	84	Flow	5- 1-67	--	134	--
13K1	M. L. Mook	50	85	21	--	6.0	97	6-30-60
						--	112	5- 1-67
13Q1	F. E. Wilder	60	83	--	--	--	116	5- 1-67
24H1	K. A. Berglund	20	207	Flow	5- 1-67	155	618	6-30-60
						195	751	5- 1-67
24J1	W. L. Frank	20	116	--	--	48	283	5- 1-67
24R1	R. H. Sprengle	20	172	19.11	5- 1-67	135	576	5- 1-67
24R2	J. E. Hansen	15	22	10	1959	40	256	5- 1-67
24R3	J. M. Taylor	20	65	--	--	140	641	5- 1-67
24R4	C. Weeks	20	115	Flow	5- 1-67	180	717	5- 1-67
25A1**	Walter Austin	25	131	Flow	5- 1-67	159	649	6-30-60
						145	623	5- 1-67
25H1**	R. W. Austin	30	--	--	--	115	535	5- 1-67
25R1**	C. O. Brown	130	180	--	--	--	100	5- 1-67

TABLE 6.--Quality of ground water in coastal areas, Thurston County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 18 N., R. 2 W.								
2C3	R. Shutt	5	28	[c]Flow	4-25-67	--	152	4-25-67
2C4	Bloom	100	120	5	5-26-59	--	169	4-25-67
2C6	E. W. Burreson	62	92	-1	5-26-59	--	159	4-25-67
2E2	Calvin Lockwood	5	200	[c]Flow	4-25-67	--	148	4-25-67
4F1	F. R. Mott	100	419	60	6-26-62	--	134	4-25-67
4F2	Don Koch	20	400	Flow	4-25-67	--	141	4-25-67
4H1	Robert Timms	18	387	Flow	4-25-67	4.0	180	7- 4-60
						--	190	4-25-67
6E2	H. E. Brower	35	45	--	--	--	138	5- 4-67
6E3	T. R. Hazelrigg	25	39	--	--	--	117	5- 4-67
14N1	Northern Pacific Railroad Co.	10	180	Flow	4-25-67	8.5	238	4-25-67
18K1	McLane School	175	180	95	--	--	91	5- 1-67
T. 18 N., R. 1 E.								
5M1	Brown Farms, Inc.	10	900	Flow	4-10-67	6.0	160	3- 6-58

						5.0	159	4-10-67
6N1	J. A. Thompson	240	253	17	1962	--	183	4-10-67
7B1	G. McMann	12	124	--	--	--	170	4-10-67
7H1	West Coast Lumbermens Assoc.	10	120	Flow	4-10-67	--	164	4-10-67
8C1	W. Koenig	10	75	Flow	4-10-67	4.0	193	4-10-67
8D2	Gordon McMann	10	118	10	4-10-67	--	183	4-10-67
8D3	West Coast Lumbermens Assoc.	10	112	9	9-29-50	--	175	4-10-67
8F2	D. Kessler	18	100	11	11-14-57	4.0	195	4-10-67
8J1	A. R. Golson	12	96	2	--	13	250	4-10-67
8K1	Anthony Kiechle	13	78	3	4-10-67	--	153	4-10-67
9M1	Valley Acres Water Co.	20	--	--	--	--	157	4-10-67
17C5	O. A. Peterson	14	128	7	--	--	156	4-10-67
17D2	Ted LaChance	15	110	--	--	--	166	4-10-67
17E2	Errett Deck, Jr.	22	109	19	11-20-57	19	200	3- 7-58
						35	304	4-10-67
18A1	H. Schols	20	120	Flow	4-10-67	19	138	3- 7-58
						6.0	137	4-10-67
18B1	Paul Braget	15	85	Flow	4-10-67	--	122	4-10-67

TABLE 6.--Quality of ground water in coastal areas, Thurston County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 3 W.								
13K1	Justin Taylor	10	86	[c]6	--	--	174	5- 5-67
13P1	H. H. Houston	25	122	8	--	--	139	5- 5-67
24D1	William Alley	95	99	(c)	--	(a)	160	5- 5-67
24D2	Lawrence Popple	10	28	--	--	--	162	5- 5-67
24D3	M. W. Dobson	95	120	0	3-27-60	--	162	5- 5-67
26E1	R. E. Klontz	50	62	31	6-17-59	--	130	5- 5-67
27K1	V. H. Butts	35	70	5	--	3.5	223	5- 5-67
27K2	Ellison Bros.	15	65	[c]10	--	--	198	5- 5-67
28K1	F. W. Huber	120	135	8	--	--	152	5- 5-67
28L1	H. G. McCool	20	70	7	--	--	192	5- 5-67
28N1	R. R. Lewis	15	30	--	--	--	125	5- 5-67
33F1	Mae Drape	60	68	--	--	5.5	210	5- 5-67
36P1	W. A. Koch	125	142	8	--	--	142	5- 2-67

T. 19 N., R. 2 W.								
1Q1	L. W. Oldford	80	118	--	--	6.5	220	4-19-67
1R1	D. G. Shacklett	70	84	2	1961	435	1,760	4-19-67
1R2	A. W. Settle	50	--	--	--	61	449	4-19-67
1R3	R. F. Kincy	80	90	20	--	85	538	4-19-67
3C1	Col. I. S. Wheeler	35	--	--	--	8.0	304	5- 3-67
3F1	W. A. Rigger	30	116	1	--	110	621	5- 3-67
3F2	Paul Todd	20	--	--	--	140	808	5- 3-67
3F3	Paul Weber	19	100	0	5- 3-67	190	934	5- 3-67
3F4	Precht	30	--	--	--	120	683	5- 3-67
3M1	--	70	--	--	--	205	1,040	5- 3-67
3M2	C. J. Ronne	60	--	55	--	200	1,020	5- 3-67
4F3	V. D. Crawford	115	158	5	9-10-59	5.0	229	5- 3-67
5Q1	Carl Adams	60	78	--	--	--	190	5- 3-67
7L1	LeRoy Patterson	10	52	0	--	--	196	5- 5-67
7L2	J. A. Rawdney	15	120	4	6-11-59	4.5	216	5- 5-67
8C1	Ben Dunkelberger	60	85	--	--	--	170	5- 3-67
8F1	H. B. Dunkelberger	6	128	0	--	--	185	5- 3-67

TABLE 6.--Quality of ground water in coastal areas, Thurston County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 2 W. - Continued								
8M1	Cleveland	10	80	Flow	5- 3-67	5.0	224	5- 3-67
8M2	Lighthouse Oyster Co.	10	300	Flow	5- 3-67	8.5	215	5- 3-67
9A1	T. F. Schmidt	110	189	-8	9-11-57	5.5	207	5- 3-67
9F1	D. A. Powell	50	93	7	--	--	116	5- 3-67
9H1	C. L. Rose	75	127	--	--	16	233	5- 3-67
9H2	P. A. Smith	60	100	--	--	--	179	5- 3-67
9L5	L. S. Morrill	15	37	0	--	--	119	5- 2-67
9N1	Morris Camus	30	37	5	--	--	139	5- 2-67
9R1	Cooper Point Water Company, Inc.	10	360	Flow	4-27-67	--	190	4-27-67
11P1	Graingers Beach Homes	15	150	--	--	--	175	4-24-67
11Q1	J. W. Graler	70	319	5	1948	16	704	4-24-67
11R1	J. Dvorak	85	524	-2	1957	5.5	270	4-24-67
12A1	Carl Stover	--	--	--	--	4.5	246	4-19-67
12B1	B. A. Campbell	100	108	5	7- 3-58	42	332	4-19-67
12C2	H. H. Lapham	60	120	--	--	210	1,010	4-19-67

12F1	G. A. Brown	40	80	--	--	130	720	4-19-67
12F2	W. L. Jones	35	40	--	--	110	677	4-19-67
12L1	Burris-Kruse-Ayer	125	513	53	8-18-53	4.0	206	4-19-67
12M1	Jerry O'Leary	70	590	--	--	--	184	4-19-67
12M2	F. T. Kluh	80	600	--	--	--	172	4-19-67
14C1	P. S. Lepper	90	220	--	--	7.0	317	4-24-67
14N1	Ralph Conner	75	89	6	11- 3-58	7.0	231	4-24-67
15M2	Bruce Reeves	40	60	--	--	205	969	4-27-67
15N1	Clearwater Water Co.	80	117	16	--	22	247	4-27-67
16A1	Huckleberry Road Water Co.	10	552	Flow	4-27-67	17	222	4-27-67
16J1	H. Kronawetter	130	152	-2	7- 8-58	--	130	4-27-67
16J4	Lewis G. Eklund	85	70	--	--	8.0	291	4-27-67
16J5	Dike Willoughby	80	--	--	--	7.5	294	4-27-67
16J6	E. G. King	80	105	--	--	7.5	193	4-27-67
16J7	Harold Potts	90	103	--	--	--	156	4-27-67
16K1	James McAllister	15	325	Flow	4-27-67	--	180	4-27-67
16K2	Arnold Koutonen	50	282	5	1962	--	177	4-27-67
16P1	F. C. Stone	40	70	--	--	120	607	4-27-67

TABLE 6.--Quality of ground water in coastal areas, Thurston County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 2 W. - Continued								
16P2	R. W. McAfferty	20	265	--	--	--	181	4-27-67
16Q1	H. W. Humphres	35	48	3	1957	--	102	4-27-67
16Q2	D. L. Montgomery	120	171	-25	1952	5.9	122	4-27-67
17A1	O. O. Boulden	60	64	12	1966	--	112	5- 2-67
18B1	Patricia Hood	25	100	20	--	3.5	266	5- 5-67
18C1	F. A. Reed	35	120	--	--	--	148	5- 5-67
18F1	E. R. Bayness	40	73	7	1967	--	194	5- 5-67
18K2	A. E. Robbins	130	166	24	1951	--	145	5- 5-67
20E1	K. H. Frohboes	85	138	65	--	--	144	5- 2-67
21E1	R. M. Murray	85	306	10	--	--	170	4-27-67
21L1	B. F. Monk	50	84	--	--	78	435	4-27-67
21L2	Steven Conner	20	82	16	1959	--	150	4-27-67
21Q3	Raymond Brower	70	297	23	1943	--	174	4-28-67
21R1	C. E. Day	130	153	3	--	--	166	4-27-67
22D1	R. E. Fitzgerald	80	90	7	--	8.0	197	4-27-67

22M3	Athens Beach Water Co.	80	87	17	--	--	175	4-27-67
22M4	J. M. Barney	65	100	-7	8-19-59	--	180	4-27-67
22M6	Beverly Beach Utilities Co.	10	441	Flow	4-27-67	15	224	4-27-67
22N1	J. L. Loring	50	65	3	8-10-59	--	168	4-25-67
22N4	Roberts	80	102	-6	1950	--	177	4-25-67
23C1	H. A. Barner	80	100	6	11- 4-59	--	170	4-24-67
23K1	W. J. Lynch	20	385	Flow	4-24-67	--	162	4-24-67
25C3	A. E. McEvers	110	128	--	--	--	103	4-24-67
25D1	C. P. Seward	90	123	1	1958	--	143	4-24-67
26B1	Marguerite Cushman	20	115	13	1-15-52	--	174	4-24-67
26H1	C. M. McDorman	150	190	--	--	--	174	4-24-67
26K1	Nell Haycox	95	138	--	--	7.5	212	4-24-67
26K2	H. D. Stigglebout	80	173	--	--	--	159	4-24-67
26Q1	U. S. Maritime Comm.	15	--	Flow	--	--	137	4-24-67
26Q3	Seashore Villa	8	80	--	--	--	193	4-24-67
26R1	C. F. Dryden	105	145	-35	--	--	190	4-24-67
26R2	William Cahill	115	137	-3	--	--	186	4-25-67
27D1	William Guffey	10	153	[c]Flow	--	130	614	4-25-67

TABLE 6.--Quality of ground water in coastal areas, Thurston County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 2 W. - Continued								
27E1	R. I. Tenney	50	60	40	--	11	293	4-25-67
27E4	Don Coleman	10	240	--	--	--	180	4-25-67
27E5	D. W. Smyth	10	240	Flow	--	--	172	4-25-67
28H1	S. Goldenberg	30	340	-3	1948	--	173	4-25-67
28J1	F. D. Dunn	10	213	Flow	--	--	172	4-25-67
28L1	Crochett	40	120	--	--	3.5	207	4-25-67
28L2	M. J. Layton	80	146	8	4-25-67	--	192	4-25-67
28L3	Don Hopkins	130	510	12	7-27-65	--	138	4-28-67
28L4	Dr. J. M. Donnell	80	100	--	--	3.5	220	4-28-67
28N2	Herbert Haynes	28	75	--	--	--	192	4-28-67
28N4	D. B. Baker	70	119	--	--	--	193	4-28-67
28N5	M. S. Bowman	35	75	--	--	3.0	214	4-28-67
28N6	H. H. Rohrbeck	45	90	--	--	3.5	239	4-28-67
28N7	H. W. Kincaid	40	72	--	--	5.0	258	4-28-67
29B1	E. S. LaBreck	25	46	-10	--	--	98	5- 2-67

29B2	C. L. Blackner	25	44	-8	--	--	177	5- 2-67
29G1	E. W. Ashburn	5	200	Flow	--	--	140	5- 2-67
29L1	H. R. Craft	15	21	--	--	--	118	5- 2-67
29M1	F. J. Breidenbach	90	150	--	--	--	146	5- 2-67
30F1	E. A. Reigel	70	130	32	--	--	116	5- 2-67
30K3	E. F. Steere	60	110	15	5- 2-67	--	143	5- 2-67
30L1	J. A. LaCasse	12	72	5	--	--	121	5- 2-67
31M1	Watson Hovis	35	86	--	--	--	139	5- 2-67
31N1	W. A. Stacey	30	50	-5	--	--	139	5- 2-67
31R1	Merle Junk	25	40	14	7-28-59	--	125	4-28-67
32A3	L. K. Merril	50	93	--	--	6.0	342	4-28-67
32A4	J. H. Biscay	70	80	--	--	3.5	226	4-28-67
32A5	E. K. Freytag	80	90	10	4-28-67	--	188	4-28-67
32B1	C. E. McArthur	10	62	Flow	4-28-67	--	177	4-28-67
32B4	Mrs. L. T. Webster	11	75	Flow	4-28-67	--	174	4-28-67
32B5	S. K. Knox	5	228	Flow	4-28-67	--	147	4-28-67
32B6	Harold Dalke	20	--	--	--	4.5	212	4-28-67
32B7	R. C. Friend	30	39	--	--	--	150	4-28-67
32B8	Karl Anderson	30	80	--	--	--	143	4-28-67

TABLE 6.--Quality of ground water in coastal areas, Thurston County-Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 2 W. - Continued								
32F1	W. N. Estes	50	51	39	--	--	143	4-28-67
32F2	Frank Waldburger	30	60	23	--	--	138	4-28-67
32F3	J. B. King	25	65	--	--	--	170	4-28-67
32M1	E. L. Stevens	35	42	18	7-28-59	--	144	4-28-67
32M2	C. Greenstreet	40	44	30	7-28-59	--	134	4-28-67
32M3	R. C. Aspinwall	35	90	--	--	--	140	4-28-67
32M4	Rob Bert	40	65	30	--	--	120	4-28-67
33H2	Don Standness	100	165	-42	--	--	175	4-25-67
33K5	W. J. Breuer	140	149	--	--	--	165	4-25-67
33Q1	Butler's Cove Water Co.	10	355	Flow	4-25-67	--	152	4-25-67
35B1	A. H. Bernhart	110	173	--	--	3.5	197	4-25-67
35G2	V. Lesh	120	160	5	5-28-59	--	193	4-25-67
35P2	A. Michalouskis	100	132	-6	--	--	185	4-25-67

T. 19 N., R. 1 W.								
4D2	Johnson Point Comm. Water Co.	120	131	20	--	4.5	280	4-17-67
4F2	C. B. Gallea	105	116	11	4-17-67	18	189	4-17-67
4G1	Lisack-Munson-Oldfield	55	90	-14	1956	420	1,680	4-17-67
4G2	Paul Thurston Herring Co.	80	102	--	--	230	1,030	4-17-67
4J2	Axel Wakkures	55	67	-1	10-12-57	350	1,330	4-12-67
4J3	H. H. Engelland	45	57	2	--	68	412	4-12-67
4L1	Dr. R. C. Brown	150	160	20	--	--	184	4-17-67
5E1	Burk Christie	40	67	--	--	7	804	4-19-67
5H1	S. E. Shumway	60	99	2	7- 3-58	15	310	4-17-67
5H3	E. T. Hyndman	65	88	1	6-22-51	6	238	4-17-67
5J1	J. F. Buttons	5	337	Flow	4-17-67	--	160	4-17-67
5J2	Havre	40	93	5	--	5	191	4-17-67
5J3	R. F. Carter	50	160	--	--	53	490	4-17-67
5M1	Col. H. E. Link	40	90	--	--	515	2,230	4-19-67
5M2	Andy Packwood	40	50	--	--	11	655	4-19-67
5N2	E. D. Brabrook	40	50	-3	10-19-59	--	150	4-19-67
5N3	Lash	55	65	3	4-19-67	4.0	277	4-19-67

TABLE 6.--Quality of ground water in coastal areas, Thurston County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 1 W. - Continued								
5R1	R. K. Gates	25	42	-1	9-15-58	--	150	4-17-67
5R3	Lien	50	90	29	9-16-58	--	183	4-17-67
5R4	R. H. Wick	40	139	--	--	5	208	4-17-67
6H1	J. M. Ward	30	144	3	--	9	742	4-19-67
6J1	Norman Benjamin	35	108	--	--	18	766	4-19-67
6J2	Gordon Newell	20	48	--	--	18	198	4-19-67
6K3	--	80	89	32	10-26-59	6.0	246	4-19-67
6K4	K. A. Heinold	60	65	--	--	--	166	--
6M2	James Rushford	65	288	--	--	1,795	6,420	7- 1-60
						145	695	4-19-67
6M3	Dr. Crabb	65	300	--	--	95	515	4-19-67
7J1	George Esterly	40	1,200	--	--	--	150	4-18-67
7N1	L. W. Wright	120	133	--	--	5.0	220	4-18-67
7R1	M. E. Creek	40	1,000	--	--	4.0	259	4-18-67
8A2	Henry Budinich	10	11	3	9-16-58	15	214	4-17-67

8A3	--do--	60	137	--	--	--	159	4-17-67
8H1	Ossie Tranum	45	80	3	9-19-58	--	164	4-17-67
8J1	Leona Bain	40	87	--	--	--	165	4-17-67
10C1	J. D. Smircich	55	75	-4	9-17-58	170	814	4-12-67
10C2	M. J. Reed	65	90	0	--	90	871	4-12-67
10C3	Hartman	65	--	--	--	45	752	4-12-67
10L1	Kenneth Jensen	70	90	--	--	9.5	230	4-12-67
10L2	Don Bennett	30	85	0	1947	255	1,000	4-12-67
10Q1	M. S. Bloom	50	68	2	--	27	288	4-12-67
15B3	R. H. Rowland	130	187	--	--	18	197	4-12-67
15G1	Kenneth Cole	40	80	0	--	--	128	4-12-67
17A2	Karl Christiansen	40	130	0	--	--	162	4-17-67
17A3	Montgomery Russell	30	128	--	--	--	150	4-17-67
17A4	G. E. Rogers	35	123	0	--	--	183	4-17-67
17K1	W. C. Madden	5	35	Flow	4-17-67	620	2,310	4-17-67
17K2	H. G. Klapstein	42	42	--	--	6.5	304	4-17-67
17K3	M. Paulsen	40	90	20	--	6.0	230	4-17-67
17M1	Weyerhaeuser Corp.	12	1,000	Flow	4-17-67	--	186	4-18-67
17N1	R. M. Koch	9	20	--	--	--	162	4-18-67

TABLE 6.--Quality of ground water in coastal areas, Thurston County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 1 W. - Continued								
17R2	H. E. Robinson	15	130	6	9-22-58	--	174	4-17-67
18D1	P. J. Dorian	110	128	0	1955	6.0	336	4-18-67
18R1	L. C. Durward	70	95	27	4-18-67	4.5	221	4-18-67
19B1	L. O. Meyers	50	85	--	--	--	168	4-18-67
19H1	Floyd Eastman	120	138	--	--	5.0	214	4-18-67
20G1	L. K. Arnold	115	158	--	--	105	587	4-17-67
20H1	Russell Jouno	150	178	3	--	5.0	221	4-17-67
20J1	L. L. Hitchcock	30	45	--	--	--	126	4-17-67
20P2	Walker	95	116	4	10- 1-59	--	182	4-18-67
20Q1	J. M. Wright	95	116	-1	1954	--	183	4-18-67
20R3	R. R. Long	15	68	4	9-23-58	--	146	4-17-67
21N1	Frederic Flahaut	125	218	75	--	4.0	299	4-18-67
23F1	W. J. Butler	5	260	Flow	4-11-67	4.0	190	4-11-67
23F2	K. R. Ashley	40	388	12	--	4.0	198	4-11-67
23F3	W. W. Hayes	92	149	--	--	5.0	200	4-11-67

23G1	Eldred Hansen	50	91	5	--	4.0	241	4-11-67
28N2	T. W. Ness	60	112	--	--	--	155	4-18-67
28N3	R. J. Farrar	20	47	--	--	--	166	4-18-67
29A1	J. E. Bloomfield	12	225	Flow	4-18-67	--	162	4-18-67
33D2	Anderson	22	108	1	9-24-58	--	174	4-18-67
33D3	A. G. Getchman	25	70	9	4-18-67	--	156	4-18-67
33E1	E. M. Lohrer	5	150	Flow	4-18-67	4.5	377	4-18-67
	T. 19 N., R. 1 E.							
30E1	National Fish and Oyster Co.	5	34	Flow	4-10-67	5.0	109	7- 6-60
						--	108	4-10-67
30L1	U. S. D'Miller	12	104	--	--	--	120	4-12-67
30M1	C. P. Foreman	55	73	15	1954	8.0	221	4-11-67
30M2	L. Weimar	60	90	5	--	--	118	4-11-67
30M3	R. M. Arter	20	50	5	1962	--	142	4-11-67
31C3	J. W. Ramez	200	238	--	--	--	177	4-11-67
31H1	Brown Farms, Inc.	10	165	Flow	4-10-67	4.0	191	7- 6-60
						4.0	182	4-10-67
31R1	--do--	10	175	Flow	4-20-67	4.0	191	4-20-67

TABLE 6.--Quality of ground water in coastal areas, Thurston County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 20 N., R. 2 W.								
28P1	Steamboat Islanders, Inc.	10	425	Flow	5- 3-67	2.0	253	7- 6-60
						2.0	256	5- 3-67
33L1	A. D. Gaffney	65	107	2	6- 2-59	677	2,467	7- 6-60
						570	2,150	5- 7-67
33L2	I. H. Loughary	55	455	5	--	10	280	5- 3-67
33Q1	Carlyon Beach Country Club	60	--	--	--	34	393	5- 3-67
33Q2	--do--	80	--	--	--	10	268	5- 3-67
34P2	William Grayum	40	200	20	8- -65	14	305	5- 3-67
T. 20 N., R. 1 W.								
33L2	Dr. R. C. Brown	5	500	Flow	4-17-67	12	229	4-17-67

PARTIAL CHEMICAL ANALASIS
OF
GROUND WATER
PIERCE COUNTY

TABLE 7.--Quality of ground water in coastal areas, Pierce County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 19 N., R. 1 E.								
6P1	Anderson Island Water Co.	50	--	--	--	27	248	7-12-68
9M1	Tom Anderson	20	52	--	--	561	2,060	7-12-68
17J1	Robert Williams	50	--	--	--	504	1,910	7-12-68
22P1	E. I. duPont de Nemours Co., well 1	208	252	0	12- -41	20	--	2- -42
						10	--	7-13-42
						6.5	--	11- -43
						8	310	2- 6-61
22P2	E. I. duPont de Nemours Co., well 2	208	266	--	--	53	--	7-13-42
						29	--	11- -43
						9	340	2- 6-61
						15	369	9-16-66
27C1	E. I. duPont de Nemours Co., well 3	216	331	10	9-10-45	12	190	2- 6-61
						27	236	9-16-66
34G1	U. S. Government, Fort Lewis, well 9	215	36	190	3- 1-60	4.5	122	1-13-58

T. 19 N., R. 2 E.								
6P1	City of Steilacoom, well 2	260	247	108	2-23-60	2	150	2- 6-61
T. 20 N. R. 1 W.								
1C1	J. W. Ulsh	60	70	--	--	5.6	188	4- 3-68
1D1	R. Johnson	19	33	--	--	2.8	194	4- 3-68
1D2	Karl Nelson	15	42	--	--	2.4	145	4- 3-68
1D3	Hein	10	47	--	--	2.6	178	4- 3-68
1D4	G. Stone	10	65	--	--	2.7	169	4- 3-68
1G1	John Klinker	120	123	--	--	3.5	152	4- 3-68
1H1	Sund	20	120	Flow	4- 3-68	3.6	183	4- 3-68
1H2	Reese	15	37	15	4- 3-68	2.5	128	4- 3-68
13P1	R. G. Johnson	20	30	6	1960	2.2	103	4- 2-68
13P2	Humphrey	20	30	--	--	3.5	120	4- 2-68
13P3	McCallister	25	36	--	--	2.6	111	4- 2-68
13P4	F. Eilers	35	180	-5	1966	2.8	264	4- 2-68
13P5	G. Gilbert	30	46	--	--	5.8	195	4- 2-68
24B1	Dorfner	20	25	--	--	4.1	61	4- 2-68

TABLE 6.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 20 N., R. 1 W. - Continued								
24B2	M. Lind	20	25	--	--	1.4	89	4- 3-68
24B3	Watkinson	18	18	--	--	2.8	77	4- 3-68
24F1	Conboy Beach Water Co.	50	285	--	--	3.2	256	4- 2-68
24G1	Tacoma Yacht Club	15	16	--	--	3.1	158	4- 2-68
24H1	Dafoe	20	195	--	--	3.4	248	4- 2-68
24L1	R. A. Van Antwerp	70	123	-10	1962	127	614	4- 2-68
24L2	P. L. Myers	65	77	--	--	116	593	4- 2-68
24L3	Pilson	50	70	--	--	1,020	3,310	4- 2-68
24L4	H. Barkemeyer	85	80	--	--	3.0	201	4- 2-68
24P1	Haumerson	70	130	--	--	25	303	4- 1-68
24P2	J. G. Atkins	70	105	15	1958	7.1	251	4- 1-68
24R1	C. Conroy	50	143	19	3-30-68	5.7	210	3-30-68
25B1	Filuce Bay Water Co.	40	167	--	--	30	291	3-30-68
25B2	Palmer	60	75	6	4- 1-68	11	315	4- 1-68
25B3	--do--	55	75	--	--	45	413	4- 1-68

25C1	Barnes	30	100	-34	1954	4.0	251	4- 1-68
25C2	E. T. Knowles	50	87	--	--	3.2	225	4- 1-68
25F1	H. K. Hardy	60	60	--	--	13	306	4- 1-68
25F2	W. A. Shook	30	40	--	--	2.7	104	4- 1-68
25N1	H. Naubert	155	173	-5	1964	70	437	3-30-68
25P1	R. W. Tritle	100	110	--	--	86	470	3-30-68
26H1	Earl Knapp	150	200	--	--	4.7	152	4- 1-68
26P1	A. Hagbo	42	90	--	--	21	271	3-30-68
26P2	Brubaker	75	80	--	--	12	211	3-30-68
35C1	Taylor Bay Estates	180	--	--	--	188	796	3-30-68
35L1	D. F. Johnson	82	98	--	--	282	1,090	3-30-68
36E1	Camp Wa-Ko-Ma	165	200	-18	3-30-68	24	275	3-30-68
36M1	D. Williams	181	220	-4	--	64	418	3-30-68
	T. 20 N., R. 1 E.							
1C1	Fox Island Water Co., well 8	50	148	-18	1964	2.4	200	5-18-68
2A1	Fox Island Water Co., well 6	119	132	3	--	4.6	176	5-18-68
6P1	Rainwater	25	200	--	--	4.4	174	4- 3-68

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 20 N., R. 1 E. - Continued								
6P2	Northwest Bible Schools	10	84	5	1962	68	576	4- 3-68
7K1	H. G. Hoskins	4	700	Flow	2-12-51	8	--	2-12-51
29Q1*	Unknown	10	87	4	6- 4-63	(a)	--	--
29Q3	R. E. Cammon	75	82	--	--	64	431	7-12-68
33R1	Carl Green	170	228	--	--	2.5	138	7-12-68
T. 20 N., R. 2 E.								
5D1	Glen Bowles	23	50	--	--	19	197	6-27-68
6N1	Fox Island Water Co., well 1	65	119	-5	1959	3.7	219	5-18-68
7F1	Fox Island Water Co., well 5	100	154	21	1965	2.6	217	5-18-68
9C1	Day Island Water District, well 1	10	480	--	--	1.9	--	11- 4-38
						3	160	2- 6-61
				8	9-13-66	4.9	162	9-13-66

9C2	Day Island Water District, well 2	20	606	--	--	2	130	2- 6-61
				-8	9-13-66	17	177	9-13-66
9C3	Day Island Yacht Club	10	608	2	4-30-65	--	183	9-16-66
9K1	University Place Water Co., well 9	190	381	17	9-15-66	5.9	182	9-15-66
16A1	University Place Water Co., well 6	310	171	214	2-26-60	11	236	9-15-66
16M1	Sunset Beach Improvement Club	120	118	45	6- 7-52	6	140	2- 6-61
20K1s	Pioneer Sand and Gravel Co.	20	--	--	--	5.9	125	9-14-66
20P1	--do--	25	1,020	--	--	3	130	2- 6-61
				Flow	1966	4.9	126	9-14-66
20Q1	--do--	15	20	--	--	7,660	21,100	9-14-66
29Q1	West Tacoma Newsprint Co., well 1	19	275	Flow	--	2.8	--	10- 1-38
						10	190	2- 6-61
							210	9-16-66
29Q2*	West Tacoma Newsprint Co., well 2	14	854	42	--	2.2	--	10- 1-38
29Q4	West Tacoma Newsprint Co., well 5	14	870	0	2- 4-63	--	132	9-16-66

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 20 N., R. 2 E. - Continued								
32B1	West Tacoma Newsprint Co., well 3	22	1,172	Flow	--	2.0	--	10- 1-38
						3	130	2- 6-61
						--	143	9-16-66
32B2	West Tacoma Newsprint Co., well 4	35	796	41	3- 5-59	--	129	9-16-66
T. 20 N., R. 3 E.								
1L1	Formerly Brookfield Gardens	15	185	16	3-16-60	--	400	5-19-62
1R1	Manza and Zarelli	20	250	8	--	11	397	9- 8-66
2N1	A. R. Bunge	20	67	15	6-10-53	3.0	269	7-13-66
2Q2	Standard Oil Company of Calif.	12	245	13	7-13-66	2.5	260	7-13-66
3L1	City of Tacoma	10	527	21	4- -60	3	140	10-19-60
						1.5	130	7-13-66
3M1*	Washington Gas and Electric Co.	12	400-500	Flow	1960	5	130	10-19-60

4D2	Tacoma Savings and Loan Assoc.	120	147	25	1956	60	217	9- 9-66
4G1	St. Regis Paper Co.	25	600	15	8-25-66	3	140	10-31-60
4H2	--do--	12	1,501	Flow	8-26-66	6.9	177	8-25-66
4H3	--do--	12	535	-3	8-25-66	8.9	166	9- 7-66
4J3	Hygrade Food Products Corp.	10	547	32	3- -58	11	160	10-19-60
						279	1,060	2-19-66
						5.4	194	3-22-66
4J4	--do--	10	590	--	--	32	155	2-11-66
						11	1,030	2-19-66
						9.9	151	7-31-66
						40	254	9- 2-66
4P1	Washington Gas and Electric Co.	15	385	Flow	--	4	150	10-31-60
4P2	Harmon Cabinets, Inc.	10	250	33	1940	--	153	8-31-66
4Q1	V. L. Pinkerton	8	490	12	8-31-66	3	130	10-19-60
							125	8-31-66
9A3	Container Corp. of America	20	320	Flow	3-16-60	2.0	123	7-21-66
9C2	Robert Cammarano	30	301	30	8-31-66	4	130	10-19-60
							138	8-31-66

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 20 N., R. 3 E. - Continued								
9C3	W. S. McHugh	30	171	15	5- 1-63	4.9	161	8-31-66
9D2	Carling Brewing Co., well 1	80	247	0	--	--	140	5-21-62
9D3	Carling Brewing Co., well 5	111	677	43	8-21-66	--	141	9- 1-66
9D4	Carling Brewing Co., well 4	106	540	62	8-23-66	4	140	10-19-60
							145	9- 1-66
9D5	Carling Brewing Co., well 6	92	594	44	2-16-64	4	--	2-27-64
							135	9- 1-66
9E4	Tacoma Ice and Cold Storage Co.	125	710	13	3-15-60	--	152	9- 2-66
9F1	Silver Springs Brewing Co.	40	618	Flow	--	3	130	10-19-60
							128	9- 7-66
10A1*	Federal Meat Co.	25	--	30	--	3	150	10-19-60
10A3	--do--	15	200	--	--	2.0	168	7-13-66
10A4	--do--	15	67	--	--	655	2,500	7-13-66
10B1*	Medosweet-Foremost Dairies	25	275	Flow	3-16-60	3	130	10-19-60

11C1	The Milwaukee Road	20	160	17	9- 8-66	27	175	9- 8-66
11J1	W. C. Bluhm	20	70	15	3-16-60	5.9	308	9- 9-66
12C1	Colonial Gardens	15	277	14	3-16-60	6.9	310	9- 9-66
12E1	C. J. Mettler	15	90	--	--	5.9	270	9- 7-66
			T. 21 N., R. 1 W.					
3G1	Olman Tract	20	--	--	--	1.6	124	3-28-68
3H1	Lustie	10	100	--	--	1.8	116	3-28-68
3J1	Sound n' Shore Realty	155	--	--	--	1.7	119	3-28-68
10F1	Dr. R. Hedberg	70	114	--	--	2.6	135	3-28-68
13Q1	T. D. Cross	30	125	--	--	2.8	195	4- 5-68
13Q2	D. Greetham	30	106	--	--	2.4	116	4- 5-68
15K1	Anderson	45	--	--	--	7.1	152	3-28-68
15K2	M. A. Putnam	35	67	-5	--	4.5	161	3-28-68
24F1	Young	40	180	--	--	3.5	131	4- 5-68
24G1	Streich	50	60	--	--	2.9	135	4- 5-68
25F1	Randall	15	68	-23	1968	2.3	143	4- 5-68
25M1	L. I. Langlow	40	48	--	--	5.6	182	4- 4-68
25P1	Corrie	25	146	--	--	4.4	195	4- 4-68

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 21 N., R. 1 W. - Continued								
25P2	Erickson	25	156	--	--	4.0	160	4- 4-68
26R1	Gilkison	20	36	Flow	4- 4-68	5.0	176	4- 4-68
26R2	McElroy	30	55	--	--	5.8	178	4- 4-68
26R3	O. L. Allen	22	55	Flow	4- 4-68	4.8	164	4- 4-68
28K1	C. M. Cox	45	--	--	--	1.8	39	3-28-68
28P1	Nicholson	45	--	--	--	3.1	153	3-29-68
28P2	Tony Figieler	20	80	--	--	3.4	131	3-29-68
32B1	Realty Sales Co.	60	85	6	--	76	421	3- -58
33C1	D. N. Wallen	60	96	10	1951	9	--	2- 6-51
35A1	R. Bischoff	20	20	--	--	1.2	111	4- 4-68
35G1	Wahlborg	10	18	--	--	1.6	107	4- 4-68
36C1	G. Snyder	30	72	--	--	6.6	305	4- 4-68
36C2	Aldrich	25	68	--	--	3.6	213	4- 4-68
36C3	Seidelman	25	68	--	--	6.4	251	4- 4-68
36C4	J. W. Mann	20	170	--	--	3.0	219	4- 4-68

36D1	Ames	70	195	3	--	6.6	157	4- 4-68
36Q1	Wash. State Parks	20	180	--	--	3.4	219	4- 3-68
			T. 21 N., R. 1 E.					
3D1	Yates	20	75	0	--	360	1,420	6-26-67
3D2	--do--	22	--	--	--	401	1,470	5-10-68
3F1	Jardene Bros.	20	75	3	--	10	177	6-26-67
3H1	Clarence Price	20	28	--	--	11	171	5-10-68
3J2	Ellery Cram	15	67	1	6-17-59	--	152	6-26-67
3J3	Marshal McCormick	15	70	--	--	2.4	135	5-10-68
3K1	G. Groth	10	93	--	--	1.8	164	5-10-68
3K2	C. T. Metzker	20	100	5	--	--	192	6-26-67
3R2	Rosedale Church	30	88	-15	--	10	216	6-27-67
3R3	Harvey McCabe	25	125	8	5-10-68	2.6	146	5-10-68
5D1	Collins	25	75	--	--	3.0	107	4- 6-68
5D2	William Case	25	86	-22	5- 8-68	3.2	124	4- 6-68
6A1	Natucci	30	85	--	--	2.6	101	4- 5-68
6A2	Ferol Hopson	30	84	-9	5- 8-68	2.4	91	4- 5-68
6D1	A. Cadle	40	47	--	--	3.4	106	4- 5-68

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 21 N., R. 1 E. - Continued								
6D2	Buekell	40	50	--	--	3.0	113	4- 5-68
6D3	Glen Cove Marina	5	45	Flow	4- 5-68	1.8	109	4- 5-68
6F1	Wilkes	15	16	--	--	4.0	114	4- 5-68
6F2	Agnor Johnson	25	76	46	--	2.2	105	4- 5-68
6L1	W. Coy	70	195	--	--	1.8	152	4- 5-68
6P1	Thompson	15	140	--	--	3.2	116	4- 5-68
7C1	Dr. Helwig	85	97	10	1957	2.8	139	4- 5-68
9J1	Fred Osmers	15	100	--	--	2.2	199	5-11-68
10A2	W. R. Garnett	35	90	5	--	9.0	191	6-26-67
10A3	J. J. Roller	23	--	--	--	2.6	153	5-10-68
10A5	J. R. Throckmorton	25	104	0	--	3.5	153	6-26-67
10C1	Raft Island Development Co.	155	309	10	11- 3-59	6.5	159	--
				-24	5-11-68	2.4	158	--
10F1	Dan Morse	45	--	--	--	2.6	180	5-11-68
10G1	G. R. Wheeler	20	100	11	1-15-51	9	--	1-15-51
						2.2	213	5-11-68

10H2	R. W. Nelson	15	76	0	7-21-58	3.0	153	6-27-67
				4	5-11-68	2.2	151	5-11-68
10H3	Roland Day, Jr.	18	65	--	--	1.8	147	5-11-68
10H4	D. P. McGuire	5	68	1	2-15-58	6.5	170	6-27-67
10H5	A. V. Blazevich	20	89	--	--	2.6	160	5-11-68
10K2	G. C. Simpson	30	75	--	--	4.2	181	5-11-68
10M1	O. A. Roeder	30	40	--	--	2.8	220	5-11-68
16L1	E. Larsen	100	126	40	--	8	--	1-15-51
16L2	Wash. State Parks	129	133	34	8-21-58	190	853	6-27-67
16Q1	William Busch	18	60	Flow	5-16-68	3.0	164	5-16-68
21K2	C. D. Gordon	19	90	--	--	4.6	159	5-16-68
21L1	Forest Beach, Inc.	50	157	--	--	66	390	5-16-68
21M3	--do--	93	168	--	--	54	365	5-16-68
21P1	C. W. Larsen	15	52	--	--	13	193	5-16-68
21Q1	J. M. Driskells	35	60	--	--	3.4	137	5-16-68
21Q2	F. Damierer	40	92	--	--	4.6	135	5-16-68
21R1	D. P. Murphy	40	135	--	--	2.0	131	5-17-68
22N2	E. E. Hedberg	30	75	--	--	7.6	154	5-17-68
24A1	Clarence Hofbauer	30	--	--	--	3.5	136	6-24-68

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 21 N., R. 1 E. - Continued								
24H1	M. D. Anderson	10	38	5	6-25-68	4.2	112	6-25-68
24J1	Ken Whiton	30	--	--	--	3.0	131	6-25-68
25M1	Edward Young	30	70	Flow	6-24-68	1.8	162	6-24-68
25P1	Elmer Morud	45	80	--	--	1.7	161	6-24-68
26E2	W. C. Oldfield	15	40	--	--	2.8	137	5-17-68
26J1	O. R. Seabloom	20	60	Flow	5-17-68	6.8	160	5-17-68
26K1	Ray Teal	45	366	0	--	9	--	2- 5-51
26K2	G. J. Price	43	52	--	--	7.8	165	5-17-68
27A1	W. R. Strickland	35	--	19	5-17-68	13	199	5-17-68
27B2	D. R. Rogers	55	--	--	--	7.2	135	5-17-68
27C1	H. C. Olson	5	30	--	--	7.4	130	5-17-68
28C1	G. Greissler	40	--	--	--	1.4	223	5-16-68
28D1	J. V. Corkery	95	98	25	--	105	--	1-15-51
28F1	Moorlands Corp.	45	140	25	5-17-68	329	1,250	5-17-68
34A1	Fox Island Water Co., well 2	70	96	3	1961	3.5	90	5-18-68

35D1	Shorewood Beach Water Co., Inc.	25	432	--	--	6.5	262	5-18-68
35J1	Fox Island Water Co., well 7	45	100	3	1959	3.1	170	5-18-68
36B1	G. J. Horseman	20	250	--	--	8	--	1-16-51
			T. 21 N., R. 2 E.					
4E1	George McDonald	100	146	17	1963	1.6	144	7- 1-68
5C1	B. L. Conen	20	--	--	--	1.9	118	7- 1-68
5L1	Jack Hersee	20	61	10	12-10-67	2.3	148	7- 1-68
8A1	J. Holmaas	45	--	--	--	2.0	138	6-28-68
8C1	City of Gig Harbor	60	265	--	--	2.0	140	7- 1-68
17L1	Rehn	330	808	--	--	14	--	1- -51
19E1	R. B. Smart	10	--	--	--	2.9	160	6-25-68
19M1	W. H. Bowers	10	67	-5	1951	1.4	136	6-25-68
21K1	R. T. Nixon	305	318	--	--	7	--	1-12-51
23H1	Tacoma Smelting Co.	20	212	-3	9-13-66	4.0	223	9-13-66
28K1	Erna Southwell	4	--	0	6-27-68	4.5	156	6-27-68
29M1	Leighton Blake	30	75	-1	6-26-68	3.2	150	6-26-68
30B1	Chet Jones	5	21	-6	6-25-68	7.3	123	6-25-68

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 21 N., R. 2 E. - Continued								
30C1	W. E. Sanders	35	--	--	--	2.1	150	6-25-68
30C2	Russell E. Carlson	15	90	Flow	1963	3.5	131	6-25-68
30F2	Davis	20	260	9	6-24-68	2.8	184	6-24-68
30H2	D. S. Buchanan	25	85	Flow	6-26-68	2.9	126	6-26-68
30P2	C. H. Harris	60	--	--	--	12	293	6-24-68
31A1	E. P. Allen	63	85	--	--	2.0	136	6-27-68
31D1	Unknown	35	--	--	--	6.5	215	6-24-68
31G1	Fred J. Ludwig	5	65	--	--	2.0	134	6-27-68
T. 21 N., R. 3 E.								
16L1	Caledonia Water Co., well 1	15	184	11	3- 7-60	160	670	7-30-59
						140	670	6- 5-60
						230	1,000	7- 5-60
						300	--	9-11-60
						149	737	7-19-66

16L2	Caledonia Water Co., well 2	50	140?	--	--	93	520	7-30-59
						32	300	6- 5-60
						140	740	7- 5-60
						240	--	8-11-60
						110	580	9-11-60
						230	991	7-19-66
16N1	Hyada Mutual Water Co., well 3	90	207	0	7-20-66	51	340	[a]7-30-59
						580	2,200	[b]7-30-59
						670	2,200	[c]7-30-59
						880	2,800	[d]7-30-59
						980	3,400	[e]7-30-59
						1,050	3,550	6- 2-60
						880	--	10-31-60
16N2*	Hyada Mutual Water Co., test well	90	419	-27	3-15-60	--	--	--
16P1	Hyada Mutual Water Co., well 1	210	272	-15	4-11-63	18	270	7-30-59
						18	250	9-11-60
						24	273	7-19-66

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 21 N., R. 3 E. - Continued								
16P2	Hyada Mutual Water Co., well 2	210	294	-6	1-17-61	400	1,600	7-30-59
						8	200	6- 4-60
						270	1,200	7- 5-60
						770	--	8-11-60
						20	264	7-19-66
16P3	Hyada Mutual Water Co., well 4	210	269	7	7-20-66	10	--	5-13-61
						24	286	7-19-66
22E1	Foss Tug and Barge Co., Tyee Marina	10	45	3	7-18-66	3.0	191	7-18-66
22F1	P. M. Jackson	10	20?	--	--	14	178	9- 8-66
22L2	Leo Sandgren and Glen Roy	5	25	2	9- 8-66	--	175	9- 8-66
22L3	N. W. Everett	10	22	(c)	--	346	1,220	9-12-66
22Q2	P. H. Mattern	10	31	0	--	--	146	9- 8-66
25L1	Woodworth Co.	125	193	27	9- 8-66	--	138	9- 8-66

26N1	City of Tacoma, tide flats well 1	11	785	--	--	12	--	1-13-38
						17	368	12-29-44
						7.5	--	2- 7-55
						11	321	7-12-66
26Q1	Buffelen Woodworking Co.	7	450	Flow	7-12-66	92	--	2- 6-39
						50	460	10-12-60
						65	555	7-12-66
27B1	Clarence Jobb	10	25	--	--	4.9	140	9- 8-66
27B2	Lloyd's Float	10	50	Flow	1964	--	143	9- 8-66
27B3	George Heitz	10	40	5	--	8.9	155	9-12-66
27H1	Karl Seigel	15	47	11	7-19-66	6.5	149	7-19-66
27J1*	Hooker Chemical Corp.	10	1,216	Flow	--	110	--	2-18-39
						48	--	2-11-49
29P1	General Mills	15	350	21	9-13-66	--	156	9-13-66
29P2	--do--	15	540	[a]21	9-13-66	--	156	[a]9-13-66
34C1*	Cope Construction Co.	18	25	--	--	6,450	18,500	7-18-66
34C2*	--do--	18	20	--	--	5,740	16,400	8-30-66
35B1	Buffelen Woodworking Co.	7	856	Flow	7-12-66	14	350	12-18-59
						12	315	7-12-66

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 21 N., R. 3 E. - Continued								
36L1	Kaiser Aluminum Chemical Corp., well 3	19	950	33	1952	8.4	273	7-12-66
36P1	Kaiser Aluminum Chemical Corp., well 1	19	824	20	7-12-66	10	250	10-19-50
36Q1	Kaiser Aluminum Chemical Corp., well 4	19	901	Flow	--	8.4	257	7-10-66
T. 22 N., R. 1 W.								
26F1	Geneva Slack	150	223	--	--	10	--	1-24-51
34G1	F. R. Titcomb	40	110	--	--	9	--	1-26-51
T. 22 N., R. 1 E.								
13N1	E. A. Christensen	5	180	Flow	5- 9-68	1.8	125	5- 9-68
14A1	E. L. Wood	10	--	Flow	5- 8-68	1.8	132	5- 8-68
22R1	Lane	40	--	--	--	2.0	118	5- 8-68
23B1	O. M. Bestwick	85	125	--	--	2.2	114	5- 8-68
23L2	R. Brochner	40	96	--	--	2.4	121	5- 8-68

23L3	Edward Goldman	10	87	--	--	1.6	125	5- 8-68
24C1	Peninsula High School	75	153	69	--	3.5	119	6-20-67
24D1	Western Oyster Co.	5	102	30	3- -40	4.5	119	6-20-67
25C2	Bart Hogeberg	50	130	10	1967	1.8	121	5- 9-68
26R2	Len Higgens	5	102	Flow	--	--	156	6-26-67
26R3	G. A. Lagerquist	15	70	Flow	5- 9-68	.6	120	5- 9-68
28L1	D. C. Smith	40	104	--	--	3.0	119	5- 8-68
28L2	J. O. Bramhall	40	300	-42	5- 8-68	3.2	116	5- 8-68
28N1	W. D. Hopping	20	--	--	--	1.3	124	5- 8-68
29J1	Manley	25	60	0	--	3.6	128	4- 6-68
29J2	Medak	25	103	--	--	3.4	130	4- 6-68
29J3	Salatino-Killian	30	100	--	--	3.2	134	4- 6-68
29J4	Gylling	25	63	--	--	3.5	152	4- 6-68
29J5	McConnell	20	68	--	--	4.5	110	4- 6-68
29J6	Strome	20	70	--	--	4.8	114	4- 6-68
29J7	Sehmel	25	140	Flow	4- 6-68	2.0	116	4- 6-68
32A2	K. O. Torgeson	45	80	--	--	2.6	110	4- 6-68
32P1	Virgil Harfst	20	80	-28	5- 8-68	3.6	106	4- 6-68
32P2	Alden Visell	20	80	-25	5- 8-68	3.1	98	4- 6-68

TABLE 7.--Quality of ground water in coastal areas, Pierce County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 22 N., R. 1 E. - Continued								
32P3	Joe Hall	20	90	--	--	3.5	108	4- 6-68
32P4	Pepper	20	65	-5	1966	4.4	110	4- 6-68
34J1	R. H. Holmes	40	121	5	12-21-59	4.5	143	6-20-67
						2.3	143	5-10-68
34J2	Peterson	50	--	--	--	7.0	147	6-20-67
34J3	Howard Armstrong	21	100	--	--	1.7	133	5-10-68
34Q2	Al Benedetti	30	66	6	6-12-60	--	175	6-26-67
34Q3	Burkey	30	93	-8	9-16-59	--	220	6-26-67
34Q4	Gene Baker	19	97	--	--	2.4	166	5-10-68
34R1	Dan Iveen	30	175	--	--	1.9	128	5-10-68
T. 22 N., R. 2 E.								
22M1	Point Richmond Development	15	--	--	--	.9	133	6-28-68
28J1	Hayes	150	190	--	--	1.9	132	6-28-68

33G1	Don Hyatt	30	58	--	--	2.6	168	7- 1-68
33P1	W. H. Krabler	340	200	--	--	12.0	200	7-17-68

TABLE 8.--Quality of ground water in coastal areas, Kitsap County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 22 N., R. 1 E.								
1M2	E. P. Eberle	50	62	Flow	6-20-67	4.0	119	6-20-67
11A1	Burley Improvement Assoc.	35	404	Flow	6-20-67	3.5	136	6-20-67
12D3	E. C. Hatch	25	385	Flow	6-20-67	3.5	138	6-20-67
12N1	E. J. Peterson	20	220	Flow	6-20-67	3.5	133	6-20-67
						1.6	144	5- 9-68
T. 22 N., R. 2 E.								
3C1	E. R. McKee	100	260	-109	4-18-67	4.5	159	4-18-67
3D4	U.S. Army	384	390	21	1- -55	5.5	191	4-18-67
3D6	McCain	340	400	42	4-18-67	4.5	199	4-18-67
3F5	J. J. Haley	310	335	10	1967	6.0	173	5-18-67
3M5	A. W. Robbecke	20	54	-5	1965	6.5	107	4-19-67
4N2	D. R. Capell	283	246	--	--	4.5	102	4-18-67
10D4	Edward Starr	60	84	-9	4-18-67	6.0	127	4-18-67

T. 23 N., R. 2 E.								
1D1	R. S. Taylor	40	50	--	--	4.5	224	4-20-67
1E1	Roy Sebring	15	49	Flow	4-20-67	18	288	4-20-67
1M1	Wash. Toll Bridge Authority	15	163	Flow	4-20-67	8.5	614	4-20-67
2A1	Owl Electric Co.	60	90	--	--	7.0	195	4-20-67
22A1	Dorothy McIlvain	15	14	3	8-15-49	10	265	4-19-67
22Q2	H. P. Greggerson	8	58	0	1966	41	276	4-19-67
T. 24 N., R. 2 W.								
19G2	William Clark	20	145	Flow	6-16-67	3.0	121	6-16-67
T. 24 N., R. 1 E.								
3H1s	Ollie Johnson	10	--	10	--	30	365	5-11-67
4C1	Atwood	15	26	-2	5- 7-67	36	295	5- 7-67
5A1	E. C. Darling	30	365	--	--	5.5	106	5- 7-67
5E1	Erlands Point Water Co.	65	254	Flow	5- 7-67	3.5	94	5- 7-67
5E2	--do--	65	311	11	5- 7-67	3.0	97	5-17-67
5M2	Richard Morey	80	96	Flow	5- 7-67	3.0	81	5- 7-67
5N1	John Kougl	65	127	Flow	5- 7-67	6.0	101	5- 7-67

TABLE 8.--Quality of ground water in coastal areas, Kitsap County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 24 N., R. 1 E. - Continued								
16J1	F. W. Ryan	15	19	0	5- 7-67	8.5	206	5- 4-67
25C1	F. Wilson	5	160	Flow	5- 2-67	3.0	185	5- 2-67
25E1*	Silver Springs Brewery	10	314	Flow	5- 2-67	180	782	5- 2-67
25G1	Annapolis Water Dist., well 6	60	1,006	Flow	5- 2-67	4.5	148	5- 2-67
25M1	City of Port Orchard, well 6	60	806	Flow	5- 2-67	3.0	142	5- 2-67
25R2	Annapolis Water Dist., well 1	95	1,257	75	1966	4.0	147	5- 2-67
26K2	Callison's Evergreen Co.	10	285	Flow	5- 3-67	3.5	135	5- 2-67
26K4	City of Port Orchard, well 5	40	792	Flow	5- 3-67	3.0	149	5- 2-67
26K5	J. W. Huth	0	88	Flow	5- 3-67	3.0	141	5- 3-67
26K6	City of Port Orchard, well 7	40	846	Flow	5- 2-67	3.5	136	5- 2-67
26L1	City of Port Orchard, well 4	40	441	Flow	5- 2-67	2.5	136	5- 2-67

26N1	Wilkins Distributing Co.	35	197	Flow	5- 3-67	3.5	137	5- 3-67
27J1	J. H. Gibbs	10	156	Flow	5- 3-67	2.5	133	5- 3-67
27R2	Jerry Rice	15	165	Flow	5- 3-67	4.0	164	5- 3-67
32K1	P. L. Hudson	15	206	Flow	5- 3-67	13	155	5- 3-67
33H4	J. M. Clerget	11	80	Flow	5- 3-67	2.5	135	5- 3-67
33H5	George Lewis	10	67	Flow	5- 3-67	3.0	104	5- 3-67
33K1	City of Bremerton, well 1	35	275	Flow	5- 3-67	3.0	123	5- 3-67
33K5	City of Bremerton, well 5	35	530	Flow	5- 3-67	3.0	125	5- 3-67
33L1	City of Bremerton, well 7	30	627	Flow	5- 3-67	10	148	5- 3-67
	T. 24 N., R. 2 E.							
3C2	School District	270	286	0	5-19-65	5.5	236	6- 7-67
3M1	Frank Prichard	20	75	--	--	6.0	173	6- 7-67
4A2	E. S. Olson	55	74	25	1962	5.5	158	6- 7-67
6M1	North Perry Ave. Water Dist.	320	419	210	1959	5.0	158	5-12-67
7D2	--do--	300	480	200	1955	3.5	181	5-12-67

TABLE 8.--Quality of ground water in coastal areas, Kitsap County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 24 N., R. 2 E. - Continued								
7M1	North Perry Ave. Water Dist.	135	286	85	2- 6-55	7.5	125	5-12-67
8A2	A. J. Allen	22	35	10	6- 7-67	9.5	174	6- 7-67
9B3	Roy Hovgaard	45	100	--	--	6.0	1,430	5-11-67
9B4	C. W. Murray	25	20	--	--	6.5	225	5-18-67
9J2	Katharine Graham	15	24	11	5-16-67	210	1,440	5-16-67
9J3	Harley Sellers	15	29	10	5-16-67	41	1,270	5-16-67
9L1	Wautauga Beach Water Co.	45	184	Flow	--	897	--	1949
10C1	Mrs. Clarence Dahl	20	23	4	1950	9.5	173	6- 7-67
13D1	B. B. Pelly	20	97	2	1950	150	1,660	6- 7-67
15N1	U.S. Navy, well 1	92	305	-17	2-15-67	2.8	--	9-20-48
						5.0	561	5-11-67
						6.0	523	5-11-67
15P1	U.S. Navy, well 2	63	353	32	2-15-67	2.5	--	9-20-48
16E2	Leo Wozleck	95	115	65	1956	3.0	222	5-11-67
16E4	Earl Cooper	85	102	52	2-23-67	5.2	251	2-23-67
16F2	Royal Bruce	70	64	50				

16F2	Royal Bruer	70	64	51	2-17-67	4.2	183	2-17-67
16F4	Harry Inks	30	6	28	2-28-67	358	1,420	2-28-67
						413	1,480	3- 9-67
16K1	U.S. Navy, well 3	40	136	34	2-15-67	5.3	--	9-20-48
						9.0	--	6- -59
						4.0	225	3- 2-67
						5.0	211	3- 2-67
						4.5	211	3- 2-67
16L2	Wautauga Beach Water Co.	55	141	7	2-14-67	7.8	209	2-14-67
						8.0	217	3- 7-67
16L3	Frank Kuhn	55	101	21	2-16-67	2.0	145	2-16-67
16M1	Eleanor Hill	102	152	68	2-23-67	2.5	215	5-11-67
17B2	N. I. Billington	15	105	Flow	4-27-67	4.0	250	4-27-67
17M1	Dr. Jeffers	15	290	Flow	4-27-67	5.5	206	4-27-67
17Q2	Gil Dyrness	230	305	78	1954	4.0	289	4-27-67
19B1	Hanna	25	320	19	1949	4.0	238	4-28-67
19L1	Fred Wilson	20	167?	Flow	4-27-67	9.0	361	4-27-67
22M1	Manchester Water Dist., well 1	60	116	49	1946	6.5	120	4-25-67

TABLE 8.--Quality of ground water in coastal areas, Kitsap County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 24 N., R. 2 E. - Continued								
22M2	Manchester Water Dist., well 2	25	100	Flow	4-25-67	5.0	115	4-25-67
27M1	G. M. Sullivan	40	65	Flow	4-21-67	4.0	124	4-21-67
27M4	P. M. Jensen	40	104	Flow	4-21-67	6.5	119	4-21-67
33H1	R. G. Scott	20	134	Flow	4-21-67	6.5	162	4-21-67
33H2	Manchester Water Dist.	20	185	Flow	4-27-67	3.0	182	4-27-67
34P1	Jack Anderson	30	141	Flow	4-20-67	3.0	186	4-20-67
35N4	R. D. Shelton	20	90	--	--	9.5	371	4-21-67
T. 25 N., R. 2 W.								
27Q1	R. Canedy	10	10	5	6-16-67	4.5	49	6-16-67
34K1	A. L. Gehri	50	46	10	6-16-67	3.0	98	6-16-67
T. 25 N., R. 1 W.								
1K1	H. Gorman	60	86	--	--	6.0	150	6-15-67
1K2	N. A. Preston	6	75	Flow	6-15-67	4.5	117	6-15-67

12L1	S. L. Taylor	40	134	38	6-15-67	5.0	139	6-15-67
14E2	W. W. Wade	40	199	Flow	6-15-67	8.5	131	6-15-67
14E3	G. E. Parsons	40	77	0	6-15-67	5.0	145	6-15-67
14F1	Amelia Apostel	60	208	55	6-15-67	3.0	126	6-15-67
15H2	Belle McKenzy	20	57	Flow	6-15-67	8.0	130	6-15-67
15K1	E. A. Fry	40	78	--	--	5.0	110	6-15-67
15N1	V. S. Conradsen	40	53	3	6-15-67	5.0	143	6-15-67
15P1	W. J. Demick	80	101	0	6-15-67	3.5	116	6-15-67
16R1	F. J. DuPuis	60	120	--	--	4.5	172	6-15-67
17N1	Miami Beach Resort	10	190	Flow	6-15-67	5.0	122	6-15-67
17P1	Kenneth Berg	40	72	36	6-15-67	5.5	162	6-15-67
19F2	G. N. Fisher	40	67	--	--	3.5	128	6-16-67
19M1	G. A. Cunningham	55	55	(c)	--	20	162	6-16-67
20D1	Priddy Vista	80	180	10	1959	6.0	120	6-15-67
21M1	Sneat	40	53	Flow	6-15-67	4.0	108	6-15-67
	T. 25 N., R. 1 E.							
1P1	R. R. Coleman	220	--	--	--	4.0	338	5-17-67
13P2	Enoch Wester	10	235	Flow	5-17-67	3.0	174	5-17-67
16P1	Duff Pendley	30	69	Flow	5-10-67	3.5	124	5-10-67

TABLE 8.--Quality of ground water in coastal areas, Kitsap County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 25 N., R. 1 E. - Continued								
16R1	Silverdale Water Dist., well 3	205	214	34	1966	5.0	94	5- 9-67
17K1	Silverdale Junior High School	160	175	10	1956	2.0	190	5-10-67
17R2	B. W. Hanberg	40	62	Flow	5-10-67	2.5	146	5-10-67
20A1	Silverdale I.G.A. Store	20	32	Flow	5-10-67	5.0	176	5-10-67
20F1	Silverdale Water Dist., well 1	180	264	48	11-11-63	4.5	98	5- 9-67
21B3	J. E. Jones	40	65	38	1965	5.5	152	5-10-67
21C1	H. S. Bartlett	30	65	Flow	5-10-67	2.5	152	5-10-67
21G2	H. S. Blay	20	50	Flow	5-11-67	4.5	123	5-11-67
21J1	C. J. Hallia	25	103	11	5-11-67	4.0	140	5-11-67
21R1	Silver Beach Community Water System	15	28	Flow	5-11-67	4.0	140	5-11-67
24H1	W. R. Whitney	10	274	Flow	5-17-67	2.0	191	5-17-67
25L1	City of Bremerton, well 11	340	750	80	1964	7.5	166	5-17-67
32M1	D. A. Campana	8	18	0	5- 9-67	5.0	118	5- 9-67

T. 25 N., R. 2 E.								
5H1	Thomas Berg	60	98	25	--	6.5	146	5-31-67
6A1	Dale Olsen	70	252	5	--	12	561	5-22-67
8G1	Richard Matheson	40	148	--	--	6.5	235	5-31-67
8N1	Charles Lowery	60	80	--	--	9.0	303	5-31-67
8N4	H. H. Plummer	20	52	5	1967	6.5	195	5-31-67
9D1	Dave Coe	16	47	--	--	8.5	215	5-31-67
9E1	Olympic Terrace Water Dist.	100	168	Flow	5-31-67	6.5	194	5-31-67
14A2	Messenger House	98	230	0	6- 6-67	9.5	226	6- 6-67
14P1	Mrs. Webster	40	20	25	6- 6-67	7.5	201	6- 6-67
14P2	Edith Kalvog	10	12	-1	6- 6-67	8.5	160	6- 6-67
17C1	U.S. Navy, Radio Station, well 2	132	910	32	--	7.0	226	6- 1-67
18J1	Frank Shepard, Jr.	15	80	3	--	11	240	5-31-67
20D1	J. Piland	50	70	-12	1950	6.0	180	5-31-67
20G1	R. S. Patch	30	46	--	--	6.5	227	5-31-67
20L1	R. C. Vanderboom	30	46	--	--	5.5	238	6- 1-67
23J1	O. Lundgren	50	105	--	--	7.0	230	6- 6-67
25C1	Yeomalt Point Water Co.	95	109	90	6- 6-67	10	260	6- 6-67

TABLE 8.--Quality of ground water in coastal areas, Kitsap County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 25 N., R. 2 E. - Continued								
25F1	Madrona Water Co.	125	160	65	1965	11	182	6- 6-67
26G3	City of Winslow, Fox well	50	86	20	1966	6.0	184	6- 2-67
26H2	City of Winslow Wing Point well	80	168	--	--	6.0	170	6- 2-67
26P1	Commercial Ship Repair Co.	10	980	Flow	6- 6-67	5.0	210	6- 6-67
27E1	City of Winslow, North Head of Bay Well	25	53	22	1966	4.5	140	6- 2-67
27E2	City of Winslow, South Head of Bay Well	20	40	14	1966	3.5	143	6- 2-67
27J1	NW Berry Packers, Inc.	110	120	85	1956	12	222	6- 7-67
27K1	City of Winslow, Weaver Road Well 1	25	801	Flow	6- 2-67	4.0	170	6- 2-67
27L1	Island Concrete Products	10	103	Flow	6- 7-67	4.0	174	6- 7-67
27L3	City of Winslow, Weaver Road Well 2	55	115	Flow	6- 2-67	4.5	170	6- 2-67
27M1	Glenn Muenz	4	55	Flow	6- 2-67	3.0	174	6- 2-67

30K1	W. O. Wesseler	70	465	30	1967	9.5	214	5-18-67
30N3	Lee Mayer	340	338	38	5-12-67	3.5	113	5-12-67
31P2	Ray Schutt	50	278	Flow	5-18-67	3.5	352	5-18-67
32L1	Forbes Barrett	35	34	9	6- 1-67	7.5	475	6- 1-67
33Q1	Jack Burke	30	35	10	1960	6.5	153	6- 1-67
35F1	Al Hass	25	56	--	--	6.0	220	6- 1-67
35F2	Sam Mirkovich	90	130	10	1966	6.0	137	6- 1-67
35H1	West Coast Wood Preserving Co.	20	30	5	6- 1-67	30	287	6- 1-67
35H2	--do--	20	500	Flow	6- 1-67	22	275	6- 1-67
35H3	--do--	10	813	Flow	6- 1-67	7.0	262	6- 1-67
35K1	"Doc" Clark	180	198	7	1950	7.0	285	6- 1-67
35K3	Ray Walls	135	132	13	1954	16	293	6- 1-67
36N1	Fred Hurt	20	604	Flow	6- 2-67	18	519	6- 2-67
	T. 26 N., R. 1 W.							
24H1	U.S. Navy	105	133	10	9- 8-64	3.0	137	5-28-67
	T. 26 N., R. 1 E.							
5K1	G. M. Adams	115	360	25	1962	3.0	150	6-14-67

TABLE 8.--Quality of ground water in coastal areas, Kitsap County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 26 N., R. 1 E. - Continued								
15K1	Nels Tornensis	40	203	Flow	5-18-67	3.5	145	5-18-67
22F1	G. L. Olson	35	67	Flow	5-18-67	4.0	186	5-18-67
25L1	J. H. Anderson	15	65	5	1950	4.5	132	5-19-67
25M2	Joe Jobe	60	205	10	1966	13	294	5-19-67
25M3	Seaberg	45	70	0	1966	4.0	193	5-19-67
25N3	O. W. Lieseke	35	57	2	1967	11	213	5-19-67
25R1	Ray Morgan	20	100	-10	1959	4.0	132	5-19-67
25R2	Fred Hill Materials	50	52	25	1952	18	211	5-19-67
26A3	L. C. Lucas	40	96	Flow	5-19-67	3.5	192	5-19-67
26N2	A. J. McFarland	20	120	--	--	6.0	289	5-18-67
27G1	J. P. Olhava	55	155	43	--	4.0	148	5-18-67
27J2	W. R. Lundquist	50	152	10	--	5.0	160	5-18-67
27Q1	Beulah Hansen	30	85	--	--	2.0	183	5-18-67
30L1	U.S. Navy	325	331	91	3-28-63	5.0	139	5-19-67
35E1	O. E. Maurer	60	118	30	1965	2.5	289	5-17-67

35F1	Loring Larm	30	38	14	9- 7-50	16	200	5-17-67
35L1	R. C. Lunde	20	46	15	1966	4.0	221	5-17-67
36P4	U.S. Navy, Keyport well 4	21	1,036	Flow	5-17-67	26	276	5-17-67
			T. 26 N., R. 2 E.					
1B2	McNabb	75	183	--	--	6.0	287	5-25-67
1B3	J. D. McCartney	55	78	2	5-25-67	10	252	5-25-67
1R1	C. H. Elbert	5	44	(c)	--	10	271	5-25-67
10R2	Indianola Water Dist.	100	80	96	5-23-67	7.0	153	5-23-67
15A1	--do--	90	55	Flow	5-23-67	7.0	176	5-23-67
16P3	Suquamish Improvement Co.	75	150	66	5-22-67	4.0	194	5-22-67
16P4	--do--	70	110	59	5-22-67	5.0	247	5-22-67
28B1	E. Peterson	20	33	15	5-25-67	5.0	104	5-25-67
28L1	F. E. Mariner	20	41	--	--	6.5	142	5-25-67
28M3	T. A. Brooks	10	60	--	--	8.5	336	5-28-67
32R1	Ward Pettit	80	107	0	1949	4.0	207	5-26-67
33M1	H. B. Pratt	60	120	--	--	3.5	361	5-26-67
34F1	S. F. Olsen	30	311	Flow	5-26-67	4.0	261	5-26-67

TABLE 8.--Quality of ground water in coastal areas, Kitsap County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 26 N., R. 2 E. - Continued								
34L1	J. H. Powel	8	1,005	Flow	5-26-67	17	297	5-26-67
34L2	--	20	102	0	1931	--	--	--
34L4	R. T. Sweeney	10	70	--	--	5.0	349	5-26-67
35B1	Monroe Point Water Co.	10	155	0	5-26-67	5.5	206	5-26-67
35C1	A. H. Knudsen	60	186	25	1950	14	61	5-26-67
T. 26 N., R. 3 E.								
7D3	Frank Buckler	50	83	7	5-25-67	14	311	5-25-67
7D4	E. H. Senn	50	115	--	--	13	430	5-25-67
7M1	U.S. Navy, Point Jefferson well 1	110	136	8	5-25-67	12	262	5-25-67
T. 27 N., R. 1 E.								
1R1	Kirby Walker	25	128	Flow	6-13-67	4.5	197	6-13-67
13E1	Ella Hudson	35	90	--	--	4.0	740	6-14-67
14H1	E. H.	20	30	10	6-14-67	8.0	222	6-14-67

14L3	Surfrest Cooperative	60	41	8	6-14-67	4.0	90	6-14-67
22H1	Wash. State Parks	43	124	118	6-14-67	4.0	177	6-14-67
22N1	J. Jensen	40	74	25	1949	3.0	185	6-14-67
22Q1	J. A. Brix	40	108	5	6-14-67	5.0	211	6-14-67
27E2	Edgewater Estates	120	267	0	3- 1-63	3.0	204	6-14-67
28K1	Clyde Lets	60	70	0	6-14-67	2.0	74	6-14-67
33N1	Irwin Smith	125	200	-17	1961	5.0	226	6-14-67
	T. 27 N., R. 2 E.							
6P1	John Sabo	80	235	5	1955	5.5	250	6-13-67
7A1	Pope and Talbot	55	178	-1	8- 3-57	4.5	386	6-13-67
17J1	D. Williams	25	66	3	6-13-67	6.5	209	6-13-67
25C2	U.S. Government	390	400	--	--	14	246	6- 8-67
25N1	Kingston Ferry Dock	5	298	Flow	6- 8-67	7.5	214	6- 8-67
26K1	J. H. Burns	30	52	--	--	8.5	194	6- 8-67
26L1	R. R. Barrick	50	65	20	6- 8-67	7.0	168	6- 8-67
26N1	U.S. Government	97	175	47	1954	7.0	229	6- 8-67
26R1	West	50	60	1	1950	8.5	177	6- 8-67
35H1	Col. Chesmore	50	58	7	1950	5.5	236	6- 8-67

TABLE 8.--Quality of ground water in coastal areas, Kitsap County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 27 N., R. 2 E. - Continued								
35H2	Ray Bird	50	128	--	--	6.0	237	6- 8-67
36Q2	Mrs. K. R. Green	20	95	--	--	8.0	280	6- 8-67
36Q4	Thor Wangberg	20	67	--	--	6.5	309	6- 8-67
T. 28 N., R. 1 E.								
12G1	Hurley	160	200	85	6- 9-67	23	567	6- 9-67
12R1	Wm. B. Laney	75	99	40	6- 9-67	350	1,530	6- 9-67
12R2	Mt. View Water District 1	80	98	12	6- 9-67	590	2,420	6- 9-67
13A2	G. D. Gallaher	80	107	-22	6- 9-67	20	406	6- 9-67
T. 28 N., R. 2 E.								
7M3	N. B. Moran	5	15	0	6- 9-67	22	330	6- 9-67
7M4	H. E. Bennett	22	20	15	6- 9-67	22	350	6- 9-67
7P1	Roy Severin	25	63	0	6- 9-67	36	416	6- 9-67

16L1	Catholic Church	15	50	--	--	10	267	6- 9-67
16L2	N. R. Owen	30	67	0	6- 9-67	10	272	6- 9-67
18B1	Chester Burdic	15	50	0	6- 9-67	20	286	6- 9-67
18C1	M. L. Pennell	20	73	0	6- 9-67	26	310	6- 9-67
20D1	Burch	25	90	4	1950	7.5	283	6-13-67
32G1	Cliffside Development Co.	100	120	8	6-30-60	5.5	191	6-13-67
35M4	J. G. Shakman	175	114	120	6- 8-67	7.5	191	6- 8-67
35N1	C. Norheim	120	160	39	1950	8.5	185	6- 8-67

TABLE 9.--Quality of ground water in coastal areas, King County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 21 N., R. 2 E.								
2Q1	William Noble	10	10	5	7- 2-68	14	287	7- 2-68
T. 21 N., R. 3 E.								
1J1	H. L. Macdonald	30	130	27	--	4.0	222	3-24-67
1K1	Bertold Bruell	210	323	165	--	7.0	210	12-11-62
1K2	Adwatco Inc.	25	300	-95	--	4.0	160	12-11-62
T. 22 N., R. 2 E.								
11B1	R. W. Johnson	70	--	--	--	3.5	182	7- 3-68
15J1	M. C. Anderson	105	280	--	--	3.9	273	7- 2-68
23L1	N. W. Standal	50	205	--	--	1.8	162	7-11-68
24H1	J. B. Hamilton	30	112	-16	7-10-68	2.7	159	7-10-68
T. 22 N., R. 3 E.								
8P1	C. W. Braiser	15	--	--	--	2.9	253	7-10-68

16E1	KIRO Radio	60	462	5	--	7.2	497	7- 8-69
17C1	Ferguson Beall	10	18	--	--	11	326	7-10-68
21E1	W. Reuter	120	475	30	10- 4-62	2.9	271	7- 9-68
23A1	King County	35	148	--	--	6.8	493	7- 9-68
29P1	Sandy Shores	315	691	77	1960	2.3	232	7- 9-68
30K1	A. C. Lundin	5	7	5	7- 9-68	6.6	201	7- 9-68
	T. 22 N., R. 4 E.							
8K4	Wesley Gardens	135	106	112	9-26-62	7.0	255	3-31-67
8K5	King County Water Dist. 54	155	245	107	1961	4.0	170	12-18-62
						4.5	177	3-31-67
8K6	--do--	125	318	--	--	4.0	146	2- 3-67
17E1	Scheper	47	385	46	1938	4.5	162	3-29-67
17G1	C. Wyckoff	102	200+	63	9-20-62	14	300	3-29-67
17K1	John Minkema	88	115	56	1958	6.5	210	3-29-67
17L2	O. D. Fisher	34	242	Flow	3-29-67	4.0	164	3-29-67
17Q1	Zenith Masonic Home, well 2	148	240	83	12-12-52	8.0	--	4-16-46
						4.0	160	12-21-62
						--	172	10- 4-63
						4.0	168	3-31-67

TABLE 9.--Quality of ground water in coastal areas, King County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 22 N., R. 4 E. - Continued								
17Q4	Zenith Masonic Home, well 1	162	946	26	3-15-63	158	--	5-23-52
						300	1,100	12-21-61
						280	1,160	10- 4-63
						5.0	185	3-31-67
20L1	Roy Juberg	176	164	--	--	6.0	298	4- 3-67
33D1	Mrs. F. E. Estergrem	300	65	--	--	7.5	178	3-29-67
T. 23 N., R. 2 E.								
13P1	Tucker	40	--	--	--	345	--	7- 3-68
T. 23 N., R. 3 E.								
7N1	Sandy Beach Club	30	125	--	--	86	994	7- 5-68
17P1	G. C. Searle	40	--	--	--	83	565	7- 8-68
18D1	N. Cederhurst Mutual Water Co.	100	320	-36	7- 5-68	658	2,400	7- 5-68

18M1	Ted Best	70	250	--	--	2.9	210	7- 5-68
20B1	George Blair	50	75	--	--	5.3	280	7- 8-68
20H1	Arnie Nelson	5	--	--	--	156	791	7- 8-68
	T. 25 N., R. 3 E.							
11R1	Ballard Ice Arena	25	250	--	--	60	582	4- 6-67
14J1	Great Northern RR	15	545	6	--	24	--	9-25-53
						15	299	4- 6-67
23Q1	U.S. Navy	19	1,084	16	--	16	--	3-12-52
						38	413	4- 6-67
	T. 25 N., R. 4 E.							
30R1	Troy Laundry	115	555	37	1938	14	327	4-12-67
31E1	Booth Fisheries	10	785	Flow	4- 6-67	520	1,970	4- 6-67
31E2	--do--	10	120	Flow	4- 6-67			

TABLE 10.--Quality of ground water in coastal areas, Snohomish County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 29 N., R. 4 E.								
1A1	Priest Point Water Co.	125	174	5	--	210	954	4-24-61
1A2	--do--	126	146	4	4-19-67	22	302	4-19-67
1B1	N. G. Kleisath	95	105	0	4-19-67	11	216	4-19-67
1B2	O. J. Reinertsen	105	160	0	1965	120	567	4-19-67
1C1	Gay's Water Dist.	125	165	2	1958	11	312	4-19-67
1G2	Earl Edgar	85	132	0	--	19	--	4-19-67
						16	269	4-19-67
1G3	J. E. Weeks	85	130	0	1940	9	--	4-19-67
						11	218	4-19-67
8F1	Hat Island Development Co.	152	172	2	4-16-62	77	--	4- 5-62
			186			1,856		4- 5-62
8F2	--do--	168	173	-3	5- 9-62	39	--	1962
			178			42	--	1962
			194			57	--	1962
			204			62	--	1962

			208			340	--	1962
			212			1,000+	--	1962
			T. 29 N., R. 5 E.					
2C1	City of Marysville	275	228	141	--	4.0	185	3-28-67
2C2	--do--	265	338	143	3-28-67	4.5	190	3-28-67
19K1	Soundview Pulp Co.	15	110	--	--	24	280	11-18-44
29G1	Eclipse Mill Co.	20	217	--	--	43	370	11-18-44
			T. 30 N., R. 4 E.					
6L1	W. L. Pape	205	230	2	4- 7-67	8.5	223	4- 7-67
7G2	Tulare Beach Assoc.	30	50	3	4- 7-67	10	275	4- 7-67
17C1	Tom Whyte	100	372	36	1946	6.0	182	10-12-60
						8.0	181	4- 7-67
17K1	T. G. Mortland	184	518	24	1959	8.0	184	4-18-67
28A1	Hermosa Point Water Co.	58	163	13	4-18-67	6.5	167	4-18-67
35R1	Potlatch Beach Water Dist.	125	172	1	4-20-67	6.0	364	10- 5-60
						7.5	355	4-20-67

TABLE 10.--Quality of ground water in coastal areas, Snohomish County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
			T. 30 N., R. 5 E.					
31B1	Dean Shaffer	15	26	15	1963	8.5	236	4-20-67
31F1	Lena Harrison	80	83	16	2-28-64	6.5	157	4-20-67
			T. 31 N., R. 3 E.					
24Q1	E. D. Hervin	165	183	4	1945	9.5	235	10-12-60
24Q2	Donald Kettrick	165	186	2	1955	8.5	339	4- 5-67
25A1	Lloyd Swimme	215	300	2	4- 6-67	9.5	270	4- 6-67
25A2	Oscar Sundberg	255	309	20	4- 5-67	13	405	4- 5-67
36B1	Atlantic Richfield Oil Co.	10	75	10	4- 6-67	7.0	204	4- 6-67
36B4	--do--	10	82	10	4- 6-67	7.5	198	4- 6-67
36J1,2	McKees Beach Water Co.	20	160	-1	4- 7-67	8.5	214	4- 7-67
		27	160					
36R1	McKees Beach Water Co.	10	96	3	4- 7-67	7.5	214	4- 7-67

			T. 31 N., R. 4 E.					
4C1	Arnold Robb	23	262	23	4- 4-67	6.0	188	4- 4-67
7L1	Methodist Church	165	219	20	4- 4-67	7.5	207	4- 4-67
18C1	H. K. Moore	210	224	23	1943	9.8	329	10- 5-60
						9.0	357	4- 6-67
			T. 32 N., R. 4 E.					
7N2	Ed McKean	115	163	16	1946	7.0	282	3-31-67
20H1	Stanwood Water Co.	115	235	25	1955	14	--	1955
29B2	Stanwood Water Co., well 4	60	249	39	3- 4-49	6.0	276	10- 5-60
30K1	Stanwood Water Co.	10	67	5	6- 4-47	(a)	--	--
30L1	--do--	10	145	4	1947	(a)		

TABLE 11.--Quality of ground water in coastal areas, Island County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 28 N., R. 3 E.								
1J1	Jim Bowers	20	74	7	5- 6-63	10	300	5- 6-63
4D1	Clay Green	10	67	1	6-10-63	14	240	6-10-63
8A1	A. B. Bently & Co.	14	92	-10	1958	26	310	6- 6-63
14A1	Heisdorf and Messenger	35	169	-50	5-30-63	17	380	5-30-63
T. 29 N., R. 2 E.								
5N2	F. G. Read	185	210	0	7-23-63	25	450	7-23-63
						26	439	3-16-67
6A4	G. C. Harriman	220	220	13	7-23-63	32	476	7-15-64
						33	479	3-15-67
6B1	Bush Point Resort	15	278	5	4- 2-64	16	413	4- 2-64
						18	427	3-16-67
8C2	Bush Point Park Water Co.	115	138	13	8-15-58	23	410	4- 2-64
						26	419	3-16-67

8K1	C. Saddler	65	95	0	4-17-35	62	570	7-25-63
						63	585	3-16-67
8K2	Windmill Heights	162	185	7	6- 5-57	24	646	3-16-67
9B1	R. F. Guptill	210	200	29	7-19-63	17	490	7-19-63
						17	513	3-17-67
10F1	F. A. Becker	25	95	1	8- 7-63	16	340	8- 7-63
						16	354	3-17-67
13J2	Useless Bay Beach and Country Club	114	126	11	8-15-63	21	360	8-15-63
						22	362	3-17-67
14Q1	D. S. Johnson	270	282	8	4-21-60	15	400	8-15-63
						16	399	3-17-67
15E1	Fred Peterson	20	34	-1	1957	24	380	7-22-63
						24	428	3-17-67
15E3	Martin Sorick	10	--	--	--	20	341	3-17-67
15R1	G. S. Brewer	130	136	8	8- 2-63	19	340	8- 2-63
						20	351	3-17-67
22L2	Barr Addition	15	51	1	6-21-63	29	380	8- 2-63
						28	391	3-17-67

TABLE 11.--Quality of ground water in coastal areas, Island County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 29 N., R. 2 E. - Continued								
22N1	Mutiny Bay Shores	15	18	8	8- 2-63	316	1,600	8- 2-63
						280	1,500	8-30-63
						180	1,160	3-17-67
23C2	D. R. Fountain	292	111	206	8-15-63	42	620	8-15-63
						35	587	3-17-67
23D1	B. C. Gates	260	268	10	8- 2-63	21	430	8- 1-63
						23	460	3-17-67
23K1	J. E. Cloke	5	41	3	8-14-63	48	560	8-14-63
						39	546	3-17-67
27E1	K. W. Ellison	105	130	12	7-12-54	37	490	8-15-63
						38	529	3-17-67
28H1	Mutiny Bay Shores	10	33	5	8- 2-63	--	510	8- 2-63
						77	510	8-30-63
T. 29 N., R. 3 E.								

2R1	Beachwood Water System	250	165	118	10- 4-63	9	230	10- 4-63
3B2	Town of Langley	175	244	11	9-11-63	6	210	9- 9-63
14H1	McDonald	295	327	152	1962	33	440	9-10-63
20N1	Holly Hill Community	150	232	72	1948	12	340	9-10-63
29R1	Stanley Norman	215	247	4	6-13-63	8	160	6-13-63
	T. 30 N., R. 2 E.							
8N1	P. R. Bakken	190	56	136	6-17-63	18	250	6-17-63
8N2	--do--	190	194	7	10- 2-63	20	248	3-16-67
9D1	A. B. Snider	8	51	4	6-17-63	525	2,040	6-17-63
						526	1,990	8-30-63
						501	2,080	9-27-63
						504	2,170	10-28-63
						520	2,210	4- 2-64
						510	2,060	6- 3-64
						569	2,180	6-30-64?
						520	2,080	7-15-64
						490	1,920	7-30-64
						515	2,040	10- 2-64
						605	2,390	3-16-67

TABLE 11.--Quality of ground water in coastal areas, Island County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 30 N., R. 2 E. - Continued								
9N3	Jesse Beach	160	171	2	6-21-63	39	320	6-21-63
						36	350	3-16-67
13B1	Gordon Erickson	185	201	5	9-13-63	250	1,200	10- 1-64
						335	1,430	3-17-67
14Q1	Saratoga Beach Development	210	290	7	10-29-64	36	600	10- 1-64
						34	619	3-17-67
16Q1	Howard Fee	105	138	-7	7-27-63	26	390	6-27-63
						30	449	3-16-67
27E2	George Handy	65	235	20	4- 3-63	1,100	3,700	4- 1-65
29M2	Wash. State Parks	225	363	0	8-25-61	14	371	8-30-63
						15	361	4-28-64
						18	356	6- 2-64
						17	360	6-30-64
						--	355	10- 1-64
						18	348	3-16-67

35H1	E. F. Jacoby	130	147	4	9-19-63	29	780	8-26-63
						33	775	3-17-67
T. 30 N., R. 3 E.								
5C1	Dan Benson	94	100	3	8- 5-64	560	2,100	8- 5-64
						575	2,300	3-29-67
5R1	Carl Challstedt	165	213	3	7-22-64	130	630	7-22-64
9B1	O. A. Greggorson	84	186	4	8- 4-64	26	360	8- 4-64
10H1	J. Stronjard	15	35	12	10-22-56	53	430	9-23-64
						30	383	3-29-67
14G1	Tyee Beach Improvement Club, Inc.	280	340	19	4-21-64	15	270	9-23-64
14N1	Vincent Helzen	120	171	--	--	490	2,100	7-28-64
						615	2,580	3-29-67
19G1	Keith Schmidt	142	160	10	9-12-63	12	329	9-17-63
						12	331	4- 2-64
						14	330	6- 2-64
						--	330	10- 1-64
						12	342	3-17-67

TABLE 11.--Quality of ground water in coastal areas, Island County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 31 N., R. 1 E.								
5A1	Clark Sherman	203	308	4	7- 3-63	92	990	4- 1-65
						87	1,020	3-15-67
5H1	Mrs. Frank Pratt	202	224	8	11-22-63	44	751	3- 4-64
						50	760	6-30-64
						50	730	10- 2-64
						50	772	3-15-67
9A1	Bob Hancock	92	50	84	3- 4-64	87	1,080	3- 4-64
				82	6-30-64	80	930	6-30-64
				71	10- 2-64	129	1,320	10- 2-64
				86	5- 4-65	--	915	5- 4-65
				82	3-15-67	84	1,040	3-15-67
14J2	City of Coupeville	18	25	6	1963	[b]52	550	7- 4-63
						64	744	3-16-67
24C1	Telaker Shores Water Co.	2	117	2	6-27-63	37	580	4-15-65
						36	605	3-16-67

T. 31 N., R. 2 E.								
3F3	L. H. Pritchard	12	18	4	1950	44	490	8-21-64
						44	471	3-30-67
3G1	Rockaway Heights Community Assoc.	230	384	5	3-10-64	20	339	4- 8-64
						21	349	3-30-67
6D2	H. Johnston	39	66	3	2-21-63	33	620	4-15-65
						33	636	3-16-67
11E1	R. K. Acre	278	20	269	8-20-64	33	320	9-23-64
19D1	Admirals Cove, Inc.	155	197	10	3-19-63	62	640	4-15-65
						64	682	3-16-67
20R1	H. A. Lancaster	60	81	3	4- 1-65	360	1,800	4- 1-65
						355	1,770	3-16-67
23Q1	Halver Halverson	158	241	17	8-18-64	25	230	9-23-64
						26	483	3-30-67
35B1	J. Milkay	50	100	20	1958	21	410	8-18-64
36L1	Wash. State Parks	150	196	0	4- 8-64	27	366	6- 1-64
						29	405	3-29-67
36Q1	--do--	250	313	21	8-18-64	22	460	4- 8-64
						28	506	3-29-67

TABLE 11.--Quality of ground water in coastal areas, Island County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 31 N., R. 3 E.								
5K1	Sunrise Point Water Co.	30	30	3	8-17-64	38	470	8-17-64
						115	765	3-29-67
5M1	R. S. Fullerton	135	176	8	4- 8-64	20	389	4- 8-64
						21	400	6- 1-64
						19	--	9-30-64
						26	412	3-29-67
6A1	William Anderson	142	176	-21	1954	16	350	8-14-64
7A1	Robert Barnum	40	48	16	10-25-60	130	810	8-13-64
						135	812	3-29-67
7E1	Driftwood Beach Water Co.	43	217	26	5-19-61	17	290	9-23-64
18D1	D. Muscola	136	205	19	8-13-64	15	290	9-23-64
18L2	Earl Heitman	66	105	6	6- 9-61	16	280	9-23-64
19F1	Dan Garrison	174	206	26	8- 6-52	17	320	8-10-64
19K1	--do--	110	170	19	6-27-58	16	340	9-23-64

31C1	Al Aiktins	39	43	2	8-13-64	16	220	8-13-64
32J1	H. D. Porter	123	158	1	11- 1-55	480	1,900	8- 7-64
32N2	W. McConnell	99	118	0	8-11-64	36	380	8-11-64
33P2	Port Susan Terrace	185	221	6	3-29-67	18	316	3-29-67
	T. 32 N., R. 1 W.							
13H1	Henry Looff	44	64	3	3-18-64	74	625	3-18-64
						76	610	6- 4-64
						83	--	10- 2-64
						79	623	3-15-67
24A1	Albert Van Dam	230	295	2	5-22-69	64	770	5-22-64
						64	786	3-15-67
24G1	Glenn Darst	220	397	0	3-18-64	75	980	3-18-64
						76	866	6- 4-64
						81	890	6-30-64
						93	--	10- 2-64
						92	--	10-30-64
						84	944	3-15-67
25E1	C. F. Larsen	60	96	3	5-19-64	84	1,080	3-15-67

TABLE 11.--Quality of ground water in coastal areas, Island County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 32 N., R. 1 W. - Continued								
25F1	C. F. Larsen	100	47	54	4- 9-64	140	1,200	4- 9-64
						132	1,120	3-15-67
25F2	--do--	110	190	--	--	265	1,560	3-15-67
25M1*	Pondilla Estates	119	275	-19	1965	(a)	13,000	9-30-65
T. 32 N., R. 1 E.								
3C2	City of Oak Harbor, well 9	215	243	38	6- 3-64	34	410	5-26-64
				39	12- 1-64	37	526	12- 3-64
				38	5- 4-65	--	417	5- 4-65
						37	443	3-10-67
3H1	Sid Eelkema	75	72	54	6- 5-57	110	680	6-23-64
						121	786	3-15-67
7L1	R. K. Hetherington	147	195	1	4-14-64	110	910	6-17-64
						106	941	3-15-67

10B1	Egbert Becksma	130	134	32	6-19-64	61	560	6-19-64
						55	570	3-15-67
14N1	R. W. H. Johnson	214	290	6	3-19-64	42	490	3-20-64
				1	6-30-64	41	470	6-30-64
				5	10- 2-64	42	--	10- 2-64
						44	493	3-15-67
22P1	R. G. Chaney	12	51	2	3-19-64	116	1,090	3-19-64
						146	1,190	7-15-64
28C1	Lambert Vander Stoep	16	83	14	10- 6-59	69	750	1- 8-65
						67	822	3- 9-67
28C2	John Blattman	18	61	-1	10-12-59	180	1,100	1- 8-65
						86	938	3-16-67
29D1	San de Fuca, Fire Dept.	75	123	3	10-24-60	50	720	5-20-64
						51	761	3-15-67
30G1	Melvin Grasser	15	442	1	5-22-64	76	680	5-22-64
32N1	Libbey Const. Co.	90	217	18	1- 7-65	14,000	35,000	1- 7-65
33G1	City of Coupeville	25	198	-5	1948	74	910	4- 9-64
						116	1,060	3-16-67

TABLE 11.--Quality of ground water in coastal areas, Island County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 32 N., R. 1 E. - Continued								
33J1	City of Coupeville	92	240	13	6-25-63	82	1,040	5-19-60
						150	1,720	9-29-60
						138	1,660	11-13-62
						74	830	4- 9-64
						83	1,030	3-16-67
35G1,2	Long Point Manor Water Co.	105	192 201	7 6	6-25-63 6-25-63	53	940	4-15-65
						56	961	3-16-67
T. 32 N., R. 2 E.								
2B1	Huntsker	30	29	11	6-25-64	33	440	6-25-64
2E1	Hans Olson	100	131	17	11-15-63	19	320	6-24-64
4Q1	U.S. Naval Air Station	105	163	100	3-20-64	19	356	4-22-64
22J1	Sherman Bast	110	172	72	10-14-45	16	300	8-26-64
23E1	Scenic Beach Water Co.	30	118	18	7-24-57	17	290	9-23-64
24D2	Svend Larson	150	213	-5	10-30-61	18	320	9- 2-64

34H1	Parker	52	62	-4	1930	80	570	8-21-64
						78	600	3-30-67
34Q1	Raymond Arnold	95	74	35	8-24-64	53	470	8-24-64
						29	486	3-30-67
				T. 32 N., R. 3 E.				
16Q1	A. V. Bucklin	105	126	5	6-26-56	150	730	9-23-64
						170	801	3-30-67
17R2	Francis Jarard	172	194	-6	8-18-51	29	630	9-11-64
						35	611	3-30-67
18A2	Arrowhead Beach Inc.	133	136	11	11-18-51	112	679	4-24-61
						430	1,600	9-23-64
						185	904	3-30-67
19C1	Utsalady Water System	80	137	-6	9-13-57	16	433	5-19-60
						17	420	9-23-64
						18	446	3-30-67
19M1	A. W. Campbell	225	241	25	6- 1-64	15	--	9-30-64
						26	314	3-30-67
19Q1	Mel Lukehart	250	267	10	9- 7-61	16	450	9-23-64
						7.5	460	3-30-67

TABLE 11.--Quality of ground water in coastal areas, Island County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 32 N., R. 3 E. - Continued								
20A2	Orville Hanstad	130	160	0	1946	28	580	9-11-64
						30	595	3-30-67
20R1	P. Johnson	40	67	3	8-26-58	19	360	9-23-64
21K1	Mike Martin	95	135	0	6-11-49	58	740	9-14-64
						55	731	3-30-67
22N1	Camano Gateway Inc.	150	186	4	7-16-59	70	--	9-30-64
						60	655	3-30-67
22P1	Arnold Moen	130	159	4	3-30-67	65	627	3-30-67
22R1	Block	65	97	8	9-15-64	23	360	9-23-64
27C1	Garrison	110	158	0	3- 3-67	344	1,580	3-10-67
27L1	Juniper Beach Coop.	63	80	3	1-17-60	73	540	9-16-64
						130	801	3-30-67
31C1	J. F. Hale	146	275	15	3-28-64	14	290	9-23-64
32L1	Harold Moe	125	164	1	11- 8-62	15	180	9-23-64

T. 33 N., R. 1 E.								
2F1	Flanagan	120	195	12	1-22-63	43	800	3-14-67
						41	860	9-24-68
3J1	Moran Beach Comm.	14	109	15	2-23-59	42	500	7-14-64
						39	520	3-14-67
11C2	Washington Land Co.	125	152	3	7-16-64	36	430	9-24-64
12N2	Ida Jenkins	45	55	16	9-20-58	25	340	9-24-64
22C1	U.S. Naval Air Station, well 4	56	98	17	3-20-64	26	551	3-20-64
26N1	Doug Traylor	155	178	5	9- 8-60	46	550	7- 9-64
27C1	R. E. Struthers	185	185	13	11-14-61	65	660	7-10-64
27M1	W. P. Powell	210	269	14	7-28-60	110	940	7-10-64
						102	954	3-14-67
28A2	Axel Hallberg	133	117	28	8- 9-63	88	860	7-10-64
						89	886	3-14-67
28R1	J. H. Kamberger	135	116	50	1-30-56	120	1,200	7- 1-64
32E1	Sunset Beach	9	109	3	6-24-64	110	860	6-24-64
32G1	R. P. Sullivan	75	203	17	12-22-60	75	700	6-23-64
						74	692	3-15-67

TABLE 11.--Quality of ground water in coastal areas, Island County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 33 N., R. 1 E. - Continued								
32G2	William Merrick	35	120	11	11-29-60	120	950	6-23-64
						114	970	3-15-67
32G3	--do--	35	30	15	6-23-64	120	1,200	6-23-64
						90	1,010	3-15-67
32L1	T. E. Ostrom	23	69	18	3-30-64	160	1,000	6-24-64
						147	1,030	3-15-67
32L2	John Blattman	15	144	17	3-23-64	100	730	6-24-64
						95	738	3-15-67
33Q3	Hillcrest Village Water Co.	202	217	39	6-30-61	50	490	6-24-64
35D1	Charles Aus	105	146	27	3-21-58	58	720	7- 1-64
36A1	Henry Mouw	30	68	20	8- 7-58	50	530	7- 7-64
						48	550	3-15-67
36N1	City of Oak Harbor, well 5	171	303	8	5-20-64	46	590	5-26-64
						53	638	3-10-67

T. 33 N., R. 2 E.								
8E1	Van Rooy	75	36	63	4- 8-60	25	350	7- 9-64
18F2	Midge Waniski	60	75	7	4-20-59	22	380	7- 9-64
26D1	McLean	90	99	13	7- 7-64	21	420	7- 7-64
						16	420	3-15-67
26R1	Albert Carlson	156	107	65	3-19-64	37	715	3-19-64
						44	706	3-15-67
30D1	F. C. Dempsey	120	41	97	9-20-63	62	680	9-24-64
31D2	Lola Park	75	85	57	7- 1-64	47	510	7- 1-64
						40	542	3-15-67
35R1	Alma Matson	170	180	84	7-12-60	24	600	7- 1-64
						19	616	3-15-67
T. 34 N., R. 1 E.								
35F1,2	Wash. State Parks	44	68	25	9-13-33	63	560	10-30-64
		45	150	29	5-15-64	50	567	3-14-67
36B1	T. Robinson	65	174	28	1- 8-65	28	410	9-24-64
						27	396	3-14-67

TABLE 11.--Quality of ground water in coastal areas, Island County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 34 N., R. 2 E.								
32P1	T. L. Graf	240	246	5	1-10-62	28	390	6- 4-64
						27	422	3-14-67

PARTIAL CHEMICAL ANALASIS
OF
GROUND WATER
SKAGIT COUNTY

TABLE 12.--Quality of ground water in coastal areas, Skagit County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 34 N., R. 1 E.								
22H1	Walla Walla College	75	78	34	4-28-67	46	580	4-28-67
T. 34 N., R. 2 E.								
3G1	Skagit County PUD 1., Whitmarsh well 2	15	18	13	2-27-61	15.5	--	3-20-61
						16.2	--	4- 6-61
3K1**	Skagit County PUD 1., Whitmarsh well 1	144	200	133	11-15-55	--	--	--
21H1	G. D. Sullivan	30	65	--	--	55	578	5- 3-67
22N1	Robert Misner	28	52	9	5-12-53	40	--	5-12-53
						30	657	5- 3-67
22N4	W. M. Grobschmit	26	78	Flow	5- 3-67	26	--	5-12-53
						30	558	5- 3-67
27D1	P. F. Wagner	22	108	4	3- -67	28	--	5-12-53
						31	486	5- 3-67
27D2	E. E. Johnson	15	72	9	5- 3-67	34	--	5-12-53
						44	536	5- 3-67

27F1	Bernard Ashland	70	42	36	5- 3-67	29	536	5- 3-67
27K3	Snee-Oosh Land Co.	45	48	15	11- 5-57	25	484	5- 2-67
27K5	--do--	50	48	--	--	25	547	5- 2-67
34B1	C. C. Long	10	112	Flow	5- 2-67	24	366	5- 2-67
34H1	P. F. Wagner	31	53	Flow	5-12-53	20	355	5- 3-67
35H1	C. J. Norkowski	160±	23	146	5-13-53	28	--	5-13-53
35H2	--do--	160	84	--	--	19	286	5- 2-67
35H3	Jack Swanson	152	180	138	5- 2-67	16	402	5- 2-67
	T. 35 N., R. 1 E.							
1H1	A. R. Veal	130	166	-4	5- 4-67	17	228	5- 4-67
12P1	H. J. Woodfield	12	22	0	Summer 1963	39	535	5- 4-67
12Q1	George Humble	31	171	1	1959	20	321	5- 4-67
27Q1	Kenneth Erickson	28	54	21	4-28-67	120	868	4-28-67
34H1	R. G. Buckan	31	12	31	4-28-67	42	550	4-28-67
	T. 35 N., R. 2 E.							
7A1	William Dober	60	110	35	4- -60	32	538	5- 4-67

TABLE 12.--Quality of ground water in coastal areas, Skagit County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 35 N., R. 3 E.								
11R1	L. H. Routon	20	197	8	1947	114	--	--
11R3	Howard Routon	20	68	7	1952	7	--	1952
19C1	A. K. Bell	15	70	[c]1	1955	39	543	4-27-67
19F1	Weyrich(?)	55	>100	--	--	18	499	5- 3-67
19Q1	R. K. Gordon	110	108	5	11- -58	11	335	4-27-67
30C1	Ed Peterson	65	70	--	--	12	461	4-27-67
30G1	Mrs. Art Stierlen	154	157	8	4-26-67	12	337	4-26-67
30P1	Wash. State Parks	55	70	-1	4-26-67	14	553	4-26-67
30P2	Bayview Homes Assoc.	32	98	5	4-26-67	18	496	4-26-67
31A1	Mrs. John Kuhl	105	125	7	4-26-67	16	557	4-26-67
31B1	Mrs. Dora McLaughlin	87	80	11	--	10	412	4-26-67
T. 36 N., R. 1 E.								
36C1	W. E. Everett	50	54	10	1942	315	1,330	5- 4-67

T. 36 N., R. 3 E.								
21A1	Chuckanut Manor Restaurant	36	52	2	Fall 1966	12	382	4-27-67
22P1	Orla Wyman	9	20	--	--	4	196	4-27-67

TABLE 13.--Quality of ground water in coastal areas, Whatcom County

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 37 N., R. 1 E.								
2E1	Victor Jones	35	85	-5	1946	18	374	9-11-68
2G2	F. W. Nolte	8	50	[c]3	4-16-56	39	494	9-11-68
2K1	Robert Bezona	10	42	5	1952	40	--	4-16-56
						40	534	9-11-68
2K5	Fred Filbert	15	47	0	9-11-68	36	603	9-11-68
2M2	Victor Jones	30	33	--	--	25	444	9-11-68
2Q3	Fred Filbert	20	55	0	1950	25	433	9-11-68
4J1	Jerry Anderson	20	55	--	--	355	2,000	9-19-68
4R1	Gramac Const. Co.	35	250	-45	1966	--	--	--
5P1	W. T. Lockwood	45	353	30	1948	19	357	9-19-68
9B1	Hilltop Water Assoc.	90	240	--	--	15	441	9-19-68
9D1	George Johnson	15	58	--	--	16	303	9-19-68
9G1	F. A. Graham	95	101	--	--	6.2	368	9-19-68
11C1	S. R. Boynton	10	150	2	1954	22	424	9-11-68
15F1	Carl Otto	100	12	--	--	14	274	9-19-68

15H2	Lester Luke	20	32	--	--	32	680	9-19-68
			T. 38 N., R. 1 E.					
4D3	Neptune Beach Water Assoc., south well	60	143	-8	1953	14	406	9-12-68
4D5	Neptune Beach Water Assoc., east well	60	--	4	1966	14	406	9-12-68
4E1	Sandy Point Water Assoc.	80	123	0	1960	12	308	9-12-68
26F1	Boynton Sunset Tracts	55	112	35	1962	16	312	9-11-68
32G1	Irene Thomas	100	153	--	--	15	574	9-19-68
32P1	Mrs. John Melcher	50	180	--	--	30	350	9-19-68
32P2	Lehr Miller	70	73	7	2- 9-60	11	177	9-19-68
33L1	Mac Granger	80	70	60	1941	25	489	9-19-68
34A1	Georgia Manor Water Assoc.	125	169	0	1962	32	387	9-10-68
34K2	Gooseberry Point Water Assoc.	60	138	-7	1968	24	416	9-10-68
34L1	Jones Water Co.	50	128	-7	1968	24	413	9-10-68

TABLE 13.--Quality of ground water in coastal areas, Whatcom County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
			T. 38 N., R. 2 E.					
7M2	Lummi School	40	25	33	1968	3.0	78	9-10-68
19L2*	N. P. Cruikshank	35	170	-3	1946	1,160	--	7-26-48
19L5	--do--	45	17	32	1968	33	312	9-10-68
23E1	Columbia Cement Co.	75	120	29	2- 6-53	15	281	9-10-68
			T. 39 N., R. 1 W.					
2P1	Charles Holeman	80	184	0	10-27-59	230	1,450	9-13-68
11F2	Grandview Beach Water Assoc.	95	113	1	11-10-59	23	339	9-13-68
11J1	Egil Melseth	100	147	-10	1942	9.1	271	9-13-68
13C1	Helmer Melseth	100	135	--	--	84	693	9-13-68
13R1	Great Northern RR	100	134	1	1941	10	--	8-12-47
						12	598	9-12-68
			T. 39 N., R. 1 E.					
6A1	Bell-Bay-Jackson Water Assoc.	90	40	80	11-17-51	1.6	260	9-13-68

6L1	O. J. Safsten	37	130	Flow	9-13-68	35	770	9-13-68
7Q2	Ludwig Benson	100	246	65	1948	140	--	8-27-48
						134	873	9-13-68
18E1	Great Northern RR	100	219	-60	1944	54	688	9-12-68
19D1	Standard Oil Co.	60	55	30	1968	27	482	9-12-68
19H1	Puget Power Co.	18	180	Flow	9-12-68	67	799	9-12-68
20M1	Arthur Watts	80	58	63	9-12-68	8.4	264	9-12-68
	T. 39 N., R. 2 E.							
30L1**	Fertile Meadows Water Assoc.	15	237	Flow	9-10-68	162	876	9-10-68
	T. 40 N., R. 3 W.							
1M1	Arnie Thorsteinson	190	157	57	--	13	518	9-18-68
2N1	Whatcom County Water Dist. 4	125	140	78	1968	14	242	9-18-68
9A1	Margaret Pudner	10	10	3	1968	285	1,390	9-18-68
9H1	Iwerson Cannery	10	14	-2	9-18-68	[b]36	494	9-18-68
9H2	Gulfwater Assoc.	10	14	0	1968	34	362	9-18-68

TABLE 13.--Quality of ground water in coastal areas, Whatcom County--Continued

Well Number	Owner or former owner	Land-Surface altitude (feet)	Depth of well (feet)	Altitude of water level (feet)	Date of level measurement	Chloride (mg/l)	Specific conductance (micromhos at 25°C)	Date of Collection
T. 40 N., R. 3 W. - Continued								
9H3	R. C. Hawkes	10	14	0	1968	113	864	9-18-68
11A1	J. C. McLennan	125	116	26	1962	29	513	9-18-68
T. 40 N., R. 1 W.								
15C1	Whatcom County Water Dist. 6	60	72	-5	1965	11	305	9-16-68
22G1	Willis Morris	110	115	37	1947	6.5	825	9-16-68
22K1	Bainter	80	125	--	--	10	921	9-16-68
22P1	Randy Ramstead	75	140	0	9-16-68	17	393	9-16-68
23C1	Birch Bay View Development	80	76	50	1968	5.8	299	9-16-68
T. 40 N., R. 1 E.								
17P1	Pat Doran	15	365	Flow	9-16-68	495	2,200	9-16-68
20D1	F. W. Fosberg	43	440	Flow	9-16-68	120	931	9-16-68
31N1	Karl Kler	35	225	Flow	9-16-68	335	--	8-16-48
						600	3,140	9-17-68