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TECHNICAL MEMORANDUM

WATER RESOURCES DEPT. SALEM, OREGON

ON

HYDROGEOLOGIC FEASIBILITY OF CLACKAMAS RIVER WATER WELL NO. 1 FOR AQUIFER STORAGE AND RECOVERY

Prepared for:

Clackamas River Water Clackamas, Oregon

Submitted by:

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1. INTRODUCTION

Clackamas River Water (CRW) is pursuing the development of an aquifer storage and recovery (ASR) system. CRW is interested in using existing Well No. 1 for ASR pilot studies and implementation. This report describes the geology and hydrogeology of the area in the vicinity of Well No. 1, provides a detailed description of geologic and hydrogeologic conditions at Well No. 1, and provides a discussion of the feasibility of using Well No. 1 as an ASR well, as well as the potential for ASR in the vicinity of Well No. 1.

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1.1 Background Information

CRW is evaluating the feasibility of using its existing Well No. 1 for ASR. Well No. 1 is located near Redland Road in Oregon City (Figure 1). The well was drilled in 1973 to a depth of 560 feet using cable tool methods, and is completed in basalt. The well was pump tested at a rate of 3,150 gallons per minute (gpm) in 1973 resulting in a drawdown of 160 feet for a specific capacity of 19.7 gpm/ft, indicating that the well is completed in permeable material. The well is currently equipped with a 100 hp, 2,000 gpm line-shaft turbine pump. The well has not been used for water supply due to poor-quality (elevated TDS) water. The well is currently used as a backup water supply source.

CRW has been pursuing ASR feasibility since the early 1990's, when initial feasibility studies were completed for the Clairmont Water District, the predecessor to CRW¹. The initial study indicated that it was feasible to use Well No. 1 for ASR, and recommended additional characterization of the regional hydrogeology and Well No. 1 to determine hydrogeologic conditions and the suitability of the well for ASR use.

1.2 Scope of Work

The scope of work for the hydrogeological characterization and ASR feasibility is as follows:

- Evaluate the geology, hydrogeology, and water quality in Well No. 1 and in other basalt wells in the vicinity of Well No. 1 to characterize the hydrogeology and water quality of the basalt aquifer;
- Conduct geophysical logging of Well No. 1, including video, caliper, spinner, fluid, and resistivity/SP logs to document the condition of the well and identify potential zones of fluid flow in the well;
- Conduct a 24-hour pumping test of Well No. 1 to determine the aquifer properties and water quality;
- Conduct a packer test in Well No. 1 to determine the aquifer properties and water quality in the upper and lower portions of the basalt aquifer; and

¹ Clairmont Water District Aquifer Storage and Recovery Feasibility Study, CH2M Hill, November 1994.

• Prepare a hydrogeologic report summarizing the local geologic and hydrogeologic conditions in the vicinity of Well No. 1, including aquifer hydraulic properties, flow system boundaries, groundwater movement, groundwater quality, and ASR feasibility.

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1.3 Report Organization

This report is organized into several sections as follows:

Section 2 describes the site setting in the vicinity of Well No. 1;

Section 3 describes the fieldwork that includes water quality sampling and testing of Well No. 1;

Section 4 describes the hydrogeologic conditions in the vicinity of Well No. 1 based on recent testing and existing regional information;

Section 5 describes the feasibility of ASR using Well No. 1 and in the basalt aquifer in the Clackamas River Water service area; and

Section 6 provides conclusions and recommendations.

Several Appendices are included with supplemental information. Appendix A contains well logs used in the construction of the geologic cross sections. Appendix B contains the results of the geophysical logging conducted in Well No. 1. Appendix C contains the results of the 24-hour pumping test and packer test conducted in Well No. 1, and Appendix D contains water quality data for Well No. 1 and recharge source(s). Appendix E contains a mixing analysis to evaluate the chemical interaction between native groundwater and recharge water.

2. SITE SETTING

This section describes the site setting, geologic units, and general groundwater occurrence in the vicinity of Well No. 1. This information is drawn from reports and studies conducted by the U.S. Geological Survey and other agencies and from well logs on file with the Oregon Water Resources Department.

2.1 Physiography

Well No. 1 is located on Redland Road, east of the Willamette River and south of the Clackamas River, near Oregon City (Figure 1). The well is located about 50 feet above the Abernethy Creek valley, a small tributary of the Willamette River. The topography rises to the north, east, and south of the well site to hills of up to 600 feet in elevation. Approximately 1 mile west of the well site, the topography flattens to the confluence of Abernethy Creek and the Willamette River.

2.2 Geologic Units

The geologic units in the vicinity of Well No. 1 include Tertiary and Quaternary volcanic and sedimentary rocks, and recent unconsolidated materials. Further information on the geologic units in the area is provided by Schlicker and Finlayson², and Leonard and Collins³. A geologic map is shown on Figure 2, and geologic cross-sections are on Figures 3 through 4. Well logs used in the construction of the cross sections are summarized on Table 1 and included in Appendix A. Well construction and depth information is summarized on Table 1 for basalt wells, and Table 2 for wells completed in the overlying sedimentary deposits. Table 2 does not include numerous shallow monitoring wells installed at the Rossman landfill, Clackamas County shop, Stimson Lumber, and other locations

2.2.1 Surfical Geologic Units

The unconsolidated materials in the vicinity of Well No. 1 include alluvial materials, terrace deposits, and silt. The unconsolidated materials are less than 100,000 years old and overlie Tertiary sedimentary deposits. Alluvial materials occur in the valleys of streams and rivers, including Abernethy Creek adjacent to the Well No. 1 site (Figure 2). The alluvial materials typically comprise sand, silt and gravel materials deposited by the streams. The thickness of these deposits is variable, and generally no more than 20 or 30 feet.

² Schlicker, H.G. and C.T. Finlayson, 1979, Geology and Geologic hazards of Northwestern Clackamas County, Oregon, Oregon Department of Geology and Mineral Industries Bulletin 99.

³ Leonard, A.R. and C.A. Collins, 1983, Groundwater in the Northern Part of Clackamas County, Oregon, U.S. Geological Survey Open-File Report 80-1049

The terrace deposits consist of boulders, cobbles, and mudflow deposits, which may be up to 200 feet thick. The terrace deposits occur along the banks of the Clackamas River north of Well No. 1.

The Willamette Silt comprises fine sand, silt, and clay deposited in a lacustrine (lake) environment. The Willamette Silt occurs on top of the bedrock surfaces in uplands to an elevation of approximately 250 feet, and ranges from less than 5 feet to about 40 feet thick. The Willamette silt is exposed in several upland areas near Well No. 1.

Groundwater occurs in all of the unconsolidated materials. Well yields are variable depending on the permeability of the material. Little water is available from the fine silty units.

2.2.2 Sedimentary Deposits

Tertiary sedimentary deposits of the Troutdale Formation and Sandy River Mudstone occur in the area of Well No. 1. The two units could not be distinguished with confidence based on the well log information. Wells completed in the coarser-grained portions or in poorly cemented zones of the sedimentary units may produce large quantities of groundwater. Wells completed in the fine-grained portions of the sedimentary deposits yield little groundwater.

2.2.2.1 <u>Troutdale Formation</u>

The Troutdale Formation consists of interbedded gravel, sand, and clay of variable thickness of middle Pliocene age, or about 3 million years old. In the vicinity of Well No. 1, the Troutdale Formation is exposed at or near the surface. Well No. 1 penetrated 300 feet of fine-grained sedimentary deposits, including clay and sand thought to be Troutdale Formation and Sandy River Mudstone overlying volcanic rocks (Figures 3 and 4).

In the vicinity of Well No. 1, much of the Troutdale Formation comprises clay, with thin, interbedded discontinuous lenses of sand or gravel. These coarse zones could not be correlated with confidence between wells (Figures 3 and 4), and likely represent discontinuous lenses or channel deposits.

2.2.2.2 Sandy River Mudstone

The Sandy River Mudstone underlies the Troutdale Formation in the general area of Well No. 1. Surface exposures of the Sandy River Mudstone do not appear at the well site; the nearest outcrop is approximately 2 miles southeast in the Abernethy Creek area. The Sandy River Mudstone is a lacustrine deposit comprising silt and clay with minor fine sand, and is approximately 5 million years old (late Pliocene).

Small, interbedded coarser sand or gravel lenses are present in the Sandy River Mudstone (Figures 3 and 4). These lenses are discontinuous and could not be correlated between wells on the cross sections.

2.2.3 Volcanic Rocks

2.2.3.1 Boring Lavas

The Boring Lavas are Quaternary basaltic flows and tuffs that occur as cappings on the higher elevations in the Oregon City area, to the north, east, and south of Well No. 1 (Figure 2). The Boring Lavas are approximately 2 million years old. Well No. 1 did not intersect the Boring Lavas.

2.2.3.2 <u>Columbia River Basalt</u>

The Columbia River Basalt is a thick series of Tertiary basalt flows. The basalt was extruded during the middle Miocene, or about 16 to 9 million years ago. In the general vicinity of the Well No. 1, the basalt is estimated to be up to 975 feet thick⁴ based on regional exposures, however, the thickness is variable due to deposition over an irregular land surface. Individual basalt flows range in thickness from 15 to 150 feet thick. The interior portions of individual flows are generally unfractured to weakly fractured. The interflow zones, or contacts between flows, are generally broken, vesicular or scoriacous, weathered, and fractured, and may contain pillow basalts (formed as molten basalt flowed into water) or thin sedimentary units of sand and gravel. Groundwater in the basalt generally occurs in the interflow zones or in strongly fractured zones.

Well No. 1 is completed in the Grande Ronde and Wanapum Formations of the Columbia River Basalt. The well intersected 260 feet of basalt material below the Tertiary sedimentary deposits (Troutdale Formation and Sandy River Mudstone) at the top of the borehole (Figures 3 and 4). The full thickness of the basalt section was not penetrated by Well No. 1. The nearest outcrop of Columbia River Basalt is along the Willamette River in Oregon City.

2.2.3.3 Skamania Volcanics

The Skamania Volcanics underlie the Columbia River Basalt in the vicinity of Well No. 1. The Skamania Volcanics are a series of late Eocene to Oligocene (40 to 26 million years old) basaltic and andesitic flows and tuffs of uncertain thickness. It is uncertain if any of the deep wells in the area of Well No. 1 penetrated the Skamania Volcanics. The nearest outcrop of the Skamania Volcanics is along the Willamette River southwest of Oregon City.

2.3 Geologic History

The geologic history of the area in the vicinity of Well No. 1 begins with the extrusion of the Skamania Volcanics in the late Eocene. The Skamania Volcanics were extensively folded and eroded to an irregular topographic surface before the extrusion of the overlying Columbia River Basalts during the middle Miocene from vents in eastern

⁴ Schlicker, H.G. and C.T. Findlayson, 1979, Geology and Geologic hazards of Northwestern Clackamas County, Oregon, Oregon Department of Geology and Mineral Industries Bulletin 99.

Oregon and Washington and western Idaho. Numerous individual basalt flows were extruded over this time, with periods of erosion and sedimentation during periods of low volcanic activity.

Folding and erosion followed the extrusion of the Columbia River Basalt. Low areas were filled with sediments of the Sandy River Mudstone and Troutdale Formation. Further structural deformation and erosion occurred prior to the extrusion of the Boring Lavas over the sedimentary rocks. Quaternary unconsolidated sediments were deposited during glacial flooding events and by rivers and streams in the area.

2.4 Structural Geology

Schlicker and Finlayson⁵ mapped several inferred normal faults and a syncline (broad-Ushaped fold) in bedrock in the vicinity of Wells No. 1 (Figures 2 and 4). The mapped faults follow general NW-SE and NE-SW alignments. The amount of displacement and age of these faults is uncertain. The faults may influence groundwater flow in two differing ways. If the faults are gouge-filled and impermeable, the faults will act as barriers to groundwater flow. If the faults are rubbly, they may be permeable and act as areas of enhanced groundwater flow.

The mapped syncline follows the NW-SE trend of some of the faults. Well No. 1 is located on the northeast limb of the syncline (Figures 2 and 4). The syncline may act as a barrier to groundwater flow, with the less fractured or unfractured basalt flow interiors retarding groundwater flow.

⁵ Schlicker, H.G. and C.T. Findlayson, 1979, Geology and Geologic hazards of Northwestern Clackamas County, Oregon, Oregon Department of Geology and Mineral Industries Bulletin 99.

3. INVESTIGATION PROGRAM

This section describes recent investigations conducted in support of the ASR feasibility studies. This work included completion of a well inventory in the area of Well No. 1, groundwater sampling and water level measurements, and geophysical logging and pumping and packer tests in Well No. 1.

3.1 Well Inventory

The Oregon Water Resources Department (WRD) was contacted to obtain water well logs on file for Clackamas County. The well logs are completed by the driller, and include information on the well location, geologic units encountered in the well, any well testing information, and well use information.

The well logs were sorted to obtain the well logs within an approximate 2-mile radius of Well No. 1. The logs within this area were used to identify additional wells completed in the basalt aquifer in the area of Well No. 1, and wells completed in the sedimentary deposits overlying the basalt. Information on the geology and aquifer properties in the vicinity of Well No. 1 was gathered from these logs. The wells completed in basalt are summarized on Table 1, and wells completed in the overlying sedimentary deposits within approximate 1-mile radius of Well No. 1 are summarized on Table 2. The logs were evaluated to identify wells completed in basalt that could be used to collect water quality samples and groundwater level measurements as part of the ASR feasibility work.

No springs were noted within a 1-mile radius of Well No. 1, based on examination of the Gladstone and Oregon City 7.5-minute topographic maps. Small unmapped springs seasonally occur where coarse-grained lenses in the sedimentary deposits are exposed along the sides of drainages.

3.2 Groundwater Sampling and Water Level Measurements

Several existing domestic, irrigation, or industrial wells completed in the basalt aquifer in the vicinity of Well No. 1 were selected as groundwater sample and groundwater level measurement locations. The wells were field checked to confirm the location, access, and suitability for sampling and measurement. The wells that were sampled are as follows:

- Lonestar Concrete Company (Figure 1, Well #6);
- 16200 Oak Terrace (Figure 1, Well #1);
- High School (Figure 1, Well #11); and
- Ogden Middle School (Figure 1, Well #9).

Water samples were collected by Montgomery Watson personnel using the pumping equipment installed in each well. In addition to these wells, water quality and water level data are available from monitoring well MW-1 at the Rossman Landfill. Additional information on these wells is provided in Table 1.

Groundwater quality samples were taken from these wells on August 26 and August 31, 1999. The wells were pumped for approximately 15 to 20 minutes to purge the well and any associated pressure tanks. Groundwater levels could only be measured in the Lonestar well (Figure 1, Well #6) due to limited access for a water level probe at the wellheads of the other wells.

3.3 Well No. 1 Investigations

Investigation of the conditions and hydrogeology of Well No. 1 was performed by geophysically logging the well, and performing a pumping test and a packer test. Each activity is described below.

3.3.1 Geophysical Logging

Geophysical logging was conducted in Well No. 1 to determine the condition of the well and the zones of water inflow to the well. The geophysical logs were collected using down-the-hole tools to collect data over the entire open length of the well or the entire water column. The geophysical logs were collected under static conditions, and selected logs were collected under pumping conditions with the pump intakes set at a depth of 112 to 115 feet below the top of the well casing. The geophysical logs are presented in Appendix B.

3.3.1.1 <u>Video Log</u>

A video log was collected from Well No. 1 prior to the pumping test. High turbidity in the water column following the removal of the pump obscured much of the borehole, making observations of the well condition difficult.

A second video log was completed to a depth of approximately 435 feet prior to the packer test, to confirm the borehole conditions at the anticipated packer depth setting. The video log shows the well casing to be clean and intact to a depth of 302 feet. Below the casing, the borehole walls are generally uniform and smooth, with some widely-spaced fractures. At approximately 430 feet, a large fractured zone, or "washout", was intersected. The depth of this fracture zone correlates with changes in fluid properties recorded on the fluid logs collected in Well No. 1 (Section 3.3.1.3).

3.3.1.2 <u>Caliper Log</u>

The caliper log is a measure of the well diameter and is useful for determining zones of "washout" or increased borehole diameter that often occur in broken or fractured zones. The caliper log may also detect breaks in the casing, if present.

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The caliper logging indicates a uniform borehole diameter of approximately 16.5-inches in the upper 300 feet of the well, corresponding with the reported cased interval (Figure B-1). Below 350 feet, the borehole diameter is 16-inches to approximately 535 feet, where the diameter narrows to approximately 7-inches. It is uncertain if this is a result of borehole cave-in or from the original drilling.

There are several zones where the borehole diameter increases up to 18-inches. These correspond to broken or vesicular basalt as noted on the well log, particularly between 315 to 324 feet and from 487 to 530 feet. There are also several zones where the borehole diameter is less than the reported 16-inches. This may be the result of small areas of partial blockage due to caving below the casing.

3.3.1.3 Fluid Logs

Fluid logs measure the fluid conductivity, fluid resistivity, and fluid temperature of the water column in the well. These logs can be used to differentiate zones of water inflow based on differences in fluid properties and temperature. The logs were run initially with the pump off under static conditions, and repeated while the well was pumped.

Under static conditions, the fluid conductivity and fluid resistivity logs indicate a relatively constant fluid resistivity and conductivity below the casing to a depth of approximately 420 feet, indicating water of uniform conductivity is entering the well between the bottom of the casing at 302 feet and 420 feet. Below 420 feet, the fluid resistivity decreases, and the fluid conductivity increases, indicating the inflow of more conductive water in the lower portion of the well (Figures B-2 and B-3). This corresponds to a vesicular basalt zone on the driller's log. This also correlates with a large broken zone noted on the video log.

The fluid temperature decreases uniformly in the well to approximately 330 to 340 feet, where a slight increase occurs. This zone corresponds to a zone of broken basalt noted on the driller's log. The temperature decreases in the well below 340 feet in a fairly uniform fashion until 420 feet, where a drop in temperature occurs (Figure B-4). The temperature continues to decrease to the bottom of the well.

The fluid logs were run during the pumping test to determine zones of water inflow. The fluid conductivity and fluid resistivity logs run under pumping conditions indicate a slight increase in fluid conductivity below the casing to a depth of 350 feet, and then a sight decrease to approximately 420 feet. This indicates water of generally uniform conductivity and TDS is entering the well over this interval. At 420 feet, a sharp increase in fluid conductivity and a corresponding decrease in fluid resistivity occurs. The higher fluid conductivity continues to the bottom of the well (Figures B-2 and B-3). The higher fluid conductivity and lower resistivity below 420 feet indicates that water with elevated TDS is entering the borehole below this depth. The temperature log collected under pumping conditions shows a gradual decrease in temperature to a depth of 430 feet. A drop in fluid temperature occurs at approximately 430 feet, indicating inflow of water at a slightly lower temperature below that depth (Figure B-4).

3.3.1.4 Spinner Log

A spinner log measures the relative flow velocity in the well under pumping conditions, which aids in the identification of zones of water inflow in the well. The spinner logging shows a relatively uniform velocity below the casing to a depth of approximately 420 feet. Below 420 feet, the velocity apparently decreases (Figure B-5). Interpretation of the spinner log is complicated by the low fluid velocities in the well and potential fouling of the spinner tools with suspended sediment in the water column, resulting from the pulling of the permanent pump.

Further characterization of the location of the inflow zones in the well was done during the packer testing (Section 3.3.3).

3.3.1.5 Formation Resistivity and SP Logs

The formation resistivity and self-potential (SP) logs measure electrical properties of both the formation and the pore water. In general, the resistivity of the basalt will be highest in the dense flow interiors and lowest in water bearing zones. The SP will be lower in the dense basalt zones.

In Well No. 1, the highest formation resistivities and low SP response are at approximately 320, 390, and 460 feet (Figures B-6 and B-7). These areas generally coincide with areas noted as hard basalt on the well log. Lower resistivities and higher SP responses are at about 340, 400, and below 480 feet. These areas generally coincide with areas of porous or broken basalt noted on the well log.

3.3.2 24-Hour Pumping Test

A 24-hour constant-rate pumping test was conducted in Well No. 1 on August 31, 1999. The existing turbine pump was pulled from the well, and the well equipped with a temporary submersible pump to allow the geophysical logging to take place under pumping conditions. The submersible pump was set at a depth of approximately 112 to 115 feet below the top of the well casing (elevation –30 feet msl). The well was pumped at a constant rate of 300 gpm during the test. Water levels were monitored in Well No. 1 and in monitoring well MW-1 at the Rossman Landfill during the pumping test. Additional details of the pumping test are included in Appendix C.

A drawdown of 2.9 feet was observed in Well No. 1 at the end of the pumping period. The specific capacity at the end of the test was 103 gpm/ft. Note that this is approximately five times higher than the specific capacity when the well was tested at 3,150 gpm (19.7 gpm/ft) following well completion in 1973. The higher specific capacity estimated from the August 1999 test data is not unexpected, and is due to the low pumping rate, as specific capacity generally decreases with increasing pumping rate due to increased turbulent well losses. The 1979 pumping test was conducted at a rate that was greater than 10 times the rate used in the August 1999 test. A pump test hydrograph is shown on Figure 5. A semi-log test hydrograph is shown on Figure 6.

3.3.3 Packer Testing

A packer test was performed in Well No. 1 on November 29 and 30, 1999. The purpose of the packer test was to evaluate the hydraulic properties and water quality of the lower (430 to 560 feet) and upper (302 to 430 feet) portions of the open hole section of the well. An inflatable packer was set in Well No. 1 at a depth of 426 to 427.2 feet. The depth of the packer setting was confirmed prior to setting the packer by conducting a downhole video log of the well to verify borehole conditions. The video log indicated rough borehole walls below a depth of 429.5 feet, so the packer was set in an area of smooth borehole wall above this depth. A 300-gallon per minute (gpm) submersible pump was set above the packer, and a small 12.5-gpm sampling pump was set below the packer. Access was provided for water level measurements above and below the packer.

After the packer was installed, water levels measured above and below the packer indicated a water level difference of 0.04 feet, with the zone below the packer having a lower water level. This indicates that there is a small downward hydraulic gradient between the basalt aquifers above and below the packer.

Field water quality parameters (pH, temperature, specific conductivity, Eh, dissolved oxygen) were monitored during the testing, and water quality samples were collected from above and below the packer.

3.3.3.1 Upper Zone Pumping

The open borehole above the packer was pumped for approximately 6-hours at 300 gpm. Water levels were monitored in Well No. 1 above and below the packer, and in Rossman MW-1. Water levels were monitored for approximately 1-hour after the pump was shut down.

A hydrograph for the pumping test conducted in the upper portion of the well is shown on Figure 8. As shown on Figure 8, approximately 21.3 feet of drawdown occurred in the well during the test. The specific capacity at the end of the test was 14.1 gpm/ft, lower than the observed specific capacity of 103 gpm/ft at the end of the 24-hour pumping test conducted in August 1999, which involved a test of the full open interval of basalt. Much of the drawdown occurred within the first 2 to 3-minutes of pumping. Water levels above the packer stabilized after approximately 4-minutes of pumping. Water levels below the packer decreased by approximately 0.25 feet during the test. The water level response in Rossman MW-1 is shown on Figure 8. The water level in Rossman MW-1 generally decreased during the pumping test, however, it is uncertain if this decrease is due to pumping at Well No. 1 or other influences such as earth tides or barometric pressure fluctuations.

Semi-log and log-log plots of the drawdown data for Well No. 1 are shown on Figures 9 and 10. These figures show the stabilization of the drawdown after the first 3 to 4 minutes of pumping. This response is typical of a "leaky" aquifer system that receives recharge or leakage from an overlying aquifer. The test response suggests that leakage from the overlying Troutdale Formation and Sandy River Mudstone sediments is

supplying water to the upper basalt aquifer. The water level recovery plot (Figure 11) shows a rapid water level recovery after the pump is shutdown, indicating a source of recharge to the aquifer. A lower permeability aquifer boundary, such as the boundary seen during the first pumping test, was not seen in this test. The lower permeability boundary seen during the first test is likely indicative of conditions in the basalt aquifer below the packer.

The drawdown data were analyzed to estimate the aquifer transmissivity and leakance. The initial two to three minutes of drawdown data are influenced by wellbore storage effects. Data collected after about four minutes of pumping are influenced by leakage effects. As a result of the wellbore storage and leakage effects, the data collected between three and four minutes were used to estimate an aquifer transmissivity. The results of the analysis indicate an aquifer transmissivity of 1,750 ft²/d. This transmissivity is less than 10-percent of transmissivity of 22,000 ft²/d estimated from the previous 24-hour pumping test conducted over the entire open interval in the well.

A leakage factor of 0.023 feet was estimated from the test data. This value of leakage indicates a high rate of leakage, or recharge to the aquifer from the overlying sedimentary deposits (Troutdale Formation and Sandy River Mudstone).

3.3.3.2 Lower Zone Pumping

The lower zone was pumped at a rate of 12.5 gpm for 16 hours. The pump was started one hour following the pumping test above the packer. Pumping removed about 12,000 gallons of water from below the packer, equivalent to 8.8 well volumes of the packed off zone.

Water levels in the well above the packer fluctuated by approximately 0.05 feet while the well was being pumped from below the packer. It is uncertain if pumping from below the packer affected water levels above the packer.

Water level data could not be collected while the well was pumped from below the packer due to the test equipment configuration. Based on the transmissivity of 22,000 ft²/d estimated from the test conducted over the entire open well (Section 3.3.2) and the transmissivity of the well above the packer (1,750 ft²/d), the transmissivity of the aquifer below the packer is estimated to be 20,000 ft²/d. Therefore, the lower portion of the basalt aquifer at Well No. 1 is significantly more permeable that the upper portion of the aquifer.

3.3.3.3 Water Quality

Groundwater quality samples were collected from above and below the packer. Each sample was analyzed for major ions, iron, manganese, and volatile organic compounds. The results of the groundwater sampling are summarized on Table 3. No constituents were detected that exceeded primary or secondary drinking water standards, except for TDS in the zone below the packer, which exceeded the secondary standard of 500 mg/L. No organic compounds, including PCE or TCE, were detected in either sample.

Groundwater from the lower portion of the well below the packer is more mineralized (higher dissolved solids) than groundwater from above the packer. The differences in water quality above and below the packer and the entire open well are summarized in the following table:

Constituent	Units	Open Well (302-560 feet)	Above Packer (302-428 feet)	Below Packer (428-560 feet)
Conductivity	µmhos/cm	860	530	975
Total Dissolved Solids	mg/L	510	330	600
Chloride	mg/L	182	101	273
Total Alkalinity	mg/L	136	141	130
Calcium	mg/L	40.9	26	50.8
Magnesium	mg/L	7.1	5.8	8.2
Potassium mg/L		12.3	9.3	13.9
Sodium mg/L		108	76.9	130
Total Hardness mg/L-CaCO ₃		131	88.8	161

Groundwater from below the packer contains higher concentrations of sodium, chloride, potassium, calcium, and magnesium, and has lower alkalinity. This is consistent with the results of the fluid logging (Section 3.3.1) which indicated an increase in fluid conductivity below about 420 feet.

Golder Associates

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4. HYDROGEOLOGIC CONDITIONS

This section describes the hydrogeologic conditions in the basalt aquifer (the target aquifer for ASR) in the area of Well No. 1, including aquifer hydraulic properties, groundwater flow, aquifer boundaries, and groundwater quality. Information for this section was compiled from U. S. Geological Survey reports and studies, and a search of well logs on file with the Oregon Water Resources Department, as well as the recent investigations conducted in Well No. 1. Well logs used in this evaluation are included in Appendix A, and summarized on Table 1.

4.1 Groundwater Conditions

4.1.1 Groundwater Occurrence

4.1.1.1 <u>Basalt Aquifer</u>

Groundwater occurs in the Columbia River Basalt primarily in the interflow zones between individual basalt flows. The interflow zones are broken, vesicular (porous) and rubbly, and may contain pillow basalts or interbedded sedimentary material such as sand and gravel. The geologic log of Well No. 1 indicates that potential interflow zones are located at the following depths:

Depth	General Description
315-324	porous gray basalt, water
333-342	broken gray basalt
382-397	medium soft black basalt
487-550	porous black basalt

These intervals are separated by zones described on the log as "hard basalt", which likely represent flow interiors. Video logging of Well No. 1 indicated that the basalt between 302 and 430 feet was generally weakly fractured or unfractured. A large fracture was noted at approximately 430 feet on the video log. A review of well logs from other deep wells completed in the basalt aquifer in the vicinity of Well No. 1 indicates similar groundwater conditions, with water occurring in zones noted on the logs as soft, porous, broken, or fractured. In general, the interiors of the basalt flows are unfractured, and little groundwater occurs in the flow interiors unless zones of strong fracturing are present. Groundwater in the basalt generally occurs under confined conditions. The sedimentary rocks overlying the basalt and the dense basalt flow interiors confine the interflow zones of the basalt aquifer.

Well yields in the basalt are variable, reflecting the variability in thickness and continuity of the interflow zones, and the number of interflow zones intersected in the well. Well yields in basalt wells in the area of Well No. 1 range from less than 10 gpm to over 3,000 gpm (Well No. 1).

4.1.1.2 <u>Sedimentary Deposits</u>

Groundwater occurs in the sedimentary deposits overlying the basalt in coarser-grained portions or lenses of the rocks. These lenses are thin and discontinuous in the vicinity of Well No. 1, and could not be correlated between wells (Figures 3 and 4). Groundwater in these formations occurs under unconfined to confined conditions. The Troutdale Formation and Sandy River Mudstone are generally fine grained in the area of Well No. 1. Wells completed in coarser-grained lenses in the sedimentary deposits in the area of Well No. 1 generally yield less than 30 gpm. Information on wells completed in the sedimentary deposits in the vicinity of Well No. 1 is summarized on Table 2. Wells logs from these wells are included in Appendix A.

The majority of the sedimentary deposits overlying the basalt near Well No. 1 are silt and clay. The silts and clays are generally not water bearing⁶ and form confining units for groundwater occurring in deeper lenses of coarse materials and in the basalt aquifer.

4.1.2 Groundwater Flow

Groundwater flow in the basalt aquifer is complex due to the continuity of the interflow zones, geologic structure such as folds and faults, and variability within the interflow zones. Many of the wells in the basalt aquifer are also open to several interflow zones and the water levels are likely affected by head differences between the zones.

Groundwater elevations in the basalt aquifer are quite variable (Table 1) due to the location of the wells in the regional flow system, the variability in the completion zones and the number of zones of differing hydraulic head where the wells are completed. A number of wells in the basalt aquifer in the vicinity of Well No. 1 have fairly consistent groundwater elevations between 20 below sea level to 20 feet above sea level (Table 1) similar to Well No. 1. This suggests that the potentiometric surface of the basalt aquifer in the area of Well No. 1 is fairly flat. A flat potentiometric surface is consistent with a high permeability aquifer.

Groundwater recharge to the basalt aquifer occurs in areas where the basalt is exposed at or near the ground surface. Recharge also likely occurs through downward leakage in areas where the hydraulic head in overlying sedimentary and unconsolidated materials is greater than the hydraulic head in the basalt. The groundwater elevation in wells completed in the sedimentary deposits overlying the basalt in the vicinity of Well No. 1 are approximately 20 to 40 feet above sea level (Table 2) indicating that vertical leakage to the basalt can occur. Due to the low permeability of the Sandy River Mudstone, this is likely a small portion of recharge to the aquifer. Groundwater upwelling from deeper sedimentary units into the basalt also may occur, as poor-quality water has been encountered in several deep basalt wells in the vicinity of Well No. 1, such as the High School and Middle School wells (Wells #9 and #11, Figure 1) without intersecting

⁶ Leonard, A.R. and C.A. Collins, 1983, Groundwater in the Northern Part of Clackamas County, Oregon, U.S. Geological Survey Open-File Report 80-1049.

sedimentary units below the basalt. This has also been reported for other deep basalt wells in the region^{7,8}.

Groundwater discharge from the basalt aquifer is uncertain. Groundwater discharge likely occurs to downgradient groundwater basins and to wells completed in the basalt. Groundwater also discharges to the Willamette River, as the elevation of the river is approximately 10 feet, and groundwater elevations of approximately 20 feet occur in basalt wells near the river. Basalt crops out along the river west and southwest of the well site.

Groundwater flow directions in the basalt aquifer and the overlying sedimentary rocks and alluvial materials are shown schematically on Figure 12. Groundwater recharge to the regional basalt aquifer likely occurs in the upland areas to the north, east, and south of Well No. 1. Groundwater flow in the basalt aquifer is toward the Willamette River, a regional groundwater discharge area. Groundwater recharge to the unconsolidated material and sedimentary rocks occurs where the units are exposed at the surface. Groundwater flow in the unconsolidated materials and sedimentary rocks is dependent on local topographic variations, and is generally to local discharge points such as Abernethy Creek, the Willamette River, and other surface water bodies.

4.1.3 Aquifer Boundaries

The boundaries of the basalt aquifer are uncertain. There are several geologic structures that could form boundaries of the basalt aquifer. These include faults, folds, and lateral thinning or changes in the interflow zones. Analysis of pumping test data collected from Well No. 1 indicates that an aquifer boundary of lower permeability was intersected during the test (see Section 3.3.2).

Several faults have been mapped or inferred in the area of Well No. 1, particularly north of the Clackamas River (Figure 2). These faults may be of lower permeability than the surrounding basalt, and restrict groundwater flow. Well No. 1 is drilled on the northeastern limb of a syncline (Figures 2 and 4). The syncline may act to restrict groundwater flow due to folding of the interflow and dense basalt interior zones.

The water table forms the upper boundary of the uppermost aquifer in the sedimentary rocks and alluvial materials, where recharge crosses the boundary to enter the groundwater flow system. If the water table intersects the ground surface, groundwater discharge occurs through evapotranspiration and discharge to surface water bodies or wetlands. The lower boundary to the aquifer is likely a low-permeability unit, such as marine sedimentary rocks or dense volcanic rocks.

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⁷ Leonard, A.R. and C.A. Collins, 1983, Groundwater in the Northern Part of Clackamas County, Oregon, U.S. Geological Survey Open-File Report 80-1049.

⁸ Hogenson, G.M., and B.L. Foxworthy, 1965, Groundwater in the east Portland Area, Oregon, U.S. Geological Survey Water Supply Paper 1793.

4.2 Aquifer Hydraulic Properties

The transmissivity of the basalt aquifer in the vicinity of Well No. 1 was estimated from available information presented on well drillers logs. The transmissivity can be estimated from specific capacity data from the short well test performed by the driller after a well is completed. The transmissivity is estimated from the following approximation⁹:

T = 2000 * Q/s		
where	T Q S	is the aquifer transmissivity in gpd/ft; is the pumping rate in gpm; and is the drawdown at the end of the test period (feet).

The transmissivity was estimated for the basalt wells used to construct the geologic cross sections. The specific capacity data were adjusted to account for well losses due to well completions (open bottom, perforations, or fracture flow) during the tests. An estimated average well efficiency of 70 percent was assumed for all wells. As shown on Table 1, the adjusted specific capacity ranges from 0.32 to 43 gpm/ft, and the estimated transmissivity of the basalt aquifer ranges from 60 to 8,750 ft²/d. This range in estimated transmissivity reflects the heterogeneity of the aquifer and differences in the thickness, extent, and permeability of the interflow zones. Well No. 1 and a well to the northeast owned by Oregon City (Well #18, Figure 1) have the highest estimated transmissivity.

4.2.1 CRW Well No. 1

Information on the aquifer hydraulic properties was provided by a 24-hour pumping test conducted in Well No. 1 in August 1999 (Section 3.3.2) and a packer test conducted on November 29 and 30, 1999 (Section 3.3.3).

During the 24-hour test, the well was pumped at a rate of 300 gpm, with 2.9 feet of drawdown in the well at the end of the test. The estimated transmissivity for the interval 302-560 feet from the test data was 22,000 ft²/d. This estimated transmissivity is the highest estimated transmissivity of the wells completed in the basalt aquifer in the vicinity of Well No. 1 (Table 1).

During the packer test, the well was tested over the interval between the bottom of the casing (302 feet bgs) and 426 feet. The transmissivity of this zone was estimated to be 1,750 ft²/d, or less than 10% of the transmissivity estimated for the entire open interval of the well. This indicates that the portion of the hole below the packer (between 426 and 560 feet) has a transmissivity of approximately 20,000 ft²/d. Therefore, the lower portion of the well is significantly more permeable than the upper portion of the well.

⁹ Driscoll, F.G., 11986, Groundwater and Wells, Johnson Filtration System, St. Paul, Minnesota.

4.3 Groundwater Quality

Groundwater quality in the basalt aquifer is variable. Several deep wells in the vicinity of Well No. 1 contain water a high total dissolved solids (TDS) content due to elevated sodium and chloride concentrations.

Water quality samples from the basalt aquifer have been historically collected at monitoring well MW-1 near the Rossman landfill. MW-1 is completed in the basalt aquifer at a depth of 204 feet. The water from MW-1 is a sodium-chloride water (Figure 13), with a TDS of approximately 290 to 380 mg/L. The water quality data from MW-1 are summarized on Table 5.

Water quality samples were collected at the end of August 1999 from several existing wells completed in the basalt aquifer, prior to the pumping test conducted on Well No. 1. The sampled wells were:

- Ogden Middle School, Figure 1, Well #9;
- High School Well, Figure 1, Well #11;
- Lonestar Well, Figure 1, Well No.#6; and
- 16200 Oak Terrace, Figure 1, Well#1

Samples were collected using the existing pumping equipment installed in each well. Further information on the wells is provided in Table 1, and the location of the wells is shown on Figure 1.

The results of the water quality sampling indicate that water from these wells is a hard to very hard sodium chloride water with a high TDS content. The results of the water quality sampling in these wells is summarized on Table 3, and shown on Figure 7.

Water from the Ogden Middle School and High School wells had the poorest water quality of the wells sampled. These wells exceeded secondary drinking water standards for chloride, and have a TDS content exceeding the secondary drinking water standard of 500 mg/L. Water from these wells also exceeds the secondary standards for iron and manganese. Water from the other two wells sampled had lower concentrations of iron, manganese, and chloride that are below the secondary drinking water standards, however, TDS exceeded the secondary standard. Water from Rossman MW-1 had the lowest TDS of the wells in the vicinity of MW-1. No organic constituents were detected in any of the wells.

The two school wells with the poor quality water are deep wells in the basalt aquifer. It is likely that that the poor-quality water is the result of upwelling of more saline water from underlying Skamania Volcanics or sedimentary rocks. Other deep wells installed in

the basalt aquifer in the vicinity of Rossman MW-1 and Well No. 1 have also been noted with poor quality water^{10,11}.

4.3.1 Well No. 1

Groundwater samples collected from Well No. 1 over the entire open well are similar in composition to groundwater from other deep wells completed in the basalt aquifer (Figure 7). The dissolved solids content is intermediate between the two school wells, which are have a TDS content of approximately 1,000 mg/L, and Lonestar and Oak Terrace wells, which have a TDS of less than 650 mg/L.

Groundwater samples collected during the packer test indicate that groundwater in the upper portion of the aquifer contains lower total dissolved solids (primarily sodium and chloride) than the lower portion of the aquifer. The total dissolved solids of the upper portion of Well No. 1 was 330 mg/L, which is similar to the TDS content of the Lonestar, Oak Terrace, and Rossman MW-1 TDS content (Tables 3 and 5). The TDS of the lower portion of the well was 675 mg/L, which is lower than the TDS of the school wells (930 to 1,000 mg/L). This indicates that the groundwater in the lower portion of the aquifer is of poorer quality than groundwater in the upper portion of the aquifer.

Organic constituents have been detected in Well No. 1 at concentrations less than the drinking water standards. Trichloroethylene (TCE) was detected twice, in 1988 and 1991, and tetrachloroethylene (PCE) was detected once in August 1999. These organic constituents were not detected in the other basalt wells sampled during the sampling conducted in August 1999. In addition, these organic compounds were not detected in Well No. 1 during the packer testing conducted in November 1999.

4.4 Groundwater Use

There are a number of wells completed in the basalt aquifer and in the overlying sedimentary rock and alluvial materials in the vicinity of Well No. 1. Many of these wells are shallow domestic wells and do not withdraw large quantities of water. Several deep wells completed in the basalt aquifer are reported on the well logs to withdraw more than 300 gpm, in addition to Well No. 1. These wells are as follows:

Oregon City Public Schools - The School District owns two wells completed in the basalt aquifer (Well # 11 and #13, Table 1 and Figure 1). One well was drilled to a depth of 602 feet, and has been pump tested at 350 gpm. The well is used for irrigation. The other well was drilled to a depth of 578 feet, and was pump tested at 295 gpm. The use of the groundwater from this well is not known.

¹⁰ Leonard, A.R. and C.A. Collins, 1983, Groundwater in the Northern Part of Clackamas County, Oregon, U.S. Geological Survey Open-File Report 80-1049.

¹¹ Hogenson, G.M., and B.L. Foxworthy, 1965, Groundwater in the east Portland Area, Oregon, U.S. Geological Survey Water Supply Paper 1793.

Oregon City Wells - Oregon City owns two production wells completed to depths of 560 and 404 feet in the basalt aquifer (Well #3 and #18, Table 1 and Figure 1). The wells were each pump tested at 300 gpm. The well completed to 404 feet was abandoned in March of 1999. The status of the other well is not known.

Dakota Minerals Well (Willamette Falls Sand and Gravel) - This well is completed to a depth of 340 feet in the basalt aquifer (Well #5, Table 1 and Figure 1). The well was pump tested at up to 600 gpm. The current status of this well is not known.

These four wells are located within 0.5 to 1 mile of Well No. 1. The current pumping rate and use of each of these wells is not known. In addition to these wells, there are three other wells in the area that are reported to pump more than 100 gpm. The wells are:

Oregon Ready Mix This is well is 248 feet deep and was pump tested at up to 100 gpm (Well #6, Figure 1).

Garvision This is a domestic well that was pump tested at 100 gpm. The well is 180 feet deep (Well #12, Figure 1).

Publishers Paper This well is 251 feet deep and was reported to produce 230 gpm (Well #8, Figure 1).

The status of these wells is not known.

5. ASR FEASIBILITY

This section describes the feasibility of ASR in the basalt aquifer in the vicinity of Well No. 1, and the feasibility of using Well No. 1 as an ASR well.

5.1 ASR Objectives

CRW wishes to develop an ASR system utilizing water either from the CRW water treatment plant or purchased from the South Fork Water Board that will be recharged into a basalt aquifer using CRW's existing Well No. 1. The initial goal is a storage capacity of 80 MG, however, CRW is interested in evaluating the maximum ASR storage capacity of the basalt aquifer. The recharged water would typically be stored for 3 to 6 months, then recovered to meet summer peak demands or emergency needs. The recovered water will be required to have a composition similar to the recharge water, and have acceptable taste and odor. The overall objective is to design a system to maximize the recovery of recharge water while providing consistent water quality to CRW's customers.

Several items that need to be addressed in the ASR feasibility evaluation and pilot testing are as follows:

- 1. What rate can water be injected using Well No. 1? Are similar recharge rates likely at other locations in the basalt aquifer in the vicinity of Well No. 1?
- 2. How much water can be recharged at Well No. 1 over a seasonal recharge cycle? How much water can be recharged over the local area?
- 3. What will the water level rise in Well No. 1, locally in the basalt aquifer, and in the overlying sedimentary deposits be?
- 4. How far will the recharged water migrate during storage?
- 5. What reactions will take place in the aquifer between the recharged water and native groundwater and between the recharged water and the basalt aquifer matrix? Will vertical leakage from the overlying or underlying deposits affect water quality?
- 6. Are there potential sources of contamination that could affect the operation of the system?
- 7. Based on the conceptual model and issues, should a pilot test be performed? If a pilot test is performed, what approach should be employed to collect the necessary information for a full-scale system?

5.2 Aquifer and Well No. 1 ASR Characteristics

This section describes the characteristics of the basalt aquifer and Well No. 1 that are relevant to ASR feasibility.

5.2.1 Aquifer ASR Characteristics

Water injected into an aquifer during ASR operations will flow into the permeable zones in the aquifer, such as interflow zones present in the basalt aquifer. The water level buildup in the aquifer from recharge is a function of recharge rate and duration, the aquifer transmissivity and storativity and the aquifer boundary conditions.

A high aquifer transmissivity is favorable for recharging large quantities of water. The aquifer transmissivity in the vicinity of Well No. 1 is approximately 22,000 ft²/d, indicating that it is highly permeable and thus capable of readily accepting recharge water. Based on the results of the packer testing, the lower portion of the well, from 430 to 560 feet, is the most permeable portion of the well, with an estimated transmissivity of 20,000 ft²/d. The upper portion of the well, between 302 and 430 feet, has a transmissivity of 1,750 ft²/d. The storativity of the aquifer in the vicinity of Well No. 1 is not known. The storativity of confined basalt aquifers is typically between 10^{-3} and 10^{-5} . A low storativity will transmit water level changes rapidly over large areas in a permeable aquifer such as the basalt aquifer intersected by Well No. 1.

The hydraulic properties of lower portion of Well No. 1 were used to make preliminary estimates of water level rise during recharge. For the estimate, a storativity of 10⁻⁴ was assumed. Under these conditions, the water level rise in the well was estimated to be less than 50 feet at a recharge rate of 2,000 gpm (i.e. 130 MG over a 90 day period). A higher storativity will result in lower buildup at the well during recharge, while a lower storativity (10⁻⁵) will result in approximately 60 feet of buildup. The water level rise at a point 2,500 feet from the well is estimated to be less than 20 feet. This water level buildup is the maximum buildup that is projected to occur at the end of recharge. After recharge stops, water levels in the immediate vicinity of the well will decrease as water levels equilibrate in the aquifer during storage. A greater water level rise will occur as the result of a higher recharge rate.

The intended recharge zone is a confined part of the basalt aquifer, that is at least 100 feet below the top of the basalt. The water level rise resulting from recharge is expected to be confined to this zone, with a muted response in the zones in the upper portions of the basalt. There are five deep wells within a 1-mile radius of Well No. 1 that likely intercept the confined zone target for recharge, including the following wells:

- Ogden Middle School, Figure 1, Well #9;
- Two wells owned by Oregon City Public Schools, Figure 1, Wells #11 and 13; and
- Clackamas Housing Authority, Figure 1, Well #3; and
- Willamette Falls Sand and Gravel, Figure 1, Well # 5.

These five wells have a depth to water of greater that 100 feet except for the Willamette Falls Sand and Gravel well (Table 1), which is located approximately 1-mile northeast of Well No. 1 (Figure 1). The water level rise in this well is anticipated to be less than 15-feet. Other wells completed in the basalt the vicinity of Well No. 1 such as Rossman

MW-1 are completed in the upper portion of the basalt, and water level rises as a result of recharge are not expected in these wells.

This analysis did not consider the effects of low-permeability aquifer boundaries, which would increase the water level buildup. The extent of the highly permeable portion of the basalt aquifer that Well No. 1 is completed in is not known. There are two additional wells that have an estimated transmissivity of greater than 8,000 ft²/d (Well #11 and #18, Figure 1 and Table 1), located 4,000 feet northeast and southwest of Well No. 1. It is uncertain if the aquifer between these wells is highly permeable.

The effects of recharge on the water levels in upper portions of the basalt and on the sedimentary deposits overlying the basalt is not known, and will be dependent on the vertical permeability of the sedimentary deposits and basalt, and the difference in hydraulic head between the basalt aquifer and the overlying aquifer in the sedimentary deposits.

5.2.2 Well No. 1 ASR Characteristics

Well No. 1 was drilled to a depth of 560 feet below ground using cable tool drilling methods. A surface seal of cement grout was installed to a depth of 30 feet into silt and clay. The well is cased to a depth of 302 feet with 16-inch diameter steel casing through the sedimentary deposits and into the top of the basalt. The caliper logging indicates the well is an open 16-inch diameter borehole below the casing. The video logging conducted prior to the packer test indicates generally unfractured basalt occurs from 302 feet to a depth of approximately 430 feet. This upper zone has a relatively low permeability. The lower zone of the well from 430 to 560 feet is highly permeable. The depth to water in Well No. 1 was approximately 61 feet below ground in November 1999.

The existing well construction is shown on Figure 14. In this condition, the well does not meet well construction standards under OAR 690-210-0150 <u>Sealing of Wells in</u> <u>Consolidated Formations</u>. A well completed in consolidated formations such as basalt must have a minimum 5-foot cement grout seal in the annulus between the well casing and formation.

Well No. 1 will need to be modified to meet seal regulations prior to usage as an ASR well. The well can be modified by telescoping 12-inch diameter steel casing in the well between a depth of 250 and 420 feet, and pressure grouting the casing in place. The proposed modification is shown on Figure 14. Starting the seal at a depth of 250 feet will provide a pump chamber that will allow a 2,000 gpm pump to be installed.

Without modifications to the well head to control leakage, the available water level buildup at Well No. 1 is limited by the depth to water in the well. The depth to water is approximately 61 feet below ground. We estimate that recharge at a rate of 2,000 gpm for 90 days will result in a water level buildup of about 50 feet in the well. This should not present a problem during ASR pilot testing and initial implementation.

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5.3 Recharge Water Migration

When recharge stops, the recharge water will migrate away from the well due to the hydraulic gradient caused by the recharge mound at the well, and due to the regional hydraulic gradient in the aquifer. The groundwater velocity due to natural groundwater flow in the basalt aquifer was estimated from the following equation:

v = Ki/n

where

v is the groundwater velocity in ft/d;
K is the hydraulic conductivity (ft/d),
i is the hydraulic gradient (ft/ft), and
n is the effective porosity (percent).

There is uncertainty in the input parameters. The hydraulic conductivity can be estimated by dividing the transmissivity by the thickness of the principal water bearing zones in the well below a depth of 430 feet. The thickness of the water-bearing zones is uncertain, but is less than the total thickness of basalt in the open well. The weakly fractured or unfractured basalt flow interiors do not contribute large quantities of water to the well. The hydraulic gradient can be estimated from the groundwater elevations, and the effective porosity for the basalt interflow zones is estimated to be between 15 and 25 percent.

Table 6 presents an estimate of 1-year groundwater travel distance for recharge water based on a range of the hydraulic properties estimated for the lower aquifer (430 to 560 feet). As shown on Table 6, the estimated 1-year travel distance is variable, depending on the estimated hydraulic conductivity, hydraulic gradient, and the effective porosity. The estimated travel distance based on these parameters ranges from less than 500 feet to as much as 7,700 feet. If storage is shorter than one year, groundwater migration will be less. It is therefore possible for the recharge water to migrate a considerable distance from the well during storage. The rate of migration will affect the quality of the stored water, and will be evaluated as part of the pilot test.

5.4 Water Quality

This section describes the quality of the recharge water and the basalt aquifer. It also includes a discussion of the compatibility between the groundwater and surface water with regard to potential mineral precipitates that may form as the result of mixing of recharge water and the native groundwater. Supplemental information is included in Appendices D and E.

5.4.1 Recharge Water

The recharge water that will be used is surface water that is currently utilized by CRW as it's water source. The recharge water is a calcium-sodium bicarbonate water. It is characterized by low dissolved solids (22 to 56 mg/L) and a near-neutral pH. Organic compounds have not been detected in the surface water. None of the constituents in the

recharge water exceed primary or secondary water quality standards. The surface water quality is generally consistent from year to year (Table 7).

Modeling results indicate that the surface water is supersaturated with iron oxides and hydroxides. These iron (hydr)oxides, however, have a very low solubility, and water in equilibrium with these compounds contains very low levels of iron (approximately 0.005 mg/L).

5.4.2 Groundwater

Groundwater quality in the basalt aquifer is variable. Several deep wells installed in the basalt aquifer in the vicinity of Well No. 1 such as the Middle School and High School wells have high levels of dissolved solids that exceed the secondary drinking water standard. Groundwater from the upper portion of the basalt aquifer is less mineralized, with a lower dissolved solids content. The groundwater pH is slightly alkaline.

Modeling results indicates that the groundwater is supersaturated with iron oxides and hydroxides. These iron (hydr)oxides, however, have a very low solubility, and water in equilibrium with these compounds contains very low levels of iron (approximately 0.005 mg/L). Groundwater is also supersaturated with respect to several silica minerals, including quartz. In general, natural waters are oversaturated with respect to quartz because the rate of attainment of equilibrium between quartz and silicic acid (i.e. dissolved silica) is extremely slow. This generally implies that the solubility of amorphous silica represents the upper limit of dissolved aqueous silica. Groundwater in the basalt aquifer is slightly undersaturated with respect to amorphous silica. As a result, clogging of the aquifer through precipitation of silica is unlikely. Other minerals commonly found to clog aquifers or form encrustations in wells such as manganese (hydr)oxides, carbonates, and gypsum are below saturation levels and should not precipitate. Saturation indices indicate that calcite is near equilibrium within the aquifer.

5.4.3 Chemical Processes During Recharge

Recharge water injected into the basalt aquifer during ASR operations will displace the existing groundwater in the permeable interflow zones replacing it with the recharge water. Under this scenario, a zone of good quality recharge water will develop around the recharge well that can be drawn on to meet peaking or emergency demands. Groundwater quality changes during recharge and storage may occur as a result of the following:

- Advection and dispersion;
- Diffusion;
- Interaction with the aquifer mass; and
- Leakage.

These processes may modify the quality of the recharge water during the storage period. Experience has shown that based on the actual hydrogeological conditions in the storage zone that these issues can be managed during ASR operations to maximize recharge water recovery. Pilot testing will evaluate the potential water storage and recovery implications of these processes. Each process is described below.

5.4.3.1 Advection and Dispersion

Advective transport is the migration of dissolved constituents within groundwater under the prevailing hydraulic conditions. Recharge water entering the aquifer will flow at a variable velocity due to differences in flow length, pore size, and friction in the pore space. These differences cause mixing along the flow paths from the differing velocities, or dispersion. Mixing occurs both parallel and transverse to the flowpath taken by groundwater.

Changes in water quality due to advection and dispersion will likely occur on the edges of the mass of recharge water as it displaces the natural groundwater in the interflow zones. This process will likely be important during recharge, when a steep gradient exists near the recharge well due to mounding of recharge water. Advection and dispersion will be less important during storage when the recharge water moves under the natural groundwater gradient. Advection and dispersion will result in a mixing zone between the recharge water and the native groundwater at the perimeter of the zone of stored water. The size of the mixing zone will be dependent on the aquifer properties and hydraulic gradients.

The potential for the stored water to migrate under the natural hydraulic gradient was briefly discussed in Section 5.3. High groundwater velocities may transport the stored water away from the recharge well, thus potentially reducing the quality of stored water.

5.4.3.2 <u>Diffusion</u>

Diffusion occurs when solutes in water move from an area of high concentration to an area of low concentration. Diffusion will occur as long as a concentration gradient exists, and the mass of solute flux is proportional to the concentration gradient. In a groundwater system, diffusion is also controlled by the tortuosity of flowpaths in the pore space of the aquifer.

A concentration gradient will exist in the aquifer between the injected water and the native groundwater. The recharge water is low in dissolved solids, while the native groundwater is significantly higher in dissolved solids. Diffusion will occur between the injected water in the interflow zones and the native groundwater along the edges of the recharge water, and between the recharge water in the interflow zones and native groundwater occurring in the dense basalt zones between interflow zones during storage. Diffusion may result in a deterioration of the recharge water during the storage period.

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5.4.3.3 Groundwater-Aquifer Mass Interactions

The injected water has the potential to interact with the aquifer rock mass, resulting in dissolution of minerals in the rock mass and consequent changes in water quality. The rate of dissolution will be dependent on the pH and chemistry of the recharge water, the mineralogy and alteration of the aquifer rock mass, and the residence time of the water in the aquifer.

Chemical interaction between the recharged water and the basalt aquifer mass is expected to be minor due to the short residence time of the recharged water in the aquifer, the relatively insoluble silicate minerals of the basalt aquifer matrix, and the near-neutral pH of recharge water. Experience at Salem, Oregon has shown little interaction between the rock matrix and recharge water, and little potential for clogging of the area around the well from reactions with the recharge water.

5.4.3.4 Leakage

During recharge there is likely to be an increased water level in the storage zone compared to the underlying and overlying aquifers. Depending on the permeability of the overlying sedimentary materials, vertical leakage from the storage zone may occur. In addition, during recovery when the well(s) are pumped, hydraulic gradients may be reversed. This could induce leakage either from underlying rocks such as the Skamania Volcanics or from overlying basalts and sediments into the storage water. Depending on the quality of water in the overlying and underlying aquifers, changes in water quality may occur.

5.4.4 Evaluation of Mixing between Recharge Water and Groundwater

The effects of mixing the recharge water and native groundwater were investigated to determine the potential for the formation of mineral precipitates which have the potential to clog the aquifer and/or the recharge wells. For the mixing analyses, groundwater to surface water ratios of 3:1, 1:1, and 1:3 were modeled. A detailed discussion of the mixing analysis is included in Appendix E.

The results of the modeling indicate that as increasing portions of recharge water are mixed with the native groundwater, the pH will decrease slightly, while the redox potential will decrease slightly. This will result in supersaturation of ferrihydrite, an iron (hydr)oxide. However, due to the low iron concentrations, precipitation would be minimal.

5.4 Potential Contaminant Sources

Potential sources of groundwater contamination near an ASR facility are important, as ASR operations can change groundwater flow directions and vertical gradients as water is injected or recovered from an aquifer. These changes could potentially result in the introduction of contaminants into the stored groundwater.

A potential source of contamination near Well No. 1 is the Rossman landfill. The Rossman landfill is located approximately 3,000 to 4,000 feet northeast of Well No. 1. The Rossman landfill has been associated with increased levels of iron, manganese, benzene, vinyl chloride, and trichloroethelyene in shallow groundwater at the landfill site. Remedial measures were taken at the landfill to limit infiltration and collect and treat leachate. Groundwater and surface water in the vicinity of the landfill are monitored semiannually. A deep monitoring well in the basalt (Rossman MW-1) installed near the landfill does not show evidence of impacts within the basalt from the landfill.

Trichloroethylene (TCE) has been detected twice in Well No. 1 (1988 and 1991) and tetrachloroethylene (PCE) was detected in one sample collected in August 1999. These compounds were detected at low levels, below the drinking water standards. The source of these compounds is unknown. These compounds were not detected in the deep monitoring well MW-1 at the Rossman landfill. The ASR storage zone is in the lower part of the basalt, and is therefore not expected to affect groundwater flow beneath the landfill.

Other sources of potential contaminants may exist in the vicinity of Well No. 1. A contaminant source inventory should be conducted following completion and analysis of a pilot test.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

- A review of the geologic and hydrogeologic conditions in the vicinity of Well No. 1 indicates that the basalt aquifer conditions are favorable for the development of ASR. The lower part of basalt aquifer is very permeable, confined, and is partially bounded with a low permeability boundary.
- Water quality data from wells in the basalt aquifer indicates that the water is a hard, sodium chloride type water, of variable quality. Water from several deep wells contains elevated dissolved solids and high sodium and chloride concentrations.
- Downhole geophysical logging using fluid and spinner logs indicates that Well No. 1 is completed in several interflow zones in the basalt aquifer. Water entering the well below approximately 420 feet has a higher TDS content and higher fluid conductivity than water that enters the upper portion of the well.
- Packer testing of Well No. 1 indicated that the lower portion of the well, below 430 feet, is significantly more permeable than the upper portion of the well. The aquifer response in the upper portion of the well indicates that leakage from the overlying Troutdale Formation and Sandy River Mudstone is occurring. Groundwater from the lower portion of the well is more mineralized than groundwater in the upper portion of the well.
- Well No. 1 is completed in a highly permeable portion of the basalt aquifer, indicating that the aquifer is capable of accepting recharge water readily without excessive water level buildup. Recharging 130 Mgal over 90 days would result in a water level rise of about 50 feet in the recharge well
- Migration of the injected water during storage under the natural hydraulic will occur. A preliminary estimate indicates that the injected water could migrate between 500 and 8,000 feet after 1-year. There is uncertainty in the estimates as a result of the uncertainty in aquifer hydraulic parameters, hydraulic gradient, and effective porosity. Pilot testing will help address this issue.
- Water quality changes during recharge and storage can occur from advection and dispersion (mixing), diffusion due to concentration gradients between the recharged water and native groundwater, and reactions between the aquifer rock mass and the injected water. These reactions combined with effects due to lateral groundwater flow will govern the amount of high-quality recharge water that can be recovered. Experience at other ASR sites suggests that under most conditions, management and conditioning of the storage zone can result in recovery of a large percentage of the recharge water.
- An evaluation of the water quality of the surface water and native groundwater indicates that they are both supersaturated with respect to iron (hydr)oxides. Due to the low iron concentrations in the surface water and groundwater, and the low solubilities of these compounds, precipitation of iron compounds is not

anticipated to be a concern. Mixing of these waters will cause a sight increase in redox potential and a slight decrease in the pH of the groundwater.

6.2 **Recommendations**

It is recommended that CRW proceed with an ASR pilot test at Well No. 1. The pilot test should target the recharge, storage, and recovery of 50 MGal or more into the lower portion of the well. Recharge of 1,200 gpm over 30-days will result in 52 MGal of water recharged into the aquifer. The components of the pilot test should include the following:

1. Well Modification

Modify Well No. 1 to comply with OAR 690-210-0150 as follows:

- Conduct a plumbness and alignment test to determine the well conditions and whether the new casing string can be placed;
- Backfill the well to a depth of 425 feet with disinfected, washed gravel;
- Backfill the well to a depth of 420 feet with bentonite pellets;
- Telescope 12-inch diameter casing inside the 16-inch casing between 250 and 420 feet;
- Pressure grout the annular space with neat cement grout;
- Clean out the gravel and bentonite with a bailer and/or air lift pumping;
- Develop the well until the water is clear; and
- Run a 4-hour step pumping test to size the permanent pump.

2. ASR Testing

- Conduct a 4 to 8-hour step recharge test to assess well performance under recharge conditions;
- Recharge and withdrawal of recharge water over several variable periods to assess aquifer response to recharge, including aquifer boundaries, water level buildup, leakage, and short-term changes in water quality;
- Recharge over a longer term period followed by a storage period of several months to assess long term water quality changes as a result of advection, dispersion, and diffusion, residual buildup, and leakage; and
- Recover the stored water while monitoring water quality. A 4 to 8-hour step pumping test should be conducted prior to the start of recovery to evaluate any changes in well performance as a result of recharge.

3. <u>Water Quality Sampling</u>

Water quality sampling should be conducted throughout the pilot test, particularly during recovery, to determine any changes in stored water quality. As part of the pilot test, a monitoring well network should be established to monitor water levels in the basalt aquifer.

Following evaluation of the pilot test results, and decision to proceed with full-scale implementation, a contaminant source inventory should be completed for a 1.5 mile radius around Well No. 1 to determine potential contaminant sources near the well, and for future wellhead protection work.

TABLES

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BASALT WELL INFORMATION

															Top of								
	1	1		1	1	1			Depth	1				Top of	Open		Bottom of					Modified	
	WRD							Ground	to		Groundwater	Depth to	Elevation to		Hole	Bottom of	Well		Pumping		Test	Specific	Estimated
Map	Well	Township	Range-		1/4	1/4		Elevation	Water	Date of	Elevation	Basalt	top of Basalt	Hole	Elevation	Well	Elevation	Aquifer	Rate	Drawdown	Duration	Capacity	Transmissivity
Number	ID	North	East	Section	Sec	. Sec	. Well Owner	(feet amsl)	(feet)	Measurement	(feet amsl)	(feet bgs)	(feet msl)	(feet bgs)	(feet msl)	(feet bgs)	(feet msl)	Test Type	(gpm)	(feet)	(hours)	(gpm/ft) ¹	(ft2/d)
1	4385	25	2E	28	nw	ne ne	Ferriaer	350	400	4/16/76	-50	372	-22	203	147	520	-170	na				1	
2	4391	2.5	2E	28	nw	nw	Okita	300	307	4/16/76	-7	203	97	203	97	522	-2.2.2	bailer	10	45	1	0.32	85
							Clackamas Housing					1											
3	4392	25	2E	28	ne	nw	Authority	330	305	1/9/63	25	218	112	2.2.2	108	560	-230		300	34	8	12.6	3370
4	4382	25	2E	28	SW	SW		50	70	4/24/81	-20	130	-80	130	-80	154	-104	air test	20	80	1	0.36	95
							Willamette Falls																
5	4398	25	2E	29	SW	ne	Sand and Gravel	30	21	6/18/70	9	139	-109	139	-109	340	-310	Pump	500	79	4	9.0	2417
-									13	2/26/1966		1.	1.11			2010	1.552.013						
6	4410	2S	2E	29	sw	nw	Oregon Ready Mix	30	13	8/31/99	17	176	-146	175	-145	248	-218	Pump	50	35	4	2.0	546
							Clairemont Water									1.							
7	4396	25	2E	29	se	se	District	85	69	8/17/73	16	299	-214	301	-216	560	-475	Pump	3150	160	24	28.1	7519
	1						1. A. B. C. 200.				Fine Sector			1.00			Sec.	15 m	15.57	-	101		
8	4419	25	2E	31	se	nw	Publisher's Paper Co.	120	49	not available	71	14	106	17	103	250	-130	Pump	230	41	na	8.0	2142
							Oregon City Public	- 19 E 1			and the second	1000	1000	1.1.1.1	-		1.1		1000		100		
9	4425	25	2E	32	nw	nw		245	450	1/10/56	-205	429	-184	453	-208	550	-305	Pump	80	42	6	2.7	727
10	4211	25	2E	19	SW	ne		90	82	12/2/71	8	113	-23	120	-30	203	-113	Pump	65	118		0.79	210
		- 972					Oregon City Public		1000		ALC: NO.	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	1					S - 2.1 (1)			1234.00		
11	4427	25	2E	32		nw		245	236	3/23/67	9	460	-215	463	-218	602	-357	Pump	350	11	8	45.5	12164
12	4430	25	2E	33	חש	nw		150	60	8/14/56	90	162	-12	164	-14	180	-30	Pump	100	56	8	2.6	682
		1.			10		Oregon City Public	Sec. And the				1. State 1.		1.1.1.1		1. 30. 1	1.0.0	1221234		1.00	12.11		
13	4431	25	2E	33	SW	_		190	165	3/4/65	25	469	-279	472	-282	578	-388	Pump	295	131	8	3.2	860
14	4222	2S	2E	19	ne	nw		100	95	6/24/76	5	70	30	118	-18	180	-80	air test	20	80	1	0.36	95
15	4384	2S	2E	28		ne		360	390	5/6/77	-30	317.0	43	317	43	455	-95	na			-		
16	20301	25	2E	28		ne		360	260	5/24/95	100	448.0	-88	500	-140	500	-140	na			-		
17	20693	25	2E	29	ne	sw		30	21	9/10/84	10	176.0	-146	204	-174	204	-174	na					
121521	Transfer 1		1	1.11			Park Place Water							-	1.1.1.1	1.1.2	11.00				10.52		
18	7121	25	2E	28	SW	nw		200	184	10/10/67	16	115.0	85	158	42	404	-204	Pump	300	10	6	43	11458
19	4437	25	2E	33	98	se		210	30	9/14/66	180	31.0	179	40	171	90	120	bailer	40	20	1	2.9	764
1.1.1					1		Oregon Conference									1200							
20	20497	25	2E	20	se	se		30	116	5/8/95	-86	7.0	23	203	-173	242	-212	na	1				
21	4429	2S	2E	33	ne	nw	King	170	40	6/6/66	130	99	71	99	71	120	50	Pump	55	70	1	1.1	300

Note:

The specific capacity was corrected assuming a 70 percent well efficiency.
 Well abandoned in March 1999.

TABLE 2 (page 1 of 4)

Water Quality Summary-Basalt Wells

		Drinkin Detection	g Water S	tandards MCL		Ödgen Middle	Senior High School	Lonestar	16200 Oak Terrace	Well 1 990901030	Well 1 990902011
Parameter	Units	Limits	Primary	Secondary	Proposed	08/26/99	08/26/99	08/26/99	08/31/99	08/31/99	09/01/99
conventional Parameters											
Conductivity	umhos/cm	0.5				1570	1700	640	560	770	860
Conductivity (Field Data)	mV/cm										
рН						7.8	7.8	8.3	8.1	8	8
pH (Field Data)			-								
Temperature (Field Data)	0C		1	1	-				L		
Total Dissolved Solids	mg/L	1			-	930	1000	380	350	470	510
Turbidity		0.05	0.5,1.0							1.1	0.1
Turbidity (Field Data)	<u>NTU</u>										
Dissolved Oxygen (Field Data)	mg/L										
Oxygen Reduction Potential (Field Data) Chloride	mV										
Nitrate	mg/L	0.1		-		464	506	134	86.9	167	182
Nitrite	mgN/L mgN/L	0.01				ND	ND	ND	ND	ND	ND
Total nitrate and nitrite	mgN/L	0.01								ND	ND
Sulfate	mg/L	0.02		250	400-500	ND	ND	ND	ND	ND nd	ND ND
Fluoride (free)	mg/L	0.2	1.00	2.50	100-300	140		ND		0.67	0.7
MBAS (Surfactants)	mg/L	0.01		1000						0.87	 ND
Total Alkalinity	mg/L	0.5	1	1		129	123	135	150	137	136
Carbonate Alkalinity	mg/L	0.5				0.644	0.615	2.13	1.49	1.09	1.07
Hydroxide Alkalinity	mg/L	0.5		1-1-1	100	0.011	0.010	0.034	0.021	0.017	0.017
Bicarbonate Alkalinity	mg/L	0.5				157	150	164	182	167	165
Carbon Dioxide (free)	mg/L	2			1	4.98	4.75	1.64	2.89	3.34	3.3
Total Phosphorus (as P)	mg/L	0.05								ND	0.02
Iodide	mg/L	0.1									
Color	ACU							_		3	5
Corrosivity	- 234										
Odor	TON			1. ee						1	1
		1	17.85								
Microbiological											
Standard Plate Count	efu/mL	1.57	1.1.1							100	2
Total Coliform	#/100 mL		5							>23	<1,1
E. Coli	#/100 ml.		5	1.00						<1.1	<1.1
Metals											
Aluminum	mg/L	· · · · · ·								ND	ND
Antimony	mg/L	0.0005									ND
Arsenic	MF/L	0.005/0.00057	0.05							ND	ND
Asbestos	mg/1,	0.2	-								L
Banum	mg/L	0.0002	2	1.1.2.1			-			41	45
Beryllium	mg/L	0.0005					++			ND	ND
Cadmium	mg/L	0.001/0.00057	0.005	-						ND	ND
Calcium	mg/L	0.05				108	130	94.5	ND	39.3	40.9
Chromium	mg/L	0.001	0.1			-				7.8	11
Copper	mg/L	0.02	TT	1						ND	ND
Cyanide	mg/L	0.004								ND	ND
Iron	mg/L	0.05		0.3		0.65	0.71	83	ND	0.11	0.13
Lead	mg/L	0.001/0.00057	TT				+			0.645	ND
Magnesium	mg/L	0.05				10	11.5	35.6	ND	72	7.1
Manganese	mg/L	0.005	0.000	0.05		91	92	1600	ND	36	36
Mercury	mg/L	0.0005	0.002		-					ND	ND
Nickel	mg/L	0.01				10.0	18/	10.4	21	ND 12	ND
Selenium	mg/L	1 0.005/0.0017	0.05			18.3	18.6	18.4	2.6	12 ND	12.3 ND
Silica (SiO2)	mg/L	0.005/0.0017	0.05			54	54	40	50		46
Silver	mg/L		,	0.1		34	54	69	50	49 ND	46 ND
Sodium	mg/L	0.001/0.00057		0.1		187	185	70	110	ND 101	108
Thallium	mg/L mg/L	0.55/0.17				18/	165	79	118	101 ND	ND
Total Hardness	mg/L-CaCO3	0.0002				311	372	382	ND	128	131
Zinc	mg/L-CaCO3	0.025/0.027	-	5		511	514	304		0.03	ND
Radionuclides	ung b	0.013/0.02/	-		10.00	1			1	1 0.05	
Gross Alpha	pCi/L	1									ND

TABLE 2 (page 2 of 4)

Water Quality Summary-Basalt Wells

Parameter	Units	Drinkir Detection Limits	g Water S Primary	tandards MCL Secondary	Proposed	Ödgen Middle 08/26/99	Senior High School 08/26/99	Lonestar 08/26/99	16200 Oak Terrace 08/31/99	Well 1 990901030 08/31/99	Well 1 990902011 09/01/99
Gross Beta	mRem/yr	1									
Radium 226	pCi/L	1	100			1					
Radium 228	pCi/L	1		201							
Radon (Rn-222)	pCi/L	1			300					260	ND
Iodine-131	pCi/L		1.000								
Strontium-90	pCi/L	1.3.3								<3.3	
Tritium	pCi/L									<291	
Uranium	ug/L	0.001				0.000					
Disinfection By-Products											
Total Haloacetic Acids	ug/L	1								ND	ND
Total Trihalomethanes	ug/L	0.0005	80								
Organics			-		11						
Benzene	ug/L	0.5	5			ND	ND	ND	ND	ND	ND
Carbon tetrachloride	ug/L	0.5	5		-	ND	ND	ND	ND	ND	ND
Chlorobenzene	ug/L	0.5				ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ug/L	0.5		State of	-	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	ug/L	0.5	600		10**	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ug/L	0.5	75		5**	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ug/L	0.5	5			ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	ug/L	0.5				ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	ug/L	0.5				ND	ND	ND	ND	ND	ND
Dichloromethane	ug/L	0.5	5			ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ug/L	0.5	5			ND	ND	ND	ND	ND	ND
Ethylbenzene	ug/L	0.5	700	1-1-1		ND	ND	ND	ND	ND	ND
Styrene	ug/L.	0.5			1.	ND	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	ug/L	0.5		-21 17		ND	ND	ND	ND	0.6	ND
Toluene	ug/L	0.5	1000			ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ug/L	0.5	70			ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ug/L	0.5	200			ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ug/L	0.5	5			ND	ND	ND	ND	ND	ND
Trichloroethene (TCE)	ug/L	0.5				ND	ND	ND	ND	ND	ND
Vinyl chloride	ug/L	0.5	2			ND	ND	ND	ND	ND	ND
Xylene (Total)	ug/L	0.5	10,000+		20,000**, +	ND	ND	ND	ND	ND	ND
Bromobenzene	ug/L	0.5	1.2.4	64		ND	ND	ND	ND	ND	ND
Bromodichloromethane	ug/L	0.5	100	1	80						
Bromoform	ug/L	0.5	100	1991	80	ND	ND	ND	ND	ND	ND
Bromomethane	ug/L	0.5		14.4		ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	ug/L	5				ND	ND	ND	ND	ND	ND
Chloroethane	ug/L	0.5				ND	ND	ND	ND	ND	ND
Chloroform	ug/L	0.5				ND	ND	ND	ND	ND	ND
Chloromethane	ug/L	0.5				ND	ND	ND	ND	ND	ND
2-Chlorotoluene	ug/L	0.5				ND	ND	ND	ND	NĎ	ND
4-Chlorotoluene	ug/L	0.5				ND	ND	ND	ND	ND	ND
Dibromochloromethane	ug/L	0.5			24	ND	ND	ND	ND	ND	ND
Dibromomethane	ug/L	0.5	100		80	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ug/L	0.5				ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ug/L	0.5		1							
1,3-Dichloropropane	ug/L	0.5				ND	ND	ND	ND	ND	ND
2,2-Dichloropropane	ug/L	0.5				ND	ND	ND	ND	ND	ND
1,1-Dichloropropene	ug/L	0.5				ND	ND	ND	ND	ND	ND
1,3-Dichloropropene	ug/L	0.5				ND	ND	ND	ND	ND	ND
Di-isopropyl Ether				1.000		ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone (MIBK)	ug/L	5			1200 1000	ND	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	ug/L	0.5				ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ug/L	0.5				ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ug/L	0.02	0.2			ND	ND	ND	ND	ND	ND
Trichlorotrifluoroethane (Freon)	ug/L	0.5				ND	ND	ND	ND	ND	ND
EDB (Ethylene dibromide)	ug/L	1								ND	ND
DBCP	ug/L	0.1	1			-				ND	ND
Hexachlorocyclopentadiene	ug/L	0.1	1000	1.1.1.1.1.1.1.1		ND	ND	ND	ND	ND	ND
alpha-Chlorodane	ug/1	0.05								ND	ND
Acenaphthylene	ug/1	0.1								ND	ND

ND is non-detect

0229Uat01x4s

TABLE 2 (page 3 of 4)

Water Quality Summary-Basalt Wells

		Drinkir Detection	ig Water S	tandards MCL		Odgen Middle	Senior High School	Lonestar	Terrace	Well 1 990901030	Well 1 99090201
Parameter	Units	Limits	Primary	Secondary	Proposed	08/26/99	08/26/99	08/26/99	08/31/99	08/31/99	09/01/9
Acifluorfen	ug/L	0.2								ND	ND
Anthracene	ug/1	002								ND	ND
Aroclor 1016	ug/L	0.07								ND	ND
Aroclor 1221	ug/L	0.1					1 1			ND	ND
Aroclor 1232	ug/L	0.1								ND	ND
Aroclor 1242	ug/L	0.1								ND	ND
Aroclor 1248	ug/L	0.1								ND	ND
Aroclor 1254	ug/L	0.01								ND	ND
Aroclor 1260		0.01	0.5							ND	ND
	ug/L		0.5				1			ND	ND
Bentazon	ug/L	0.5									
Alpha-BHC	ug/L_	0.07								ND	ND
Beta-BHC	ug/L	0.01								ND	ND
Delta-BHC	ug/L	0.01	<u> </u>		1942				-	ND	ND
Polychlorinated Biphenyls	ug/L	0.4									
2, 4 D	ug/L	0.75					+			ND	ND
2,4-DB	ug/L	2	l				┼───┤			ND	ND
2,4-Dinitrotoluene	ug/l	0.1								ND	ND
Dalapon	ug/L	7	I							ND	ND
Dicamba	ug/L	0.05								ND	ND
Dichlorprop	ug/L	0.5								ND	ND
3,5-Dichlorobenzoic Acid	ug/L	0.5								ND	ND
DCPA	ug/L	0.1								ND	ND
Dinoseb	ug/L	0.3								ND	ND
Pentachlorophenol	ug/L	0.2								ND	ND
Picloram	ug/L	0.1	2							ND	ND
2,4,5-T	ug/L	0.2								ND	ND
2,4,5-TP (Silvex)	ug/L	0.1								ND	ND
Alachlor	ug/L	0.1								ND	ND
Aldrin	ug/L	0.1								ND	ND
Atrazine	ug/L	0.5	2	1						ND	ND
Benzo(a)pyrene	ug/L	0.4	1	1.00						ND	ND
Benz(a)Anthracene	ug/L	0.05								ND	ND
Benzo(b)Fluorethane	ug/L	0.02								ND	ND
Benzo(g,h,I)Perylene	ug/L	0.05	1			0.00				ND	ND
Benzo(k)Fluoranthene	ug/L	0.02								ND	ND
Butylbenzylphthalate		0.5	-							ND	ND
Bromacil	ug/L	0.3								ND	ND
	ug/L									ND	ND
Butachlor	ug/L	0.9	-		-						
Caffeine	ug/L	0.02	-		-				···	ND	ND
Chrysene	ug/L	0.02	-	-						ND	ND
Chlordane	ug/L	0.2							<u> </u>	ND	ND
Chlorthalonil	ug/L	0.01								ND	ND
Dibenz(a,h)Anthracene	ug/L	0.05								ND	ND
Di(2-ethylhexyl)adipate	ug/L	0.02	2	-						ND	ND
Di(2-ethylhexyl)phthalate	ug/L	0.04	0.4		-					ND	ND
Diethylphthalate	ug/L	0.5								ND	ND
Dieldrin	ug/L	0.02	0.2			-				ND	ND
Dimethylphthalate	ug/L	0.5		191						ND	ND
Dimethoate	ug/L	10	-			1				ND	ND
Di-n-ButyIphthalate	ug/L	0.5								ND	ND
Endosulfan I	ug/L	0.01								ND	ND
Endosulfan II	ug/1	0.01								ND	ND
Endosulfan Sulfate	ug/L	0.01								ND	ND
Endrin	ug/L	0.1	1							ND	ND
Endrin Aldehyde	ug/1	0.01	1							ND	ND
Fluorene	ug/L	0.05								ND	ND
Heptachlor	ug/L	0.02	0.2							ND	ND
Heptachlor epoxide	ug/L	4	40	-						ND	ND
Hexachlorobenzene	ug/L.	0.1	-							ND	ND
Indeno(1,2,3,c,d)Pyrene		0.05								ND	ND
	ug/L	0.05	1				<u> </u>			ND	ND
Isophorone	ug/L		-	-	-						ND
Lindane (gamma-BHC)	ug/L	1	3			-				ND	L NU

ND is non-detect

02,29(ab.1,x)6

TABLE 2 (page 4 of 4)

Water Quality Summary-Basalt Wells

		Drinki Detection	ng Water S	tandards MCL		Odgen Middle	Senior High School	Lonestar	16200 Oak Terrace	Well 1 990901030	Well 1 990902018
Parameter	Units	Limits	Primary	Secondary	Proposed	08/26/99	08/26/99	08/26/99	08/31/99	08/31/99	09/01/99
Methoxychlor	ug/L	1								ND	ND
Metolachlor	ug/L	2			0-2					ND	ND
Molinate	ug/L	0.2								ND	ND
Metribuzin	ug/L	2								ND	ND
4-Nitrophenol	ug/L	5								ND	ND
trans-Nonachlor	ug/L	0.05			-					ND	ND
p,p' DDD	ug/L	0.01	1			in a second				ND	ND
p,p' DDE	ug/L	0.01								ND	ND
p,p' DDT	ug/L	0.01								ND	ND
Phenanthrene	ug/L	0.02								ND	ND
Prometryn	ug/L	0.5				1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	_			ND	ND
Propachlor	ug/L	0.5		1						ND	ND
Pyrene	ug/L	0.05		1	7		_			ND	ND
Simazine	ug/L	1.5								ND	ND
Thiobencarb	ug/L	0.2					-		-	ND	ND
Toxaphene	ug/L	2								ND	ND
Trifluralin		0.1								ND	ND
Aldicarb	ug/L	10	-		-				-	ND	ND
	ug/L			-			-		<u> </u>	ND	ND
Aldicarb sulfone	ug/L	20	-							ND	ND
Aldicarb sulfoxide	ug/L	10		-	-					ND	ND
Baygon	ug/l	2	-	-						_	
Carbaryl	ug/L	1.9								ND	ND ND
Carbofuran	ug/L.	1.9	-		-					ND	
3-Hydroxycarbofuran	ug/L	0.5	Part of		_				·	ND	ND
Methoicarb	ug/1	2							<u> </u>	ND_	ND
Methomyl	ug/L	0.5	-							ND	ND
Oxamyl (Vydate)	ug/L	0.5	-	-		-				ND	ND
Glyphosate	ug/L	0.5		-						ND	ND
Endothall	ug/L	0.5	-		-					ND	ND
Diquat	ug/L	0.5	-	-	-					ND	ND
Paraquat	ug/1	2		_						ND	ND
2,3,7,8-TCDD	ug/L	0.5	-		-					ND	ND
Total TCDD	ug/L	0.5			-						
1,2,3-Trichlorobenzene	ug/L	0.5	-			ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	ug/L	0.5	-			ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	ug/L	0.5									
1,3,5-Trimethylbenzene	ug/L	0.5		- C - 1	-	ND	ND	ND	ND	ND	ND
4-Isopropyltoluene	ug/L	0.5	_		-	ND	ND	ND	ND	ND	ND
Bromochloromethane	ug/L	0.5				ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ug/L	0.5	1.13		1	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	ug/L	0.5		1.1							
Isopropylbenzene	ug/L	0.5				ND	ND	ND	ND	ND	ND
n-Butylbenzene	ug/L	0.5	1			ND	ND	ND	ND	ND	ND
n-Propylbenzene	ug/L	0.5				ND	ND	ND	ND	ND	ND
Naphthalene	ug/L	0.5		12.20		ND	ND	ND	ND	ND	ND
sec-Butylbenzene	ug/L	0.5		11	100	ND	ND	ND	ND	ND	ND
tert-Butylbenzene	ug/L	0.5		100		ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	ug/L	0.5		100000		ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ug/L	0.5				ND	ND	ND	ND	ND	ND

TABLE 3 (page 1 of 2)

993-1586.003

WATER QUALITY DATA-ROSSMAN MW-1

	Duth		F: 11	T 1							Total				
	Depth to		Field	Lab				Alkalinity			Kjeldahl	Nitrate+			Dissolved
	Water	Temperature	Conductivity	Conductivity	Field pH	Lab pH		(mg/L-	Ammonia	Nitrite	Nitrigen	Nitrite	Chloride	Sulfate	Iron
Date	(feet)	(C)	(umhos/cm)	(umhos/cm)	(su)	(su)	Color	CaCO3)	(mg/L-N)	(mg/L-N)	(mg/L-N)	(mg/L-N)	(mg/L)	(mg/L)	(mg/L)
9/22/81	23.7			460		10.3		88.4		0.094		0.1	110	9.4	< 0.05
10/27/81						8.4		144.63					96.5		
1/27/82	19.92			575		8.8		147.9		0.005		0.069	103	<4	0.02
5/5/82	18.28			510		8.9		98.6		0.013		0.051	136	<4	0.05
8/17/82	20.2			525		8.7		136.4		0.7		0.095	96.2	<1	0.12
10/13/83	20	12	396	450	9	9.2	15	51	1.03			< 0.02	100	4.9	0.52
2/2/84	20.2	12		468		9.1	10	52	1.1			0.46	130	5.3	< 0.05
6/13/84	16.5	14	565	590	8.4	8.3	<5	130	0.57			0.01	104	0.9	0.06

Source: Oregon Department of Environmental Quality Rossman Landfill Files

WATER QUALITY DATA-ROSSMAN MW-1

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									1 1		Total	Chemical	Total
		Dissolved	Total	Dissolved	Dissolved	Calcuated					Dissolved	Oxygen	Organic
	Total Iron	Manganese	Manganese	Calcium	Magnesium	Hardness	Sodium	Potassium		Boron	Solids	Demand	Carbon
Date	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	Zinc (mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L-C)
9/22/81				25.1	0.71		73.5	11.2	0.006	< 0.2	288	365	
10/27/81							73.1					13	
1/27/82				30.8	6.86		85.2	7.8	0.011	0.3	378	10	
5/5/82				15.9	7.04		75.9	11.5	< 0.005	< 0.2	258	<1	
8/17/82				30	8.23		72.3	8.64	0.008	< 0.2	366	8	
10/13/83				11	2.5	38						10	4
2/2/84	1.3	0.03	0.05	12	2.9	42						13	4
6/13/84	0.08	0.12	0.12	29	8.3	110						5	<1

Source: OrSource: Oregon Department of Environmental Quality Rossman Landfill Files

ESTIMATED GROUNDWATER VELOCITY AND 1-YEAR TRAVEL DISTANCE

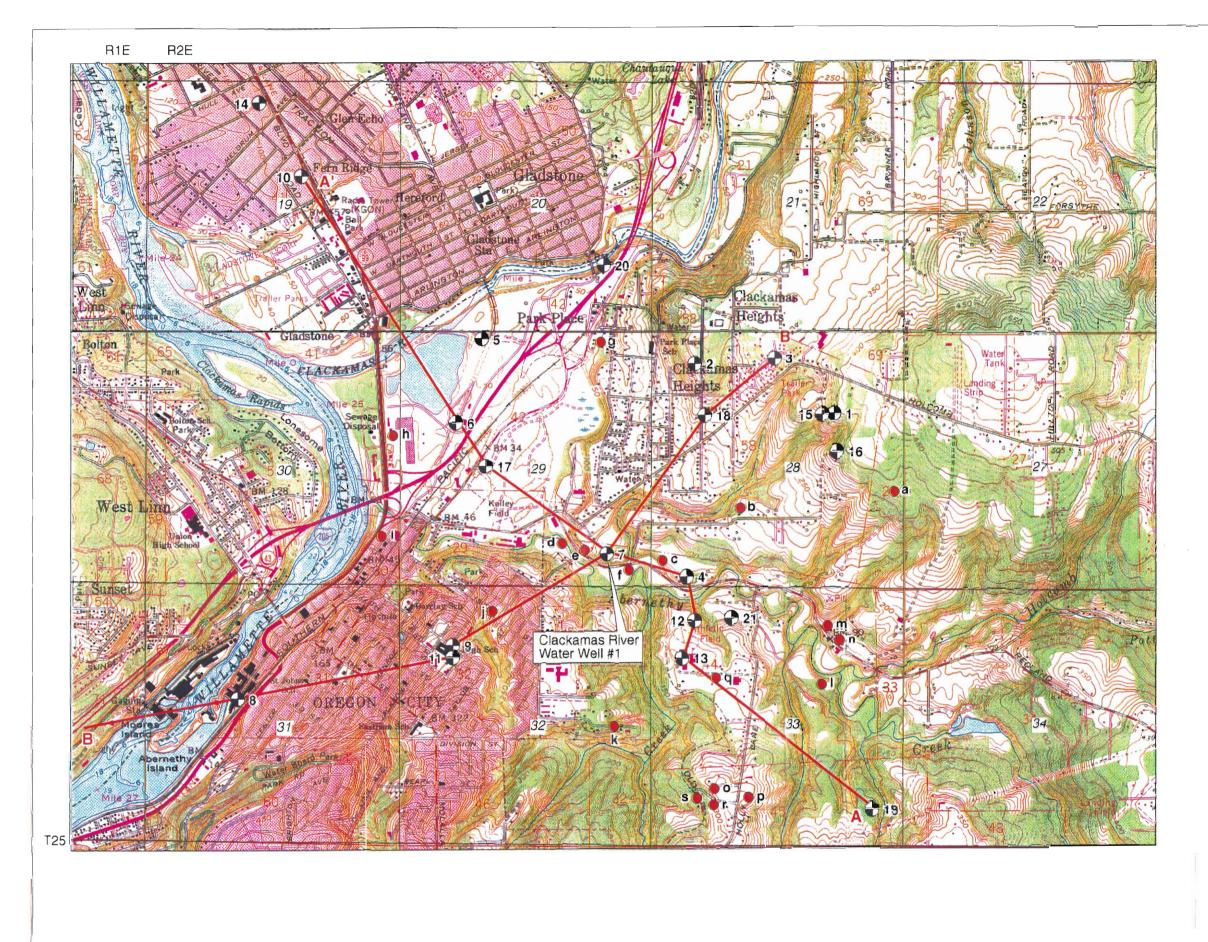
				1-Year
Hydraulic	Hydraulic	Effective		Travel
Conductivity ¹	Gradient	Porosity	Groundwater	distance
(ft/d)	(ft/ft)	(percent)	Velocity (ft/d)	(feet)
110	0.002	0.15	1.5	535
110	0.002	0.25	0.9	321
110	0.008	0.15	5.9	2141
110	0.008	0.25	3.5	1285
220	0.002	0.15	2.9	1071
220	0.002	0.25	1.8	642
220	0.008	0.15	11.7	4283
220	0.008	0.25	7.0	2570
440	0.002	0.15	5.9	2141
440	0.002	0.25	3.5	1285
440	0.008	0.15	23.5	8565
440	0.008	0.25	14.1	5139

Note

1. The hydraulic conductivity as estimated by dividing the transmissivity of $22,000 \text{ ft}^2/\text{d}$ by estimated interflow zone thicknesses of 50, 100, and 200 feet.

FIGURES

and the state of the



Source: USGS Oregon City and Gladstone, OR 7.5 Minute Quads, dated 1961.

PPOJECTINO 993 198 03 DRAWING NO 84960 DATE 2/10/2000 DRAWN BY EA

▲ Basalt well located to nearest 1/4-1/4 section. Number corresponds to inventory number (see Table 1 and Appendix A)

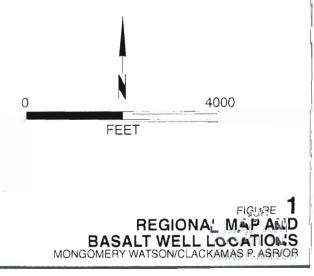
 Wells completed in sedimentary deposits located to nearest 1/4-1/4 section (see Table 2 and Appendix A)

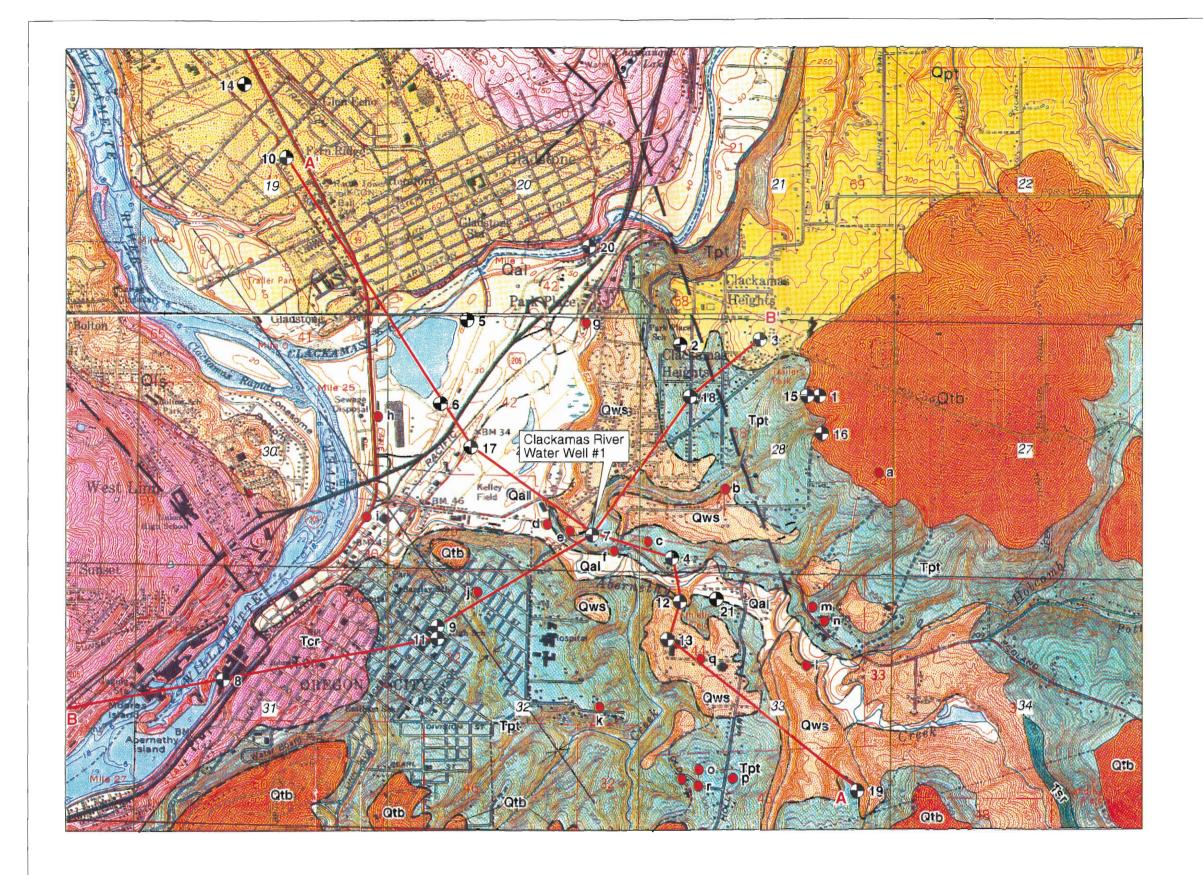
A A Geologic cross section

34 Section numbers

BASALT WELL INFORMATION

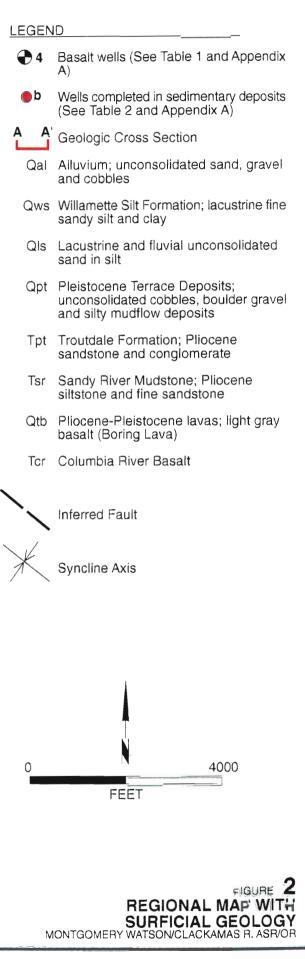
		Weil	Depth to	Depth to	Groundwater	
Мар		Depth	Basalt	Water	Elevation	Date of
Number	Well Owner	(feet)	(feet bgs)	(feet)	(feet amsi)	Measurement
1	Fernaer	520	372	400	-50	4/16/1976
2	Okita	522	203	307	-7	4/16/1976
2	Clackamas Housing	JEE	200	507		411011010
3	Authority	560	218	305	25	1/9/1963
4	Harrington	154	130	70	-20	4/24/1981
4	Willamette Falls	154	130	70	-20	472-471501
5	Sand and Gravel	340	139	21	9	6/18/1970
3	Sand and Glaver	340	139	13	3	2/26/1966
6	Oregon Ready Mix	248	176	13	17	8/31/99
0	Clairmont Water	240	170	15	17	0/0//38
7	District	560	299	69	16	8/17/1973
/	District	560	299	09	10	0/1//19/3
8	Publisher's Paper Co.	250	14	49	71	not available
	Oregon City Public					
9	Gehools	550	429	450	-205	1/10/1956
10	Skyles	203	113	82	8	12/2/1971
	Oregon City Public					
11	Schools	602	460	236	9	3/23/1967
12	Garvison	180	162	60	90	8/14/1956
	Oregon City Public					
13	Schools	578	469	165	25	3/4/1965
14	Pay 'n Pack Store	180	70	95	5	6/24/1976
15	Smith	455	317.0	390	-30.0	5/6/1977
16	Hayes	500	448.0	260	100.0	5/24/1995
17	Rossman Landfill	204	176.0	21	9.5	9/10/1984
	Park Place Water					
18	District 2	404	115.0	184	16.0	10/10/1967
19	Domreis	90	31.0	30	180.0	9/14/1966
	Oregon Conference	,,,				
20	of SDA	242	7.0	116	-86 0	5/8/1995
21	King	120	99	40	130	6/6/1966

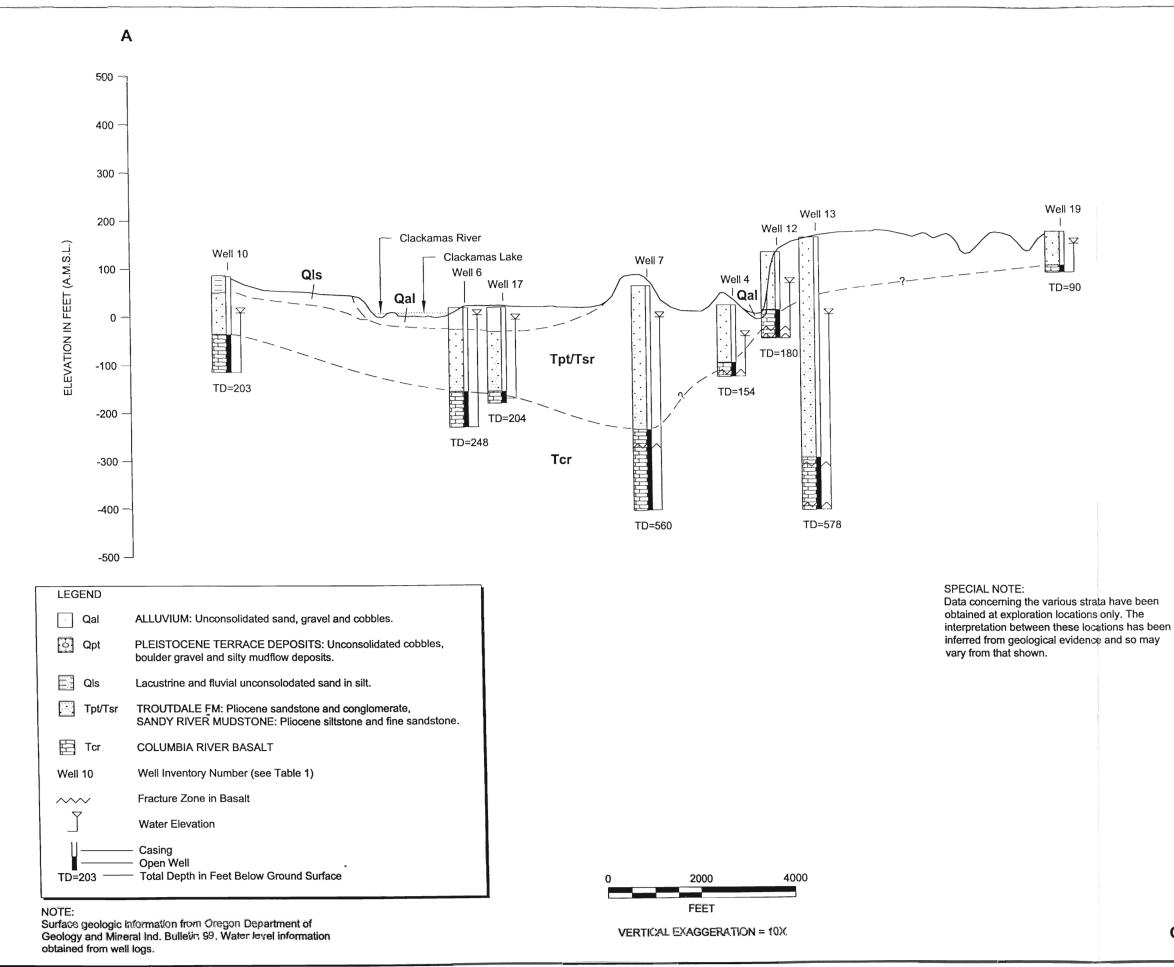




Source: Oregon State Department of Geology and Mineral Industries Bulletin 99.

PROJECT NO. 993 1586.003 DRAWING NO. 84981 DATE 2/10/2000 DRAWNIBY EA





J_SNOW|K:\CAD\SDSKPROJ9931586\003\89752.dwg|11-4-99 11:10|x:-|i:-

FIGURE **3** GEOLOGIC CROSS SECTION A-A' MW/CLACKAMAS RIVER WATER ASR/OR

A'

- 500

400

300

200

100

0

-100

-200

-300

-400

-500

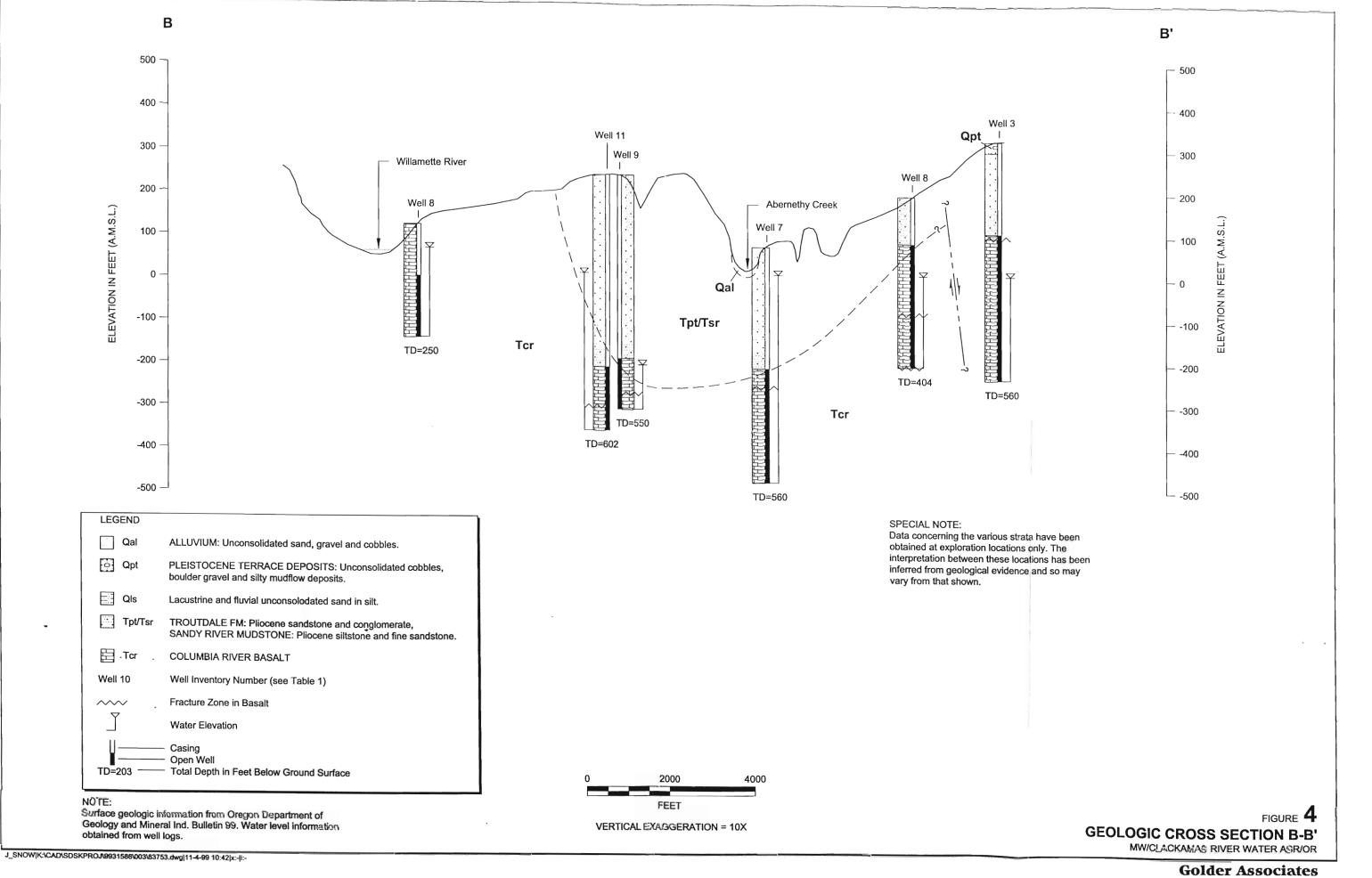
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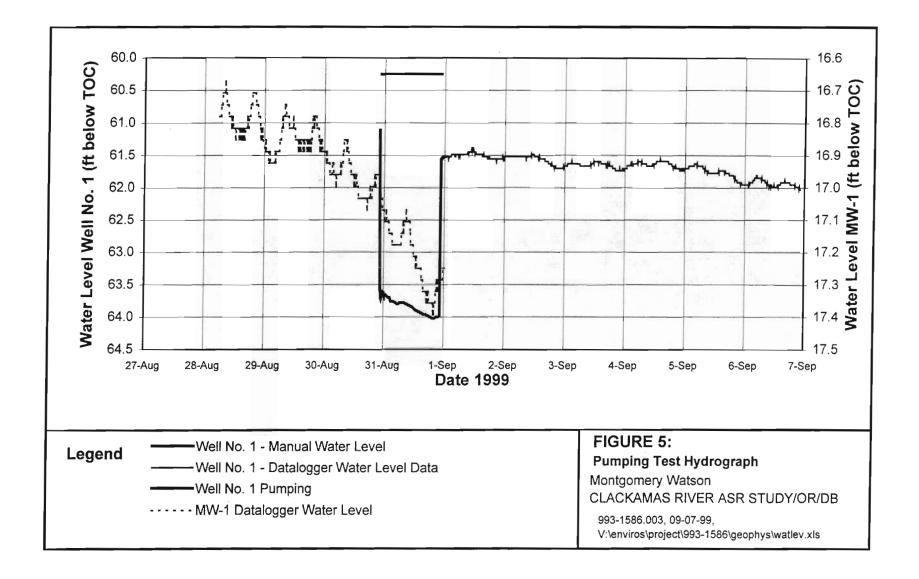
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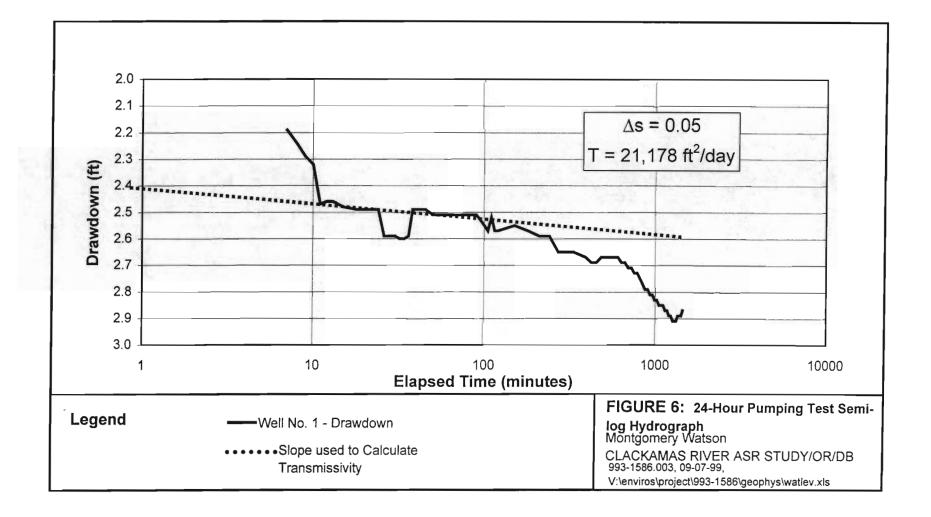
IN FEET

NO

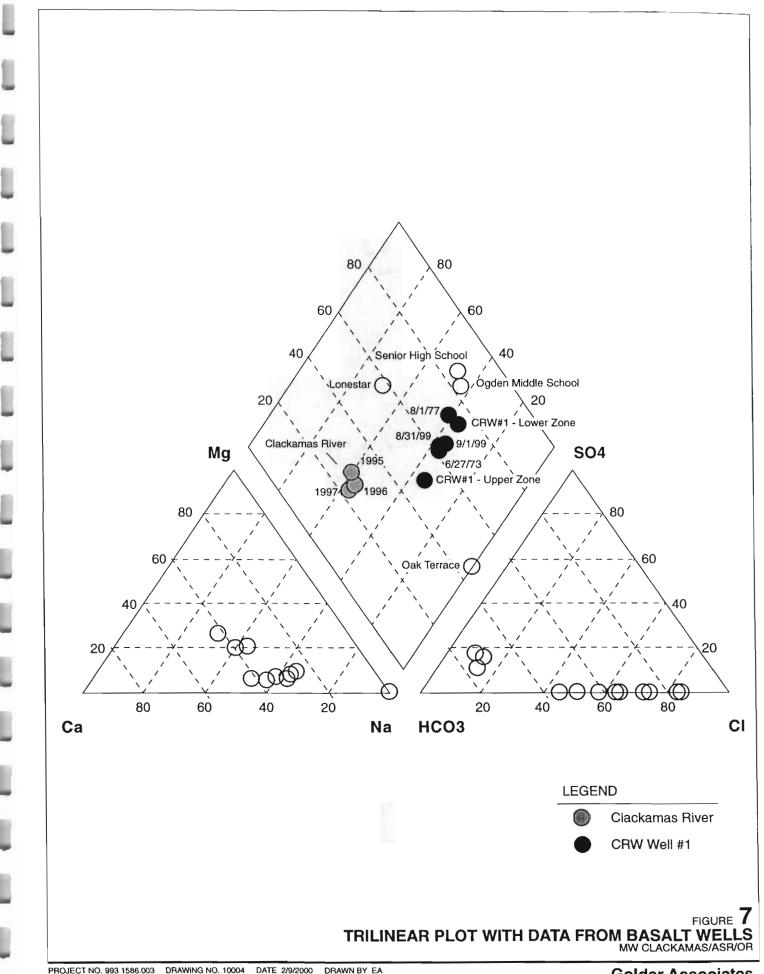
ELEVAT



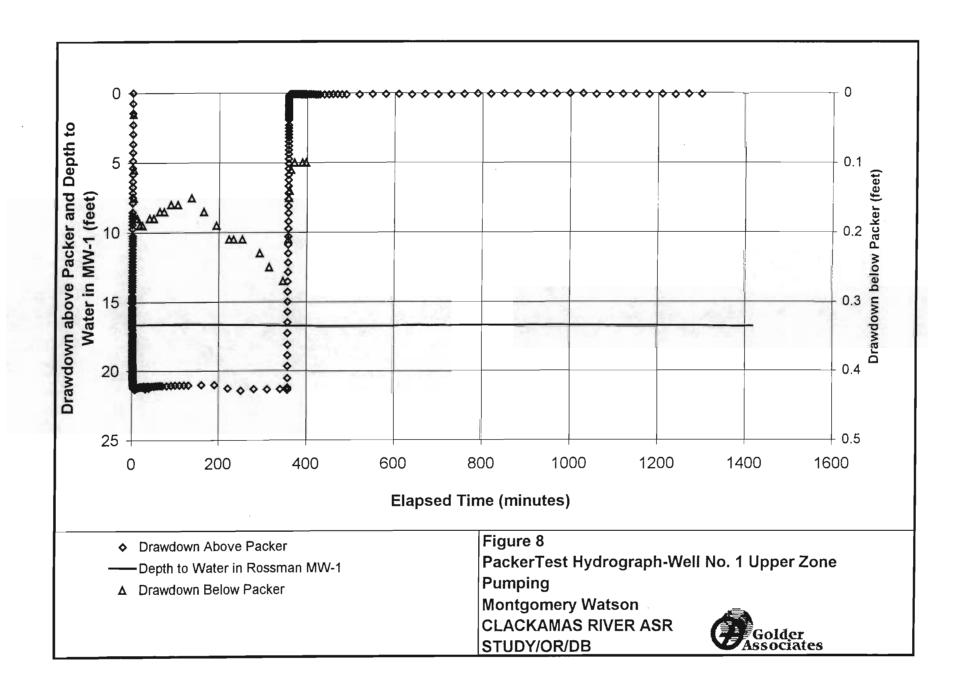


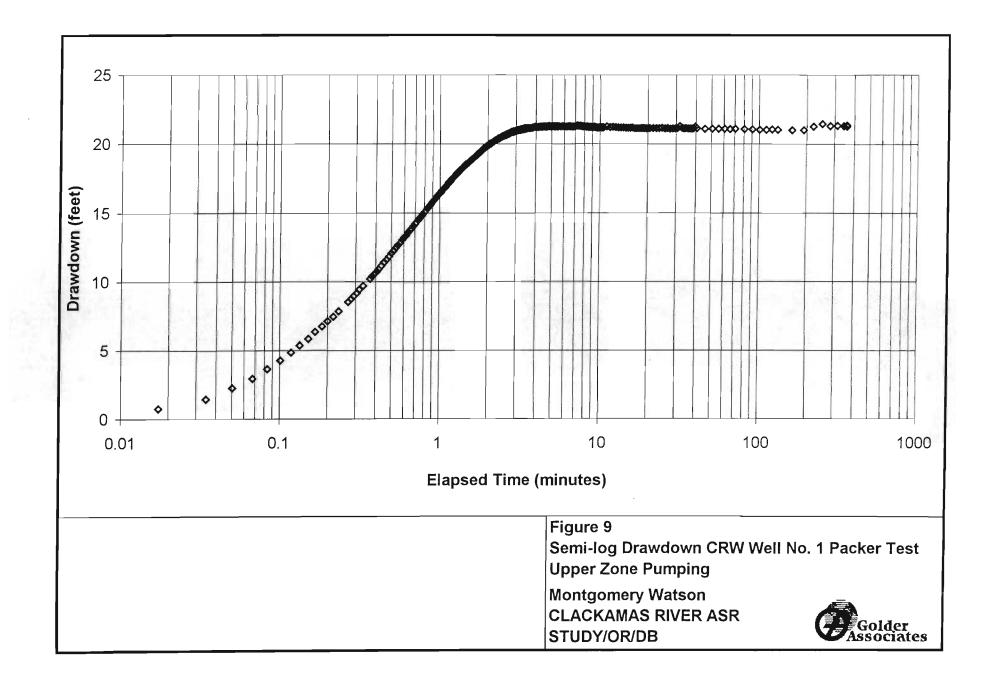


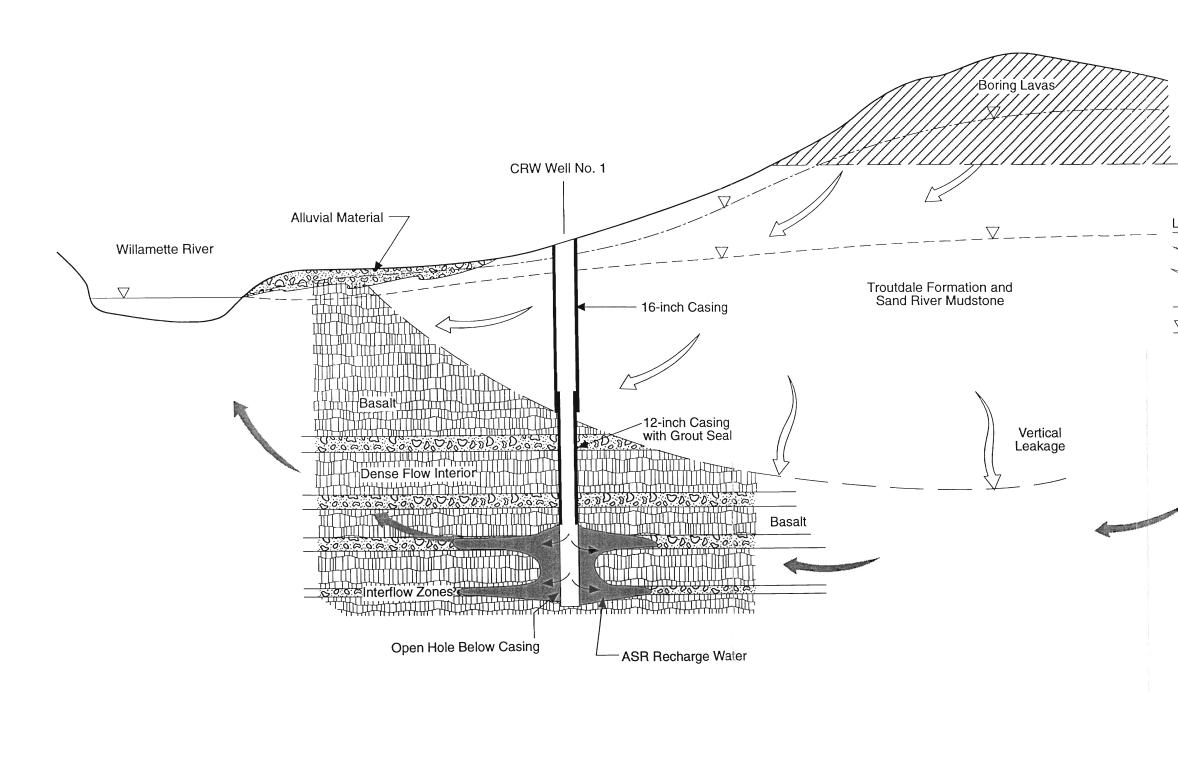
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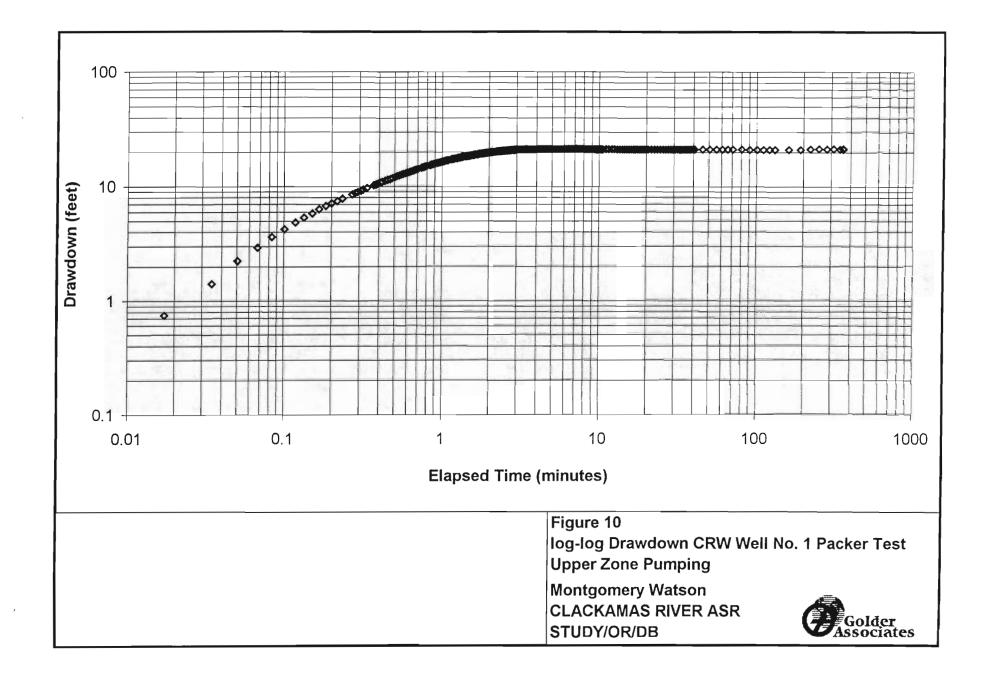


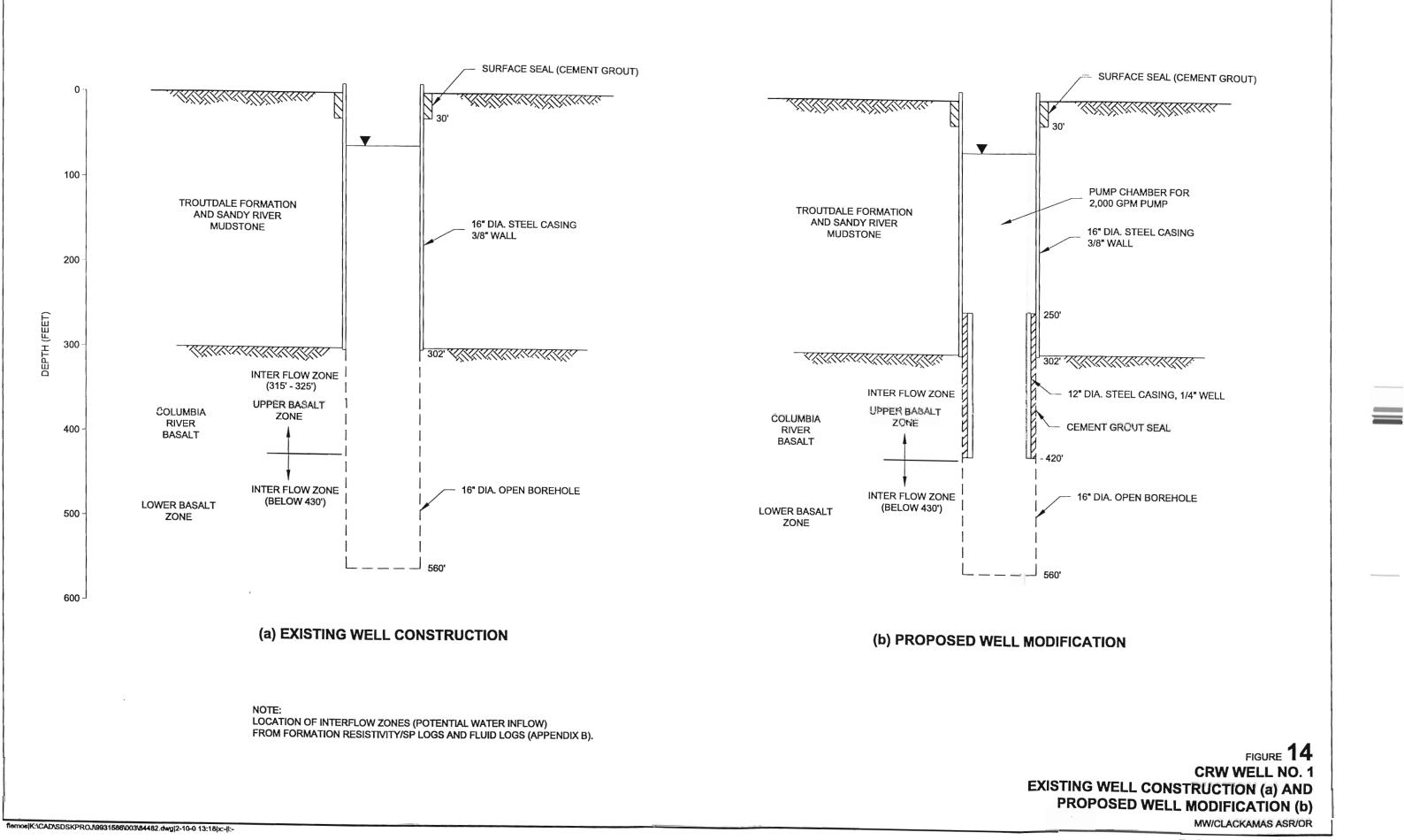


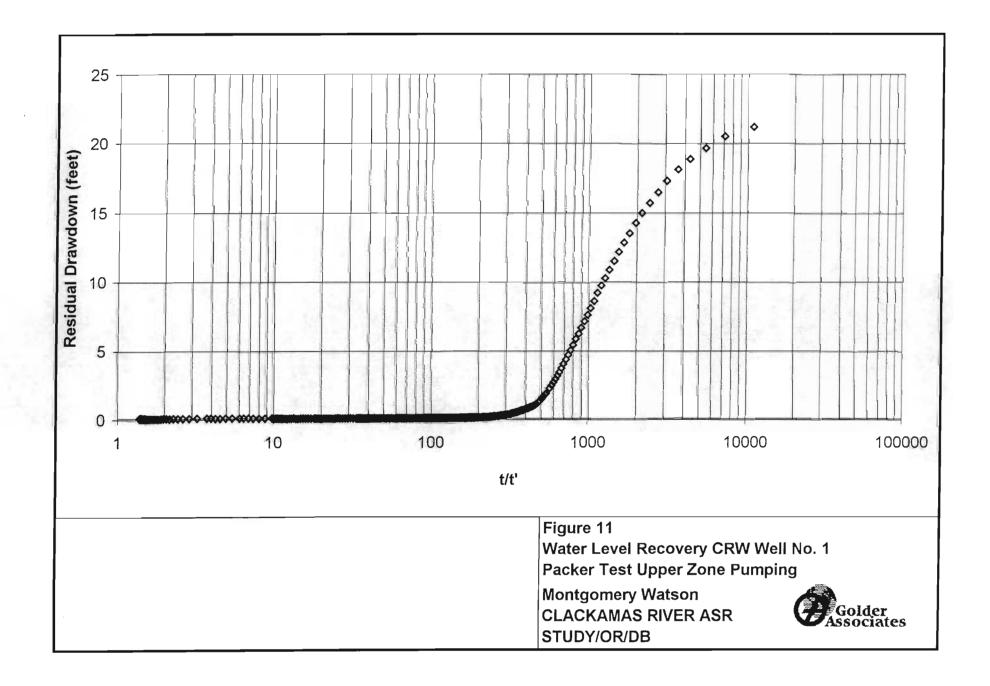
LEGEND

- Regional Groundwater Flow
- Local Groundwater Flow
- $_
 abla _$ Basalt Aquifer Potentiometric Surface
- \square Water Table









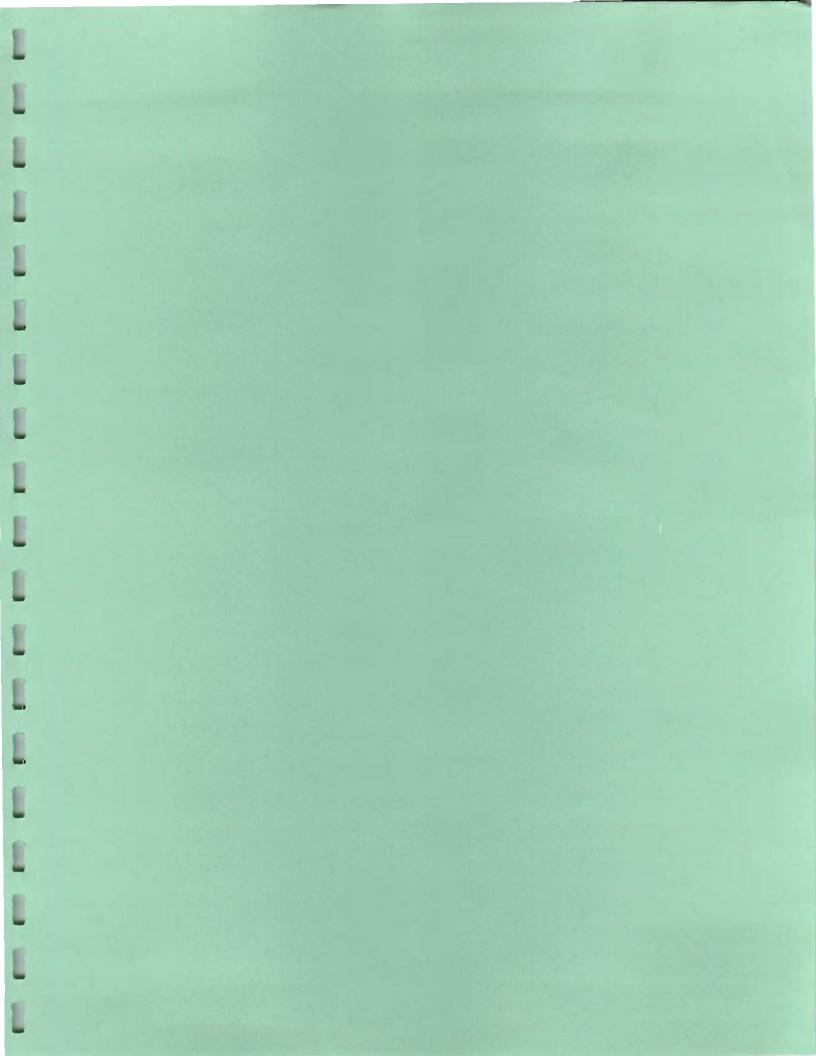
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APPENDIX A

WELL LOGS





NOTICE TO WATER WELL CONTRACTOR The original and first cond ECEIVEVATER WELL I of this report are to be DEC13 1971 STATE OF ORI	REPORT	12	-19	
filed with the DEC13 1971 STATE OF ORD	EGON GO State Well No. 2.	1-01		
BTATE ENGINEER, SALEM, OREGON 9700 within 30 days from the state TE ENGINEER of well completion. SALEM. OREGON mot write above	this line) Grate Permit No.			
	10) LOCATION OF WELL:			
	ounty GLACKAMASDriller's well num	ber		
	Carly Unathania			
Address 19215 S. E. McLOUGHLIN BLVD GLADSTONE, OREGON 97027				W.ML
(2) TYPE OF WORK (check):	caring and distance from section or subdivision	corner	• •	
New Well D Deepening Reconditioning Abandon				
		×		
	11) WATER LEVEL: Completed we	11. 7		
	Depth at which water was first found . I	, 		ft
Rotary B Driven Domestic B Industrial Municipal E	Static level 82 ft. below land su	face. I	Date 12	- 8-7
	Artesian pressure lbs. per square	inch. I	Date	
CASING INSTALLED: Threaded D Welded P			1	11
	(12) WELL LOG: Diameter of well be	low cas	ing 6	
	Depth drilled 203 ft. Depth of comple	ed well	20.	<u>} n</u>
	Formation: Describe color, texture, grain size an			
	and show thickness and nature of each stratum with at least one entry for each change of formati			
	position of Static Water Level and indicate princ			
Type of perforator used	MATERIAL	From	Ta	3WL
Size of perforations in. by in.		0	15	
	BROWN CLAY SANDY BROWN CLAY	1:5.	18	
perforations from ft. to ft	BOILDERS	18	36	
perforations from ft. to ft.	BROWN CLAY	36	39	
perforations from ft. to ft.	GRAVEL.	39	112	
(7) SCREENS: Well screen installed? Ves Vivo	BROWN CLAY	12	67	
Manufacturer's Name	- RED CLAY	67	76	
Type Model No	BROWN CLAY	76	86	
Diam Blot size Set from ft. to ft.	BED CLAY	86	97	
Diam Slot size Set from ft. to ft.	BROWN CLAY	97	113	
(8) WELL TESTS: Drawdown is amount water level is	BASALT, BLACK	113	11.5	
(6) WELL TESTS: lowered below static level	BASALT, OREY	145	169	L
Was a pump test made? QYes D No It yes, by whom? Drilley	BASALT, BLACK & POROUS 5gpm	169	178	
Yield: gal/min with ft. drawdown after hrs.	BASALT, BLACK	178	203	
65 - 118	BASALT, GREY	203		
. 46 . 78				
Bailer test 30 gal./min. with 38 ft. drawdown after hrs.			──	
L5				
Artesian flow				
The erature of water Depth artesian flow encountered ft.	Work started Nov. 21 1971 Comple	ed De		19
(9) CONSTRUCTION:	Date well drilling machine moved off of well	Dec.	2	19
8 T To colla 1 L	Drilling Machine Operator's Certification			
Well seal-Material used Matonice, of times	This well was constructed under my	dire.	ct supe	rvisi
Well sealed from land surface to	Materials used and information reported	l above	are tr	ue to
Diameter of well bore to bottom of seal, 10 in. Diameter of well bore below seal 718 + 16 in	best knowledge and bellet.	-	De-	10.5
Number of sacks of cement used in well seal sacks	[Signed Drilling Machine Operator)	Date	De	L.S.C., 19.
Number of sacks of bentonite used in well seal sacks	Drilling Machine Operator's License No.		271	
Brand name of bentonite Mattorial			/	
Number of pounds of bentonite per 100 gallons	Water Well Contractor's Certification:			
of water 100 lbs./100 gals.	This well was drilled under my juris	diction	and this	в герол
Was a drive shoe used? (Yes D No Plugs Size: location ft.	true to the best of my knowledge and b			
Did any strata contain unusable water? OXYes [] No	Name SKYLES DRILLING & SUPPLY (Pergon, firm or corporation)	L_TNC	(Type or	print)
Type of water antemioral appin of strata 47	AddressOLDSTONE, OREGON			
	La T	01	1	
Method of scaling strate of Prain (Pin 1 to ment			11:20	
Method of scaling strata off ("sping (Pin) + cement	[Signed] [Signed] (Water Well Co	5	×	
Method of scaling strata off (soing (fin) + cement Was well gravel packed?] Yes & No Size of gravel: Gravel placed from ft. to ft.	[Signed] (Water Well Co Contractor's License No58 Date	. //	Q_ 1	1

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6	
NOTICE TO WATER WELL CONTRACTOR The original and first copy of this report are to be - WATER WEL	LAC Showing 2/2-20
filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion. STATE OF (Please type	
(1) OWNER: Name Oregon Reddy Mix Address Melcoghlin Bludy (2) LOCATION OF WELL:	(11) WELL TESTS: Drawdown is amount water level is lowered below static level Was a pump test made? Yes □ No If yes, by whom? Yield: 50 gal./min. with 3.5 ft. drawdown after 4// hrs. - 100 - - 100 - Baller test 4 ○ gal./min. with 3.0 ft. drawdown after 2// hrs.
County (12(12)) Driller's well number <u>14</u> <u>14</u> Section .30 T. 7,5 R. 2 F. W.M. Bearing and distance from section or subdivision corner	Artesian flow g.p.m. Date Temperature of water Was a chemical analysis made? [] Yes [] No (12) WELL LOG: Diameter of well below casing Depth drilled 7 4 \$\forall tt.
	Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.
(3) TYPE OF WORK (check):	MATERIAL FROM TO
It	Lociety remented ordue) 18 45 water pedving 9 valued 45 54 blue eldy 54 130 Sand of clay water pering 130 135
(6) CASING INSTALLED: Threaded Welded 	soft Lova rock with day 160 176 Sedurs, Land rock, 176 193 soft Land water pearing 193 230 hard hava rock 230 248
Type of perforator used Size of perforations in. by	
(8) SCREENS: Well screen installed? Yes No Manufacturer's Name	
Diam. Slot size Set from ft. to ft Diam. Slot size Set from ft. to ft Of am. Slot size Set from ft. to ft (9) CONSTRUCTION: Conjuting from ft ft	Work started Jd1 1966 Completed Feb 26 1964 Date well drilling machine moved off of well Ach 25 1964 (13) PUMP:
Well seal—Material used in seal <u>DECYCC</u> Depth of seal <u>III</u> <u>III</u> tt. Was a packer used? Diameter of well bore to bottom of seal <u>IIII</u> in. Were any loose strata cemented off? <u>Yes</u> <u>ONO</u> <u>Depth</u> Was a drive shoe used? <u>Yes</u> <u>No</u>	Water Well Contractor's Certification:
Was a drive shoe discurpt res 100 Size of gravel; Was well gravel packed? Yes 100 Gravel placed from ft. 10 Did any strata contain unusable water? Yes No Type of water? Yr. depth of strata SO	I true to the best of my knowledge and belief
Method of sealing strata off (1.16) (10) WATER LEVELS:	= Drilling Machine Operator's License No 245 (Signed) (Water Wett Contractor)
Artesian pressure lbs. per square inch Date (USE ADDITIONA	_ Contractor's License No Q. Date _ Md. V. Ch. 19.6

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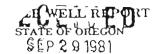
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Name Possmans Land Pill Ox 149

(2) TYPE OF WORK (check):

WATER RESOURCES DEPT (1) OWNER OREGON

Address F.C.

<u>city Creson "ity</u>

State Well No

State Permit No.

*0	und later]	onitori
	(10) LOCAT County 'la	TON OF W
		14 Section
State Cr.	Tax Lot #	
	Address at well k	cation: n
	movt to	Topyuc

New Well Deepening 🗆 Reconditioning 🗆 Abandon 🛛

11 abandonment, describe mate (3) TYPE OF WELI	trial and procedure in Item 12 (4) PROPOSED USE (check):
Rotary Air XI Driven () R Mud () Dug () C. () Bored ()	Domestic Industrial Municipal Irrigation Test Well Other 2 Thermal: Withdrawal Reinjection
Diam from	Threaded D Welded 204 ft Gauge Sch 40 ft to ft Gauge
Type of perforator used	
Size of perforations	in by in
	perforations from ft_ to ft perforations from ft_ to ft perforations from ft_ to ft
	Well acroen installed? 🖾 Yes 🗆 No

(8)	VELL TESTS	:		wn is amo	unt water	level in	s lowered	
Diam		Slot Size		Set from		ft. to .	f	2
Diam.	2	Slot Size	040	Set from	194	. ft. to	204 1	t
Туре	Lachine	slo	t		Model	No		
Manuf	acturer's Name	PVC 1	Hydr	ophil	Lic			

a pump test made? I Yes I No If yes, by whom? Yield: gal/min. with ft. drawdown after hrs. " gal Jmin. with drill stem at Air test ro ft hrs. Bailer test gal Jmin with It. drawdown after hrs. sian Now g.p.m. Depth artesian flow encountered ft. Temperature of water

(9) CONSTRUCTION: Special standards: Yes D No D Well seal-Material used <u>Cement</u> Well sealed from land surface to <u>178</u> Diameter of well bore to bottom of seal in. How was cement grout placed? ______ DUmDed

Was pump installed?	no	т	уре	HP.	Depth	
Was a drive shoe used? Did any strata contain	ti Yes	□ No	Plugs			
Type of Water?		d.	pth of st	rata		
Method of sealing strain	ta off				1215-116	
Was well gravel packed	? CI Ye	No No		Siz	e of gravel: Sin.	1

IL to 2014 Gravel placed from 179 NOTICE TO WATER WELL CONTRACTOR The original and first copy of this report are to be filed with the

Intern Consistor		i	1	(n)	
later : onitor	<u>:1n:</u>	<u>. ert "</u>	1		
10) LOCATION OF		L:			
ounty 'lackamas	5	Driller's well	number	J	
K K Secti	on 29	<u>т.</u> 2s	<u>r</u> 2e		W.M
ax Lot #	Lot	Bik	Sut	division	
ddress at well location:	none	2			
next to Terry	s bur	cer on	lash	instor	ı St
11) WATER LEVE	L: Cor	npleted w	vell.		
Depth at which water was first		26			ft
Static level 20,5		ft. below	land surfac	e. Date 9-	-108
Artesian pressure			er square is		
(12) WELLLOG:	Diamet	er of well below	cauing	6	

Depth drilled 204 ft. Depth of completed well 2014 ft Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL.
Soil med brn	0	1	
lay silty med brn	1	26	
ravel med sand brn	26	<u>1</u> i8	··· ·
ravel med gray	48	51	
Clay silty blue	51	85	
Clay silty brn	85	114	
Clay med red	114	125	
Clay med brn	125	143	
Clay med brn, blue strks	143	155	
Clay med brn arn strks	155	178	
Easalt med brn, green	178	190	
Easalt hrd gray	190	204	
	1		
	1		
Work started 7-29 19 81 Compl	eted 8	-4	198
Date well drilling machine moved off of well 8-			198

Drilling Machine Operator's Certification;

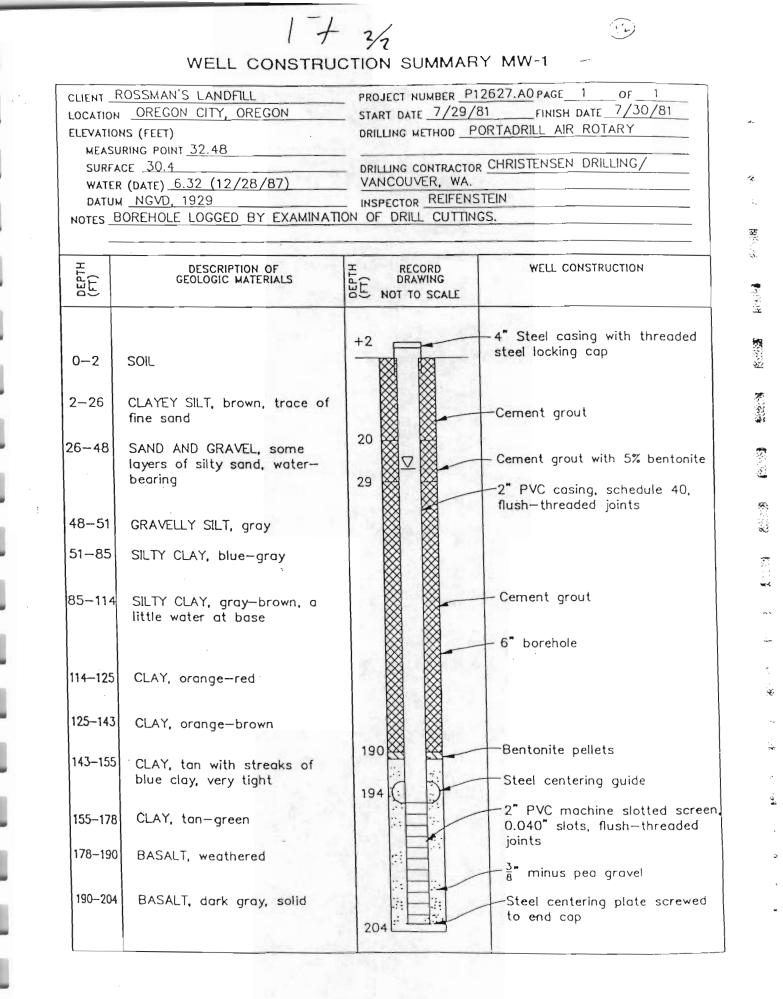
This well was constructed underfly direct supervision. Materials user and information reported above official or my best knowledge and belief. Date 9-4 19.81 hund (Signed) .1 Drilling

Water Well Contractor's Certification: This well was drilled under my jurisdiction and this report is true to

This well was diffice there into juliacheeron a	in tim toport -
he best of my knowledge and belief.	
Name lest Oast Drillin fo	Ir:C.
(Person, firm or corporation)	(Type or print)
Address , ty in cl, Ur. 047	3

(Signed) Chaple Tedel. Contractor's License No. 519 Date 9-4 1981

WATER RESOURCES DEPARTMENT, SALEM, ORECON 97310 within 30 days from the date of well completion.



RECEIVED ALOUNC 12-17-65 NOTICE TO WATER WELL CONTRACTOR WATER WELL REPORT SEP 1 3 1973 tate Well No. 753 The original and first copy of this report are to be ELAC filed with the STATE ENGINEERie Permit No. STATE ENGINEER, SALEM, ORECAN 97910 (Please type or print) within 30 days from the date 04396 (Do not write above this line) SALEM, OREGON of well completion. (1) OWNER: (10) LOCATION OF WELL: CLAIEMONT WATER County CLACK Driller's well number Name SET NWW 14 Section C T. 2.5 R. 3 Bearing and distance from section or subdivision corner 5. HEPRICI Address 15223 ORFRED CITY (2) TYPE OF WORK (check): · · · 11 - 16-5-24 - 11.6.1 - 6 - 6-6. We water 17-Deepening [] Reconditioning [] New Well Abandon [] If abandonment, describe material and procedure in Item 12. (11) WATER LEVEL: Completed well. (3) TYPE OF WELL: (4) PROPOSED USE (check): 315 Depth at which water was first found Driven D Rotary 9 ft. below land sulface. Dato Domestic [] Industrial [] Municipal Static level Jotted D Cable 6 Bored [] Irrigation [] Test Well [] Other Tos. per square inch. Date D Artesian pressure Dug CASING INSTALLED; Threaded D Welded be (12) WELL LOG: Diameter of well below casing __ 16 " Diam from + 2 A. 10 302 H. Gage 1375 560 ft. Depth of completed well Depth drilled 60 8 " Diam. from _____ Formation: Describe color, texture, grain size and structure of materials; 47 ft. Gage . " Diam. from tt. to . and thow thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in PERFORATIONS: position of Static Water Level and indicate principal water-bearing strata. Perforated? [] Yes XNo. MATERIAL From SWL Type of perforator used In by the second ROWN (LAY 41 ð Size of perforations 41 76 PACKED BROWN SAND. ___ perforations from ____ 74 192 BLUE AND GREY LIAY ft to _. ___ perforations from ____ RED AND BROWN CLAYSTOCK 192 219 perforations from --tt: to _ 299 301 DECCHAROSED ROCK (7) SCREENS: 315 Well screen installed? [] Yes W No 301 BLACK BASALT Manufacturer's Name . -32:A ORDUS GREY BASAUT 315 Model No. Type 32.4 333 MED. HARD BLACK BASALT in to - 11 BROKEN GREY BASKIT 333 342 Diam. _____ Blot size _____ Bet from ____ HARD BLACK BASALT 342 371 BLACK HASAS 374 522 HARD MED Drawdown is amount water level is lowered below static level (8) WELL TESTS: MED SOFT BLACK BASALT 382 39 Was a plimp lest made? WYCS DNo 11 yes. by whom? STRASSER 397 402 HED HARD BLACK BASA 3150 gal/min. with 160 12 drawdown after 24 HARD BLACK BASACT 1/03 425 MED HARD BLACKBASS r 4/2 2 14,7 - as a region card of pract 462 The second second second second second GRET BASALT 48 157-500 PRECUS BLACK BASACT gal./min. with ft. drawdown Bailer test HARD BLACK BASALT 550 550 A. 41 24 = 10. 41 2 . 10. Artedan flow 8.p.m. Work started APR 1.3 1973 completed AUG 251873 AUG 26 197. Date well drilling machine moved off of well (9) CONSTRUCTION: Drilling Machine Operator's Certification: CEMENT Well scal-Material used ____ This well was constructed under my direct supervision 30 Well sealed from land surface to _ Materials used and information reported above are true to my best knowledge and belief. Dismeter of well bore to bottom of seal ... [Signed] [A. for Angen Date 9/10 1973 Dlumeter of well bore below seal ______ in Number of sacks of cement used in well seal _____SB Drilling Machine Operator's License No. Number of sacks of bentonite used in well seal Brand name of bentonic _____ Water Well Contractor's Certification: Number of pounds of bentonile per 100 gallons This well was drilled under my jurisdiction and this report of water __ 1bs./100 gals. true to the best of my knowledge and heliof. Was a drive above used! XYou DNo Plugs ___ Size: locetion ____ ft. STRASSER DRILLING Name .K.~ Did any strata contain unusable water! D Yes X No (Person, firm or corporation) Type of water? depth of strata Address SILOSE SUNSET LAKE GRYLAN Method of scaling sires off 1.1.0 [SIgned] WAR well grovel packed. IT Yes So Slie of grovel: Contractor's License No. 10 Date SENT 10

WATER WELL REPORT

RECEITED SLALE Well No 25/ SE-28 CO MAY 20 1931 STATE OF OREGON 40 0438 BR RESOURCES DEPT MC State Permit No. SALEM. OREGON (10) LOCATION OF WELL: (1) OWNER: Name Patrick Harrington Driller's well number 1581 County Clackamas Address 14161 S. Redland Rd. SW 4 SW 4 Section 28 T.2.5 <u>R</u> 2E WN city Oregon City Oregon Tax Lot # Lot Blk Subdivision State Address at well location: 14161 S. Redland Rd (2) TYPE OF WORK (check): Oregon City, Oregon 97045 New Well 🗺 Deepening [] Reconditioning [] Abandon D (11) WATER LEVEL: Completed well. If abandonment, describe material and procedure in Item 12. Depth at which water was first found 142 (3) TYPE OF WELL: (4) PROPOSED USE (check): Static level Q ft. below land surface. Date4-24-Rotary Air Driven D Domentic CX Industrial D Municipal O lbs. per square inch. Date Artesian pressure Rotary Mud 🗋 Dug Irrigation Test Well D Other 0 Π Bored \square Thermal Withdrawal Reinjection 0 (12) WELLLOG: ft. Depth of completed well 154 f Depth drilled 154 (5) CASING INSTALLED: Steel Plastic CX Formation: Describe color, texture, grain size and structure of materials; and sho Welded Threaded Sx thickness and nature of each stratum and aquifer penetrated, with at least one entr for each change of formation. Report each change in position of Static Water Leve and indicate principal water-bearing strats. LINER INSTALLED: MATERIAL. From Τo SWL Soil 0 2 Clay Brown 2 16 (6) PERFORATIONS: Perforated? D Yes X No Gravel Med 16 18 Type of perforator used Clay Grey 18 25 Size of perforations in by in. Clay Brown w/small grave 25 29 Clay blue silty 29 51 Clay grey silty 51 85 Clay binue 85 94 (7) SCREENS: Well screen installed? [] Yes OxNo Clay grey silty 94 105 Manufacturer's Name Clay grey 105 123 Clay grey silty 123 130 . Basalt black 130 142 Diam. Basalt black fractured 142 154 70 -Drawdown is amount water level is lowered (8) WELL TESTS: below static level * a pump test made? [] Yes [XNo If yes, by whom? gal/min_with ft. drawdown after hrs. "75 gal/min. with drill stem at 154' Airtest 20 gal/min. with drill stem at 80 ft. 1 hrs. Bailer test gal Jmin. with ft. drawdown after hrs. wian flow g.p.m. ...perature of water Depth artesian flow encountered ft. Work started 4-23-81 4-24-198 19 Completed (9) CONSTRUCTION: Special standards: Yes 🗆 No 🖄 Date well drilling machine moved off of well 198 ' 4-24 Well seal-Material used Cement 5% Bentonite Drilling Machine Operator's Certification: Well scaled from land surface to ______18_______ft_ This well was constructed under my direct supervision. Materials use Drilling Machine Operator's License No. 224 Water Well Contractor's Certification: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Name Sky Les. Drilling. & Supply ... Inc. Was a drive aboe used? 💢 Yes 🗆 No Plugs Size: location ft. Address 1169 Molalla Ave. Oregon City, Ore. Did any strata contain unusable water? 🖸 Yes 📿 No____ Type of Water? depth of strata ٨ Styl-(Signed) Method of sealing strata off all Contra Contractor's License No.5.53 Date 4 - 2 4 19.81 Was well gravel packed? () Yes GeNo Size of gravel: WATER RESOURCES DEPARTMENT. 9P*12658-69 NOTICE TO WATER WELL CONTRACTOR The original and first copy of this report SALEM, OREGON \$7310 are to be filed with the within 30 days from the date of well completion

ORIGINAL	12	
ORIGINAL File Original, and L. A. C. C. 4430ATER Duplicate with the L. A. C. C. 4430ATER STATE ENGINEER. SALEM. OREGON	STATE OF ORE	
(1) OWNER:		(10) WELL TESTS: (32),
Name Jim Garvison		Was a pump test made? ZYes O No If yes, by whom? Driller
Address / /	1.184.28	Yield: 100 gal./min. with 56 ft. draw down after 8 hi
OF AND THE OP INC	1.5	H H H
(2) LOCATION OF WELL:		u u u
County Clack and Owner's number. if any-		Artesian flow
R. F. D. or Street No.		Shut-in pressure lbs, per square inch.
Bearing and distance from section or subdivision corner		Bailer test g.p.m. with ft. drawdow Temperature of water 52 Was a chemical analysis made? Yes N
NW 1/4 NW 1/4 B Sec 33 T 2 9	R. ZE WM.	Was electric log made of well? Yes No
		(11) WELLLOG:
		Diameter of well, 6 inches.
(3) TYPE OF WORK (check):	Contraction and	Total depth 180 ft. Depth of completed well 180
New well Deepening Reconditioning		100
If abandonment, describe material and procedure in Item		Formation: Describe by color, character, size of material and structure, an show thickness of aquifers and the kind and nature of the material in eau stratum penetrated, with at least one entry for each change of formatio
	EQUIPMENT:	85 m. to 150 m. Blue clay
	able 🖸	150 " 162 " Blue clay & sand mixed ;
ITTIGRIAN I. Test Well D Other D	ug Well	162 <u>163</u> Broken basalt
(6) CASING INSTALLED:		1632" 165 " Solid baselt
Threaded D Welded D	ravel packed	165 " 168 " Broken basalt <-
Gage	r from to	<u>168 " 174 " Solid basalt</u> 174 " 180 " Broken basalt ←
FROM BUL to LOUZIL O'Diam. Wall of Bore	ft_ft_ft_	" "
		Water from broken basalt area. Fine sand
		Dead' static "60 ft.
		RECEIVED
	и и	
Type and size of shoe or well ring Size of	gravel:	JUN 2 0,1977
Describe joint Butt Weld	11	
") PERFORATIONS:		THATER RESOURCES DEPT.
) of perforator used		SALEM. CESCON
SIZE of perforations in., length, b	y in	RECEIVED
FROM ft. to ft. perf per foot	No. of rows	KEUEIVEU
······		FEB - 21977
· · · · · · · · · · · · · · · · · · ·		
· · · · · · · · · · · · · · · · · · ·		WATER RESOURCES DEPT
		SALEM, OREGON
SCREENS: Give Manufacturer's Name, Model No. and Size	e	
(0) CONSTRUCTION:		
Was a surface sanitary seal provided? [] Yes [] No To	What denth	
were any strata sealed against pollutions of at	o what depth fl.	
FROM		Ground elevation at well site feet above mean sea leve Work started Aug. 14 1956. Completed Aug/ 28 19.5
H		
METHOD OF SEALING		Well Driller's Statement: This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
(9) WATER LEVELS:		in and the start of the start o
Depth at which water was first found		NAME John W. Beck Well Drilling (Person, firm, or corporation) (Typed or printed)
Standing level before performe	50 n	the printed (
Standing level after perforating no perforat	the second se	DOX 40, Canov, Ore,
Log Accepted by:	tions n	
[Signed]	-77 54	(Signed) JAN 11 13: The
Owner Dated	10.14	License No 95 (Well Driller)

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CLAC 12		04431		
NOTICE TO WATER WELL CONTRACTOR .(The original and first copy of this report are to be	ECEPVE WATER WEL	L REPORT $\frac{39}{2/2}$	3300	4
filed with the constant STATE ENGINEER, SALEM, OREGON 97940 - within 30 days from the date of well completion.	STATE OP.		2-1 1	5
(1) OWNER:		(11) WELL TESTS: Drawdown is amount w lowered below static lev	ater level 1	S
Name (OREGON (ITY	PUBLIC Scheers	Was a pump test made? A Yes D No If yes, by whom?	DRILLIN	$\dot{c} \in (c)$
Address CIREGON' CITY	ORE,	Yield: 24,5 gal./mln. with 13/ ft. drawdown	a after =	hrs.
(2) LOCATION OF WELL:		- 255 - 92 -		1/2
County CLACK. Driller's well	number 4189	Baller test gal./min. with ft. drawdow Artesian flow g.p.m. Date	vn after	hrs.
14 14 Section 33 T.	25 R. 2E W.M.	Temperature of water 37 Was a chemical analysis m	ade? Xe	s No
Bearing and distance from section or subdivisi	on comer	(12) WELL LOG: Diameter of well below ca	sing	$\overline{\mathcal{V}}$
		Depth drilled 578 ft. Depth of completed we	u 57	78 _{ft.}
		Formation: Describe by color, character, size of material show thickness of aquifiers and the kind and nature of t stratum penetrated, with at least one entry for each cl	l and struct the materia lange of fo	ture, and I in each prmation.
		MATERIAL	FROM	TO
(3) TYPE OF WORK (check): Well D Deepening Reconv	ditioning Abandon O	BROWN CLAY AND SAFD	0	20
If abandonment, describe material and proceed		SANDY CLAY (BROWN) SANDY (LAY (BLUE)	20	<u>90</u> 123
(4) PROPOSED USE (check):	(5) TYPE OF WELL:	SANDY (LAY (GREY)	173	130
Domestic 📋 Industrial 📋 Municipal 📋	Rotary Driven D	BROWN JAROSTONIZ	130	135
Irrigation [] Test Well [] Other 🛛 🕱	Cable S Jetted Dug Bored	SANDY (LAY (GREY)	135	148
(6) CASING INSTALLED: Three	aded [] Welded	GREY AND BLUE SUCKY CIA	148	<u> </u>
16- Diam. from 0 ft. to	186 the Gage 312	GREY JANDY CLAY	320	336
/ 2. " Diam. from ft. to	472 th. Gage 330	REDDISH BROWN (LAY	336	435
Diam. from ft. to	ft. Gage	GREY CEMENTED GARAVEL	435	40 <u>5</u> 469
(7) PERFORATIONS: Perf	forated? Ves No	FRACTURED BROWN ROCK	469	473 *
Type of perforator used	in.	HARD BROWN ROCK	473	494
perforations from	ft. to ft.	- AROWN ROCK	507	507
	ft. to ft.	HARD BLACK ROCK	520	567
perforations from		- DARK RED BROKEN Rock	-	57: "
perforations from		HARD BLACK POCK	572	- 3./8
(8) SCREENS: Well screen in	stalled? I Yes XNo			
Manufacturer's Name	1.			
2		1		
Diam Slot size Set from Diam Slot size Set from		Work started NOV. 3019 4 Completed	MAR :	26 19 6
(9) CONSTRUCTION:		Date well drilling machine moved off of well MA	<u>RJ30</u>	19 [1]
Well seal-Material used in seal	MENT GROUT	(13) PUMP:		
Well seal—Material used in seal (L) Depth of seal 26 ft. Was	a packer used? NO	Manufacturer's Name		
Diameter of well bore to bottom of seal	6 -	Туре:	H.P	
Were any loose strata cemented off? [] Yes	Depth	Water Well Contractor's Certification:		
Was a drive shoe used? XYes 🗆 No Was well gravel packed? 🗆 Yes 🗙 No	Size of gravel:	This well was drilled under my jurisdiction true to the best of my knowledge and belief.	a and this	s report is
Gravel placed from		NAME R.J. STRASSER DRILL (Person, tim or corporation)	NG	(o .
Dld any strata contain unusuable water? (D Yes XNO	Address SIIOSE SUDJET LAND	Type or pru	nt) A ADO CA
Type of water? depth of Method of sealing strata off	of strata			
(10) WATER LEVELS:		Drilling Machine Operator's License No.	,6 A	00 51
11-	alili	5 [Signed] Actint & Marsh		
	land surface Date $2/4/4$ square inch Date	(Water Well Contractor's License No	PR 1	1965
		SHEETS IF NECESSARY)		
	THIS TO A PRIMA PARTY			

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CLAC 19	
NOTICE TO WATER WELL CONTRACTOR The original and first copy of this report are to be filed with the STATE ENGINEER. SALEM, OREGON 97310 within 30 days from the date of well completion. WATER: WELL STATE OF (Please type)	OREGON State Well No.
1) OWNER:	(11) WELL TESTS: Drawdown is amount water level is lowered below static level
Tame Norman Domrats	Was a pump test made? [] Yes (I No If yes, by whom?
Address 12312 S. E. Merrill Drive	Yield: gal./min. with ft. drawdown after hrs
Portland, Oregon	
(2) LOCATION OF WELL:	
County Clackamas Driller's well number 57-63 SE 14 SE 14 Section 33 T. 25 R. 2E W.M.	Bailer test LO gal./min. with 20 ft. drawdown after 1 hrs. Artesian flow g.p.m. Date Temperature of water 53° Was a chemical analysis made? Yes Xo
Bearing and distance from section or subdivision corner	(12) WELL LOG: Diameter of well below casingin.
	Depth drilled 90 ft. Depth of completed well 90 ft.
	Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each
	show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.
	MATERIAL FROM TO
(3) TYPE OF WORK (check):	
Norw Well Deepening Reconditioning Abandon	
sundonment, describe material and procedure in Item 12.	Rock, soft grey 31 36
	Rock, bard grey
(4) PROPOSED USE (check): (5) TYPE OF WELL:	Rock, decomposed, brown 146,50
Domestic d'Industrial D Municipal D Cable T Jetted D	Rock, soft red 50 55
Irrigation] Test Well] Other Dug Bored]	Rock, hard grey 55-3 67
(6) CASING INSTALLED: Threaded To Welded to	Rock, soft grey, yellow clay seams 67 83
(6) CASING INSTALLED: Threaded □ Welded © 	Clay, yellow 83 86
Diam. from ft. to ft. Gage	Rock, grey, medium hard 86- 90
(7) PERFORATIONS: Perforated: D Yes & No	All water coming in below 30 ft.
Type of perforator used	
Size of perforations in. by in.	
perforations from ft to ft	
perforations from ft. to ft	
perforations from ft. to ft	
perforations from ft_ to ft	
(8) SCREENS: Well screen installed? I Yes INO	
Manufacturer's Name	
Model No.	
m Slot size Set from ft. to ft	work starte gua o to complete are set
Diam Slot size Set from ft. to ft	11. Date well drilling machine moved off of well Sart. 11 19 55
(9) CONSTRUCTION:	(13) PUMP:
Well seal-Material used in seal Puddlad alar i dudla out	Manufacturer's Name
Depth of seal ft. Was a packer used?	
Diameter of well bore to bottom of seal In.	
Were any loose strata cemented off? Yes XNo Depth	Water Well Contractor's Certification:
Was a drive shoe used? Tres ONo	This well was drilled under my jurisdiction and this report is
Was well gravel packed? [] Yes [] No Size of gravel:	true to the best of my knowledge and belief.
Gravel placed from	NAME Stointen Pros.
Did any strata contain unusable water? 🔲 Yes 🖾 No	Address 2222 S.E. "of Dightin Plyd. Vilas kie, C-
Type of water? depth of strata	Address 2112 0.2. 21 0162112 2170. 113. 115)
Method of sealing strata off	Drilling Machine, Operator's License No.
(10) WATER LEVELS:	
	[Signed] Alect 12 marcing Brit
Static level 30 ft. below land surface Date 9-11-	Contractor's License No. T Date Sent. 12, 19

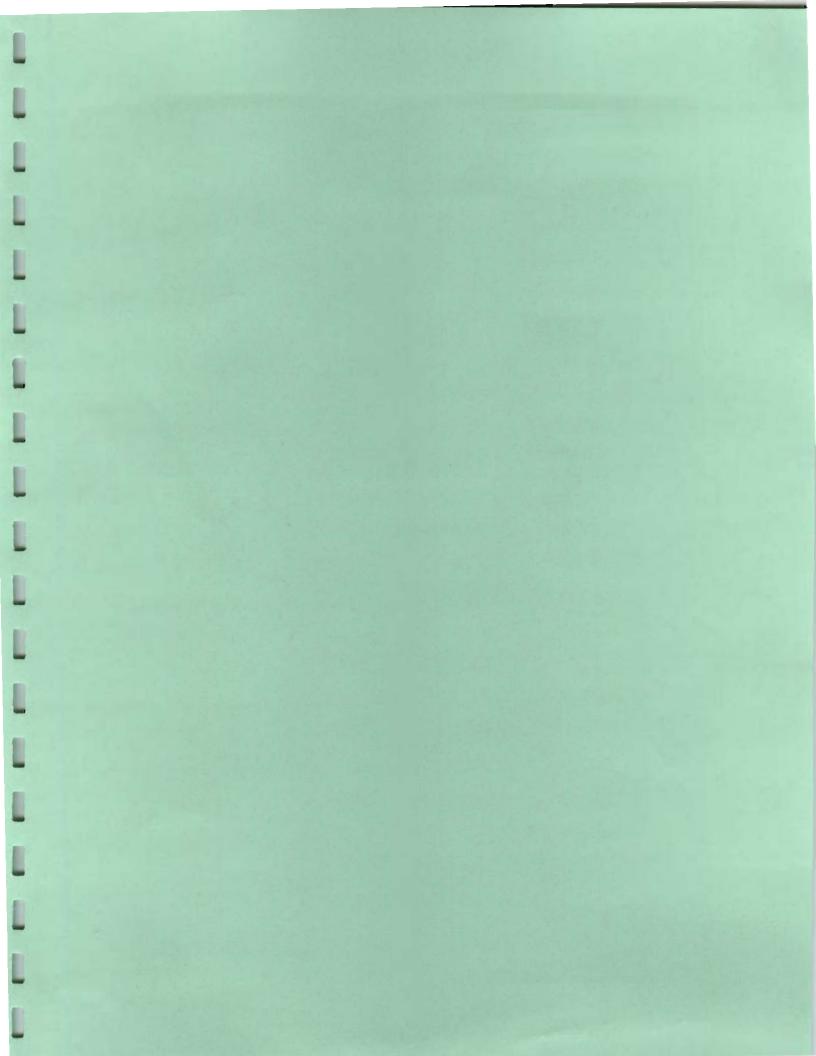
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SECTION B-B'

	1/2 (->0	() $()$ $()$
Salem, Oregon CLAC	Well Record	STATE WELL NO. 2/2-31F(COUNTY Clackamas APPLICATION NO. <u>CR-707</u>
WNER: Publisher's Pape:		31 bd (21)
OCATION OF WELL: Owner's No	CITY AND STATE:	Oregon City, Oregon
SE 1/4 NW 1/4 Sec. 31 T. 2 S.	, R. 2	
earing and distance from section or sul		
from NE corner of Section		F(1)
R. 2 E.		
ltitude at well 120' Interpolate		
CYPE OF WELL:Drilled Date Cor Depth drilled250' Depth case		Section
CASING RECORD:		
FINISH:		
	S. S. Barris	
AQUIFERS: WATER LEVEL: 49 feet		
WATER LEVEL: 49 feet	eming turgine	н.р
WATER LEVEL: 49 feet PUMPING EQUIPMENT: TypeD Capacity220G.P.M. WELL TESTS:		
WATER LEVEL: 49 feet PUMPING EQUIPMENT: TypeD Capacity220G.P.M. WELL TESTS: Drawdown41ft. after	hours	H.P. 20 230 G.P G.P
WATER LEVEL: 49 feet PUMPING EQUIPMENT: Type Capacity220G.P.M. WELL TESTS: Drawdown1 ft. after Drawdownft. after USE OF WATERManufacturing SOURCE OF INFORMATIONGR- DRILLER or DIGGERR.J. Stre ADDITIONAL DATA:	hours	2 <u>30</u> G.P

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STATE ENGINEER Salem, Oregon



State Well No. 2/2-31F(1) County Clackamas Application No. GR-707

31 ha

Owner: Publisher's Paper Company		Owner's No	1
Driller: R. J. Strasser		led 1940	
CHARACTER OF MATERIAL		'and surface)	Thicknes
	From	<u>To</u>	(feet)
Fill material	0	14	14
Hard rock	14	43	29
Rock, not so hard	43	76	33
Very hard rock	76	89	13
Honey comb_w/water	89	113	24
Hard rock w/seams	113	148	35
Hard rock w/seams	148	221	73
Honeycomb rock w/water	221	225	4
Hard rock	225	235	10
Rock not so hard	235	242	7
Hard blue rock	242	251	9

	and a first star a particular	-	
Very hard rock	76	89	
-> Honey comb_w/water	89	113	
Hard rock w/seams	113	148	
Hard rock w/seams	148	221	
->Honeycomb_rock_w/water	221	225	
Hard rock	225	235	
Rock not so hard	235	242	
Hard blue rock	242	251	
and the second			
1 Martine Stre			

Page 101 1 C---NOTICE TO WATER WELL CONTRACTOR - La 1 The original and first copy of this report are to be filed with the O AWAYZER WELL REPORT State Well No. .. STATE OF OREGON (Please type or print) STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion. 1 P State Permit No. Drawdown is amount water level is lowered below static level (11) WELL TESTS: (1) OWNER; OREGON (ITY PUBLIC SCHOOLS Was a pump test made? Yes I No If yes, by whom? Name Yield: 160 gal./min. with 12/ fl. drawdown after OREGON CITY OREGON Address 125 102 41 (2) LOCATION OF WELL: gal./min. with Bailer test ft. drawdown after County CLACKAMAS Driller's well number Artesian flow g.p.m. Date SE 14 NW 14 Section 32 T. 25 58 Was a chemical analysis made? 🗆 Yes 🕅 Temperature of water Bearing and distance from section or subdivision corner (12) WELL LOG: Diameter of well below casing . Depth drilled ft. Depth of completed well Formation: Describe by color, character, size of material and structure, a show thickness of aquifers and the kind and nature of the material in ea stratum penetrated, with at least one entry for each change of formatic MATERIAL FROM TO (3) TYPE OF WORK (check): 2 C TOP SOIL New Well 🕅 Deepening [] Reconditioning [] Abandon П 2: 14 RED CLAY indonment, describe material and procedure in Item 12. <u>83</u> BUJE CLAY 14 831 48 BROWN CAY (4) PROPOSED USE (check): (5) TYPE OF WELL: BLJE CLAY 132 98 Rotary X, Driven D Domestic 📋 Industrial 🗋 Municipal П BROWN CLAT 132 180 Cable × Jetted [] Irrigation 🗙 Test Well 🗌 Other 180 Dug 0 Bored [] 183 CEMENTED GRAJEL (6) CASING INSTALLED: GREY CLAY 183 24 Threaded D Welded STICKY BLUE GREEN LLAS 246 29 8 ___ Diam from 0. 1. 10 463 n. Gage 277 34 GREYAND BLUE CLAY 294 ft. Gage __ PROWN AND RED LAY 343 41 ft. Gage . " Diam, from ft to 44 STICKY CONGLOMERATE 413 (7) PERFORATIONS: 449 460 Perforated? [] Yes XNo GREY LLAY 498 450 MED SOFT BLACK BASAU Type of perforator used 498.52 DARK GREY BASALT Size of perforations in, by BLACK BASALT 523 549 SOFT perforations from ft 10 ft. ft. perforations from perforations from perforations from ft. 10 ft. (8) SCREENS: Well screen installed? [] Yes XNo Manufacturer's Name Model No. OCT /719 6 D Completed Work started ft. to .. ft. Date well drilling machine moved off of well 20 FY (9) CONSTRUCTION: BENTONITE AT (13) PUMP: Well seal-Material used in sgal CEMENT Manufacturer's Name Depth of seal 458-463 ft. Was a packer used? Type: .. Diameter of well bore to bottom of seal ______ In. Water Well Contractor's Certification: Were any loose strata cemented off? [] Yes WNo Depth . This well was drilled under my jurisdiction and this report i true to the best of my knowledge and belief. Was a drive shoe used? Yes DNo Was well gravel packed? 🗌 Yes 🗶 No Size of gravel: ... DEILLING LO Gravel placed from STRASSER ... ft. to .. ft. NAME Address SILO SE SUNSET LANE Did any strata contain unusable water? 🗆 Yes 🕅 No Type of water? depth of strata Drilling Machine Operator's License, No. 54 Method of sealing strata off (10) WATER LEVELS: trasser [Signed] 236 167 ft. below land surface Date Static level Contractor's License No. 10 Date APR 5 1967 Artesian pressure lbs. per square inch Date (USE ADDITIONAL SHEETS IF NECESSARY)

NOTICE TO WATER WELL CONTRACTOR The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion. Pieze type	OREGON 0442 Guale Well No. 2/2-32
(1) OWNER: Name OREGON CITY PUBLIC SCHOOLS Address OREGON CITY OREGON (2) TYPE OF WORK (check): New Well Deepening Reconditioning Abandon D If abandonment, describe material and procedure in Item 12. (3) TYPE OF WELL: (4) PROPOSED USE (check): Rotary Driven D Cable Jetted D Domestic Industrial Municipal D Irrigation Test Well Other D (., CASING INSTALLED: Threaded D Welded D	 (11) LOCATION OF WELL: County CACK Driller's well number 4244 JE 1, PUL, Section 327. 25 R. 2E w Bearing and distance from section or subdivision corner (12) WELL LOG: Diameter of well below casing 8 Depth drilled 607 ft. Depth of completed well 607 Formation: Describe color, texture, grain size and structure of materia and show thickness and nature of each stratum and aquifer penetration
(C., CASING INSTALLED: Threaded [] Welded []	with at least one entry for each change of formation. Report each char. In position of Static Water Level as drilling proceeds. Note drilling rat MATERIAL Prom To SWI BLACK BASA CT 544 538 BROKEN BLACK BASALT 538 565 HARD BLACK BASALT 538 565 HARD BLACK BASALT 565 572 POROUS ROCK 572 580 BLACK BHSALT 580 581 RED POROUS ROCK 581 570 BLACK POROUS ROCK 570 592 MED. HARD BLACK BASAKT 5712 602
(7) SCREENS: Well screen installed? Yes Yes Manufacturer's Name Model No. Model No. Type Model No. Model No. Diam. Slot size Set from ft. to Diam. Slot size Set from ft. to Diam. Slot size Set from ft. to (8) WATER LEVEL: Completed well. Static level 23 (c) Static level 23 (c) ft. below land surface Date A. dan pressure Ibs. per square inch Date	
(9) WELL TESTS: Drawdown is amount water level is lowered below static level. Was a pump test made? Yes O No If yes, by whom? STRASSE? 3.50 gal/min. with // ft. drawdown after B hrs Baller test gal/min. with ft. drawdown after hrs Artesian flow g.p.m. Date Temperature of water 58 Was a chemical analysis made? Yes O N	Work started JULY S 19 5 Completed JULY 239 t Date well drilling machine moved off of well RIG LIEFT TR Drilling Machine Operator's Certification: REMOVE RUM This well was constructed under my direct supervision. Mat- rials used and information reported above are true to my be knowledge and belief.
(10) CONSTRUCTION: Well seal—Material used (EMEENT GROJT Depth of seal fogged to bottom of seal fogged from fogged to bottom of seal fogged from fogged from fogged to bottom of seal fogged from fogged from fogged from fogged from fogged from	Drilling Machine Operator's License No. 54 Water Well Contractor's Certification: This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief. NAME T. STRASSER DRILLING GO. (Person, firm or corporation) (Type or print) Address 110 SE SUSSET LAWE PORTLANE (Signed) Rabert T. Massac

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USE ADDITIONAL SHEETS IF NECESSARY

ATE ENGINEER. LEM. OREGON	TER WELL DRILL STATE OF OR	EGONI () Fill In State Permit No. 32bb
) OWNER: me Oregon City Junior High	. 04425	5(10) WELL TESTS: 1 (29)
me Oregon City Jugior High	School	Was a pump test made? XYes I No If yes, by whom?
dress Oregon City Oregon		Yield: 80 gal./min. with 42 ft. draw down after 6
		- 70 ··· 29 ··· 0
		- 60 - 19 - 6
) LOCATION OF WELL:		Arteslan flow
unty Clackamas Owner's number, if	ny—	Shut-in pressure
F. D. or Street No. Athletic Field	funior High	Baller test
ring and distance from section or subdivision cor	ner	Temperature of water 61 Was a chemical analysis made? [] Yes
		Was electric log made of well? [] Yes []No
		(11) WELL LOG:
	100 C 100 C 100 C	Diameter of well, 8 inches.
3) TYPE OF WORK (check):	and a management	Total depth 550 ft. Depth of completed well 550
wwell Deepening Recondition		Formation: Describe by color, character, size of material and structure, show thickness of aquifers and the kind and nature of the material in structure ponetrated, with at least one entry for each change of forma
abandonment, describe material and procedure in		show thickness of aquifers and the kind and nature of the material in
PROPOSED USE (check):	(5) EQUIPMENT:	n. w 7 n. Clay
estic 🔲 Industrial 🗌 Municipal 🔲	Rotary	7 " 26 " Sandy clay, some broken
rigation Test Well Other	Cable	26 " 55 " Large broken rock and c.
	Dug Well	55 " 84 " Brown cly, broken rock
6) CASING INSTALLED:	If gravel packed	84 " 156 " Blue clay
hreaded 🖸 Welded E		156 - 161 . Hard dark grey clay
	meter from to	161 - 168 - Sandy clay
ROM fL to 452 ft. 8 Diam 25.5 Wall of	Bore ft ft	168 - 197 - Blue clay
н н н н		197 - 202 " Hard clay some broken r
		202 - 217 " Sandy clay
H H H H H		217 - 242 - Grey silt
		242 - 265 Blue clay
ype and size of shoe or well ring Stid abo	e of gravel:	265 - 277 - Sandy clay
Describe joint 8" pipe pressure p		tom 277 289 " Blue clay
		289 292 - Hard dark grey clay
7) PERFORATIONS: none		292 305 " Blue clay
Type of perforator used		305 - 312 - Sandy clay
of perforations in., len		
and it to the peripe	r foot No. of rows	
		419 . 429 . Blue shale
	н нн н	429 - 438 " Hard grey rock
		438 - 443 - Silty blue clay
		443 - 491 - Hard black rock
SCREENS:	Sec 1	491- 496 - Soft black rock
Give Manufacturer's Name, Model No. ar	d Size	496 · 503 · Broken black rock
		503. 517 . Soft black rock
(8) CONSTRUCTION:	and the second second	517 - 524 - Hard black rock
Was a surface sanitary seal provided? Yes D 1		
Were any strata sealed against pollution? A Yes		Ground elevation at well site feet above mean set
If yes, note depth of strate Surface WB FROM ft. to	ter n	- Work started July 1955 Completed Dec.
		- Well Driller's Statement:
		- This well was drilled under my jurisdiction and this rep
METHOD OF SEALING neat coment	grout	= true to the best of my knowledge and belief. R. J. Strasser Drilling Co.
(9) WATER LEVELS:		NAME Robert L. Strasser- partner
Depth at which water was first found 540	1	(Person, firm, or corporation) (Typed or printed
Standing level before perforating		Address 8110 SE Sunset Lane-Portland
		n Driller's well number 307.5
Standing level after performing 450		- RILI H
Log Accepted by		[Signed] a about of Analy

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· · · · · · · · · · · · · · · · · · ·	DEDELLER OCIDICITY
NOTICE TO WATEL WELL CONTRACTOR The original and first copy	REGEVEN A STATE AND
of this report are to be OT AC WATER WELL.	RECEIVED ALOUNC 12-11-50 VILLE
STATE OF OR	EGON SEP 1 3 19/ State Well No. 2000
STATE ENGINEER, SALEM, Olkeg fr 97310 (Please type or within 30 Jays from the date	print) STATE ENGINFER
of well completion. 04396 (Do not write above	this line) SALEM, OREGON
	10) LOCATION OF WELL:
Nome (LAIRMONT WATER DIST.) Address 15223 5 AEL'RICI BOAD	county CLACE Driller's well number 5451
OREACH LITY DEE. 97045	SEW NW VI Section C T. 2.5 R. 3 E W.M. Bearing and distance from section or subdivision corner
(2) TYPE OF WORK (check):	Bearing and distance from section or subdivision corner
New Well Deepening T Reconditioning T Abandon D	- the state of the second of t
	(11) WATER LEVEL: Completed well.
(3) TYPE OF WELL: (4) PROPOSED USE (check):	Depth at which water was first found _315 , th
Rotary Driven D Domestic D Industrial D Municipal	Static level 69 ft. below land sufface. Dato 8/17/72
Cable D. Jotted D Jonnestric D Industrial D Montespan pa Dug D Bored D Irrigation D Teat Well D Other D	Artistan pressure This, per square inch. Date
	Alosian fressure nus, per aquare meri. Daie
To CASING INSTALLED: Threaded D Welded W	(12) WELL LOG: Diameter of well below casing //4
16 " Dian from + 2 H. W 302 H. Gago 1375	Depth drilled 560 ft. Depth of completed well 560 ft.
" Dism. from fl, to ft. Gage	Formation: Describe color, texture, grain size and structure of materials;
"Diem. fromft. toit. Gage	and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in
PERFORATIONS: Perforated? Ves X10	portion of Static Water Level and indicate principal water-bearing strata.
Type of perforator used	MATERIAL From To SWL
Stre of perforations in. by	BROWN (LAY 0 41
perforalions from ff. to tt.	PACKED BROWN SAND 41 76 F
perforations from ft to ft	BLUE AND GREY CLAY 76 192
perforations from tf. to tt.	DECOMPOSOD ROSE 299 301
(7) SCREENS: Well screen installedt I Yer W No	BLACK BASALT 301 365
Manufacturer's Name	PARNUS GREY BASAUT 315324
Type	MED. HARD BLACK BASALT 324 333
Diem Blot size Bet from fit to fi	BROKEN GREY PASKIT 33 342 -
Dlam	-HARD BLACK BASAIT 31/2 371
(8) WELL TESTS: Drawdown is amount water level is lowered below static level	MED HARD BLACK BASAS 374 522
Was a purp lest mader & Yes DNo 11 yez, by whom 257RASSE	MAD SOFT BLACK BASALT 382 397
init: 3150 gal/min. will 160 it drawdown after 24 hrs	HARD BLACK BASALT VO 428
	MED HARD BLACK BASA- 428 462
a second a second se	GRET BASALT 462 487
Bailer test gal/min, with A drawdown after bit	PAROUS BLACK BASAUT YET SO
Artecian flow	HARD BLACK BASALT_SSO 560
meruture of water 57 Depth attestan flow encountered	Work started APR 1.3 197,3 completed AUG 251473
	Date well drilling machine moved off of well AUG 26 10 73
(9) CONSTRUCTION:	
Well schl-Material used CEMENT (TROUT	This well was constructed under my direct supervision.
Well sealed from land surface to	Materials used and information reported above are true to my
Diameter of well have to bottom of seal in.	Signed W. M. Converse Date 9/10, 1973
Disructer of well bore below seal in B and B B B B B B B B B B B	(Drilling Machine Operator)
Number of sacks of bentmite used in well seal	Drilling Machine Operator's License No.
Brand name of bentonite	Water Well Contractor's Certification:
Number of pounds of bentonlike per 100 gallons	This well was drilled under my jurisdiction and this report
of water ibs /100 c	and I true to the best of my knowledge and belief.
Was a drive aboc used! Xver [] No Plugs filter incetion	Name A 22/ Allost Children
Did any strate contain unussible watert D Yes IX Ha	Address SILOSE SUNSET LANE FORTLAND
Type of valer? deput of strate	DR. L. L.
McClud of scaling strate off	[Signed] (Water Well Contractor)
Was well prevel packed () Yes No file of gravel	Contractor's License No. 10 Date 55.37 10 1
Gravel plassed from A to B.	
then ADDITION	AL SHWETS IF NECESSAUT) RP.65

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NOTICE TO WATER WELL CONTRACTOR (1 A C	13			
The original and first copy	PEROPT			
filed with the	1	2/2	20	r .
STATE OF		S. J. K	- ~ 8	6
within 30 days from the date (Do not write ab		2 :	i.co	
of well completion.	State Permit No.		(11)	*****
			(4)	
(1) OWNER:	(11) LOCATION OF WELL:			
Name PARK PLACE WATER DIST.	County CLACK, Driller's well nur	nber 🖌	425	9
		-		/
Address 507 17TOST. ORE CITY, OKE.	S. W 14 NW 14 Section 28 T. 25	<u>R. 2</u>	E_	W.1
	Bearing and distance from section or subdivision	corner		
(2) TYPE OF WORK (check):				
New Well Deepening C Reconditioning Abandon C				
If abandonment, describe material and procedure in Item 12.				
(3) TYPE OF WELL: (4) PROPOSED USE (check):				
Rotary D. Driven D. Domestic D. Industrial D. Municipal M	(12) WELL LOG: Diameter of well b			0
cable of selled 1	Depth drilled 404 ft. Depth of comple	ted well	40	4.
Dug Bored I Irrigation Test Well Other	Formation: Describe color, texture, grain size a	and struct	ure of m	aterial
CASING INSTALLED: Threaded Welded	and show thickness and nature of each stratur			
10 - Diam from 0 th to 158 th Cage 279	with at least one entry for each change of form. in position of Static Water Level as drilling pro			
Diam. from ft. to ft. Gage				
	MATERIAL	Trom	То	SWL
" Diam. from ft. to ft. Gage	BROWN CLAY	C	10	
PERFORATIONS: Perforated? D Yes X No.	GRAVEL	10	16	p =
Type of perforator used	BROWNAND BLUE CLAY	16	95	
	SAND	95	97	
Size of perforations in. by in.	BLUE SHALE	97	11.5	
perforations fromft. toft.	BLACK ROCK	115	195	
perforations from ft. to ft.	HARD BLACK BASALT	195	218	
perforations from ft. to ft.	SOFT POROUS Rock	218	226	
perforations from ft. to ft.	BROWN ROCK	226	237	
perforations from ft. to ft.	MED. HARD BLACK BASAG		262	
	HARD BLACK BASALT	262	270	
(7) SCREENS: Well screen installed? [] Yes X No	BROKEN BASALT	270	275	
Manufacturer's Name	SOFT BLACK BASALT	275		
Type	HED. HARD BLACK BASH			
Diam. Slot size Set from ft. to ft.	RED LANA	3/2	318	
Diam Slot size Set from ft. to ft.	MED HARD BLACK BASAC		377	
(9) WATER LEVEL Completed and	HARD BLACK BASALT		362	
(8) WATER LEVEL: Completed well.	MED HARD BLACK BASAC		206	
Static level 184 ft. below land surface Date 10/10/67	BROKEN BLACK BASALT	700	12gril	
sian pressure lbs. per square inch Date	- DEOREN DACK DASACT	206	TUT	
(9) WELL TESTS. Drawdown is amount water level is				1
(9) WELL TESTS: Drawdown is amount water level is lowered below static level				+
Was a pump test made? Yes D No If yes, by whom? JTRASSER		<u> </u>		
. 300 gal/min with 10 ft. drawdown after 6 hrs.	Work started JULT 26 196 Comple	eted O	CT /	Z- 19 *
250 - 8 - 7 -	Date well drilling machine moved off of well	\bigcirc	T	2- 196
- 150 - 5 - 8 -	Drilling Machine Operator's Certification			
	This well was constructed under my		pervisio	n. Mate
Bailer test gal./min. with ft. drawdown after hrs	rials used and information reported ab	ove are	true to	my bes
Artesian flow g.p.m. Date	knowledge and belief.	١.	1/0.1	47.1.
Temperature of water 57 Was a chemical analysis made? I Yes X No	[Signed] Jan O Kyuna	Date .	NU	19
	- (Drilling Machine Oderator)	1-	Jun Them	
(10) CONSTRUCTION:	Drilling Machine Operator's License No	50		۵
well scal-Material used				
Depth of seal 1.58 up to 148 th	Water Well Contractor's Certification:			
Diameter of well bore to bottom of seal	This well was drilled under my juri	sdiction	and this	report 1
Were any loose strata cemented off? 🗌 Yes 🕅 No Depth	true to the best of my knowledge and be		4 /~	
Was a d. ive shoe used? XYes I No	NAME A STRASSER (Person, firm or corporation)	1	ype or pri	nt)
Did any strata contain unusable water? [] Yes No	QUASE SUVERI	aut ?	BATTA	NOR
Type of water? depth of strata	Address 8.1.C SL SURCHETZ			
	G. R. NY T	the	sh	>
Method of sealing strata off	- [Signed] (Water Well Com	tractor)		
Was well gravel packed? [] Yes No Size of gravel:		1/0	127	- 186
Gravel placed from	Contractor's License No Date			19

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(USE ADDITIONAL SHEETS IF NECESSARY)

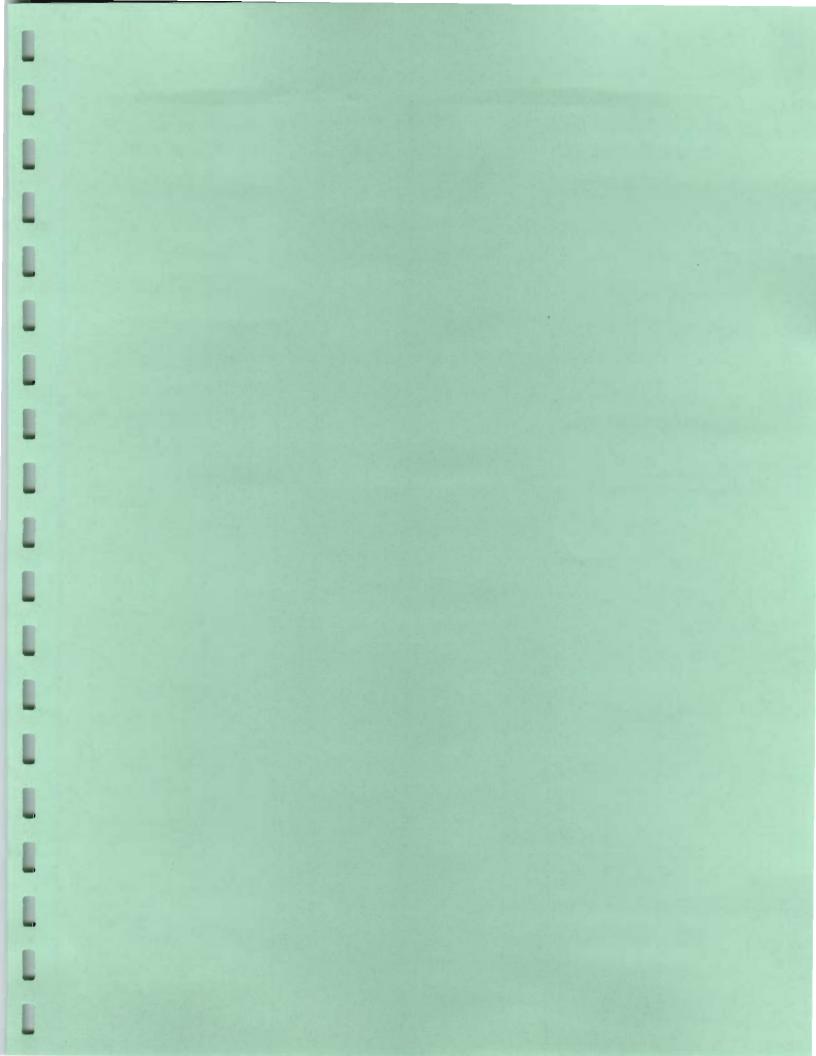
	CLASGI MAR &	EIVED 18 8 4 1999
1	STATE OF OREGON WATER SUPPLY WELL REPORT (as required by ORS 537.765) Instructions for completing this report are on the last page of this form.	OURCES DEPT. WELLID #L
1	(1) OWNER: Name City of OREgon City Address 320 Milling Rd City OREGON City State ORE Zip (2) TYPE OF WORK	(9) LOCATION OF WELL by legal description: County CLACK Latitude Longitude Township 2 South N or S Range 2 EAST B or W. WM. Section 28 1/4 1/4
Ε	New Well Deepening Alteration (repair/recondition) Abandonment (3) DRILL METHOD: Rotary Air Rotary Mud Cable Auger	Tax Lot 500 Lot Block Subdivision Stroot Address of Well for nearost address) 16310 Heinster Au. (10) STATIC WATER LEVEL:
	Other (4) PROPOSED USE: Domestic Community Industrial Irrigation Thermal Injection Livestock Souther BANDON	Image: Artesian pressure Ib. per square inch. Date Artesian pressure Ib. per square inch. Date
	(5) BORE HOLE CONSTRUCTION: Special Construction approval Yes No Depth of Completed Well YOH tr. Explosives used Yes No Type Amount HOLE SEAL	Depth at which water was first found
	Diamoter Prom To Material Prom To Sacks or pounds	N/A
1	How was seal placed: Method A B C D B	(12) WELL LOG: Ground Elevation UNK
1	Backfill placed from ft. to ft. Material Gravel placed from ft. to ft. Size of gravel (6) CASING/LINER:	Material From To SWL 10°C.56 to 150°AS PER 609
1	Diameter From To Gauge Steel Plantic Welded Threaded Casing: 10 0 150 250 250 250 10 10 10 10 10 10 10 10 10 10 10 10 10	No LINER- PERFORATIONS 6 PER FF
1	Liner:	Byde cement pumped To surface.
	(7) PERFORATIONS/SCREENS: Performions Method Mills Karfe Screens Type Material	
	Prem To else Number Diameter size Casing Liner	
1	(8) WELL TESTS: Minimum testing time is 1 hour	Date started 3/13/99 Completed 3/16/99 (unboaded) Water Well Constructor Certification:
1	Pump Bailer Air Flowing Yleid gal/min Drawdown Drill stem at Time 1 hr.	I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
1	Temperature of water Depth Artesian Flow Found Was a water analysis done? Yes By whom Did any strata contain water not suitable for intended use? Too little Salty MuddyOdor CgloredOther	WWC Number Signed Date (bonded) Water Well Constructor Certification: I accept responsibility for the construction, alteration, or abandonment work performed on this woll during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
-	Depth of strata:	Signed Desg Congrist Date 3/01/99

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR / THIRD COPY-CUSTOMER

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5	AL 0.4392 (2)
NOTICE TO WATER WELL CONTRACTOR The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM 10, OREGON within 30 days from the date of well completion. WATER WEL STATE OF (Please type)	OREGON State Well No. 22-28 C
(1) OWNER: Name CLACKAMAS HOUSING ANTHORN Address 500 A STREFT OREGON CITY ORE	(11) WELL TESTS: Drawdown is amount water level is lowered below static level Was a pump test made? Yes No If yes. by whom? P.J. STRAS: Yield: 300 gal./min. with 34 ft. drawdown after 8 hrs 2.50 " 26 "
(2) LOCATION OF WELL: <u>County</u> <u>CLACK</u> Driller's well number <u>4137</u> <u>34</u> <u>14 Section</u> <u>38</u> <u>T. <u>35</u> <u>R. <u>35</u> <u>W.M.</u> Bearing and distance from section or subdivision corner</u></u>	Baller test gal./min. with ft. drawdown after hrs Artesian flow g.p.m. Date Temperature of water 58 Was a chemical analysis made? Ves D No (12) WELL LOG: Diameter of well below casing
	Depth drilled 560 ft. Depth of completed well 560 ft. Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.
TYPE OF WORK (check): Well Deepening Reconditioning Abandon I If abandonment, describe material and procedure in Item 12.	TOP SOLL OZ OPT LARGE GRAVEL AND GAY 2 14 LIGHT BROOM GAY 14 SC BROWN CLAY AND THE SAND SE 9.5
(4) PROPOSED USE (check): Domestic [] Industrial [] Municipal [] Rotary [] Driven [] Irrigation [] Test Well [] Other [] Dug [] Bored []	REDDISH BROWN SAND 140 211
(6) CASING INSTALLED: Threaded Welded A -/D-Diam from ft to ft Gage Diam from ft to ft Gage	BROWEN BASALT (BLACK) 218 245 BROWN JAND 215 218 BROKEN BASALT (BLACK) 218 229* BLACK BASALT 516 295
(7) PERFORATIONS: Perforated? Yes No Type of perforation used Size of perforations in. by in.	HARD GREY BASALT 245 324 SOFT BLACK ROCK 324 33C MED. HARD BLACK ROCK 330 345
perforations fromft_ toft_ perforations fromft_ toft_ perforations fromft_ toft_ perforations fromft_ toft_ perforations fromft_ toft_	
(8) SCREENS: Well screen installed I Yes No Ufacturer's Name	HARD (TREY BASALT 576 520 BLACK RECE WITH CRELKES 520 555 HARD (TREY BASALT STU 538 BLACK ROCK 558 STU
Vpe Model No. Diam. Slot size Set from ft. to ft. Diam. Slot size Set from ft. to ft. (0) CONSUMPTION CONSUMPTION Set from ft. ft.	Work started OCT 6 19 6. 2 Completed JAN 18 19 6 Date well drilling machine moved off of well JAN 19 19 6
(9) CONSTRUCTION: Well seal-Material used in seal CEAJEAT CROUT Depth of seal 21 ft. Was a packer used?	(13) PUMP: Manufacturer's Name Type:
Were any loose strata cemented off? XYes DNo Depth 222-23. Was a drive shoe used? XYes DNo Was well gravel packed? DYes XNo Size of gravel: <u>Gravel placed from</u> ft. to ft.	This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Did any strata contain unusable water? Type of water? Depth of strata Method of sealing strata off	- NAME <u>ILL STRASSER</u> <u>DRILLIN'EF</u> (O (Person, firm or corporation) (Type of print) Address <u>SIIC SE SUNSET LANE</u> PART CA = Drilling Machine Operator's License No. <u>56</u>
(10) WATER LEVELS: Static level <u>30.5</u> ft. below land surface Date <u>44</u> 9 19 Artesian pressure lbs. per square inch Date	(Water Well Contractor) Contractor's License No. Date JAN 19, 1963 SHEETS IF NECESSARY)

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OTHER LOGS USED FOR GROUNDWATER ELEVATIONS

NOTICE TO WATER WELL CONTRACTOR. JUL - 1 1970 Well No. 2/2 - 29 The original and first copy WATER WELL RECREDE CLAC of this report are to be filed with the STATE OF OREG STATE ENGINEER, SALEM, OREGON 97310 Please type or print) within 30 days from the date of well completion. WALENI: LANGEN (11) LOCATION OF WELL: (1) OWNER: County Clockama SDriller's well number Rich Name 14 M'd/ 14 Section 29 TIS R. 2 1= 20 Address Bearing and distance from section or subdivision corner (2) TYPE OF WORK (check): New Well 🕱 Deepening 🗌 Reconditioning [] Abandon [] If abandonment, describe material and procedure in Ifem 12. (4) PROPOSED USE (check): (3) TYPE OF WELL: (12) WELL LOG: q1 Diameter of well below casing Rotary R Driven 🗖 Domestic 🔲 Industrial 🔭 Municipal 🗋 Depth drilled 340 ft. Depth of completed well 34 ft. Cable Jetted D Irrigation [] Test Well [] Other D Ðu**r** Bored [] Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change CASING INSTALLED: Threaded D Welded 10 " Diam. from _ D____ ft to 159 ft. Gage 1250 in position of Static Water Level as drilling proceeds. Note drilling rates. MATERIAL From SWL " Diam. from ______ft. to ______ft. Gage __ vel D 19 31 **PERFORATIONS:** Perforated! [] Yes 🕅 No. 2 139 Type of perforator used 39 280 Size of perforations in. by in. 80 370 mond ___ perforations from _____ ft to ++ 340 30 perforations from _____ ft. to #1 perforations from _____ ft. to _ 10 whill to ft. perforations from 25 (7) SCREENS: Well screen installed? [] Yes W No Manufacturer's Name . Туре Model No. . . Diam. _____ Slot size _____ Set from _____ tt. to _ ft. ft. to ... (8) WATER LEVEL: Completed well. Static level ft. below land surface Date 12-7 sian pressure lbs. per square inch Date Drawdown is amount water level is lowered below static level (9) WELL TESTS: Was a pump test made? Yes I No If yes, by whom? Drill Work started May 29 1970 Completed 10 20 gal./min. with 79 ft. drawdown after 4 YEN:500 hrs. Date well drilling machine moved off of well 0 19 20 600 .. 29 .. Drilling Machine Operator's Certification: This well, was constructed under my direct supervision. Mate-Bailer test gal./min. with ft. drawdown after hrs. rials used and information reported above are true to my best knowledge and belief. s.p.m. Date Artesian flow [Signed] [ligeni M. Alle Date 6 -23, 19 20 Was a chemical analysis made? 😴 Yes 📋 No Temperature of water illing Machine (10) CONSTRUCTION: Drilling Machine Operator's License No. 271 Well seal-Material used C. Amana Water Well Contractor's Certification: Depth of seal 11 Diameter of well bore to bottom of seal ______5___ This well was drilled under my jurisdiction and this report is in. true to the best of my knowledge and belief. Were any loose strata cemented off? I Yes No Depth NAME S/Ky) es Dr1) Ing + Supply Was a drive shoe used? [] Yes WNo Did any strata contain unusable water? 🔲 Yes 🞽 No Address depth of strata Type of water? Method of sealing strata off [Signed] .c Was well gravel packed? [] Yes K No - Size of gravel: Gravel placed from ft: to Contractor's License No. Date Date km ft., (USE ADDITIONAL SHEETS IF NECESSARY)

	RECE	IVED	Ľs/	2e	12	Rac
STATE OF OREGON WATER WELL REPORT (as required by ORS 537.765)		5 1995	(START CARD) #	6781	<u> </u>	Out
Instructions for completing this report are on the last page of this for	TER RESC	OURCES DEPT.	(onlice childs) #		-4	
(1) OWNER: Well Number			YELL by legal descrip	otion:		
Name Dave Harres		County Clare	& Latitude	Longit		
Address P.O. BOX 14635		Township 2	N of S Range	21	E dr W.	WM.
City Portland State Or Zip9-	7214	Section 28	5W 1/4	-	4	-
(2) TYPE OF WORK			otBlock		livision	+
New Well Deepening Alteration (repair/recondition) Abando (3) DRILL METHOD:	onment	Street Address of Wel	(or nearest address)	H-Kee	than	
Rotary Air Rotary Mud Cable Auger	(1	10) STATIC WATE 260 ft. bel		Da	te 5-2	4-95
(4) PROPOSED USE:		Artesian pressure	lb. per square		te	
Domestic Community Industrial Irrigation	T	11) WATER BEAR				
Thermal Injection Livestock Other						
(5) BORE HOLE CONSTRUCTION:	D	bepth at which water wa	s first found 448)		
Special Construction approval _ Yes No Depth of Completed Well 4						
Explosives used Yes No Type Amount		From	То	Estimated 1		SWL
HOLE SEAL		448	475	20	+	260
Diameter From To Material From To Sacks or pour	unds					
10 0 119 Portland 0 59 43						
6 1.19 500						
		(12) WELL LOG:	Lane 2			
How was seal placed: Method $\square A \square B \square C \square D$			d Elevation		_	
Other						
Backfill placed from ft. to ft. Material		Mater	ial	From	То	SWL
Gravel placed from ft. to ft. Size of gravel					^	
(6) CASING/LINER:		TOP SOIL	5112	0	2	
	Threaded	CLAY TAN		2	6	
$Casing: 6 +1 119 -250 \times \square \times$			UN BOULDER	24	24 48	
		CLAY TAN CLAY RED	BPT.II	48	54	
		Rock	DICUUN	54	80	
Liner: <u>5</u> 70 470 188 🛛 🕅		CLAY BLU	E	80	125	
			SANDY CLAY	125	448	260
Final location of shoe(s)		FRACTURE		448	475	
(7) PERFORATIONS/SCREENS:		ROCK		475	500	1
APerforations Method Torch						
Screens Type Material						
Slot Tele/pipe	Liner					
From To size Number Diameter size Casing	X				ļ	
			- 45			
	<u> </u>					
(8) WELL TESTS: Minimum testing time is 1 hour		Date started 5-9	-95 Com	pleted 5	5-24-	95
	1100		ell Constructor Certifica			(-1
Flor Pump Bailer Air Arte	owing		rk I performed on the cor		ration. or a	bandonmei
	Time	of this well is in comp	liance with Oregon water	supply well co	onstruction	standards.
	2hr.	Materials used and ini and belief.	ormation reported above a	ac que to me	oest of my	MIOWICUBE
				WWC N	imber	
		Signed			Date	
Temperature of water 55° Depth Artesian Flow Found			Constructor Certificati	on:		
Was a water analysis done? Yes By whom		I accept responsibi	lity for the construction, a	lteration, or a	andonmen	t work
Did any strata contain water not suitable for intended use?	little	performed on this well performed during this	I during the construction time is in compliance with	h Oregon wat	above. All er supply w	vell
Salty Muddy Odor Colored Other	•	construction standard	. This report is une to the	e best of my k	nowledge a	nd belief.
			11 1/1	11	. 1	220
Depth of strata:		\sim	111111111	WWCN		-30-9

No. of Street, Street,

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CIAC	ve this ALER RESOURCES DEPT.			
) OWNER:	(10) LOCATION OF WELL:			
me Barbara & Gerald Smith	County Clackamas Driller's we	ll number]	57-7	7
dress 16267 S. Oak Tree Terrace, Oregon	34 34 Section 28 T. 2	S R. 21	Ξ	W.M.
(Oregon, 97045) City_	Bearing and distance from section or subd	lvision corner		
) TYPE OF WORK (check):	Lot 7, Holcomb Hill #2			
w Well 🔯 Deepening 🗌 Reconditioning 🗌 Abandon 🗋 abandonment, describe material and procedure in Item 12.				
) TYPE OF WELL: (4) PROPOSED_USE (check):	(11) WATER LEVEL: Completed			
tary VI Driven	Depth at which water was first found Static level 39D ft. below is	410		<u>ft.</u>
ble Jetted Domestic & Industrial Municipal g Bored Irrigation Test Well Other		und surface.		6/11
	Artesian pressure	quare men.		
CASING INSTALLED: Threaded D Welded St	(12) WELL LOG: Diameter of w	vell below cas	ing6	11
5 " Diam from 0 ft. to <u>317</u> ft. Gage <u>250</u> " Diam from ft. Gage <u>1</u> ft. Gage ft.	Depth drilled 455 ft. Depth of c	ompleted well	455	ft.
" Diam. fromft. toft. Gage	Formation: Describe color, texture, grain			
	and show thickness and nature of each s with at least one entry for each change of fo	ormation. Rep	ort each o	change in
PERFORATIONS: Perforated? Ves X No.	position of Static Water Level and indicate	principal wa	ter-bearin	ig strata.
ppe of perforator used	MATERIAL	From	То	SWL
ze of perforations in. by in.	Clay, brown Gravel Cemented	0	34 67	
perforations fromft. toft.	Clay, brown	67	83	
perforations from ft. to ft.	Sandstone, brown, soft	83	270	
	Clay, blue	270	283	
7) SCREENS: Well screen installed? Yes X No	Clay, brown	283	317	
anufacturer's Name Model No	Basalt, Black, hrd.	317	336	
lam Slot size Set from ft. to ft.	Basalt, black, frct: Basalt, grey, hrd.	336	358	
fam Slot size Set from ft. to ft.	Basalt, grey, fract.		412	
8) WELL TESTS: Drawdown is amount water level is lowered below static level	Water, bearing Basalt, grey, brd,	437-	437	390
as a pump test made? [Yes [XNo If yes, by whom?	basart, grey, mo.			390
rid: 12 gal/min. with Otalit. drawdown after 1 hrs.				
······································				
<i>II</i> <u>N</u> <u>N</u> <u>N</u> <u>N</u>		7		
aller test gal./min. with ft. drawdown after hrs.			+	<u> </u>
rtesian flow g.p.m.				
perature of water Depth artesian flow encountered ft.	Work started 5/3 19 77 co		5/6	19 77
9) CONSTRUCTION:	Date well drilling machine moved off of	well 5	5/7	19 7
Vell scal-Material used Cement	Drilling Machine Operator's Certifica	ation:		
Well sealed from land surface to 20 ft.	This well was constructed under Materials used and information repu			
Diameter of well bore to bottom of seal in.	best knowledge and belief	11	5/6	7
Diameter of well bore below seal	[Signed] (Drilling Machine Operator)	Date	570	, 19
How was cement grout placed?	Drilling Machine Operator's License	No	883	
Foureu	Water Well Contractor's Certification		1 A	-
	This well was drilled under my		and this	report i
Was a drive shoe used? N Yes No Plugs	" true to the best of my knowledge an	id belief.		
Did any strata contain unusable water Ves KNo	Name S & M Drilling & (Person, firm or corporation)	Supply	Inc.	rint)
Type of water? depth of strata	Address 399 S.E. Walnut			
Method of sealing strata off	Isimal 1/n FTI. 8	2010		
Was well gravel packed? [] Yes ge No Size of gravel:		n Contractor)	~	
Gravel placed from ft. to ft.	Contractor's License No	ate	5/6	, 197.
(USB ADDITIONAL S	HEETS IF NECESSARY)			8P*45656-11

TATE ENGINEER, SALEM, OREGON RIE CEIVERAD OF				
of well completion. JUN 15 1977 not write ab	ove this line)			
1) OWNER:	(10) LOCATION OF WELL:			
John L. & Sharyl A. Furrierscon	County Clackamas Diller's well nu	nber De	58-77	· · · · · · · · · · · · · · · · · · ·
Address 164 N.E. 5th_St., Canby Oregon 970	1.3 NW 1/4 NE 1/4 Section 28 T. 25	<u>R. 2 T</u>	S	W.M.
	Bearing and distance from section or subdivisio	n corner		
2) TYPE OF WORK (check):				
New Well []; Deepening [] Reconditioning [] Abandon []				
f abandonment, describe material and procedure in Item 12.	(11) WATER LEVEL: Completed we	ell.		
3) TYPE OF WELL: (4) PROPOSED USE (check):	Depth at which water was first found 19			ft.
Rotery N Driven	Jopa of Halle Halls one port total	,		
Cable D Jetted D. Domestic D Industrial D Municipal D	1			9/11
Dug 🛛 Bored 🗋 Irrigation 🗋 Test Well 🗍 Other 🔲	Artesian pressure Ibs. per squar	e inch. I	Date	
CASING INSTALLED: Threaded □ Welded £	(12) WELL LOG: Diameter of well b Depth drilled 520 ft. Depth of comple	eted well	52	20 st.
/ Diam. from ft. to ft. Gage	Formation: Describe color, texture, grain size a			
	and show thickness and nature of each stratur with at least one entry for each change of format	ion. Repo	rt each c	hange in
PERFORATIONS: Perforated? Ves No.	position of Static Water Level and indicate prin	cipal wat	er-bearin	g strata.
Type of perforator used	MATERIAL	From	То	SWL
Size of perforations in, by in.	Topsoil	0	2	
perforations from ft. to ft.	Clay, brown	2	15	
perforations fromft. toft.	Basalt, grey	15	30	
perforations from ft. to ft.	Clay, brown	30	71	
periorations done statestates at the statestatestate at	Gravel, cemented	71	93	
(7) SCREENS: Well screen installed? Yes No	Clay, brown	93	132	
Manufacturer's Name	Clay, blue	132	157	
TypeModel No	Sandstone, brown	1.57	316	
Diam Slot size Set from ft. to ft.		316	351	
Diam	Clay, brown, sandy	351	37.2	
(8) WELL TESTS: Drawdown is amount water level is	Basalt, black, fractured	372	_415	<u> </u>
(6) WEDE TESTS. lowered below static level	Basalt, black, hard	415	448	<u> </u>
Was a pump test made? [] Yes [] No If yes, by whom?	Basalt, black, fractured	448	_507	
meld: 15 gal./min. with TOtak. drawdown after 1 hrs.	Basalt, black, hard	507	-512	
и и и	Basalt, black, fractured	51,2		
N N N N	Water bearing		520	400
Bailer test gal./min. with ft. drawdown after hrs.				
Artesian flow g.p.m.	······································			
				10 77
aperature of water Depth artesian flow encountered		ted	6/9	
(9) CONSTRUCTION:	Date well drilling machine moved off of well		6/9	19 77
Well seal-Material used Cement-	Drilling Machine Operator's Certification			
Well sealed from land surface to 38 ft	This well was constructed under my Materials used and information reported	direc	t supe	rvision.
Diameter of well bore to bottom of seal	best knowlodge and belief	above	are uu	le to ng
Diameter of well bore below seal in.	[Signed] a trick onnellie	Date		9, 197.7.
Number of sacks of cement used in well seal7sack	(Drilling Machine Operator)			-
Number of sacks of bentonite used in well seal sack	Drilling Machine Operator's License No.		10.3	
Brand name of bentonite Poured	- Water Well Contractor's Certification:			/
Number of pounds of bentonite per 100 gallons	This well was drilled under my juris	diction o	nd this	report is
of water Ibs./100 gala	true to the best of my knowledge and b	elief.		
Was a drive shoe used? [3] Yes [] No Plugs Size: location ft	Name <u>S & M Drilling & Su</u> (Person, firm or corporation)	pply.	Inc.	
Did any strata contain unusable water? 🖸 Yes 🖾 No	300 CE Walnut Ct	- C	bype or p	rint)
Type of water? depth of strata	Address Address	•, Cal	iny (O	101011
Method of sealing strata off	- [Signed] //alte Maal	1		
Was well gravel packed? [] Yes [] No Size of gravel: Gravel placed from ft. to ft.	Contractor's License No497Date		6/9	19_7

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filed with the CLAU STATE OF C	DREGONG 1 19 10 1 State Well No. or print) MAY 51976	2s/c	RE-	28[
STATE ENGINEER, SALEM, ORECON 97310 within 30 days from the date of well completion. 0439 to not write abo	ove this line)	• •		· · · · · ·
	TER RESOURCEN			·
(1) OWNER:	(10) LOCATION OF WELL:			
Name Gilbert S. OKita	County Clackamas Driller's well nu			
Address 6708 S. E. Hazel St.	NW 14 NW 16 Section 28 T. 25	r. 2E		W.M.
Portland, Oregon 97206	Bearing and distance from section or subdivision	n corner	_	
(2) TYPE OF WORK (check):				
New Well Deepening D Reconditioning D Abandon D				
If abandonment, describe material and procedure in Item 12.	(11) WATER LEVEL: Completed w	ell.		
(3) TYPE OF WELL: (4) PROPOSED USE (check):	Depth at which water was first found 505			źt.
Rotary Driven Domestic Dindustrial Dimensional	Static level 307 It. below land a	utrace. I	Date 4/	16/76
Cable DX Jetted D Intigation D Test Well D Other D	Artesian pressure lbs. per squar			<u>~~</u>
G CASING INSTALLED: Threaded [] Welded [] G Diam. trom R. to Cage _250	(12) WELL LOG: Diameter of well 1 Depth drilled 522 ft. Depth of compl		$\frac{6}{522}$	2 n.
	Formation: Describe color, taxture, grain size	and struct	ure of m	unterials;
"Diam. from	and show thickness and nature of each stratu with at least one entry for each change of forms	m and aq	uifer per	netrated.
PERFORATIONS: Perforated7 D. Yes D No.	position of Static Water Level and indicate prin			
Type of perforator used	MATERIAL	From	то	SWL
	Top soil & gravel			
		<u> </u>	- 2	
perforations from	Clay, gravel, brown			
perforations from	Clay, blue & gravel	10	35	
perforations from	Gravel some clay, blue		- 42	
(7) SCREENS: Well screen installed? D Yes IN No	Clay, tan & gravel	44	- (· · ·	
Manufacturer's Name	Sandatone, brown	74	93	
Type Model No	Sand, brown	93	_112	
	Gravel, med. brown	112	178	
DiamSlot sizeSet fromft. toft. DiamSlot sizeSet fromft. toft.	Sand, grey, mica	178	185	
Diant,	Clay & sand, brown	185		
(8) WELL TESTS: Drawdown is amount water level is lowered below static level	Sand, brown	195	199	··
	Clay, blue, herd	199	203	<u> </u>
Was a pump test made? [] Yes A No It yes, by whom?	Rock, black, baselt	203	243	1
	Rock, brown			<u> </u>
" v "	Bock, basalt, black	255		
N	Bock grey, hard_	385		
Bailer test 10 gal/min, with 45 ft. drawdown after] hrs.	Hock, basalt, bleck	+ 400	505	207
ian flow g.p.m.	Rock, black, soft	505		307
the tratine of water Depth artesian flow encountered ft.	Work started 2/21 19 76 comple		20	1976
(9) CONSTRUCTION:	Date well drilling machine moved off of well	4/	20	1976
Well seal-Material used <u>Bentonite & puddled clay</u> Well sealed from land surface to <u>48</u> Diameter of well bore to bottom of seal <u>10</u> in.	Drilling Machine Operator's Certification This well was constructed under m Materials used and information reporte best knowledge and belief.	v direc	t supe are tru	rvision. ie to my
Diameter of well bore below seal in.	Isimal the Source -	Date L	+/26	1926
Number of sacks of cement used in well seal sacks	(Drilling Maching) Deretor)		42	u.e.
Number of sacks of bentonite used in well seal l sacks	Drilling Machine Operator's License No			
Brand name of bentonite International				
Number of pounds of bentonite per 100 gallons	Water Well Contractor's Certification:			
af water 100 gals	I due to the best of my knowledge and t		and fura	report 18
Was a drive shoe used? D Yes D No Plugs Size: location ft				
Did any strata contain unusable water? [] Yes 2 No	Name <u>C. G. Westerberg</u> (Person, firm or corporation)	(?	Cype or p	rint)
Type of water? depth of strata	Address Rt - 1, Box 151 Mul	ino(Jrear	<u></u>
Method of sealing strata off	n llond Ard		080	
Was well gravel packed? Yes 1 No Size of gravel:	[Signed]	ntractor)		
Out of Butter Party of Butter International Contraction of Butter and Contraction of the			/	m(
Gravel placed from ft, to ft	Contractor's License No. 86 Date	4/20	5	10/0

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102.00	JEVENHERM	
NOTICE TO WATER WELL CONTRACTOR The original and first popy of this report are to be filed with the	- JJ. 1 2 8 1956 LL REPORT OREGON	
BTATE ENGINEER, SALEM, ORE ON 97310 withm 30 days from the date of well completion.	OREGON	·····
(1) OWNER:	(11) WELL TESTS: Drawdown is amount water	level is
Name KING, John	Was a pump test made? Ves No If yes, by whom?	
		er hrs.
	Yield: 5.5 gal./min. with 70 ft. drawdown att	/ "
	- 7020 -	
(2) LOCATION OF WELL:	Bailer test gal./min. with ft. drawdown a	after hrs.
County Clackamaa Driller's well number/946-17	Artesien flow g.p.m. Date	
14 14 Section 33 T. 2 8 R. 2 K W.M.	Temperature of water 54 Was a chemical analysis made	Yes No
Bearing and distance from section or subdivision corner	(12) WELL LOG: Diameter of well below casing	6
	150	4 4 4
	Dept: drilled 20 - ft. Depth of completed well	<u>120 a.</u>
	Formation: Describe by color, character, size of material and show thickness of aguifers and the kind and nature of the n stratum penetrated, with at least one entry for each chang	aterial in each
	stretum penetrated, with at least one entry for each chang	e of formation.
	MATERIAL	OT MO.
(3) TYPE OF WORK (check):	thouse + Sand	03
Well Deepening Reconditioning Abandon D	Sand Brown mud	323
Sandonment, describe material and procedure in Item 12.	Play Blow Sandy	2336
(4) PROPOSED USE (check): (5) TYPE OF WELL:	alail anan Banchi	36 99
Botary (Briven (Para	99 112
Domestic of Industrial Municipal Cable D Jetted	Laira porous (Waters 1	12 118
Irrigation Test Well Other Dug Bored	tara 1 1	1 120
(6) CASING INSTALLED: Threaded Welded		
6 " Diam from 0 th to 99 th Gage 1250		
"Diam, fromft, toft, Gage		
"Diam. fromft. toft. Gage		
(7) PERFORATIONS: Perforated? [] Yes B-No		
Type of perforator used		
Size of perforations in, by in.		
perforations from		
perforations from ft. to ft.		· · · ·
perforations from ft. to ft.		
perforations fromft, toft.		
perforations from	1 1	· ·
(8) SCREENS: Well acreen installady D Yes Derio		
Manufacturer's Name		
Model No.		·································
Tim Slot size Set from ft. to ft	Work started June 3 1966 Completed June	6 1966
Diam Slot fize Set from ft. to ft	Date well drilling machine moved off of well June 7	1966
(9) CONSTRUCTION:	(13) PUMP:	·····
	M. O ha m.	
Well seal-Material used in seal Bentonite	Manufacturer's Name Loutonto -1110	re
Depth of seal ft. Was a packer used?	Type: Aud Mergeble HI	P2
Diameter of well bore to bottom of seal	Water Well Contractor's Certification:	
Were any loose strata comented off? [] Yes FNO Depin	-	
Was a drive shoe used? I Tes No	This well was drilled under my jurisdiction an true to the best of my knowledge and belief.	a this report is
Was well gravel packed? [] Yes ZLNO Size of gravel:		
Gravel placed from ft. to ft.	- NAME SKYLES DRILLING & SUPPLY (Person, firm or corporation) (Type	or print)
Did any strata contain unusable water? 🗌 Yes 🔲 No	Address GLADSTONE, OREGON	
Type of water? depth of strain	- L L	4 /
Method of sealing strata off	- Drilling Machine Operator's License No.	7
(10) WATER LEVELS:	I man Same . H. Ab	les
Static level 40 ft. below land nurface Date Que, 6-	[Signed] (Water Well Configuration)	
Artesian pressure lbs. per square inch Date	Contractor's License No. # 58 Date June 9	19 66
	. SHEETS IF NECESSARY)	

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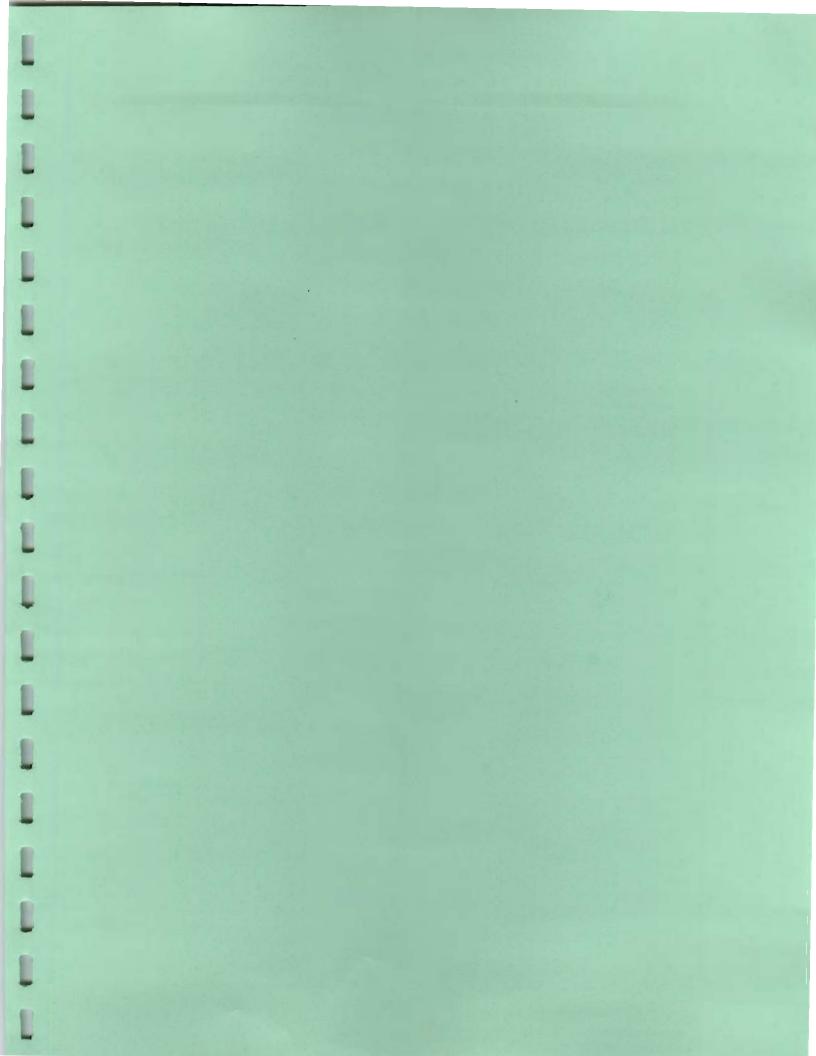
filed with the	REGON JUL 2 1 19/6 Well No print) JUL 2 1 19/6 DEPI, No	25	lai-	19ba
of well completion. (Do not write above	re this INFLITER RESOURCES DEFI.	1		
	(10) LOCATION OF WELL:			
Name Pay 'n' Pak Store	County Clackamas Driller's well nus	mber 3	6-76	
Address 18625 SE McLoughlin Blvd.	NE 14 NW 14 Section 19 T. 25	r. 2E		W.M.
Milwaukie, OR 97222	Bearing and distance from section or subdivisio	n corner		•
(2) TYPE OF WORK (check):				
New Well X Deepening Reconditioning Abandon				
If abandonment, describe material and procedure in Item 12.	(11) WATER LEVEL: Completed w	ell.		
(3) TYPE OF WELL: (4) PROPOSED USE (check):	Depth at which water was first found 140			ft.
Rotary X Driven D Domestic D Industrial D Municipal	Static level 95 ft. below land s	urface	Date 6.	•
Cable Jetted Jetted Inducting Story	Artesian pressure lbs. per squar			44 -70
	Altestan pressure	<u> </u>		
CASING INSTALLED: Threaded D Welded 2X 6 Diam. from +1 rt. to 71 rt. Gage . 250	(12) WELL LOG: Diameter of well h Depth drilled 180 ft. Depth of compl			5
5_ Diam. from +1 ft. to 118 ft. Gage 188				
"Diam. from ft. to ft. Gage	Formation: Describe color, texture, grain size a and show thickness and nature of each stratus with at least one entry for each change of forma	m and a	quifer per	netrated,
PERFORATIONS: Perforated? Øxes D No.	position of Static Water Level and indicate prin	cípal wa	t er- bearin	g strata.
Type of perforator used Torch	MATERIAL	From	To	SWL
Size of perforations in, by in.	Topsoil	0	1	
perforations from ft. to ft.	Sandy Clay	1		
perforations fromft. toft.	Clay brown	25	70	
perforations from ft. to ft.	Lava grey	70	73	
	Lava weathered	73	118_	
(7) SCREENS: Well screen installed? [] Yes DXNo	Lava grey with layers	118	180	95
Manufacturer's Name	of weathered material			
TypeModel No				·
Diam Slot size Set from ft. to ft.			+	
Diam Slot size Set from ft. to ft.				
(8) WELL TESTS: Drawdown is amount water level is lowered below static level		-	+	
Was a pump test made: DXXes [] No If yes, by whom? Driller		-		
Yleid: 20 gal./min. with 80 ft. drawdown after 1 hrs.				
Baller test gal/min, with ft, drawdown after hrs.		_	1	
Artesian flow g.p.m.				
perature of water Depth artesian flow encountered ft.	Work started 6-22 1976 Compl	eted (5-24	1976
(9) CONSTRUCTION:	Date well drilling machine moved off of well	6-	-24	1976
Coment	Drilling Machine Operator's Certificatio	n:		
Well scal-Material used Cellient Well scaled from land surface to40ft	This well was constructed under m	y dire		
Diameter of well bore to bottom of sealin	best knowledge and belief.	d above	e are tr	ue to my
Diameter of well bore below seal f in.	Isimodi work MM. Shalf	Inta	7-14	, 17.6.
Number of sacks of cement used in well seal sack	y orming machine Operatory			
Number of sacks of bentonite used in well seal sack	Drilling Machine Operator's License No), k .L.	L	
Brand name of bentonite	Water Well Contractor's Certification:			
Number of pounds of bentonite per 100 gallons	This well was drilled under my juri	sdiction	and the	report is
of water Ibs./100 gal	true to the best of my knowledge and		and the	. vohové m
Was a drive shoe used? Xes No Plugs Size: location f	Name	L Sup	ply	
Did any strata contain unusable water? Vestor No	(Person, firm or corporation)	0	(Type or	- ·
Type of water? depth of strata	_ Address 1169 Molalla Ave.		yonc	T.T.À."OB
Method of scaling strata off	[Signed] - Starman A.St.	= ske		
Was well gravel packed? [] Yes XXNO Bize of gravel:	(Water Well 9	r		
Gravel placed from ft_ to ft.	Contractor's License No		4	19.7.6
(USE ADDITIONAL	SHERTS IF NECESSARY)			BP•45656-119

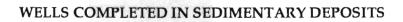
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	ra 11 6	2			
ALAC.	. 2 3- 6				
STATE OF OREGON		·			
WATER SUPPLY WELL REPORT 2049 RECEI	VEU	(STARU CHARD) DE	LIVI	3	
	INTENT	(STAR OARD)		<u> </u>	
Instructions for completing this report are on the last page of this form.	1995 SAL	FAL ORFOUN			
(1) OWNER: Well Number 2	OREGON 2 S	VELL by legal descrip	otlon:		
Name Oregon conference of STATER RES	ORFGUN LECKON	18 BLaitude	Longi	tude	
Address 13455 S. F. 97 th Ave. SALEM, City Clackomas Star Ore. Zin97015		N or S Range	<u> </u>	E or W.	WM
City Clackomas State Ore. Zip97015 (2) PYPE OP WORK		<u>SE</u> 1/4 S of Block	<u>E</u> _1		
New Well Deepening Alteration (repair/recondition) Abandonment		(or nearest address)		division	
(3) DRILL METHOD:	natfield 1	d. clackoma	5 0re		
Rotary Air Rotary Mud Cable Auger	(10) STATIC WATER		- 1120.		
Other	111	ow land surface.	D	to <u>5-8</u> -	-95
(4) PPOPOSED USE:	Artesian pressure	lb. per square		ite	
Domestic Community Industrial Irrigation	(11) WATER BEARI	NG ZONES:			
Themal Injection Livestock Other					
(5) BORE HOLE CONSTRUCTION	Depth at which water was	first found	_		
Special Construction approval The DNo Depth of Completed Well 242 ft.					
Explosives used Yes Zero Type Amount	From	To	Estimated	Flow Rate	SWL
HOLE SEAL	118	21.0	(0)		i
Diameter From To Material From To Sacka or pounds 1011 0 19 cement 0 19 12 Szk	110	240	60 GI	M	+
					+
61: 19 242'					
	(12) WELL LOG:				
How was scal placed: Method A B C D E		d Elevation			
Other	0.000			·	
Backfill placed from ft. to ft. Material	Mater	al	From	To	SWL
Gravel placed from ft. to ft. Size of gravel		ck (proken)	0	1	
(6) CASING/LINER:	Broken Bock		1	7	
Diamoter Prom To Gauge Steel Phasik Weldod Threaded			7	38	
Casing: $6!! + 1 = 19! 250 12 = 10 = 10$	Bock broker		38	40	
	POck hard n		40	118	
	Rock with	neycone Roc		225	
Liner: 411 4' 242	pock hard		225 238	256	
	Tool nord .	1000.1.0	<u></u>	- <u> 4</u>	
Final location of shoe(s)					
(7) PERFORATIONS/SCREENS:		in the second second		1	
Perforations Method Saw Cut					
Screens Type Material	1				
Stot Tcle/plps	DODING	SON DRILLING	<u> </u>		
203 223 13/8 Number Diameter size Casing Line	WELL	S& PUMPS			
	4520 Da	Illas-Salem Hw	у.		
	Salen	n. Ore. 97304			
		371-1844	_		
(9) WELLTESTS, MILLING, MILLIN	61	25	,		l
(8) WELL TESTS: Minimum testing time is thour	Date started 5-1			5 -8- 95	
Pump Bailer Air Anesian		ell Constructor Certifica		nution or -L	and
UPump Bailer Arir Arcesian Yield gaUmin Drawdown Drill stem at Time	of this well is in compl	rk I performed on the con iance with Oregon water	supply well o	onstruction a	tandards.
60 GPM 240' Ihr.	 Materials used and infe and belief. 	ormation reported above a	re true to the	best of my k	nowledge
50 GPM 220 hr			WWC N	umber	
	Signed			Date	
Temperature of water 52 Depth Artesian Flow Found		Constructor Certificatio	m:		
Was a water analysis done? Yes By whom	I accept responsibil	ity for the construction, al	teration, or a		
Did any strata contain water not suitable for intended use?	performed on this well	during the construction d time is in compliance with	lates reported	above. All	work
Salty Muddy Odor Colored Other	construction standards	. This report is true to the	best of my k	inowledge at	nd belief.
Depth of strata:	a the first second where the second se		-	lumber QC	413
	Signed Learnes	Difficiencia	2		-15-9

ORIGINAL & FIRST COPY-WATER RESOURCES DEPARTMENT SECOND COPY-CONSTRUCTOR THIRD COPY-CUSTOMER







CIAC NOTICE TO WATER WELL CONTRACT NOTICE TO WATER WELL CONTRACTOR C ELL REPORT State Well No. 04390 State Permit No. EM. ORECON Drawdown is amount water level is lowered below static level (11) WELL TESTS: (1) OWNER: Curtis Robinson 🗋 No If yes, by whom? Name Was a pump test made? [] Yes Yield: 25 gal./min. with 57 rolar Brdavin after Boy 86 Address hrs Qr " " Z60 . .. (2) LOCATION OF WELL: gal./min, with ft. drawdown after Bailer test hrs. County Clackamas Driller's well number/966 "g.p.m. Date Artesian flow ATTL - AND THE THE AND 14 Section 28 T. 25 R, 2 EW.M. 34 Was a chemical analysis made? [] Yes 4 NO Temperature of water . Bearing and distance from section or subdivision corner. (12) WELL LOG: Diameter of well below casing ... 260 ft. Depth of completed well 260 Depth drilled Formation: Describe by color, character, size of material and structure, and show thickness of douifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation. Are - tracks ······· MATERIAL FROM ťб (3) TYPE OF WORK (check): Vai Brouss 4 w Well Deepening [] Reconditioning Abandon [] えろ Sanda 11 mic abandonment, describe material and procedure in Item 12. Dand Cermen 24 30~ 17. 35 c1-8 (4) PROPOSED USE (check): ti-(5) TYPE OF WELL: cley gray 58 104 Rotary 🛛 Driven Domestic 🖢 Industrial 🔲 Municipal 📋 la 106 14 9 Cable Jetted D Ia. Irrigation [] Test Well [] Other D Bored D Dug 149 Class, 2 181 (6) CASING INSTALLED: tan Tore ord D Welded ON G - Diam. from . ft. to gadue a.C. 184 T. It. Gage 1.20 198 Buries 218 1COn - 11. to 2. 60 11 Gage 10ga " Diam, from . Cla 218 120 gra .". Dlam. from ... th to ____ . ft. Gage . 220 Bani 2.29 nDas (7) PERFORATIONS: 229 Perforaled? Tes D No 243 21 5 920 Circ 58 Type of perforator used 2113 out) an Size of perforations 1/8 by 14 144 _ perforations from ft. to perforations from perforations from to perforations from . ft. to #1 • . ____ perforations from ____ ft. to ff. (8) SCREENS: Well screen installed! I Yes & No .) Manufacturer's Name . -0 Model No. Jiam. _____ Slot size ____ Set from _ ft. to Work started Oct 5 1966 Completed () 29 / Diam. ._ Slot size ____ - Set from . ft. to 186 Date well drilling machine moved off of well (9) CONSTRUCTION: (13) PUMP: Dentonile Manufacturer's Name . ft. Was a packer used? .. no H.P. Type: 9 Diameter of well bore to bottom of seal . in. Water Well Contractor's Certification: Were any loose strata camenfed att7 D Yes 14 No Depth This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief. Was a drive shoe used! Is Yes [] No Was well gravel packed? [] Yes DrNo Size of gravel: SKYLES DRILLING & SUPPLY Gravel placed from ta_ NAME ... (Person, firm or corporation) (Type or print) Did any strata contain unusable waterz . Yy KNo Address GLADSTONE, OFEGON Type of water? depth of strata Method of sealing strata off - 5 Um Drilling Machine Operator's License No. . - 10th - - 15 -- 1 -(10) WATER LEVELS: 11-2-4 [Signed] (Water Well Contractor) atic level ft. below land surface Date . Date Arteslan pressure USE ADDITIONAL SHEETS IF NECESSARY) -----JAN

	L REPORT OREGON or print) over this line 04387.State Permit No.	1		40
within 30 days from the data STATE ENGINEER with an of well completion. STATE ENGINEER	nove this lines			71
1) OWNER:	(10) LOCATION OF WELL:			-{
I) OWNER.			0.10	
ame Robert Hadn adress 14200 S. Livesay Rd., Oregon City,	County CT 2 Chamse Driller's well nu			
Ore. 97045				W.M.
2) TYPE OF WORK (check):	Bearing and distance from section or subdivisio	on corner		
ew Well To Deepening Reconditioning Abandon D				
abandonment, describe material and procedure in Item 12.	(11) WATER LEVEL: Completed w	-11		
3) TYPE OF WELL: (4) PROPOSED USE (check):		EIL		
	Depth at which water was first found 42			ft.
otary Driven able Domestic Bored Irrigation Trigation Test Well	Static level 64			<u>z-70</u> ,
CASING INSTALLED: Threaded D Welded	(12) WELL LOG: Diameter of well b		6	11
CASING INSTALLED: Threaded D Welded A "Diam from 0 rt to 140 n. Gage 250	(12) WELL LOG: Diameter of well h Depth drilled 160 ft. Depth of compl	eted wall	<u> </u>	
-5 Diam. from _1.35 ft to _160 _ ft. Gage _10	Formation: Describe color, texture, grain aize a			IL.
" Diam. from ft. to ft. Gage	and show thickness and nature of each stratur with at least one entry for each change of format	n and aq tíon. Repo	uifer per ort each c	hange in
PERFORATIONS: Perforated Ta Yes D No.	position of Static Water Level and indicate prin	r		
ype of perforator used Morch	MATERIAL	From	To	SWL
ite of perforations 1 in. by 13 in.	Topsoil-Brown		2	~
9	Cley-Sandy-Brown	2	42 84	
perforations from ft. to ft.	Sand-Fine-Silty Water	47	- 04	
perforations from fi to ft.	Glay-Blue-Sandy T	84	94	
7) SCREENS: Well screen installed? [] Yes Z No	Sand-Fine-Mics-BlWeter	94	98	
lapulaciurer's Name	Sand-BlFine-Gravel-Med-	-98	100	
Type	Micky Water			
Diam Stot size Set from ft. to ft.	<u>Clay-Blue</u>	100	128	
Diam	Clsy-Gray-Sandy	128	138	4.0
8) WELL TESTS: Drawdown is amount water level is lowered below static level	Clay-Gray-Gravel Trace- Fine-Med-Water	138		42
Was a pump test made? [] Yes [] No If yes, by whom?	Clay-Blue	140		
field: gal./min. with ft. drawdown after hrs.	Sand-Med	156	_160	
M II M	17 T. 21 41.4 1. 1.4 1.4			
N N N N				
Bailer test 30 gal./min. with 76 ft. drawdown after 2 hrs.				
Arteslan flow g.p.m.				
reperature of water Depth artesion flow encountered ft.	Work started 8-4 19 Complet	ed 8	_7	19 70
J) CONSTRUCTION:	Date well drilling machine moved off of well	8-8		19.7
Well seal-Material used Bentonite-Puddled Clay	Drilling Machine Operator's Certification:			
Well sealed from land surface to	This well was constructed under my Materials used and information reported	direct	super	vision
Dismeter of well bore to bottom of seal in.	best knowledge and belief.	m		:
Diameter of well bora below seal in	[Signed] 25 Lange Line Street	Date 8	-18	, 1970
Number of sacks of cement used in well seal	Drilling Machine Operator's License No.			
Number of sacks of bentonite used in well seal sacks Brand name of bentonite National		211		
Number of pounds of bentonite per 100 gallons	Water Well Contractor's Certification:			
of water Ibs./100 gals.	This well was drilled under my jurisd true to the best of my knowledge and be		nd this 1	eport is
Was a drive shoe used! 2 Yes D No Plugs Size: location ft.	Name S & M Drilling & Su			
Did any strata contain unusable water? [] Yes 🕅 No	(Person, firm or corporation)	(T	ype or pri	nt)
Type of water?	Address Rt. I Box 31, Canby	, Ore	d	
Method of sealing sirata off	[Signed] Dennetty Al	en	nor	
Was well gravel packed? [] Yes [] No Size of gravel:	(Water Well Cont	ractor)	,	
	Contractor's License No5.20 Date	8_18		_, 19_7
Gravel placed from, ft. to, ft				
	HEETS IF NECESSARY)		3	P*45656-1)

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The original and first copy of this report are to be filed with the	L REPOR RECEIVED OREGON OF WITH APR 1 2 1977	20	175	-75
WATER RESOURCES DEPARTMENT SALEM, OREGON 97310 within 30 days from the date of well completion. 04386 (Do not write ab	OREGON BLACE Well No. or print) APR 1 ?; 1977 Sove this UWATER RESOURCES DEPT.	2 <u> </u>	~~ { /	$\overline{\frown}$
	Inten RESOURCES DEPT.			()
(1) OWNER:	(10) LOCATION OF WELL			=
Name George A. Munson	County Driller's well no			
Address 14077 S. Redland Rd. Oregon City, Oregon 97045	SW 14 SW 14 Section 28 T. 25	R. 2	<u> </u>	W.M.
(2) TYPE OF WORK (check):	Bearing and distance from section or subdivisi	on corner		
New Well D Deepening Reconditioning Abandon		~		
If abandonment, describe material and procedure in Item 12.				
(3) TYPE OF WELL: (4) PROPOSED USE (check):	(11) WATER LEVEL: Completed w	ell.		
Ratery D Driven D	Depth at which water was first found 138 Static level 74 ft. below land		3/	A/77
Cable Delted Dug Bored Image: Solution Test Well Other	Static level 74 ±t. below land of Artesian pressure Ibs. per squar			9111
CASING INSTALLED: Threaded Welded	(12) WELL LOG: Diameter of well			
59/16 Diam from 123 ft to 129 ft Gage # 250 59/16 Diam from 123 ft to 163 ft Gage # 188	Depth drilled 163 ft. Depth of comp	7	60	fL
" Diam. from ft. to ft. Gage	Formation: Describe color, texture, grain size			
DEDEOD ADYONG	and show thickness and nature of each stratu with at least one entry for each change of forms position of Static Water Level and indicate prin	tion. Rep	ort each o	hange in
Type of perforator used TOPCh	MATERIAL.	From	То	SWL
Size of perforations 7 in by 3/16 in.	Top soil	0		
40 periorations from 138 th to 163 th	Clay, tan	3	6	
perforations from	Gravel & clay, tan	6	14	
perforations from ft. to ft.	Clay, grey	14	29	
(7) SCREENS: Well screen installed? [] Yes (7) No	Clay, blue	29	57	
(1) SCREENS: Well screen installed? Dyes 2 No Manufacturer's Name	Clay, grey Clay, blue, gritty	<u>57</u> 82	82 108	
Type Model No.	Cley, grey	108	111	~~~~~~
Dism Slot size Set from ft. to ft.	Clay, blue	111	123	
Diam. Slot size Set from ft. to ft.	Clay, grey	123	138	
(8) WELL TESTS: Drawdown is amount water level is lowered below static level	Sandstone, black Claystone, blue	1 <u>38</u> 146	146 148	74
Was a pump test made? DYes No If yes, by whom?	Sandstone, black	148	163	. 94
gal/min. with ft, drawdown after hrs.				
and the second s				
H H H H H				
Baller test 25 gal/min. with 38 ft. drawdown after 1 hrs.				
Artesian flow g.p.m.				
Derature of water " Depth artesian flow encountered	Work started 3/8 1977 Comple	ted	/11	1977
(9) CONSTRUCTION:	Date well drilling machine moved off of well			19/ /
Well seal-Material used Bentonite	Drilling Machine Operator's Certification This well was constructed under my		suner	vision
Well sealed from land surface to	Materials used and information reported best knowledge and belief.			
Diameter of well bore below seal	[Signed] (Drilling Machine Operator)	Date 3	/14	1977
Number of sacks of cement used in well seal			942	.,
How was cament grout placed? 2001bs of International Jel bentonite	Drilling Machine Operator's License No.			
and a second	Water Well Contractor's Certification:	14 at		
and the second	This well was drilled under my jurise true to the best of my knowledge and be		na trus i	report is
Was a drive shoe used? XYes I No Plugs	Name C. G. Westerberg.			
Type of water? depth of strata Method of sealing strata off	Address Rt. Bor 151, M	utinc	r,	28;0n
Was well gravel packed? [] Yes [] No Size of gravel:	[Signed] Law Market Well Con	Inseter		
Gravel placed from ft. to ft.	Contractor's License No.	3/7	4	10 7
	HEETS IF NECESSARY)			19
THEP A MILPHIALT A				P-45656-11

NOTICE TO WATER WELL CONTRACTOR CLAC The original and first copy of this report are to be PECEIVATER WE filed with the TATE ENGINEER, SALEM, OREGON DIMAR 25 1970 (Please type within 30 days from the difference of the completion) of well completion. STATE ENGINEER	OREGON ALAC State Well No.	1		19de
SALEM. OPEGON			(F
I) OWNER:	(11) LOCATION OF WELL:			
ame Lester Yakas	County Clack anias Driller's well nu			L.
daress Rt 2 Bax 10 Drugens City, Ora	SW. 14 SE 14 Section 29 T. 25	R. 2	E	W.M.
2) TYPE OF WORK (check):	Bearing and distance from section or subdivision	1 corner		
ew Weil Deepening P Reconditioning P Abandon D			·····	
abandonment, describe material and procedure in Item 12.		· · · ·		*****
3) TYPE OF WELL: (4) PROPOSED USE (check):				H
able Jetted Domestic Industrial Municipal	(12) WELL LOG: Diameter of well b			
Bored D Irrigation D Test Well D Other D	Depth drilled 70 ft. Depth of comple Formation: Describe color, texture, grain size a			11.
5 CASING INSTALLED: Threaded welded "	and show thickness and nature of each stratuu with at least one entry for each change of form in position of Static Water Level as drilling pro	m and ac ation. Re	quifer pe port eac	netrated, h change
"Diam. from ft. to, ft. Gage	MATERIAL	From	To	SWL
Diam' trom				
PERFORATIONS: Perforatedt E Yes D No.	Well was gravel packed			· · ·
upe of perforator used Tor cch	fron 44-60'			
ize of perforations 1/8 in by 12 in.	Etanel was drilled put		· · · ·	
72 perforations from 45 th to 62 ft.	and well was deepend			· · ·
perforations from ft, to ft,	40.65'			
perforations from				
perforations from	Sand grad wadium	45	65	29
	China and	65	70	29
7) SCREENS: Well screen installed? I Yes @ No	- they gray		10	
Janufacturer's Name				
Diam Slot size Set from fl. to ft.				
Diam, Slot size Set from ft. to ft.		····	├───	
8) WATER LEVEL: Completed well.			· · · · ·	
it below land surface Date 3 2 -70				
liesian pressure lbs. per square inch Date				
9) WELL TESTS: Drawdown is imount water level is				
IOWEIEG DEIGW Static level		· ·		÷ ÷ · ·
as a pump test mader of Yes D No If yes, by whom the staff ar	Work started March 12 19 78 Complete	ed Mar	ch 12	19 70
1: 3.2 gal./min. with 3.6 ft. drawdown after / hrs.	Date well drilling machine moved off of well			19 70
	Drilling Machine Operator's Certification:			
Baller test ral./min. with ft. drawdown affer hrs. Ariceian flow g.p.m. Date	This well was constructed under my d rials used and information reported abo knowledge and belief.	irect sur ve are t	pervision true to	n. Mate- my best
remperature of water NO Was a chemical analysis made? U Xes ENo	[Signed] Harmin P. Shippes	Date -Z	-18	. 1970
(10) CONSTRUCTION:	(Drilling Machine Operator)		~ ~ <i>.</i> , , , , , , , , , , , , , , , , , , ,	C.
Well seal-Material used S" casing Not-Disturbad	Drilling Machine Operator's License No.	·		
Depth of seat ft.	Water Well Contractor's Certification:			
Diameter of well bore to bottom of seal in.	This well was drilled under my jurisd true to the best of my knowledge and bell		nd this	report is
Were any loose strata comented off? Ves I No Depth	NAME 1/31/55 Dri)///	045	4 JON	ly te
Was a drive shoe used? Ves No	(Person, firm or corporation)	(TY)	e br brin	67
Did any strata contain unusable water! I Yes Gro	Address gladstine	are	ggn	
Type of water? depth of strata Method of scaling strata off	Berne I	1	6.6	1
Was well gravel packed? [] Yes [] No Size of gravel:	[Signed] (Water Well Contra	ctor)	-ye	
Gravel placed from ft. to ft.	Contractor's License No. 58 Date	3-10	Þ	19 70
	HEETS IF NECESSARY)			
<u>. y</u>				

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NOTICE TO WATER WELL CONTRACTOR	KEGEIVED			de
	REPORT NO OTOTA	,		
filed with the	L REPORTAN 2 9 1974	25	2E	-24
STATE ENGINEER, SALEM. OREGON 97310	STATE ENGINEER	1		
within 30 days from the date OAAG Obolnot write abo	ove this lines ALEM. OREGONState Permit N	ó		F-V
UTTO T				IE)
(1) OWNER:	(10) LOCATION OF WELL:		·	N
Name DENNIS MAGNUS	County (LACKAMHY Driller's well no	mber	280	j - j
Address 19671 S. Mc CUBBIN RO	SW 45E 14 Section 29 T. 25	R.	25	W.M.
OREGON CITY OREGON	Bearing and distance from section or subdivisi	on corne	r.	
(2) TYPE OF WORK (check):		~		
New Well Deepening Deepening Abandon				
If abandonment, describe material and procedure in Item 12.	(11) WATER LEVEL: Completed w	ell.		
(3) TYPE OF WELL: (4) PROPOSED USE (check):	Depth at which water was first found	80		- ft .
Rotary Driven Domestic Findustrial D Municipal D	Static level 60 ft. below land s	urface.	Date / -	17-74
Cable D Jetted D Irrigation D Test Well D Other	Artesian pressure		· · · · ·	1
	Alterian pressure			
CASING INSTALLED: Threaded D Welded	(12) WELL LOG: Diameter of Well	below cas	ing (o ^u
10 " Diam. from _ O H. to 147 th. Gage _ 250	Depth drilled / 50 ft. Depth of compl	eted wel	15	O fL
"Diam. from	Formation: Describe color, texture, grain size	and strue	ture of n	naterials;
" Diam. from ft. to ft. Gage	and show thickness and nature of each stratu- with at least one entry for each change of forma			
PERFORATIONS: Perforated? FYes INo.	position of Static Water Level and indicate prin			
Type of perforator used MILLS KIVIFE	MATERIAL	From	To	SWL
Size of perforations SR in. by 2 in.	TOP SOIL	0	1	
240 perforations from 80 ti to 140 ti	BROWN CLAY	1	6	
perforations from ft. to ft_	CLAY AND GRAVEL	6	37	
perforations fromft. toft,	BROWN CLAY	37	57	A
(7) SCREENS: Well screen installed? Ves 2 No	CEMENTED CARAVEL	51	14-1	60
Manufacturer's Name	DROWN CLAY	19-1	130	·
Type Model No.				
Diam Slot rize Set from ft to ft		1		
Diam				
(8) WELL TESTS: Drawdown is amount water level is				
lowered below static level		+		·
Was a pump test made? [] Yes [] No If yes, by whom?				
Yield: gal/min. with ft. drawdown after hrs.	AT A STREET PROVIDENT AND A STREET A			· · ·
H H H H	12-1			
11 W I I W				
Baller test 35 gal./min. with Sit. drawdown after hrs.				
Artesfan flow g.p.m.				
parature of water Depth artesian flow encountered ft.	Work started 1 - 2 19 73 Comple	led 1-	17	19 74
(9) CONSTRUCTION:	Date well drilling machine moved off of well	.1-1-	7	19 74-
(Ded in 17 - King in a summer	Drilling Machine Operator's Certification	:		
Well sealed from land surface toft.	This well was constructed under my	direc		
Diameter of well bore to bottom of seal in.	Materials used and information reported best knowledge and belief.	above	are tru	e to my
Diameter of well bore below scal	[Signed] ARKING	Date	1-26	19.74
Number of sacks of cement used in well seal sacks	(Drilling Machine Operator)	. 4	462	
Number of sacks of benionite used in well seal sacks	Drilling Machine Operator's License No.			
Brand name of bentonite NATIONAL	Water Well Contractor's Certification:			
Number of pounds of bentonite per 100 gallons	This well was drilled under my jurise	ilction a	nd this	report is
of water H B. 19 14 SH hs./100 gals. Was a drive shoe used? Grea D No Pluga Size: location ft.	true to the best of my knowledge and be		\mathcal{C}	
Did any strata contain unusable water? [] Yes DNo	Name LELER WELL d KLU	-m.G	ype or pr	int)
Type of water? depth of strats	Address 5345 5.E - HILLW000	M		1115
Method of sealing strata off	Dove	nO.		•
Was well gravel packed? [] Yes [] No Size of gravel:	[Signed]	tractor)		
Gravel placed from ft. to	Contractor's License No. 462 Date	1-	26	10 74
	HEETS IF NECESSARY)			329-45656-119
		- 1		

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HPORT EIVE EGON NOV 91972 State Well No. FATE ENGINEER Parmit No. HEADLEEM. OREGON 10) LOCATION OF WELL: Sounty CLACKAMIAS Driller's well nu SE 14 SE 14 Section 29 T. Q.S. Searing and distance from section or subdivision (11) WATER LEVEL: Completed we Depth at which water was first found 74 Static level 39 ft. below land s Artesian pressure This, per squar (12) WELL LOG: Diaméter of well 1 Depth drilled 75 ft. Depth of completed formation: Describe color, texture, grain size is and show the construction of static with at least one entry for each change of formations that text one entry for each change of formations is fully TO PSOIL HARK ISROWN CLAY BROWN FINE PALKED	e inch. below ca oted wal and struct n and a tion. Ref	Date Oc Date sing cture of r quifer pe port each of tter-bearth	<u>w.m.</u> <u>1t.</u> <u>7 26,7</u> '2. <u>6</u> '' <u>5 11.</u> materials; metrated,
County CLACKAMIAS Driller's well nu SE 4 SE 4 Section 29 T. R.S. Bearing and distance from section or subdivision (11) WATER LEVEL: Completed we bepth at which water was first found 72 Static level 39 ft. below land s Artesian pressure This, per squar (12) WELL LOG: Diamèter of well h Depth drilled 75 ft. Depth of completions Formation: Describe color, fexture, grain size a and show thickness and nature of each stratum with at least one entry for each change of forma position of Static Water Lavel and indicate print MATERIAL SAMPY TO PSOIL HATERIAL HATERIAL	R. 2/2 on corne officient of the second officient of the second s	Date Date Date sing cture of r quifer pe bort each of tter-bearth	$\frac{11}{27 \times 6,7}$
SE 45 K Section 29 T. Q.S. Stearing and distance from section or subdivision 11) WATER LEVEL: Completed w Depth at which water was first found 74 Static level 39 Artesian pressure Its. per squar 12) WELL LOG: Diaméter of well h Depth drilled 75 Static level 75 Artesian pressure The peth of completed w Depth drilled 75 Static level 76 Static level 76 Artesian pressure The peth of completed w Depth drilled 75 Static Weitre color, texture, grain size is and show thickness and nature of each stratum position of Static Water Lavel and indicate printiposition of Static Water Lavel and indicate printiposic	R. 2/2 on corne officient of the second officient of the second s	Date Date Date sing cture of r quifer pe bort each of tter-bearth	$\frac{11}{27 \times 6,7}$
Itearing and distance from section or subdivision 11) WATER LEVEL: Completed w Depth at which water was first found Zetatic level 39 Static level 39 Arteslan pressure This. per square 12) WELL LOG: Diaméter of well h Depth drilled 75 ft. Depth of completed not be stratume of each stratume of show the levels and nature of each stratume with at least one entry for each change of formation of Static Water Level and indicate print matter level and indicate print MATERIAL SAMPY TO PSOIL HATRIAL	e inch. e inch. e inch. e inch and struct n are struct n	Date Date Date sing cture of r quifer pe bort each of tter-bearth	$\frac{11}{27 \times 6,7}$
Itearing and distance from section or subdivision 11) WATER LEVEL: Completed w Depth at which water was first found Zetatic level 39 Static level 39 Arteslan pressure This. per square 12) WELL LOG: Diaméter of well h Depth drilled 75 ft. Depth of completed not be stratume of each stratume of show the levels and nature of each stratume with at least one entry for each change of formation of Static Water Level and indicate print matter level and indicate print MATERIAL SAMPY TO PSOIL HATRIAL	e inch. e inch. e inch. e inch and struct n are struct n	Date Date Date sing cture of r quifer pe bort each of tter-bearth	5 11. naterials; enetrated,
Depth at which water was first found 74 Static level 39 ft. below land s Artesian pressure Ibs. per squar (12) WELL LOG: Diaméter of well h Depth drilled 75 ft. Depth of completion of status Yormation: Describe color, texture, grain size in discussion of static Water Level and indicate print MATERIAL SALUPY TO PSOIL HAIRS IBRDWN	e inch. e inch. eted wel and struc m and a tion. Rej cipal va From	Date sing ill cure of r quifer pe port each iter-bearth	5 11. naterials; enetrated,
Depth at which water was first found 74 Static level 39 ft. below land s Artesian pressure Ibs. per squar (12) WELL LOG: Diaméter of well h Depth drilled 75 ft. Depth of completion of status Yormation: Describe color, texture, grain size in discussion of static Water Level and indicate print MATERIAL SALUPY TO PSOIL HAIRS IBRDWN	e inch. e inch. eted wel and struc m and a tion. Rej cipal va From	Date sing ill cure of r quifer pe port each iter-bearth	5 11. naterials; enetrated,
Depth at which water was first found 74 Static level 39 ft. below land s Artesian pressure Ibs. per squar (12) WELL LOG: Diaméter of well h Depth drilled 75 ft. Depth of completion of status Yormation: Describe color, texture, grain size in discussion of static Water Level and indicate print MATERIAL SALUPY TO PSOIL HAIRS IBRDWN	e inch. e inch. eted wel and struc m and a tion. Rej cipal va From	Date sing ill cure of r quifer pe port each iter-bearth	5 11. naterials; enetrated,
Static level 39 1t. below land s Artesian pressure This, per squar (12) WELL LOG: Diameter of well 1 Depth drilled 75 ft. Depth of compil Formation: Describe color, fexture, grain size i and show thickness and nature of each stratum with at least one entry for each change of formation of Static Water Level and indicate print MATERIAL SAMPY TO PSOIL HAIRS ISRDWN	e inch. below ca eted wel and struc m and a tion. Rep cipal wa From	Date sing ill cure of r quifer pe port each iter-bearth	5 11. naterials; enetrated,
Arteslan pressure This, per squar (12) WELL LOG: Diameter of well 1 Depth drilled 75 ft. Depth of compl formation: Describe color, fexture, grain size i and show the kness and nature of each stratum with at least one entry for each change of forma position of Static Water Level and indicate prin MATERIAL SAMPY TO PSOIL HATRIN ISROWN CHAY	e inch. below ca eted wel and struc m and a tion. Rep cipal wa From	Date sing ill cure of r quifer pe port each iter-bearth	5 11. naterials; enetrated,
12) WELL LOG: Diamèter of well i Depth drilled 75 ft. Depth of compl Formation: Describe color, fexture, grain size i and show thickness and nature of each stratum with at least one entry for each change of forma position of Static Water Lavel and indicate prin MATERIAL MATERIAL SAMPY TOPSOIL HARD BROWN CLAY	eted wal eted wal and struc m and a tion. Rep cipal wa From	sing	netrated,
Depth drilled 75 ft. Depth of compl formation: Describe color, texture, grain size is and show thickness and nature of each stratum with at least one entry for each change of forma position of Static Water Lavel and indicate print MATERIAL MATERIAL HARDY TOPSOIL HARDY ISROWN CLAY	eted well and struc m and a tion. Rep cipal wa	u 7 e	netrated,
Formation: Describe color, texture, grain size i and show thickness and nature of each stratus with at least one entry for each change of forma position of Static Water Level and indicate prin MATERIAL SAMPY TOPSOIL HARD TOPSOIL HARD TOPSOIL	and struc n and a tion. Rep cipal wa From	cture of r quifer pe bort each iter-beart	netrated,
and show thickness and nature of each stratun with at least one entry for each change of forma position of Static Water Lavel and indicate prin MATERIAL SAMPY TOPSOIL HARD BROWN CLAY	n and a tion. Rep cipal wa	quifer pe fort each a ter-bearth	netrated,
HARDY TOPSOIL			
HARDY TOPSOIL		To	SWL
HARD BROWN CLAY		4	
BROWN FINE PALKED	4	15	
	15	3.5	ч.,
· SANIL	-		
BROWN HARD CLAY	3.5	74	
NICE FINE COLORED	74	7.5	39
CRAVELS AND SAND			
WATER BEARING	74.	75	
······································			
وترسيع من من ق			
			<u> </u>
			+
			1
Work started OCT24 19 72 Cample	ed Oc	T 20	5 1072
Date well drilling machine moved off of well	00	127	1875
This well was constructed under my Materials used and information reported	direc	are tru	rvision.
best knowledge and belief.			-
[Signed] Walliam Starnett	Date	hours	1972
Drilling Machine Operatory	19	0	
And a statistic operator & incense Mo.			
Water Well Contractor's Certification:			
		and this	report is
sales to the to manage the	lief.		
(Person, firm or corporation)		Type or pr	int)
	RD	DRE	ECITY
Address 361 WARNER MUNE	22	ALA	
man A A	nn	<u>vo</u>	
[Signed] William 1 St	tractor)	Æ	
	Date well drilling machine moved off of well Drilling Machine Operator's Certification This well was constructed under 'my Materials used and information reported best knowledge and belief. [Signed] Mathine Operator's License No. Drilling Machine Operator's License No. Water Well Contractor's Certification: This well was drilled under my jurisd true to the best of my knowledge and be Name MALAA DI. STENAL (Person, firm or corporation) Address 36. NARNER MILAN	Work started OCT24 19 72 Completed OC Date well drilling machine moved off of well () C Date well drilling machine moved off of well () C Drilling Machine Operator's Certification: This well was constructed under my direct Materials used and information reported above best knowledge and belief. [Signed] Continue Machine Operator Drilling Machine Operator's License No. 17. Water Well Contractor's Certification: This well was drilled under my jurisdiction is true to the best of my knowledge and belief. Name MALAM DI. STENMETT (Person, firm or corporation) Address 361. WARMER MILLAR BID	Work started OCT24 19 72 Completed OCT20 Date well drilling machine moved off of well CCT27 Drilling Machine Operator's Certification: This well was constructed under 'my direct super Materials used and information reported above are tru best knowledge and belief. [Signed] Machine Operator's License No. 17.0 Drilling Machine Operator's License No. 17.0 Water Well Contractor's Certification: This well was drilled under my jurisdiction and this true to the best of my knowledge and belief. Name MILLIAM DISTENNETT (Person, firm or corporation) (Type or pr Address 361 WARNER MILLIAM BR. BR. DRE [Signed] Machine Machine Machine MILLIAM DISTENNET

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STATE ENGINEER Salem, Oregon	CLAG	Well R 04403	ecord	STATE WEL COUNTY ^{CLA} APPEX/XXXX	L NO.2/2- CKAMAS	-29 A }-2063
OWNER. Claud & Sa	urio M. Salisbu	ry	ADDRESS: RT.	5 Box 29		
LOCATION OF WE			CITY AND	on City, Ore		
NE 1/4 NE 1/4 Sec.	29 т. 2	E. 2 10 V	V.M.	!	a a	1
Bearing and distance corner 1250' W & 2	from section or su	bdivision			A	
corner						
Altitude at well					1	1
TYPE OF WELL:I	Drilled. Date Con	nstructed	6]
Depth drilled	Depth ca	sed		Section 2	9	
FINISH:						
	soil, hard r	rock, sandstor	10			
AQUIFERS:	soil, hard r 15'	rock, sandstor	10			
AQUIFERS: WATER LEVEL:	151		10		H.P	1 = 1 = 2
AQUIFERS: WATER LEVEL: PUMPING EQUIPM Capacity	151				H.P	1를
AQUIFERS: WATER LEVEL: PUMPING EQUIPM Capacity2400 WELL TESTS: Drawdown15	15 ¹ ENT: Type Paci G.P.M. ft. after	<u>fio Pump</u>	nours	0		G.P.1
FINISH: AQUIFERS: WATER LEVEL: PUMPING EQUIPM Capacity2400 WELL TESTS: Drawdown15 Drawdown15	15 ¹ ENT: Type Paci G.P.M. ft. after	<u>fio Pump</u>	10Urs	0		G.P.I
AQUIFERS: WATER LEVEL: PUMPING EQUIPM Capacity	15 ¹ ENT: Type Paci G.P.M. ft. after ft. after rrigation RMATION GR-387 ER A:	fic Pump k k k	10urs	0		G.P.1 G.P.1 , G.P.1
AQUIFERS: WATER LEVEL: PUMPING EQUIPM Capacity 2400 WELL TESTS: Drawdown 15 Drawdown 15 Dr	15 ¹ ENT: Type Paci G.P.M. ft. after ft. after rrigation RMATION GR-387 ER A:	fic Pump k k k	10urs	0		G.P.N G.P.N , G.P.N

State Printing 89318

ORIGINAL File Original, and WATER WELL DRIL	LERS REPORT $1 = 2/2 = 70.111$
Duplicate with the	Do Not State well No.
SALEM. OREGON	EGONCLAC Fill In State Permit No. 30da
(1) OWNER: Ready My 10.	to? WELL TESTS:
Address P.O. Box 107	Was a pump test made? If yes, by whom? Yield: gal/min. with ft. draw down after hr
- preyen coly the	
(2) LOCATION OF WELL:	Artesian flow
County Owner's number, if any-	Shut-in pressure lbs, per square inch.
R. F. D. or Street No. D. O. Px 107	Bailer test
Bearing and distance from section or subdivision corner	Temperature of water Was a chemical analysis made? I Yes X N
In the N.E. Corner of the N.E. 1/4 of the S.E. 1/4 of Sec. 30 R.2.E.	Was electric log made of well? [] Yes DNo
T.2.S.	(11) WELL LOG:
	Diameter of well inches.
(3) TYPE OF WORK (check):	50
New well Deepening Reconditioning Abandon	Formation: Describe by color character size of material and structure
bandonment, describe material and procedure in Item 11.	show thickness of aguifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation
(4) PROPOSED USE (check): (5) EQUIPMENT:	ft. to ft.
omestic 🕱 Industrial 🗆 Municipal 🗆 Rotary 🔲	0 " 37 " silt & losm
Irrigation Test Well Other Dug Well	37 " 48 " cement gravel no water
	48 " 52 " loose gravel lots of water
, CASING INSTALLED: If gravel packed	M 4
Threaded D Welded D Gage	
FROM ft. to ft. Diam. Wall of Bore ft. ft.	
<u>0 52 6 250</u> ""	PI 10
N 11 11 11 11 11 11 11	
N 11 11 11 11 11 11 11 11 11 11 11 11 11	
· · · · · ·	
Type and size of shoe or well ring BCBB1 Size of gravel:	
Describe joint	
(7) PERFORATIONS:	PT 14
Type of perforator used	н н
STE of perforations none in., length, by in.	H 1/
A ACOM ft. to ft. perf per foot No. of rows	
· · · · · · · · · · · · ·	
SCREENS: Give Manufacturer's Name, Model No. and Size	
none	
(8) CONSTRUCTION: Was a surface sanitary seal provided? Yes No To what depth ft.	
Were any strata sealed against pollution? [] Yes [] No	Ground elevation at well site BO feet above mean sea leve
If yes, note depth of strata	Work started Jan. 19 56 Completed Jan. 195
FROM Back filled and sealed with	Well Driller's Statement:
" cuttings at stress 37 Teet	This well was drilled under my jurisdiction and this report true to the best of my knowledge and belief.
	MANTE OF L
(3) WATER LEVELS	NAME Steinman Bros
(9) WATER LEVELS: Depth at which water was first found ft.	NAME Steinman Bros (Person, firm, or corporation) (Typed or printed)
Depth at which water was first found ft.	(Person, firm, or corporation) (Typed or printed)
Depth at which water was first found ft. Standing level EXERCISE Static 16 feet ft.	(Person, firm, or corporation) (Typed or printed) Address 8332, S. E. 16th. Ave. Portland 2. Ore
Depth at which water was first found ft. Standing level ster perforating ft.	(Person, firm, or corporation) (Typed or printed) Address 8332, S. E. 16th Ave Portland 2, Ore Driller's well number 256
Depth at which water was first found ft. Standing level EXERCISE Static 16 feet ft. Standing level after perforating ft. Log Accepted by:	(Person, firm, or corporation) (Typed or printed) Address 8332, S. E. 16th. Ave. Portland 2,0re Driller's well number 256 [Signed]
Depth at which water was first found ft. Standing level ster perforating ft.	(Person, firm, or corporation) (Typed or printed) Address 8332, S. E. 16th, Ave. Portland 2, Ore Driller's well number 256 (Signed) Superior 256
Depth at which water was first found ft. Standing level Static 16 feet ft. Standing level after perforating ft. 16 feet ft. Log Accepted by:	(Person, firm, or corporation) (Typed or printed) Address 8332, S. E. 16th. Ave. Portland 2, Ore Driller's well number 256 [Signed]
Depth at which water was first found ft. Standing level Static 16 feet ft. Standing level after perforating ft. 16 feet ft. Log Accepted by:	(Person, firm, or corporation) (Typed or printed) Address 8332, S. E. 16th Ave Portland 2,0re Driller's well number 256 [Signed]
Depth at which water was first found ft. Standing level Static 16 feet ft. Standing level after perforating ft. 16 feet ft. Log Accepted by:	(Person, firm, or corporation) (Typed or printed) Address 8332, S. E. 16th Ave Portland 2,0re Driller's well number 256 [Signed]
Depth at which water was first found ft. Standing level Static 16 feet ft. Standing level after perforating ft. 16 feet ft. Log Accepted by: Signed] Jated 12, 19.54	(Person, firm, or corporation) (Typed or printed) Address 8332, S. E. 16th Ave Portland 2,0re Driller's well number 256 [Signed]
Depth at which water was first found ft. Standing level Static 16 feet ft. Standing level after perforating ft. 16 feet ft. Log Accepted by: Signed] Jated 12, 19.54	(Person, firm, or corporation) (Typed or printed) Address 8332, S. E. 16th Ave Portland 2,0re Driller's well number 256 [Signed]

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NOTICE TO WATER WELL CONTRACTOR The original and first copy A WATER WEI of this report are to be filed with the STATE OF	OREGRECEIVED		Ø	\overline{T}
STATE ENGINEER, SALEM, OREGON 97310 0 4411 (Please type within 30 days from the date of well completion. (Do not write all	or print) JAN281976 State Permit	No		\mathcal{I}
(1) OWNER:	(10) LOCATION OF WELL:			
Name Dan Onion	County Clackamas Driller's well r			
Address 7171 S. Barnards Rd. Canby, OR	SE 14 SE 14 Section 30 T. 2S		E	W.M
(2) TYPE OF WORK (check):	Bearing and distance from section or subdivis	ion corne	r	
New Well X Deepening Reconditioning Abandon				
If abandonment, describe material and procedure in Item 12.	(11) WATER LEVEL: Completed			
(3) TYPE OF WELL: (4) PROPOSED USE (check):	Depth at which water was first found 21	-		
Rotary X03 Driven D Domestic I Industrial Municipal	Static level 142 ft. below land		- 1.	-22-5
Cable [] Jetted [] Domestic [] Industrial [] Municipal [] Dug [] Bored [] Irrigation [] Test Well [] Other []	Divide letter 1 - In Below Mild			
	Artesian pressure lbs. per squa	re inch.	Date	
(5) CASING INSTALLED: Threaded D Welded CX 6 Diam from 0 ft to 246 ft Gage 250	(12) WELL LOG: Diameter of well Depth drilled 248 ft. Depth of comp		•	6 #1
" Diam. from ft. to	Formation: Describe color, texture, grain size	and struc	ture of n	naterials
(6) PERFORATIONS: Perforated? Yes ¥No.	and show thickness and nature of each stratu with at least one entry for each change of form position of Static Water Level and indicate pri	ation. Rep	ort each d	change in
Type of perforator used	MATERIAL	From	То	SWL
Size of perforations in. by in.	Topsoil	0	1	
perforations from ft. to ft.				
perforations from ft. to ft.	Clay brown & large	1	_6	
perforations from ft. to ft.	boulders	1	70	
(7) SCREENS: Well screen installed? Ves KNo	Clay brown	1 6	30	
Manufacturer's Name	Clay brown	- 30	60	
Type Model No	Clay yellow	170		
Diam		- 60	240	
Diam. Slot size Set from ft. to ft.	Clay blue	010		41.5
(8) WELL TESTS: Drawdown is amount water level is ALT lowered below static level	Sand grey	240.	247	142
Was a pump test made? The DNo If yes, by whom? Driller	Clay blue	247	248	
Yield: 25 gal./min. with 98 ft. drawdown after 1 hrs.	UIU		240	
. 20 . 90 . 1 .				
Bailer test gal./min. with ft. drawdown after hrs.				
rtesian flow g.p.m.	1 21 76	1-1-1	22	1976
cperature of water Depth artesian flow encountered ft.	Work started 1-21 19 76 Comple	tea		
(9) CONSTRUCTION:	Date well drilling machine moved off of well	1-22	2	19 7(
Well seal-Material used Bentonite and cement Well sealed from land surface to 180 rt. Diameter of well bore to bottom of seal in. Diameter of well bore below seal in.	Drilling Machine Operator's Certification This well was constructed under my Materials used and information reported best knowledge and belief. [Signed]	direct above	are tru	vision to my
Number of sacks of bentonite used in well seal 7 sacks Number of sacks of bentonite used in well seal 7 sacks Barold	Drilling Machine Operator's License No.			
Brand name of bentonite Barold Number of pounds of bentonite per 100 gallons of water 100 lbs./100 gals. Was a drive shoe used? XXYes I No Plugs Size: location ft. Did any strata contain unusable water? Yes XXNo Type of water? depth of strata	Water Well Contractor's Certification: This well was drilled under my juris true to the best of my knowledge and by Name Skyles Drilling a (Person, firm or corporation) Address 1169 Molalla Ave.	nd Su	_	nt)
Method of sealing strata off Was well gravel packed? Yes No Size of gravel:	[Signed] Marine D. Super (Water Wei/Con	tractor)		
Gravel placed from ft, to ft,	Contractor's License No. 553 Date	1-26	•••••	-asa-110

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(USE ADDITIONAL SHEETS IF NECESSARY)

ATE ENGINEER.	STATER WELL DRILL	EGON Do Not State Well No. 72-32 C Fill In State Permit No.
LEM. OREGON	FCEIVEN	(10) WELL TESTS:
meO.J. Hovee, Route 5	NOV 25 1957 19	Was a pump test made? [] Yes [] No If yes, by whom?
dress Oregon City, Oregon.		Yield: gal/min. with it. draw down after 1 5.
5	AIL ENGINEE	" " "
	SALEM OPECON	
2) LOCATION OF WELL:		
	14 ann	Artesian flow g.p.m.
	Li ung-	Shut-in pressure lbs. per square inch.
F. D. or Street No.	······································	Bailer test g.p.m. with _Totalft_ drawdown
earing and distance from section or subdivision	The second secon	Temperature of water Was a chemical analysis made? [] Yes 🙀 No
NE tof the NW t of section		Was electric log made of well? I Yes gNo
T2S	· · · · · · · · ·	(11) WELLLOG:
A TRADE OF MORE (shall)		Diameter of well,6 inches.
3) TYPE OF WORK (check):		Total depth 178 ft. Depth of completed well 118 ft
ew well 2 Deepening Reconditions Reconditions Reconditions Records Rec	ioning Abandon []	Formation: Describe by color, character, size of material and structure, and show thickness of aquifer and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation
PROPOSED USE (check):	(5) EQUIPMENT:	stratum penetrated, with at least one entry for each change of formation 0 ft to 20 ft.Clay-yellow
iomestic 🕱 Industrial 🗇 Municipal 🖂		20 " 49 "Graval, clay and boulders
	Cable IT	49 " 55 "Brown clay
rrigation 🗆 Test Well 🗌 Other 🗌	Dug Well 🛛	
CASING INSTALLED:		55 OU Sand
	If gravel packed	60 " 67 "Loose gand and gravel
hreaded 🖾 Welded 🗌 Gage	and the second second	\$1 \$P/
or	Diameter from to of Bora ft. ft.	67 98 Course cement gravel
ROMO ft. 61.661 ft.611:Diam. 250 Wall	" "	98 " 107 "Loosley cemented fine gravel
the set of the set of the set		107" 114 "Blue clay
" 1051-1181 "5" liner 3/16	· · · · · · · · · · · · · · · · · · ·	114" 118 "Grey clay
17 11 17 79 ····		12 41
19 92 32 3J in 111 14		n 1)
11 33 23 3Y 1000 14		
Type and size of shoe or well ring Spring	Size of gravel:	
Describe joint Welded		
(A) DEDECT ATTONS.		р I)
(7) PERFORATIONS:	- I dda a danab	
the of periorator used Silotted with		
	length, by 1/6 in. per foot No. of rows	
	in i	
lou.	W HAT IS AFT	
	1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	21 F7
De H H		H D
n n he		19 57
SCREENS:	internet a constructed of a	22 11
Give Manufacturer's Name, Model No.	and Size	11 11
		10 JJ
(8) CONSTRUCTION:		
(8) CONSTRUCTION: Was a surface sanitary seal provided? I Yes [No To what depth 33 ft.	n w
Were any strata sealed against pollution?		Ground elevation at well site feet above mean ses leve
If yes, note depth of strata		Work started Ang. 187 . Completed Aug 195
FROM It. to	ñ.	
i) 1/	H THE LEAVES ALL THE RELETION	Well Driller's Statement: This well was drilled under my jurisdiction and this report
METERON OF STATIST		true to the best of my knowledge and belief.
METHOD OF SEALING		· · · · · · · · · · · ·
(9) WATER LEVELS:	Charles and the second second	NAME Steinman Bros.
Depth at which water was first found	fL	15112 S.E. McLoughlin Blvd.
Standing level before perforating	67 E	Address Milwaukie 22, Oregon
the second se	87 it.	Driller's well number 22-57
Standing level after perforating	<u> </u>	RO MOP AR
Log Accepted by:	ed aug 14 , 1957	[Signed] (Well Driller)

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A start when the star	RECEIVED /
STATE OF OREGON CLAC 04421	JUN 1 4 1984 25/2E-32.d
WATER WELL REPORT	PRINT INVATER RESOURCES DEPT
N ORWER	SALEH, OTEGON (for official use only)
1) OWNER:	(10) LOCATION OF WELL by legal description:
Name Herman Martin	County LACKAIIIAS SE % NE% of Section 32 for Township 2 South Range 2 East WM
Sity Oregon City State Oregon	(Township in North or South) (Range is East or West)
2) TYPE OF WORK (check):	Tax Lut Block Subdivision MARLING ADDRESS OF WELL (or nearest address) 17475 Harriet
lew Well Deepening Reconditioning X Abandon fabendonment, describe material and procedure in Item 12.	Oregon City, OR. 97045
(3) TYPE OF WELL: (4) PROPOSED USE (check): Rotary Air X Driven Doucestic X Industrial	(11) WATER LEVEL of COMPLETED WELL: Depth at which water was first found 240 ft.
Rotary Mud Dug Irrigation Withdrawal Reinjection	Static level 207 ft. below land surface. Data 6-11-84. Artesian pressure Ibs. per square inch. Data
Bored Piezometric Grounding Test	(12) WELL LOG: Diameter of well below casing
5) CASING INSTALLED: Steel Plastic Welded	Depth drilled 265 ft. Depth of completed well 254 ft. Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.
LINER INSTALLED: Steel	
4 ⁻ Diam. from 200 ft to 249 ft. Gauge 160 ∰	This well was originally drilled by
	Lanz Well Drilling in Aug. 1974 for
6) PERFORATIONS: Perforated? XYes INo Size of perforations 1/2 in. by 2 ha.	Gesela Goctsche of Rt. 1 Box 229 BB
184 perforations from 244 A to 254 A.	Eagle Creek, OR.
perforations from	The 6" casing was perferated opposite
perforations from	a water bearing zone from 244' to 253'
(7) SCREENS: Well screen installed? X Yes D No	A 4" PVC screen was then installed with
Manufacturer's NameJ.ohnson	4" PVC pipe above it to bring it above
Model No. Diam. 4." Slot Size 01,58et from 249 n. to 254 n.	the static level, then #12 Monterey filter sand was placed betwaan the 4"
Diem Slot Size Set from ft. to ft.	screen and the perferations in the 6"
8) WELL TESTS: Drawdown is amount water level is lowered below static level	casing and the well was developed.
Was a pump test made? 🗆 Yes 🕱 No If yes, by whom?	
i gal/min. with ft. drawdown after hrs.	
hir test 13 gal./min. with drill stem at 245 ft. 1 hrs.	
Bailer test ggl./min. with ft. drawdown after hrs. urteslan flow g.p.m.	
experature of water Depth artesian flow encountered	
A) CONCEPTION ON	Date work started 6-11-84 /completed 6-12-84
9) CONSTRUCTION: Special standards: Yes D No X Yell seal-Material used Seal was not changed	Date well drilling machine moved off of well 6-1.2 1984
Well sealed from land surface to	(unbonded) Water Well Constructor Certification (if applicable):
Diameter of well boro to bottom of seal in.	This well was constructed under my direct supervision. Materials used and
Diameter of well bore below seal	information reported above are true to my best knowledge and belief.
mount of scaling material	[Signed], 19
How was cement grout placed?	(bonded) Water Well Constructor Certification: Bond 94-97-459 Issued by Fidelity & Deposit Co.
Was pump installed?	(number) (Surety Company Name) On behalf of Marvin D. Skyles(Skyles Drilling) (type or print name of Walter Well Constructor)
Was a drive shoe used? Q Yes XNo Pluga Size: location fl. Did any strata contain unusable water? Yes XNo	This well was drilled under my jurisdiction and this report is true to the
Type of Water? depth of strata Method of sealing atrata off	Best of my knowledge and belief:
	(Signed) (Water Well Constructor)
Was well gravel packed? X Yes I No Size of gravel: #12filte Gravel placed from239 ft. to254 ft.	C(Dated)6-12-84

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filed with the CLARA 22 STATE OF		25	JE-	ac -33/
CATE ENGINEER, SALEM, OREGON 973 of 4 4 1 (Please type within 30 days from the date of well completion.	or print) SECO INFER	•		
) OWNER: ame PAUL STOME	(10) LOCATION OF WELL: County Charlow Driller's well nu	mber 2	35	7.8
Idress 124 084 5 REOLAND Rd ORAGON CITY	5W 14 NE 14 Section 33 T. 2 5	R. 0	ZE	W.M.
2) TYPE OF WORK (check):	Bearing and distance from section or subdivision	· · ·	r	
abandonment, describe material and procedure in Item 12.	(11) WATER LEVEL: Completed we			
B) TYPE OF WELL: (4) PROPOSED USE (check): otary Driven oble Jetted Domestic Dimestic Domestic Industrial Municipal Industrial Ifrigation Test Well	Depth at which water was first found Static level / 4 ff. below land so Artesian pressure lbs. per square		Date 3	It. Nov 73
CASING INSTALLED: Threaded D Welded B Diam. from ft to ft Gage Diam. from ft to ft Gage	(12) WELL LOG: Diameter of well b Depth drilled 5 2 ft. Depth of complete Formation: Describe color, texture, grain size a and show thickness and nature of each stratum	elow ca	sing 1 {] ture of r	
) PERFORATIONS: Perforated 2 Tes I No.	with at least one entry for each change of format position of Static Water Lovel and indicate print	ion. Rep	ort each	change in
ype of perforator used 540T	MATERIAL	From	To	SWL
ize of perforations 4 in. by 7 in.	BROWN CHAY	0	10	
perforations from ft. to ft.	ALKE CLAY	10	18	
perforations from ft. to ft.	GRAVEL	18	22	
perforations fromft. toft.	LARCEN 9HALP	22	43	
7) SCREENS: Well screen installed? Yes TNo	<u> </u>		52	
ype Model No		·		
liam Slot size	· · · · · · · · · · · · · · · · · · ·			
Diam,				
8) WELL TESTS: Drawdown is amount water level is lowered below static level				
Vas a pump test made? [] Yes [] No If yes, by whom? At R /2. gal./min. with 3 8 ft. drawdown after / hrs.				
Air test - "				
N N N N N N N N N N N N N N N N N N N				
Baller test gal./min, with ft. drawdown after hrs.	and the second s			
rtesian flow g.p.m.			<u> </u>	
anperature of water O Depth artesian flow encountered	Work started 3 Alav 19 73 Complet	ed 🕴	Nox	1973
(9) CONSTRUCTION:	Date well drilling machine moved off of well	3. N	, øY	19 71
Well seal-Material used BEAT ONITE Well sealed from land surface to 3.0 Diameter of well bore to bottom of seal 9.1 Diameter of well bore below seal 6.1 Diameter of secks of cement used in well seal 3.2 Sumber of secks of bentonite used in well seal 3.2	Drilling Machine Operator's Certification: This well was constructed under my Materials used and information reported best knowledge and belief. [Signed] Den (Defling Machine Operator) Drilling Machine Operator's License No.	direc above Date _	$\frac{1}{2} \frac{1}{3}$	te to my
Brand name of benionite <u>RAIK GAL</u> Number of pounds of benionite per 100 gallons of water <u>Ibs./100</u> gals.	Water Well Contractor's Certification: This well was drilled under my jurisd true to the best of my knowledge and be		and this	report is
Was a drive shoe used? Eves DNo Plugs Size: location ft. Did any strata contain unusable water? D Yes No	Name Sur Ff WATER Well (Person, firm or corporation)		1/1 W	rint)
Type of water? depth of strata	Address 121 SW 674 10	18.7	ANC	
Method of sealing strata off	[Signed] Jos Mym	-h		•
Was well gravel packed? I Yes No Size of gravel:	. (Water Well Cont			,
Gravel placed from ft. to ft.	Contractor's License No. 5.76 Date			10

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BFART SURPERIS, ALEXA OUTCOLY STID 04423 Offer and the present of the second state of		REPRESEIVED	25/2E-32
(1) OWNER: SALEM CREEDIN: Name GEACH ACCEL Control of WELL Control of Low 229 BB 72P 97022 Sale Sale 72 82 82 82 82 82 82 82 82 82 82 82 82 82	STATE EXCHALER, SALER, OREGUN \$(310) (Plage tune		/
Simm GE661A Go C16 G G Go Actions Bit Box 229 R 26 wither (b) TYPE OF WORK (check): No Standad No Standad (c) TYPE OF WORK (check): No Standad No Standad (c) TYPE OF WORK (check): Domestic No industrial Manaferial Manaferial (c) TYPE OF WORK (check): Domestic No industrial Manaferial (c) TYPE OF WORK (check): Domestic No industrial Manaferial (c) TYPE OF WELL: Domestic No industrial Manaferial (c) TATEST Domestic No industrial Manaferial (c) CASING MIN DESTALLED: Domestic No industrial Manaferial (f) State Manaferial State Manaferial Manaferial (f) State Manaferial State Ma		SALEM. OREGON	
Andress Bill Gov 229 EB 729 7022 1	(1) OWNER:	(10) LOCATION OF WELL:	
Creating and outcome from section or mindpring or correct memory of more where the material and presentant for management describe material and presentant for material and material for materi	Name GESCIA GOCTSCHE		mber
(2) TYPE OF WORK (check): New Weil Disponing One description winter in the state in the state of		34 54 Section 32 T. 2-5	R 2-E W.M.
New Weil Despending D Reconditionate D Adandem If adandamment, desprise material and percedupt in item 2 Adandem If adandamment, desprise material and percedupt in item 2 (1) WATER LEVEL: Completed well. Construction Operation 2400 Refere J Driven Driven District on Material Mandeminit CASING INSTALLED: Densette District on Material District on Materia		Bearing and distance from section or subdivisio	on corner
17 Abandomment. Generike material and proceedure in Here 18. (3) TYPE OF WELL: (4) FROPOSED USE (check): Chain generic Manadatia Distancial Manadatian Distancial Distancia Distanci Distencial Distancial Distancial Distancial Di			
(3) TYPE OF WELL: (4) PROPOSED USE (check): Board Direction Commenter Mundational Board Direction The Well Commenter Direction			
Refary Differed Domestic Manufapal Refary Differed Dread time Differed CASING INSTALLED: Theseded Well edited Differed CASING INSTALLED: Theseded Well edited Differed CASING INSTALLED: Theseded Well edited Differed Differed The per equare inch. Date (12) WELL LOG: Differed Differed Differed The per formations Fr. Gage PERFORATIONS: Per contrast Tom F. Gage Type of performations from ft. to ft. to metrorations from ft. to ft. to Type of performation from ft. to ft. to			
Chile Diministration			<u>O</u> <u>n.</u>
G_ Diam. from G_ to 25.0 (10) Main from ft. to 10 (11) Main from ft. to 10 (12) Main from ft. to 10 (12) Main from ft. to 10 (12) Main from ft. to 10 (13) Main from ft. to 10 (14) Main from ft. to 10 (14) Main from ft. to ft. to (15) PERFORATIONS: Periorstions from ft. to ft. to (17) SCREENS: Well screen fundalloft [] Yes Yes ft. to ft. to (17) SCREENS: Well screen fundalloft [] Yes Yes ft. to ft. to (17) SCREENS: Well screen fundalloft [] Yes Yes ft. to ft. to ft. to (16) Well screen fundalloft [] Yes Yes ft. to ft. to ft. to ft. to ft. to (17) SCREENS: well screen fundalloft [] Yes Yes ft. to ft. to ft. to ft. to	Cable D' Jetted [] Domestic . M Industrial [] municipal []		
	CASING INSTALLED: Threaded D Welded		h
Diam. ft to ft. Gage Demailer. from ft. to ft. Gage PERFORATIONS: Perforations Ft. Gage Disc. Demailer. from ft. fo ft. fo She of perforations from ft. fo ft. fo ft. fo ft. fo Demoil for of Static Water Level and indicate principal under-barring tractions from ft. fo ft. fo <td>6 Diam. from 0 # to 263 # Gage _ 250</td> <td></td> <td>A</td>	6 Diam. from 0 # to 263 # Gage _ 250		A
PERFORATIONS: Perforator Und Type of perforator und in. by in. Size of perforations from fi. 50 fil. perforations from fil. 50 fil. (7) SCREENS: Well screen installed? Yes Manufacturers' Name Model No. fil. Type files files files file Bilen dists Set from fil. 10 file CIAY BLUE file file CIAY BLUE file file CIAY BLUE file file Observed blows wide file file file file Via s pump test made? Yes No. file O ONSTAT Asfants file file O optimize file file Wate s pump test made? Yes file file <t< td=""><td></td><td></td><td></td></t<>			
Type of perforation used Number of sector used in will sector used in sector usector in sector used in sector used in sector used in sector usec		with at least one entry for each change of format	ion. Report each change in
Bite of perforations in. by in. perforations from ft to ft. perforations from ft to ft. comperforations from ft. ft. ft ft. ft. ft. ft ft. ft. ft. ft ft. ft. ft. ft. ft ft. ft. ft. ft. ft ft. ft. ft. ft. <t< td=""><td>PERFORATIONS: Perforated? Tes No.</td><td>position of Static Water Level and indicate prin</td><td>cipal water-bearing strata.</td></t<>	PERFORATIONS: Perforated? Tes No.	position of Static Water Level and indicate prin	cipal water-bearing strata.
		MATERIAL	
perforestions from ft. to ft. perforestions from ft. to ft. perforestions from ft. to ft. (7) SCREENS: Well screen installedt [] Yes X No Manufacturer's Name (1) GAU GR FY (1) GU GR FY Type Model No. ft. (1) GAU GR FY Diam. Slot size Set from ft. to ft. Diam. Slot size Set from ft. to ft. Diam. Slot size Set from ft. to ft. Main and C I Yee X to if yee, by vhom? (1) GU GR FY (1) GU GR FY (1) GU GR FY Diam. Slot size Set from ft. to ft. Market a pump test made() Yee X to if yee, by vhom? (1) GU GR FY (1) GU GR FY Yee a pump test made() Yee X to if yee, by vhom? (1) GU GR FY (1) GU GR FY Yee a fyllo' Cafe Kiny Tan/Alled of Acmondured ft. (1) GU GR FY (1) GU FY Yee a fyllo' Cafe Kiny Tan/Alled of Acmondured ft. (1) GU FY (2) GU FY (2) GU FY Work started used to below hand surface fore and ftof makethan operator's Carlifostiton:		CIAY YELLOW	
pertorations from n. to n. (7) SCREENS: Weil screen installedt Yes No (7) SCREENS: Weil screen installedt Yes No Manufacturer's Name Model No. CIAU GREY 1142 0 Type Model No. GRAW GRAW GRAW 1342 0 Type Model No. GRAW GRAW 1342 0 Type Model No. GRAW GRAW 1342 243			
(7) SCREENS: Well screen installedt Yes X No (7) SCREENS: Well screen installedt Yes X No Type Model No. Type Model No. Type Model No. Stot size Set fromft. toft. Bland. Stot sizeSet fromft. toft. CIAV BLUE 142 134 0 CIAV BLUE 245 3 (245 / 433 Diam. Stot sizeSet fromft. toft. (8) WELL TESTS: Drawdown is amount weter level is Dovered below statil level Was a pump test made() Yee X No if yee, by whom? Zildd: gal/min. with ft. drawdown after hr. Filler test 2 O gal/min. with ft. drawdown after 3 hr. Image: 1 and 1 an			
Manufacturer's Name			
Type Model No. SAME AND SAME CRAVE/W/S 240 253/87 Diam. Stot size Set from ft. to ft. Stot size Set from ft. to ft. ft. Stot size Set from ft. to ft. ft. Stot size Set from ft. to ft. ft. Stot size Set from ft. ft. ft. Stot size Drawdown is amount water level is ft. ft. Was a pump test made? Yee X No If yee, by whom? ft. ft. ft. Stot size gal/min. with ft. drawdown after hrs. ft. Stot size gal/min. with ft. drawdown after hrs. ft. Stot size gal/min. with ft. drawdown after hrs. ft. Stot size gal/min. with ft. drawdown after hrs. ft. <tr< td=""><td>(7) SCREENS: Well screen installed? I Yes No</td><td>CIAY GREY</td><td>142 184 0</td></tr<>	(7) SCREENS: Well screen installed? I Yes No	CIAY GREY	142 184 0
Diam. Stot size Set from ft. to ft. Diam. Biot size Set from ft. to ft. Diam. Biot size Set from ft. ft. Diam. Biot size Set from ft. ft. (8) WELL TESTS: Drewend below statle level is CIAV BLUF 295 SIO 198 (8) WELL TESTS: Drewend below statle level is CIAV BLUF 295 SIO 198 Was a pump test made? Yee X No If yee, by whom? It ft. CIAV BLUF 295 SIO 198 Stot size gal/min. with ft. drawdown after hns. ft. ft. Diate set antarial used Common and surface to well set antarial used Common and surface to set and the drawdown after ft. ft. Well sealed from and surface to			184 240 0
Diam Bot size Bet from ft. to ft.			240 253 00
(8) WELL TESTS: Drawdown is amount water level is Dowered below static level Was a pump test made? □ Yee No If yee, by whom? Lidd: gal/min. with ft. drawdown after hns. Baller test 2.0 gal/min. with ft. drawdown after 3 hns. Artosian flow E.p.m. Preruire of wyler Depth artesian flow encounteredt. STFFF 2010/CGSE iNg TrajAlled & RemoUed (9) CONSTRUCTION: Well seal-Material used CEMENT Rudded CIAY4 Bin Towite Well sealed from and surface tot. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of well bors to bottom of gest 810, in. Diameter of bentonite used in well seal sacks Number of acks of bentonite used in well seal sacks Number of acks of bentonite used in well seal sacks Number of bentonite well well and suffer the fill and starts 20 FT. Method use strais of PEPE Were well gravel packedt [] Yes @ No _ Bize location			295 310 168
Wes a pump test made? I ves No if yes, by whom? Yield: gal/min, with if. drawdown after """"""""""""""""""""""""""""""""""""		CLAY GREY	310 350/88
Kield: gal/min. with ft. drawdown after hrs. " " " Baller test 2.0 gal/min. with ft. drawdown after hrs. " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " "	(8) WELL TESTS: Drawdown is amount water level is lowered below static level		
Baller test 20 gal/min. with 4 ft. drawdown after 3 hrs. Presture of wgier Depth artesian flow encountered	Was a pump test made? [] Yes X No If yes, by whom?		
Bailer test 20 gol/min. with 4 ft. drawdown after 3 hm. Artesian flow gp.m. Interstan flow gp.m. Well sealed from land surface to fs. Diameter of well bore below seal gp.lo. Interstan flow fs. Diameter of well bore below seal gp.lo. Number of sacks of cement used in well seal gp.m. Number of sacks of bentonite used in well seal gp.lo. Interstan flow encoursed in well seal gp.lo. Interstan	Yield: gal/min. with ft. drawdown after hrs.	AND	
Bailer test 20 gol/min. with 4 ft. drawdown after 3 hm. Artesian flow gp.m. Interstan flow gp.m. Well sealed from land surface to fs. Diameter of well bore below seal gp.lo. Interstan flow fs. Diameter of well bore below seal gp.lo. Number of sacks of cement used in well seal gp.m. Number of sacks of bentonite used in well seal gp.lo. Interstan flow encoursed in well seal gp.lo. Interstan	M W M		
Artesian flow g.p.m. Terrature of water Depth artesian flow encountered ft Strift Still Construction The set of	н н н		
International contraction Atternation Atternation Atternation Atternation Work started Aug 4 19 74 Completed Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Date well drilling matchine moved off of well Aug 25 19 Diameter of well bore to botom of geal 3-10_ in Diameter of well bore below seat 3-5_10_ in Number of sacks of cement used in well seal 3 sacks Brilling Matchine Operator's License No. Number of pounds of bentonite used in well seal 1 sacks Mater also contain unusable waters 10 gallons Date 200 gallon Of water 60 waters SANdy depth of strate 20 FT. Mater als packedt 1 Yes 10 No Size of gravel: Type of waters SANd	Bailer test 20 gal/min. with 4 ft. drawdown after. 3 hrs.		
(9) CONSTRUCTION: Well sealed from land surface to <u>55</u> <u>th</u> Diameter of well bore below seal <u>6</u> in. Diameter of well bore below seal <u>6</u> in. Number of sacks of cement used in well seal <u>3</u> sacks Number of sacks of bentonite used in well seal <u>3</u> sacks Brand name of bentonite used in well seal <u>3</u> sacks Brand name of bentonite used in well seal <u>3</u> sacks Brand name of bentonite used in well seal <u>3</u> sacks Brand name of bentonite used in well seal <u>3</u> sacks Brand name of bentonite used in well seal <u>3</u> sacks Brand name of bentonite used in well seal <u>6</u> in. Number of sacks of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in well seal <u>7</u> sacks Brand name of bentonite used in trata <u>700</u> galaxa Gravel placed from <u>1</u> to <u>7</u> the <u>1</u> sacks of gravel: <u>1</u> sacks <u>700</u> sacks <u>700</u> <u>700</u> sacks <u>700</u>	Artesian flow g.p.m.		
Well seal-Material used CEMENT Puckled CAY4 Birm Jow Te Drilling Machine Operator's Certification: Well sealed from land surface to	57 FT 8x10" CasEINS INTAlled & Removed		Aug 25 197
Well sealed from land surface to 5.5 1. Diameter of well bore to bottom of geal 8-10 in Diameter of well bore below seal 6 in. Number of sacks of cement used in well seal 3 sacks Number of sacks of bentonite used in well seal 3 sacks Brand name of bentonite Name of bentonite used in well seal 1 Number of pounds of bentonite per 100 gallons 1 sacks of water 60 100 gallons of water 60 100 gallons of water 90 100 100 100		Drilling Machine Operator's Certification:	77
Diameter of well bore to bottom of geal 8-10 in Diameter of well bore below seal 6 in well seal 6 in Number of sacks of cement used in well seal 6 in Number of sacks of bentonite used in well seal 6 in Number of sacks of bentonite used in well seal 6 in Number of pounds of bentonite per 100 gallons 6 in of water 60 in well seal 7 in Number of pounds of bentonite per 100 gallons 7 in Dis./100 gale. Was a drive aboe used? Yes No Plugs Size: location ft Did any strats contain unusable water? Yes No Plugs Size: location ft Did any strats contain unusable water? Yes No Type of water? SANdy 6 depth of strats 20 FT. Method of scaling strats off PfPE Was well gravel packed? Yes Mo Size of gravel: 6 in the contractor's License No. 9 in (USE ADDITIONAL SHEETS IP NECHSBARY) BF4555	FF.	This well was constructed under my	direct supervision
Diameter of well bore below seal in. Number of sacks of cement used in well seal sacks Number of sacks of bentonite used in well seal sacks Brand name of bentonite used in well seal sacks Brand name of bentonite well in well seal sacks Brand name of bentonite per 100 gallons of water D Ibs./100 gale. Number of pounds of bentonite per 100 gallons of water D Ibs./100 gale. Was a drive aboe used? W Yes No Plugs Size: location ft. Did any strate contain unusable water? M Yes No Type of water? SANdy depth of strate 20 FT. Method of scaling strate off PfPE Was well gravel packedt Yes @ No Size of gravel: (USE ADDITIONAL SHEETS IF NECESSARY) (USE ADDITIONAL SHEETS IF NECESSARY) Diame BP'45555	Diameter of well hore to bottom of geal 8-10 in		above are the wing
Number of sacks of cement used in well seal sacks Number of sacks of bentonite used in well seal sacks Number of sacks of bentonite used in well seal sacks Brand name of bentonite MATIONAL Number of pounds of bentonite per 100 gallons mass drive shoe used? of water Contractor's Certification; Wass a drive shoe used? Yes Did any strata contain unusable water? Yes Type of water? Size: location Type of water? Size of gravel; Wass well gravel packed? Yes Wass well gravel packed? Yes The to the Outset of promotion in the to The to The to the Outset of packed? Yes Wass well gravel placed from to The to the Outset of the placed from to The to the Outset of the placed from the to The to the The t		[Signed] Paur Will hand	Date
Number of sacks of bentonite used in well seal sacks Brand name of bentonite MATIONAL Number of pounds of bentonite per 100 gallons muster of water 60 of water 60 Did any strata contain unusable water? Myss Did any strata contain unusable water? Myss Method of scaling strata off PiPE Wass well gravel placed from Hto Of user in placed from Hto Did any strata off PiPE Wass well gravel placed from Hto Of user in placed from Hto Did any strata in placed from Hto Of user in placed from	1		2.46
Number of poinds of bentonite per 100 gallons of water			
of water GO Ibs./100 gals. Was a drive aboe used? Yes D No Plugs Size: location ft. Did any strata contain unusable water? Yes D No No ft. Type of water? SANdy depth of strata COFT			
Was a drive aboe used? Yes D No Plugs Size: location ft. Did any strata contain unusable water? Yes D No No Person, firm or corporation) (Type or print) Type of water? SANdy depfh of strata 20 FT. Address 1.5 70.2 S. Moi bur Rd Ore. CA Method of scaling strata off PiPE [Signed] Print (Water Well Converter) Was well gravel packed? Yes MNo Size of gravel: (Water Well Converter) (Water Well Converter) Gravel placed from H. to th. Contractor's License No. Sby. Date 19 BP4500 Strate Strate Strate Strate Strate Strat	of water 60 Ibs./100 gals.		
Method of scaling strata off PiPE Was well gravel packedt Yes MNo Size of gravel: Gravel placed from It to ft. (Use ADDITIONAL SHEETS IF NECESSARY)		Name LANZ WELL DRILLI	41.0
Was well gravel packed? Yes Wo Size of gravel: [Signed] A = 0.04 a. (Water Well Constructor) Gravel placed from H. to Contractor's License No. 565. Date 16-2, 19 (USE ADDITIONAL SHEETS IF NECESSARY) BP4566	Type of waters SANdy depth of strata 20FT.	Address J. 70.2 S. norbui	- Rd OVP. C.I.
Was well gravel packed? Yes Who Size of gravel: (Water Well Constructor) Gravel placed from H to Contractor's License No. 565 Date 10-2 19 (USE ADDITIONAL SHEETS IF NECESSARY) BP4555	Method of scaling strata off PfPE	[Signed] Amerel & Lan	
(USE ADDITIONAL SHRETS IF NECESSARY) BF4565	Was well gravel packed? Wes MNo Size of gravel:	(Water Well Cond	
	Gravel placed from h to th	Contractor's License No. 5.25. Date .A	<u>a-d</u> , 19.2
		BRETS IF NECESSARY)	8P*45656-11
	A		
		and the second s	

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NOTICE TO WATER WELL CONTRACTOR	ALULIVED	۷		ah
The original and first copy of this report are to be filed with the	L REPORTATE THOMAS AND A STATE Well	. 25	DE-	33
STATE ENGINEER, SALEM, OREGON 07310	OREGON STATE ENGINEER	No.		
within 30 days from the date of well completion. C4432 Do not write abo	ove this lingALEM. OREGON	II No	(
(1) OWNER:	(10) LOCATION OF WELL:			
Name Tim JoHNSTON	County CLACKAMPS Driller's we			
Address 2363 SE 22ND PORTLAND	NW 14 NE 14 Section 33 T. 2 Bearing and distance from section or subd		Г. 	W.M.
(2) TYPE OF WORK (check):	Desiding tind distance	,		
New Well & Deepening 🛛 Reconditioning 🗋 Abandon 🗌				· · · · · · · · · · · · · · · · · · ·
If abandonment, describe material and procedure in Item 12	(11) WATER LEVEL: Complete	ł well.		
(3) TYPE OF WELL: (4) PROPOSED USE (check):	Depth at which water was first found		J	8 % IL
Rotary A Driven D Domestic M Industrial D Municipal		and surface,	Date	I ist 7
Cable [] Jetted [] Dug [] Bored [] Irrigation [] Test Well [] Other []		quare inch.	Date	
5) CASING INSTALLED: Threaded I Welded	(12) WELL LOG: Diameter of v	ell below cas	ing	6"
6 " Diam. from <u>t1</u> it to <u>39</u> st. Gage <u>1250</u>	Depth drilled 50 ft. Depth of c	ompleted wel		O tt.
ft. Gage ft. Gage ft. Gage	Formation: Describe color, texture, grain			
	and show thickness and nature of each st with at least one entry for each change of fo	umation. Rep	ort each	change in
) PERFORATIONS: Perforated? . Yes No.	position of Static Water Level and indicate	principal wa	ter-bearin	ng strata.
Type of perforator used	MATERIAL	From	То	SWL
Size of perforations in, by in.	-Sibt	0	5	
perforations from ft. to ft.	CLAY SILTY GREY	- 5	38	F
	GR GBAUEL,	- 38	47	6
berforations from ft. to ft.	CLAY, GREY	47	50	
(7) SCREENS: Well screen installed? [] Yes 10 No				· · · ·
Manufacturer's Name		413		
Type Model No.				
Diam, Slot size Set from ft, to ft.	· · · · · · · · · · · · · · · · · · ·			
Diam Slot size Set from ft. to ft.		·		
(8) WELL TESTS: Drawdown is amount water level is lowered below static level				· · · · ·
Was a pump test made? [] Yes D No If yes, by whom?				
Yield: gsl./min. with ft. drawdown after hrs.				
· · · · · ·				
- N/0		•.		
Baller test 25 gal./min. with ft. drawdown after / hrs.				
Artesian flow g.p.m.		<u> </u>	1	
perature of water Depth artesian flow encountered	Work started 115 19 74 Con	npleted	_4//	<u>t 10 74</u>
(9) CONSTRUCTION:	Date well drilling machine moved off of	7ell	<u>i1//</u>	4 10 74
Well seal-Material used <u>CEMENT BROUT</u> Well sealed from land aurface to <u>P 19 th</u> Diameter of well bore to bottom of seal <u>16</u> in Diameter of well bore below seal <u>611</u> in. Number of sacks of cement used in well seal <u>5 sacks</u>	Drilling Machine Operator's Certifica This well was constructed under Materials used and information repu- best knowledge and belief. [Signed]	my direct above	are tru	
Number of sacks of benionite used in well seal sacks	Drilling Machine Operator's License	No	D.Z./	
Brand name of bentonite	Water Well Contractor's Certification	:		• •
Number of pounds of hentonite per 100 gallons of water lbs./190 gals.	This well was drilled under my j		and this	report is
of water ibs./100 gals. Was a drive shoe used? [] Yes 20 No Plugs Size: location ft.	true to the best of my knowledge an	a bellef. NCII NA	Nº1 Sa	15 Tak
Did any strata contain unusable water? Yes No	(Person, firm or corporation)		Type or p	(int)
	Address H21 SW 6TH	ALE.	Pas	TLAND
Type of water? depth of strain	ALKUA COD	< ¥	/	
Type of water? depth of strata	1. mill	A.L.		
Method of sealing strata off	Signed Los Mullin	(AL.)		
	[Signed] for Mathematic	i dontractor) te	2.6	19 <u>7</u> ~/

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ALEM, OREGON		State Permit No.		1
1) OWNER:	CHINEFR	(11) WELL TESTS: Drawdown is amount w	vater leve	is -
ame Canil E. Jones STAL	TE ENGINEER	Was a pump test made? Yos X No If yes, by whom	-	
ddress Route 2 Box 83 SAL	EM, OREGON	Yield: gal./min. with ft. drawdow		h
Oregon City, Oregon				
		11 P D		
2) LOCATION OF WELL:	mbas if our	Bailer test 20 gal./min. with totalft drawdown	n after	1 h
ha managar	25 B. 2F. W.M	Artesian flow g.p.m. Date		
earing and distance from section or subdivision	and the second s	Temperature of water Was a chemical analysis ma	de? D 3	res 🕅
		(12) WELL LOG: Diameter of well	6	inch
	and the second	Depth drilled 120 it. Depth of completed w		
	······	Formation: Describe by color, character, size of materia show thickness of aquifers and the kind and nature of a stratum penetrated, with at least one entry for each c	the mater hange of	lal in ed formati
	A C	Dirtuand gravel	GROM	150
() TYPE OF WORK (check):		Yellow silt	15	20
	ditioning D Abandon	10	20	52
abandonment, describe material and proced		Blue course packed sand(mica)	52	55
		Course sand with a trace of fina		
1) PROPOSED USE (check):	(5) TYPE OF WELL:	(6 gpm) gravel	55	57
omestic 🖾 Industrial 🗋 Municipal 🗖	Cable I Jetted	Blue clay(sticky)	57	78
rigation 🔲 Test Well 📋 Other 📜 🔲	Dug 🛛 Bored 🗆	78Blue silty clay	78	90
6) CASING INSTALLED: Th	readed [] Welded 🕅	Grey silty clay	90	110
	-10" ft. Gege _250	Grey silty send	110	1.20
	59 At Gage 3/16			
" Diam. from ft, to	Anner	-		+
	ft Gage		1	
	ft Gage	-		
7) PERFORATIONS: Pe	riorated? Yes			
7) PERFORATIONS: Pe	riorated? Yes tob		 	
7) PERFORATIONS: Performance of performance Slotted with Size of performations 1/8 in. by	th outting torch			
7) PERFORATIONS: Performance of performance state of performance state of performance of the performance of	th outting torch 12 m. 12 th			
7) PERFORATIONS: Performations 1/8 in by performations from60	riorated? Yes St 1 th outting torch 12 in. it toi			
7) PERFORATIONS: Performance of performance of performance of performance of performance of the performance	riorated? Ver 1000 1th outting torch 12 in. 1 to ft 1 to ft			
7) PERFORATIONS: Performance of performance of performance of performance of performance of the performance	riorated? Yes 1000 1th outting torch 12 in. ft to ft to			
7) PERFORATIONS: Performance of performations of the second state of the second	riorated? Yes 1000 1th outting torch 12 in. ft to ft to			
7) PERFORATIONS: Performation used Solutions 1/8 Interformations 1/8 Interform 60 performations	rforated? Yes 200 1th outting torch]2 in. ft toft ft toft			
7) PERFORATIONS: Performation used State State NIZE of perforations 1/8 in, by perforations from perforations from 60 perforations from 90 perforations from 90 perforations from 90 perforations from 90 SCREENS: Well screen Wanufacturer's Name 90	riorated? Yes 250 1th outting torch]2 in. ft toft ft toft			
7) PERFORATIONS: Performation used Slotted with the second strend s	rforated? Yes 250 1th outting torch]2 in. ft toft ft toft ft toft ft toft ft toft ft toft installed □ Xes DE No Model No.			
7) PERFORATIONS: Perforator used Slotted with the second strenge of perforations 1/8 IZE of perforations 1/8 IZE of perforations 1/8 perforations from 60 perforations from 60 perforations from 9 perforations from 9 perforations from 9 well screen 9 Manufacturer's Name 9 Otam Slot size	riorated? Yes Sto 1th outfing torch]2 in rt to ft to			
7) PERFORATIONS: Perforator used Slotted with the second strenge of perforations 1/8 IZE of perforations 1/8 IZE of perforations 1/8 perforations from 60 perforations from 60 perforations from 9 perforations from 9 perforations from 9 well screen 9 Manufacturer's Name 9 Otam Slot size	riorated? Yes Sto 1th outfing torch]2 in rt to ft to			
7) PERFORATIONS: Perforator used Slotted with the second strence of perforations from	riorated? Yes Sto 1th outfing torch]2 in rt to ft to			
7) PERFORATIONS: Perforator used ype of perforators used Slotted with the second s	riorated? Yes 1000 1th outting torch]2 In. 	t Work started October 1957. Completed (
7) PERFORATIONS: Perforator used Slotted with the second strence of perforations 1/8 IZE of perforations 1/8 in. by perforations 1/8 in. by perforations from 60 Socreen 9 Oam Slot size Set from 9) CONSTRUCTION: 8 Was well gravel packed? Yes XI No	riorated? Yes 1000 1th outting torch]2 In. 	t. Work started October 1957. Completed ((13) PUMP:	Letobe	
7) PERFORATIONS: Perforator used Slotted with the second strent str	riorated? Yes 1000 1th outfing torch]2 in rt to ft to ft to ft to ft to ft to ft to ft to ft to ft to installed □ Yes DE No Model No. ft to ft to	t. Work started October 1957. Completed ((13) PUMP: Manufacturer's Name Jacuzzi Type:Jet		
7) PERFORATIONS: Perforator used Slotted with the second strent st	riorated? Yes 100 1th outfing torch]2 in 	t. Work started October 1957. Completed ((13) PUMP: Manufacturer's Name Jacuzzi Type:Jet Well Driller's Statement:	н.р. 1	12
7) PERFORATIONS: Perforator used STZE of perforators STATE of perforations perforations 1/8 in. by perforations from Slot size	riorated? Yes 100 1th outting torch]2 in 	t t t t Work started October 1957. Completed ((13) PUMP: Manufacturer's Name Jacuzzi Type: Jet Well Driller's Statement: This well was drilled under my jurisdiction	н.р. 1	12
7) PERFORATIONS: Perforator used Slotted with the second sec	riorated? Yes 100 1th outfing torch]2 in 	t. Work started October 1957. Completed ((13) PUMP: Manufacturer's Name Jacuzzi Type:Jet Well Driller's Statement:	н.р. 1	12
7) PERFORATIONS: Perforator used STZE of perforators STATE of perforations perforations 1/8 in. by perforations from Slot size	riorated? Yes 100 1th outting torch]2 in 	Work started October 1957. Completed (13) PUMP: Manufacturer's Name Jacuzzi Type:Jet Well Driller's Statement: This well was drilled under my jurisdiction true to the best of my knowledge and bellef.	H.P.] and thi	z s repo
7) PERFORATIONS: Perforator used Slotted with the second sec	riorated? Yes 100 1th outting torch]2 in 	t t t t t t t t t t t t t t t t t t t	H.P.] and thi	z Z
7) PERFORATIONS: Perforator used Slotted with the second sec	riorated? Yes 100 1th outting torch]2 in 	Work started October 1957. Completed (13) PUMP: Manufacturer's Name Jacuzzi Type:Jet Well Driller's Statement: This well was drilled under my jurisdiction true to the best of my knowledge and bellef.	H.P.] and thi	2 5 repo:
7) PERFORATIONS: Perforator used Slotted with the second strent str	riorated? Yes 100 1th outting torch]2 In ft to	t t t t t t t t t t t t t t t t t t t	H.P.] and thi	2 5 repor
7) PERFORATIONS: Perforator used Slotted with the second strent str	riorated? Yes 350 1th outfing torch 12 in rt to 90 is rt to 90	Work started October 1957. Completed (t Work started October 1957. Completed ((13) PUMP: Manufacturer's Name Jacuzzi Type: Jet Well Driller's Statement: This well was drilled under my jurisdiction true to the best of my knowledge and belief. NAME Steinman Bross. (Person, firm, or corporation) Address15112. S.E. McLoughlin-Milway Driller's well number 32-57.	H.P.] and thi	z Z
7) PERFORATIONS: Perforator used Slotted with the second strent str	riorated? Yes Sto th outting torch]2 in rt to	Work started October 1957. Completed ((13) PUMP: Manufacturer's Name Jacuzzi Type:Jet Well Driller's Statement: This well was drilled under my jurisdiction true to the best of my knowledge and belief. NAME Steinman Bross. (Person, firm, or corporation) (Address15112_S.E. McLoughlin_Milway	H.P.] and thi	2 5 repor

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(RIAC) NE	GEIVED
STATE OF OREGON 44 76) NC	DV 21984 0442825/2E-33
WATER WELL REPORT	- / \
	FROURCES DEPT.
SAL	MI UNLOUN
) OWNER:	(10) LOCATION OF WELL by legal description:
me CAROL SCIRINO D	county CLOCKAMAS 4 yor Section 33
Idress 4012 S. MORTON KD	Township, Range, Why (Range is East or West)
ity DRE CITY State DR	Tax 25500 tot Mock Subdivision
2) TYPE OF WORK (check):	MAILING ADDRESS OF WELL (or nearest address)
www.Weil Deepening D Reconditioning D Abandon D	14072 S. MORTAN KD
abandonment, describe material and procedure in Item 12.	ORE CITY, OR 47045
3) TYPE OF WELL: (4) PROPOSED USE (check):	(11) WATER LEVEL of COMPLETED WELL;
otary Air Driven D Domestic D-maustrial D Municipal D	Depth at which water was first found Z85
plary Mud Dug D Irrigation Withdrawal Reinjection	Static level 2055 A. below land surface. Dato
OrLer;	Artesian pressure The. per square inch. Date
Bored Decometric Crounding Text	(12) WELL LOG: Diameter of well below casing
5) CASING INSTALLED: Steel - Plastic D .	Depth drilled 304 A. Depth of completed well 29(a
Threaded Welded	Formation: Describe color, texture, grain size and structure of materials; and show thickness
Le Diam from + 2 A to 282 A Gauge 1250	and nature of each stratum and aquifer penetrated, with at least one entry for each change formation. Report each change in position of Static Water Level and indicate princip
Diam. from ft. Gauge	water-bearing strata.
LINER INSTALLED: Steel Disting	MATERIAL Prom To SWL
Diam, from ft to ft. Cauge	TOP SOLL 01
	BROWN CLAY 1 21
6) PERFORATIONS: Perfocated? in by in.	GRAY CLAY ZI 47
	GRAY CLAYSTONE 42 163
perforations from	CEMENTED GRAVEL &
perforations from	163 187
perforations from	GRAN CLAYSTONE 187232
7) SCREENS: Well screen installed?	BROWN CLANSTONE
Annufacturer's Name 6hNSON	
ype STAINLESS STEEL Model No.	SAUD W/SOME SM. 285 295 205
Nam. 5.1/2	GRAY CLAY & GRAVEL 295 304
Diam Slot Size Set from A to A	GKNY LENY GIRCOLL LOUSE
8) WELL TESTS: Drawdown is amount water level is lowered below static level	
Vas a pump test mado? I Yes INT If yes, by whom?	NOTE: 4 1/2 FEET OF 5 INCH CASIN
gal./min. with fl. drawdown after hrs.	BBOVE AND BELOW SCREEN.
gaily and white stream and the	
hir test 30+ gal/min. with drill stem at 7 (ch R. Z. hrs.	
Bailer test gal/min. with ft. drawdown after hrs.	
urtesian flow g.p.m.	
verature of water Depth artesian flow encountered fl.	
9) CONSTRUCTION: Special standards: Yes I No G	Date work started 9/24/84 /completed 10/0/84
9) CONSTRUCTION: Special standards: Yes I No BY	Date well drilling machine moved off of well 10/6 15
Vell scaled from land surface to R.	(unbonded) Water Well Constructor Certification (if applicable):
Diameter of well hore to bottom of seal 10-t- in.	This well was constructed under my direct supervision. Materials used a
Diameter of well bore below seal	information reported above are true to my best knowledge and belief.
Amount of sealing material B sauks @_pounds D	[Signed]
How was cement grout placed?	(bonded) Water Well Constructor Certification:
	Bond Issued by:
	(number) (Surety Company Name)
Was pump installed?	On behalf of DANLEL V. U.M. As an (bype or print name of Water Well Constructor)
Was a drive shoe used? Ares No Plugs Size: location	مع منه و المحمد و المراج في المحمد المالية و المحمد المحم
Did any strata contain unusable water?	This well was drilled under my juridiction and this report is true to best of my knowledge and belief:
Method of sealing strata off	(Signed) (Water Will Constructor)
Was well gravel packed? Yes A No Size of grevel:	(Dated) 10/20/84
Gravel placed from ft_to ft_	WATER RESOURCES DEPARTMENT, 89*46966

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original and plicate with the Arts Engineer. LEM. OREGON	ATER WELL DRIL STATE OF OF		Fill In 5	ermit No. 2/2	
) OWNER: STATE ENGINEER	1/CLA	(1) WELL T	ESTS:		T - T
me MrSALEMrs Robert	Mooller		nade? I Yes Xo	If yes, by whom?	
tress Oregon Gity, O	re.	Yield:	gal./min. with	it. draw down aft	er hrs.
Route				the second second second	**
				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	14
) LOCATION OF WELL:	1.	Artesian flow		n. P	
unty Clackamaa Owner's number. 1	any-	Shut-in pressure		per square inch.	
T. D. or street No. 3 earing and distance from section or subdivision of	THAT A THE REAL OF A	Bailer test	.5		ft. drawdown
ast of Oregon City about		Temperature of w		mical analysis made?	Yes No
artis on Beaver Greek roa	d. North on	Was electric log n	nade of well? Tes		
Cly Lane to 4th house 6	n left.	(11) WELL I	.0G:	•	
		Diameter of well.	6_ inches.		
3) TYPE OF WORK (check):	A CONTRACTOR	Total depth		of completed well	429 st.
wwell D Deepening Recondition	- LJ	Formation: Descr	ibs by color, characte	r, size of material and	structure, and
pandonment, describe material and procedure		show thickness of stratum penetration	adulters and the kind	r, size of material and l and nature of the mining for each change	of formation.
PROPOSED USE (check):	(5) EQUIPMENT:	0 11 to 52	IL Brown St	icky slay	
omestic 🖾 Industrial 📋 Municipal 🗔	Rotary	52 100	free too profit a sta	prown sand	,
rigation 🔲 Test Well 📋 Other 🔲	Cable 🗖	100 172	· Denne	wn clay	
CACINYO THYOMAXYYD		172 327	" Blue ola		
CASING INSTALLED:	If gravel packed	327 355	Brown a	green clay	
readed 😰 Welded 🗆	a service was	355 366	Tightle	y packed bla sed soft roo	iok sand
	flameter from to of Bore ft. ft.	366 " 378	the second se		
"351 " 429 "4t " t	19 U	378 398	" Brown o	black sand	Chottom
" "liner"	A	398 429		eet loose s	
25 25 27 77 Latin and			B GHO I		with 1
H H H H H H H			H	- 19+	
	n' n		н		· .
vpe and size of shoe or well right added s	A PULLIAN A COMPANY AND				
escribe joint threaded aleave					
7) PERFORATIONS:			5.5 ······		
the of perforator used	and the local		13		
	ngth, by In. er foot No. of rows		17	· · · · · · · · · · · · · · · · · · ·	
ROM ft. to tf. pert p	H H IN DI N B		1) v v z		
ti ii i	n n n n n n n n n n n n n n n n n n n				· · · · ·
A CALL AND	1		11		
The second second by an	й и у а у <u>а</u>		22		
SCREENS:	The state and the part of				N 14
Give Manufacturer's Name, Model No. a			10	9	
	and a state of	2 H	in Act	3. 77	
8) CONSTRUCTION:	35		11	· · · · · · · · · · · · · · · · · · ·	
Was a surface sanitary seal provided? TYPes	No To what depth of ft.		0	28	· · · ·
Were any strata sealed against pollution?" X Yes	No No		n at well site ADOU		mean sea level
f yes, note depth of strata	-11 ····	Work started	ept.10 10 55	Completed Oct	. 29 19 5
IVY	2-9	Well Driller's			••••
	The and the station	This well the bes	was drilled under n it of my knowledge	and belief.	this report is
METHOD OF SEALING					
(9) WATER LEVELS:		NAME	Floyd Ber	son	- mulad-al
Depth at which water was first found	426 11				r printed)
Standing level before perforating	289 1		10 S.E.Rool	WOOD AVe I	Portland
Standing level after perforating	Time States	Driller's well	number 5	·	22,0
			111 1 12	,	-

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10	STATE OF OREGON CLAC WATER WELL REPORT 787 AUG - 7		Z	15	2[n -	
i'e	WATER WELL REPORT 787) AUG - ?	1992			121	\prec	21,
		1004		7-6	-E/	L	2000
	(as required by ORS 537.765)		(START CARD) #_W	-2810	0	1	
	(1) OWNER: Well Number 15-952LEM, C	REGON				7	
	(1) OWNER: Well Number 15-92 Name Marvin A./Shirley McIntosh	(9) LOCATION (OF WELL by legal				
	Address 14130 S. Donovan Road	Thumshin 2-5	.amarfatitudeN or S, Range	2-E	ougitude_	E or W	WW
	City Oregon City, State OR Zip 97045	Section 33	SW	4 NW	И		
	(2) TYPE OF WORK:	Tax Lot 01100	Lot Block		Subdiv	ision	
	(3) DRILL METHOD:	Street Address of V Road Orego	Well (or nearest address)	9704	15	Dong	Ivan
	Rotary Air Rotary Mud XCable	(10) STATIC WAT					
	Other	and the second se	below land surface.				0/92
	(4) PROPOSED USE:	Artesian pressure		uare inch.	Date		`
	Thermal Injection Other	(II) WATER BEA	TRING ZONES:				
	(5) BORE HOLE CONSTRUCTION:	Depth at which water	was first found _ 199	fee	t		<u> </u>
	Special Construction approval Yes X No Depth of Completed Well 214 R.			1			
	Explosives used Yes XNo TypeAmount	Fmm 199 feet	10 208 feet	50 (ated Flow	Rate	SWL 136
	HOLE SEAL Amount Diameter From To Material From To sacks or bounds	1001	479 LGEL		arnii -		1.20
	10" 0 32 Bentonite 0 25 27 sacks.						
	6" 32214						
		(12) WELL LOG	Ground cleva	tion			
	How was seal placed: Method A DB C D D E						
	XXOther Rentonite		Material		From	To	SWL
	Backfill placed from 25 ft. 10.32 ft. Material Bentonite Gravel placed from ft. to ft. Size of gravel	Clay: brog			0 32	32	
	(6) CASING/LINER:	Clay: may			91	94	
	Diameter From To Gauge Steel Plastic Welded Threaded	Sandstone	hrown		94	107	
	Casing: 6" +1 204.250 X X	Clay; gray				<u>128</u> 141	
		Sand: gray	ravel: brow	-	141		
		Clay; blue	e		147	166	
	Liner: <u>5"</u> <u>198</u> 203.250 X 5" 208 214,250 X X	Clay; gray				199	
	5" 208 214.250 X	black	rse and pea	grav		208	136
	(7) PERFORATIONS/SCREENS:	Clay; bro				214	
	Perforations Method						
	EXScreens Type-Telescopiquaterial State						
	From To size Number Diameter size Casing Liner						
	203 208 20 6" [] , [XX .	1			·		┼──
							+
	(8) WELL TESTS: Minimum testing time is 1 hour	1 7/2	3/92 Co		7/30	/92	
	Pump XX Bailer Air Artesian	Sur Sur Co	Vell Constructor Certifi	mpleted _	1750	116	
		I certify that the	work I performed on the	construc			
	Yield gal/min Drawdown Drill stem at Time 50 gpm 15 feet 1 hr. 1		compliance with Oregon reported above are true				
	50 grm 15 feet	Ronald F.	McConnell,	dba			
		Steinman B	ros. Drilli	ing Co	Date		
	5 20	(bonded) Water We	I Constructor Certifica				
	Temperature of Water 53 Depth Artesian Flow Found	I accept responsi formed on this well d	bility for the construction uring the construction da	, alteration les reporte	1, or aban d above. J	donmeni All work	t work per performe
	Did any strata contain water not suitable for intended use?	during this time is in	compliance with Oregon my knowledge and belie	well consti			
	Salty Muddy Odor Colored Other		alad		WWC	Number	1
	Depth of strata:	Signed Konglo					14.

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AUG 2 3 1991

) OWNER:				Well Numbe	er:	
De		abe St				
e ss		SO2 SE	d State	07	710 0 70	06
TYPEO			id male	OR	Zip 972	00
TYPE OI			Describer			
ew Well_			Recordition	.L Ab	andrin	
DRILL N Rotary Air			Cable			
Other		- · ·				
PROPOS	SED US	SE:				
Domestic [Industrial	D irrigat	on .	• ••
Thermal [Injection	n 🗆	Other			
BOREH	OLE C			I: .		1.0.0
etal Construction		Yes No		of Complete	d Well	103 ft.
	es Nu D			Amount		
HOLE	-		SEAL			unt
meter From		Materia		То	Amor sacks or	pounds
	103 Ce		0	19	8	aks.
6 103	250 Dr		utting	0.50		
			103	2.50	-	
was seal placed	Mathud	L A	BIXC		JE	
Other	u		· · · · · · · · · · · · ·			
kfill placed from	103	25				
process month		L. (1)	D_ft. Matt	rial Dr11	1 cutt	ing_
el placed from_	_19(r. to _10	13 ft. Nate	nf gravel _1	1 cutt 14 - 3	ing_ /8
el placed from_	_19(r. w _10	13 ft. Nate	of gravel 1	1 cutt 14 - 3	ing /8
CASING Diameter	 /LINE From	$\frac{1.10}{R}$	Gauge Steel	of gravel _1	<u>/4 - 3</u> Velded TI	18
CASING Diameter	<u>19</u> /LINE From +1	$\begin{array}{c} 1 \\ \mathbf{R} \\ \mathbf{R} \\ \mathbf{T}_{0} \\ 20 \\ 2 \\ \end{array} $	Gauge Steel	Plastic V	<u>/4 - 3</u> Velded TI	hreaded
CASING Diameter	 /LINE From	$\begin{array}{c} 1 \\ \mathbf{R} \\ \mathbf{R} \\ \mathbf{T}_{0} \\ 20 \\ 2 \\ \end{array} $	Gauge Steel 250 X 180 I	Plastic V	Velded TI	breaded
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Yes By whom .

. ..

Did any strata contain water not suitable for intended use? 🔲 Too little

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT

Salty Muddy Odor Colored Other

Was a water analysis done?

Depth of strata: __

	-		,		
EPT.	ð	Sla	E/3	3 C	\sim
	TART CARD) #			/	, `
	OF WELL by le				-
Clacker	DASI winds	garde	scripti	.on: /	
Truncio 23	nas Latitude S Nor S. Range 3 SW4	2E	Longitude		~ ′
Saction 3.	3 SW	Sk	7	E or W. V	W M1.
Tax Lot 200	D Lot Bluel		- ²⁴ Subdu	leine	
Street Address of W	D Lot Block 'ell for nearest address) L	7917 8	SW Wal	dow R	d.
	0	regon	City,	OR	
O) STATIC W	ATER LEVEL				
<u>30</u> n.1		•	Dete	08/13	/91
	Ib. per squ	aca inch		<u>Y01 ± 4</u>	
the second se			Date		
I) WATERB	EARING ZONE	30 30			-
pth at which water was	s first found	30			
From	To		ated Flow	Rate	SWL
30	43	6	gpm		30
62	.81	4	gpm		ŧ1
	· · ·				
2) WELL LO	G: - Ground elevat	ion			
	Material		From	To	SWL
rown clay w/	rock fragment	.s	0	11	
ray wax blac			11	18	
irm brown cl	ay & brkn bas	alt	18	30	
roken brown	basalt		- 30	43	
ray silty cl			43	62	
ray brown cl			62	81	
lue gray cla			81	116	
ray clay			116		
ark gray cla	LY		153		
1rm gray sar	Instone		175	188	
	ray claystone	2	188 205	205	
irm gray cla irm gray bro			241	<u>241</u> 250	
TIM BLAY DIG	Wh cray		241	250	
Well complet	ed at 103 ft.				
2200					
	1960 1 294 7				
ere started08	/11/91Cor	npleted	0.8/1	3/91	
inbonded) Water	Well Constructor Co	ertificat	ion:		

certify that the work I performed on the construction, alteration, o mment of this well is in compliance with Oregon well construction rds. Materials used and information reported above are true to my bes dge and belief.

WWC Number <u>1492</u> Date <u>08/16/91</u> aby m

ed) Water Well Constructor Certification:

	 accept responsibility for the construction, alteration, or abandonmen work performed on this well during the construction dates reported above. al work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and
	belief. K 2 WWC Number 1265
	Signed Date
SEC	COND COPY - CONSTRUCTOR . THIRD COPY - CUSTOMER 9809C 3/8

STATE ENGINEER, SALEM, OREGON 9736 2 3 1974 (Pinase type	an andress Life U.C. July	25 35	1
within 30 days from the datSTATE ENGINEER(no not write a)	ALL STATE ENGINEEDState Permit	No	
SALEM OREGON 0443	A SALEM ORECONLAC		1
(1) OWNER:	(10) LOCATION OF WELL:		the
Name RICHARD HEMPHILL	County Me Camp & Driller's well 1	number 30	19
Address 14161-5-REDMAID RD DC.	17 12 12 12		·-/
address 1110 - 1 - 1 - 1 - 1 - 1		R.ZE	W
(2) TYPE OF WORK (check):	Bearing and distance from section or subdivis	sion corner	
New Well [] Deepening [] Reconditioning [] Abandon []			
If abandonment, describe material and procedure in Item 12.	(11) WARDED I WHET - Completed		
(3) TYPE OF WELL: (4) PROPOSED USE (check):	(11) WATER LEVEL: Completed		
	Depth at which water was first found	36	
Cable] Jetted]	Static level /8 ft. below land	surface. Date 2	Nor
Dug 🔲 Bored 🗋 Irrigation 🗋 Test Well 🗍 Other 📮	Artesian pressure fbs. per squ	are inch. Date	
) CASING INSTALLED: Threaded D Welded	(12) WELL LOG: Dismeter of well		/
6 Diam from 0 It to 20 It. Gage 250	inductor of wen	below casing	
5 " Diam from 0_ # to 40 it. Gage 1.98	Depth drilled 4/D ft. Depth of com	pleted well 4 (2
" Diam. fromft toft. Gage	Formation: Describe color, texture, grain size and show thickness and nature of each strat		
	with at least one entry for each change of form	nation. Report each	chang
PERFORATIONS: Perforated? Fres D No.	position of Static Water Level and indicate pr	incipal water-bear	ing str
Type of perforator used tour LW	MATERIAL	From To	sw
Size of perforations in by 8 in.	AROWN CLAY	0 5	
perforations from ft to ft_	BLUE CLAY	5 36	
perforations from ft. to ft.	GRAVEL	76 40	
perforations from ft. to ft.		_ <u></u>	
(7) SCREENS: Well screen installed? [] Yes PI No			
(1) SCREENS: Well screen installed? Yes 2 No Manufacturer's Name			
Type Model No			
DiamSlot size'Set fromft. toft			
Diam Slot size Set from ft. to ft.			+
			1
(8) WELL TESTS: Drawdown is amount water level is howered below static level			
Was a finito lest made? I Yes ANo If yes, by whom?	12 Alexandre		
Yield: 12. gal./min. with 40 ft. drawdown after hrs.			
Air test "			
	· · · · · · · · · · · · · · · · · · ·	····	
	a the second s		
Bailer test gal./min. with ft. drawdown after hrs.			
Artesian flow g.p.m.			<u> </u>
mperature of water CODepth artesian flow encounteredft.	Work started Nov 2 19 73 Compl	leted Nov 2	15
(9) CONSTRUCTION:	Date well drilling machine moved off of well	Nov 2	11
Well seal-Material used BENTONITE	Drilling Machine Operator's Certificatio	n:	
Well sealed from land surface to	This well was constructed under m	ny direct supe	ervisi
Diameter of well bore to bottom of seal in.	Materials used and prormation reported		
Diameter of well bore below seal		_ Date 2/NC	20 10
Number of sacks of cement used in well seal sacks	[Signed] (Drilling Machine Operator)	- Dave 6 7 1	, ·
Number of sacks of bentonite used in well seal sacks	Drilling Machine Operator's License No)J	
Brand name of bentonite QUIK Geli	A COLORADO A		
Number of pounds of benionlie per 100 gallons	Water Well Contractor's Certification:		
of water 50 22 1bs./100 gals.	This well was drilled under my juri true to the best of my knowledge and k		s repoi
Was a drive shoe used? If Yes No Plugs Size: location ft.	Name Swify WATER Well	DRYLIN	9
Did any strata contain unusable water? D Yes & No	(Person, firm or corporation)	(Type or)	ormi)
Type of water? depth of strata	Address Hal Sin 694 Po	elland_	
Method of scaling strata off	seinen de mill	61	
Was well gravel packed! [] Yes [] No Size of gravel:	[Signed] (Water Web Co	miractor)	
			, 1



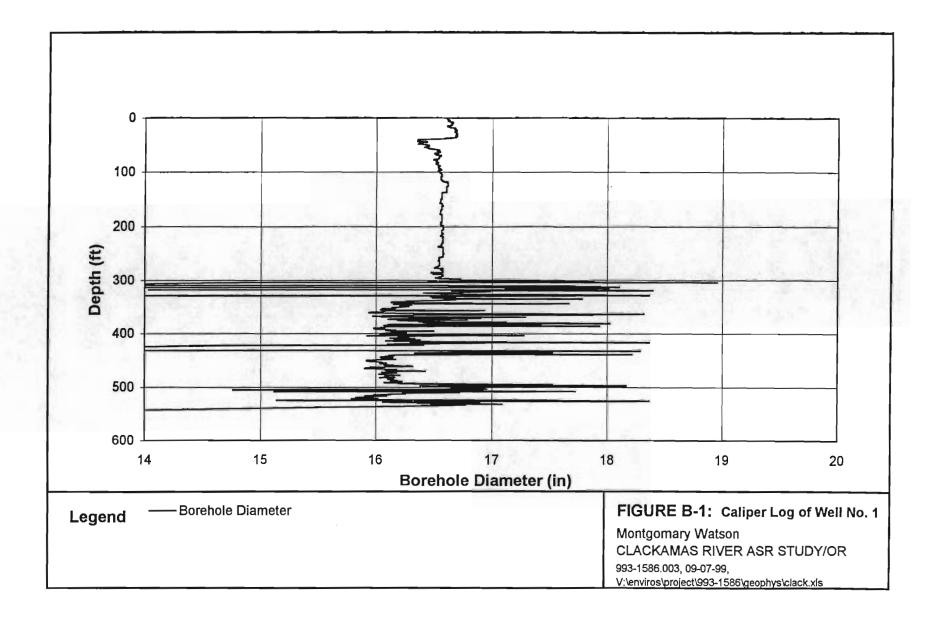
APPENDIX B

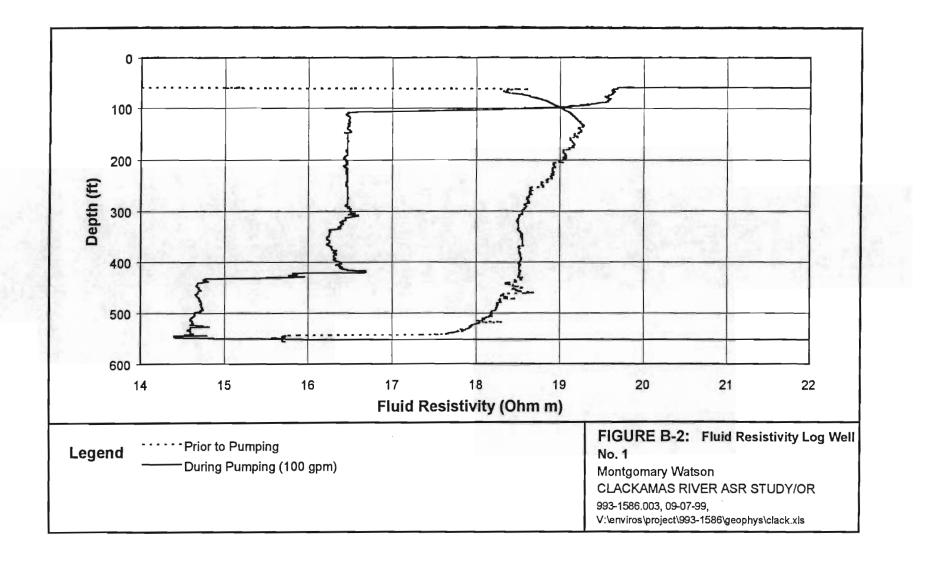
WELL NO. 1 GEOPHYSICAL LOGS

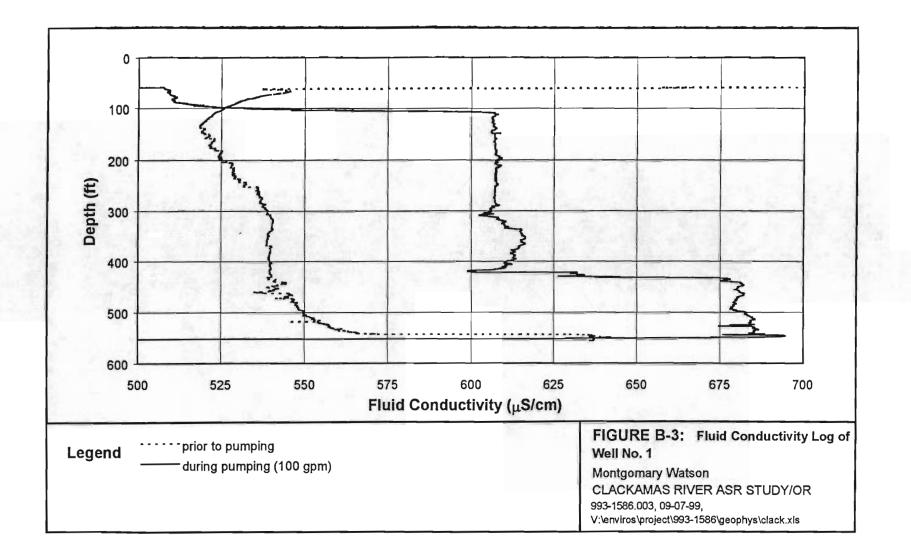
Golder Associates

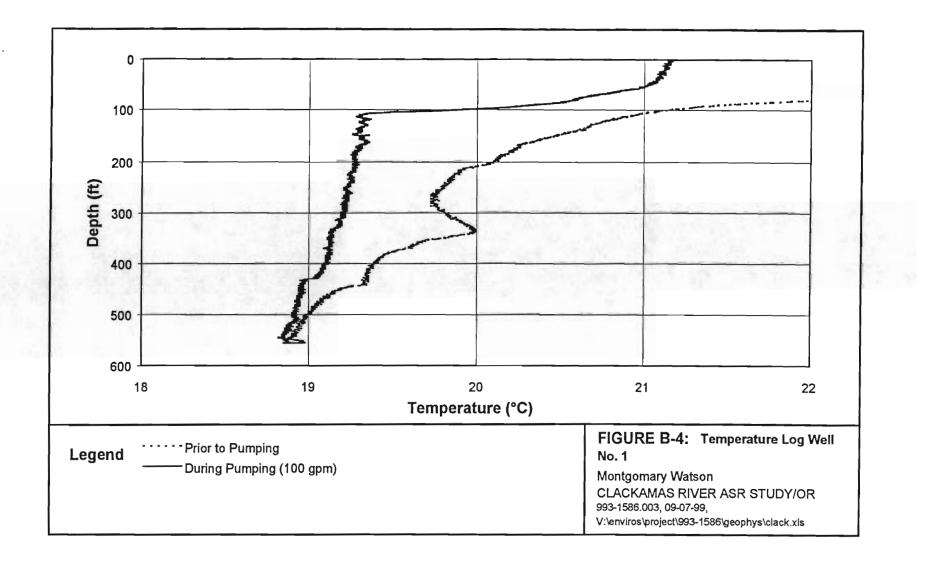
WELL NO. 1 GEOPHYSICAL LOGS

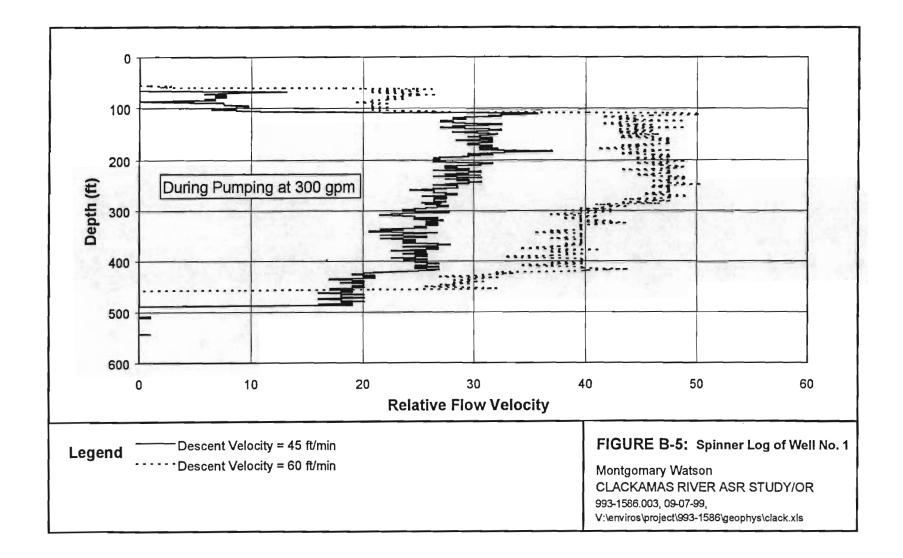


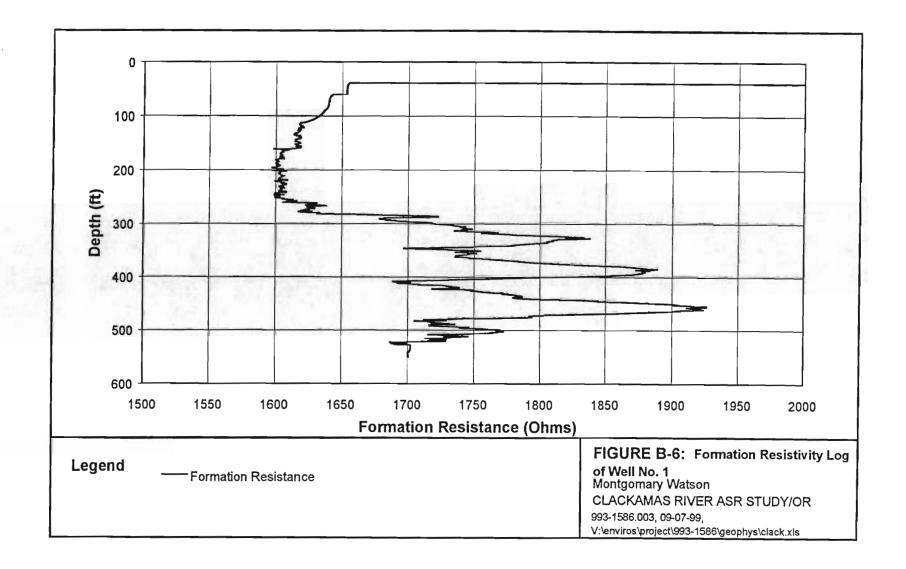


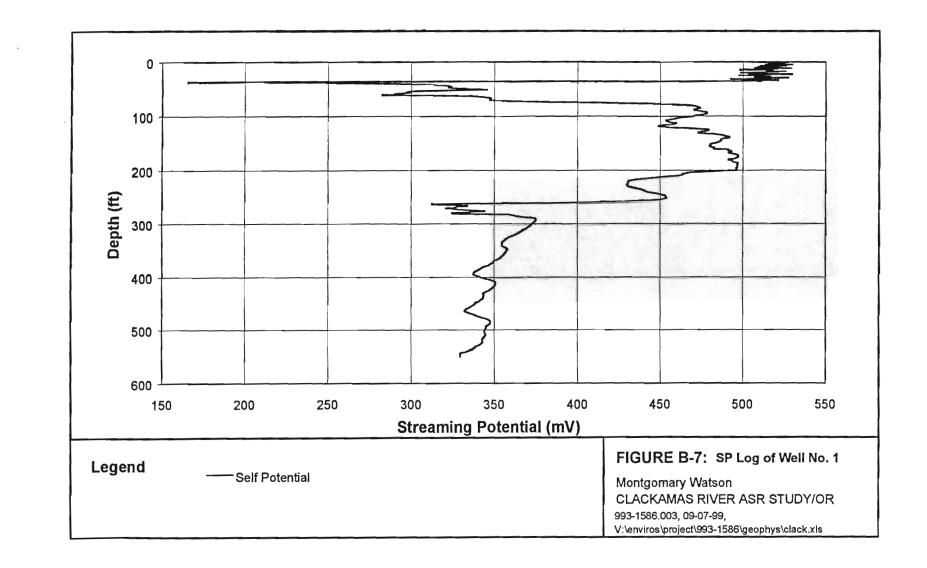














APPENDIX C

24-HOUR PUMPING TEST AND PACKER TEST INFORMATION

Golder Associates

24-HOUR PUMPING TEST AND PACKER TEST INFORMATION

WELL TEST DATA SHEET

Stettler Supply Company + 1810 Lana Avenue NE + Salem, OR 97303 + Phone: 585-5550 Fax: 581-6799

Owner's	Name	Lackam	AS River W.		ocation	Red hand	
		_		Date		8-31-	99
VVell Dia.			60' Static Level	61.11			Perforated at
			Pump Size	Air-Lin	e 📈	robe Te	sted By Bute
Static aft	er Test	Dep	th after Test	Drilled	By	Те	st Started
Test Stop	oped	Max	GPM	Pumpi	ng Level		•
		ren P					
GPM	PUMPING	TIME OF	CONDITION OF	GPM	PUMPING	TIME OF	CONDITION OF
	LEVEL	DAY	WATER	- · · · ·	LEVEL	DAY	WATER
	1.1.11	10.12	11297600	300	1.3.68	12:25	11332 800
300	(<i>a</i>). <i>ii</i>	10:36	11297600		63,68	12:20	
-200	63.30	10:37			63,66	1.00	
1	63.35	10 30 1			63.68	1:30	
}	63.30	10-39			63.70	2'00	
	6343	10 410			63,70	230	
	63.58	10:11		1	3.76	3.00	
	63.57	10.04		300	63.76	5 36	11388900
	63.5%	10.43		1 500	63.76	1	11208450
	63.58	12.43		1	63.77	1. 1 <u>.</u> 1. 1 <u>.</u>	
1.100			11300000				
1300	63.59	<u> </u>	11300000		(-3.78	5 0	
	63.60	10 118		1	63.80		
	4340	10.50			12 20	6.1	
1		10 5 2			63.78		
<u> </u>		10 5 4		1 2 - 4	63.72	221	:41. 22
2.00	63.2-	15 36	11303200	300	6.3.78		1467300
300	63.70	10 55	11303700	1	43.78	8	
	1.3.20	11.00			1200	8 1	
	63.71	52			63,80	4.00	
	63.	12 - 4			63.80	1 43	
	63.7	11			62.32	10:00	
	63.60				63.5:	10 :10	
	63.60	11 10	(12-00)		63.84	t.*	
Pice_	63.60	2. 14	113098:20		63.811	11.35	
·	12.1.2	11 2.5		1 -	63.86	12.10	
	47.62	1		300	23.67		11361100
7	63.22				\$3.90	1.0	
	63.62				43.70		
7	Li3	. 1 . 4/ "		-	63.92	2 -1	
300	43.22	1	1		65.23	2 '3r'	
1	63.62	11.32	-		13.94	3.0	
	63.1.2	11:33		1.7	13.9:1	7 2 1	1 11.0
	63.62	12.00		300	63.92	11:1	1421200
	1211	12 ::			1.3.12	1 S.1	
	63.66	12:15			63.72	9. m	
	1 2 1 2	12.15		1	63.78		
	63.63	12:25		1	(e) - 1		

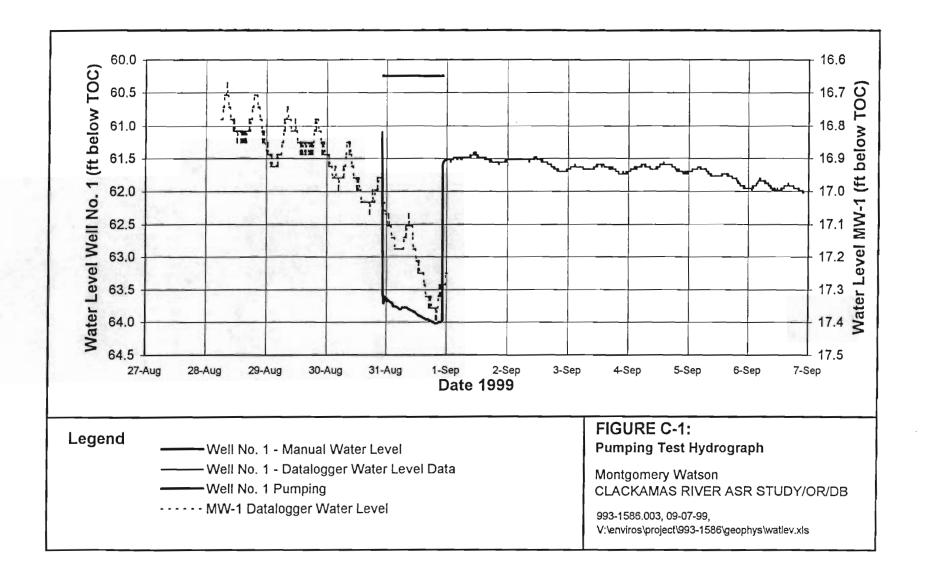
WELL TEST DATA SHEET

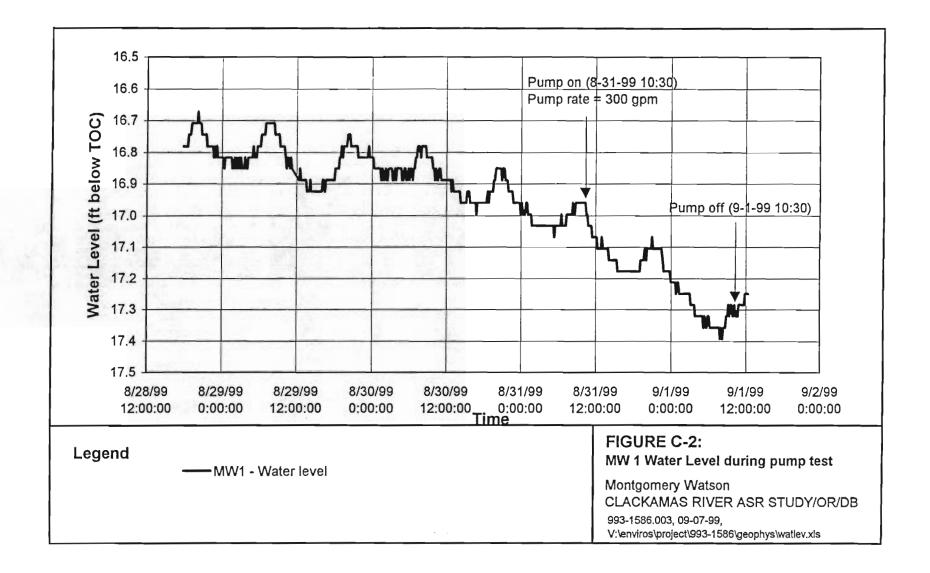
Stettler Supply Company + 1810 Lana Avenue NE + Salem, OR 97303 + Phone: 585-5550 Fax: 581-6799

Owner's Name	hart	MAS W	<u>a ·· </u> 1	Vell Location	Red	and r	· · ·
			L	Date	- /	- 99	
Well Dia.	Depth	560' Stati	cLevel 61.1	// Cased to		Perforated	at
Test Pump Setting	£^``	Test Pump Size	30	tir Lin e	Pares	Tested By	(
Static after Test		Depth after Test	C	Drilled By		Test Started	
Test Stopped		Max GPM	F	oumping Level			

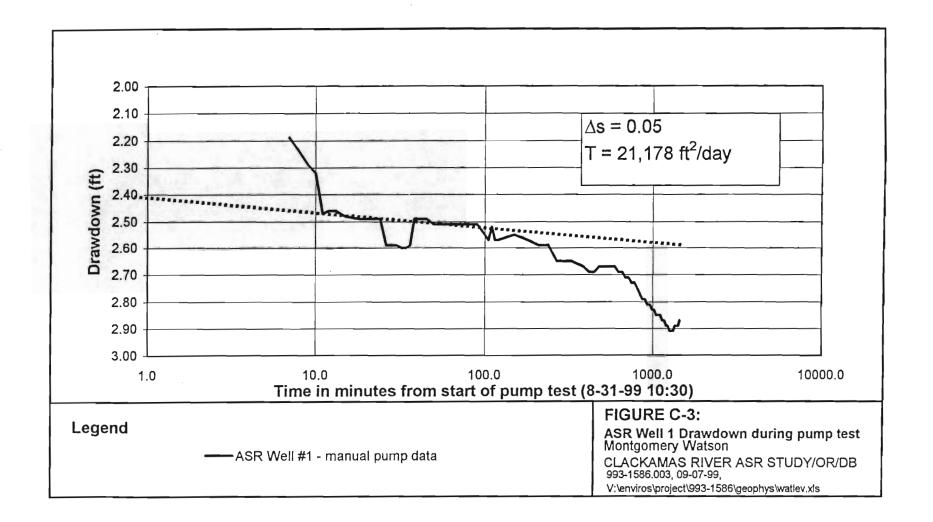
GPM	PUMPING LEVEL	TIME OF DAY	CONDITION OF WATER	GPM	PUMPING	TIMEOF	CONDITION OF
1200	(41.00					DAY	WATER
1211-14		6:30	1167431		61.53	11:25	
	6-21.00	2:00			61.33	11:30	
	64.02	7 30			41.53	11:35	
	62				41.52	11:40	
	64.00	630			61,52	11:45	
	1.00	2-0	11717600		61.52	11:5.2	
	-11.50	2.			61.52	11:35	
1	64.00	10:00			61.52	12:50	
77	63.78	10 35	11745950		61.52	12:13	
					İ		· · · · · · · · · · · · · · · · · · ·
			Recovery	5			
	61.64	10:31					
	61.55	10:32					
	61.58	10-33		Sec.	1.		
-	61,58	10:24					
	61.56	10:35				· · · · · · · · · · · · · · · · · · ·	
	61.56	10.36					
	le1.56	10:32					
	61.56	10:38					
	61.56	10:39					
	61.56	10:40					······································
	61.55	10142			and the state		
	61.55	10:44		1.			
	61.55	10 11					
	61.55	10.45					
	61.55	10:50					
	61.55	16:52		23.3.1.1.2.4			
-	61.55	10:54					
	61.54	10 54					
	61.54	10:55					
	61.54	11.25					
	6-154	11:05					
	61.53	11.12					
	61.53	1. 5					
	61.53	11,20		1.5			

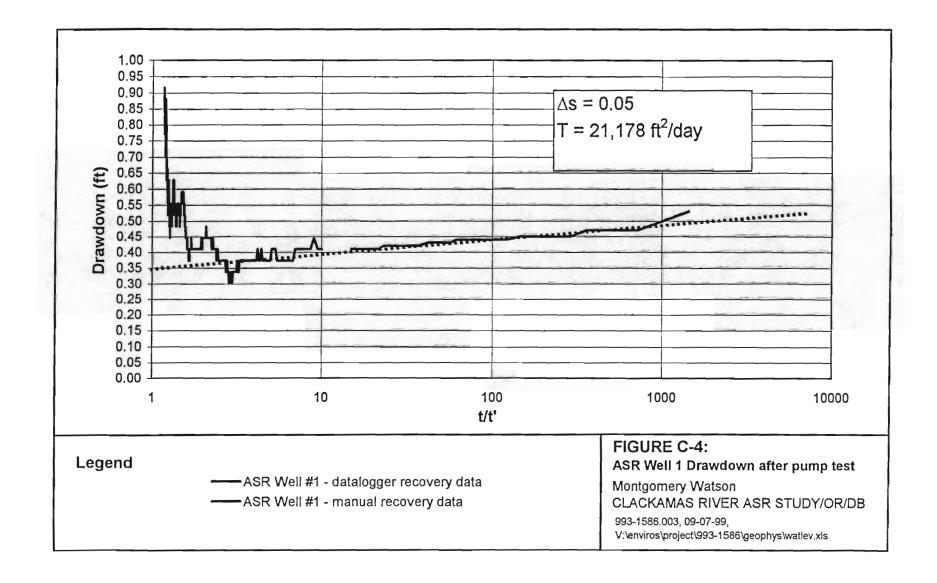
1313 - Set ". opsi trata hear at ~ 72 ft. Nata land probe Malfun House No landing

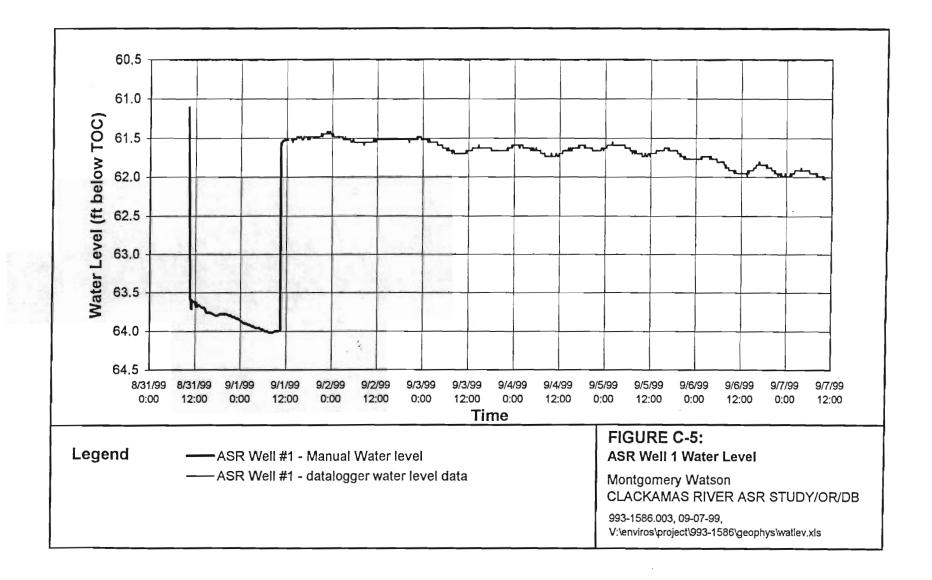


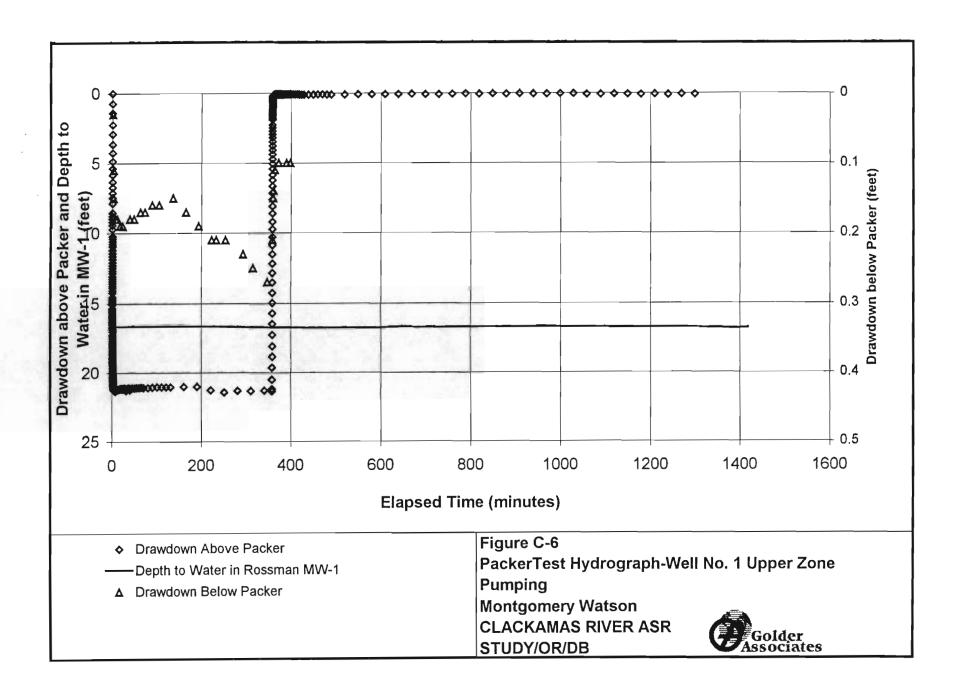


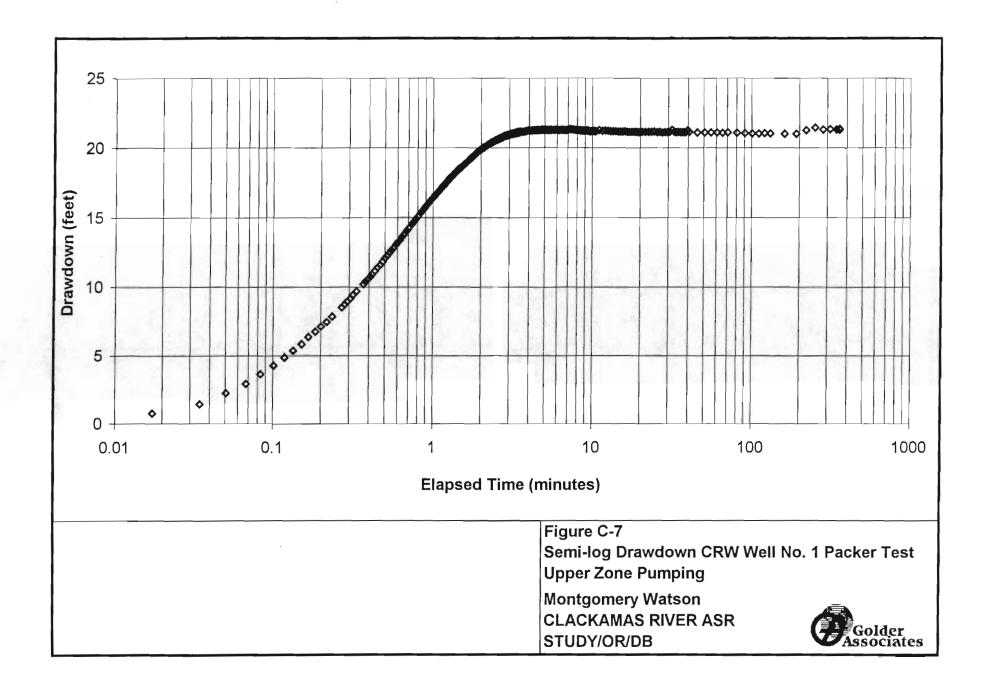
ASR Well #1 - manual pump data

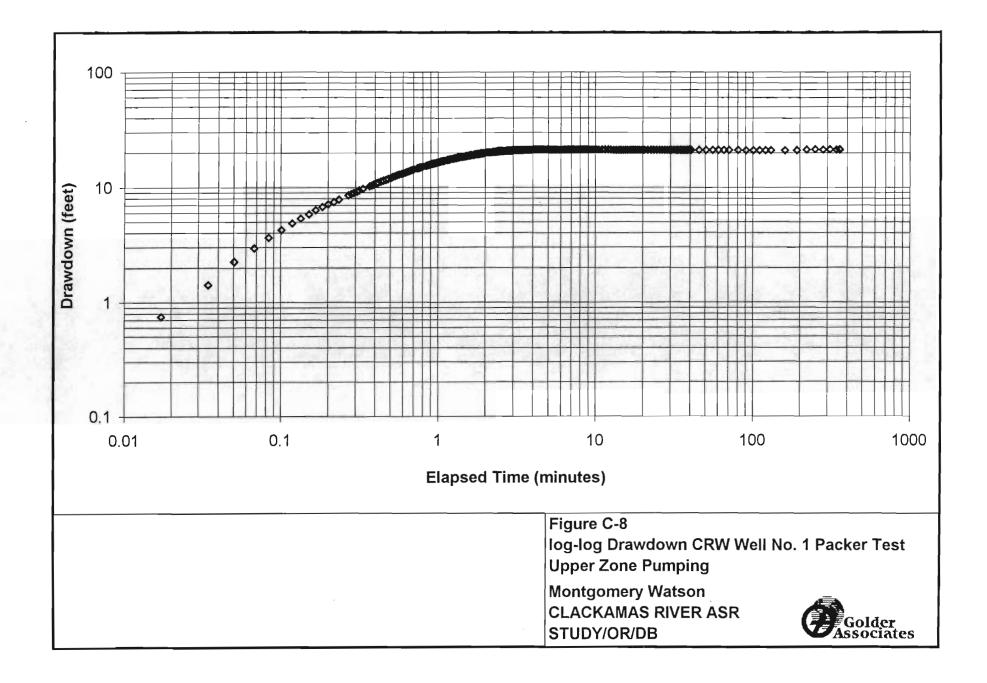


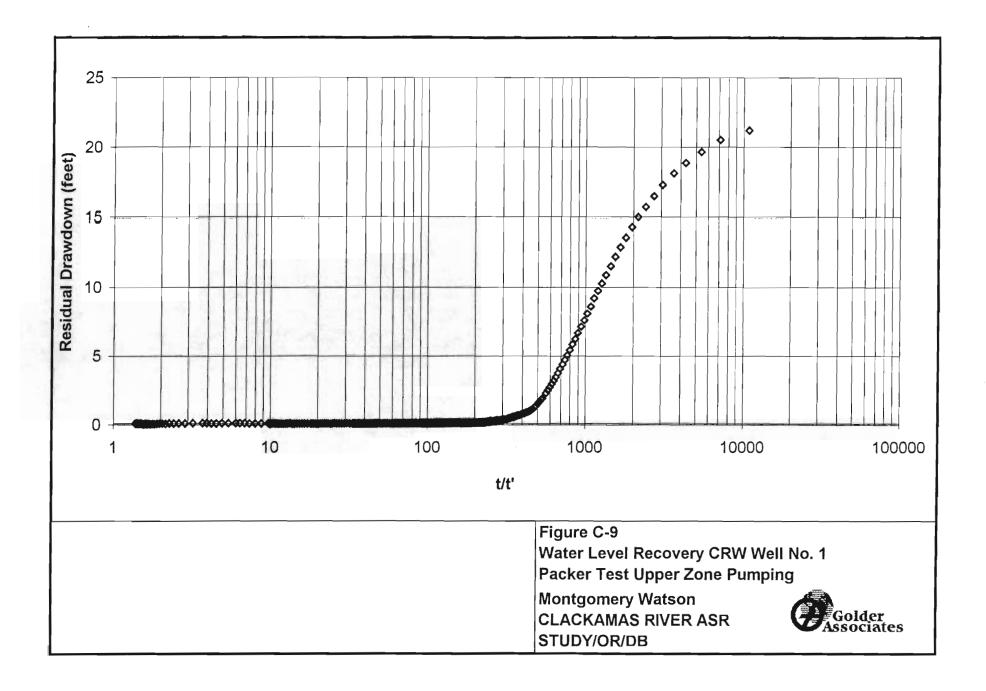


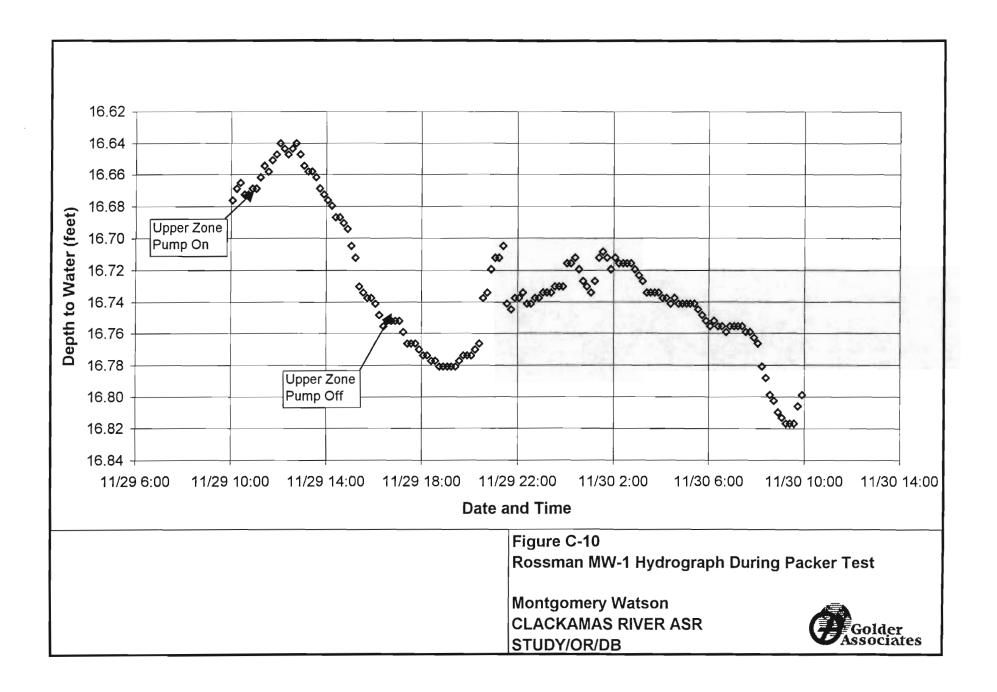


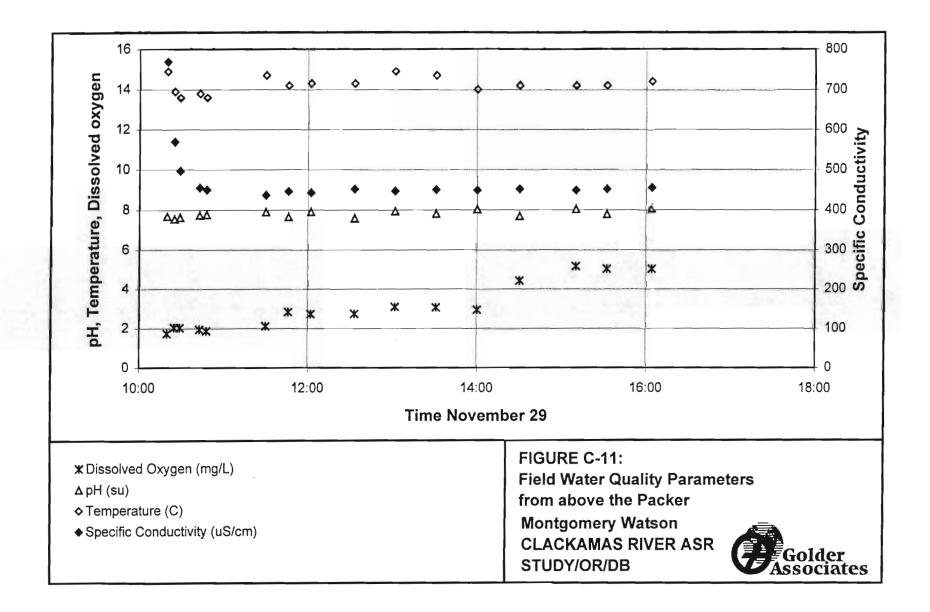


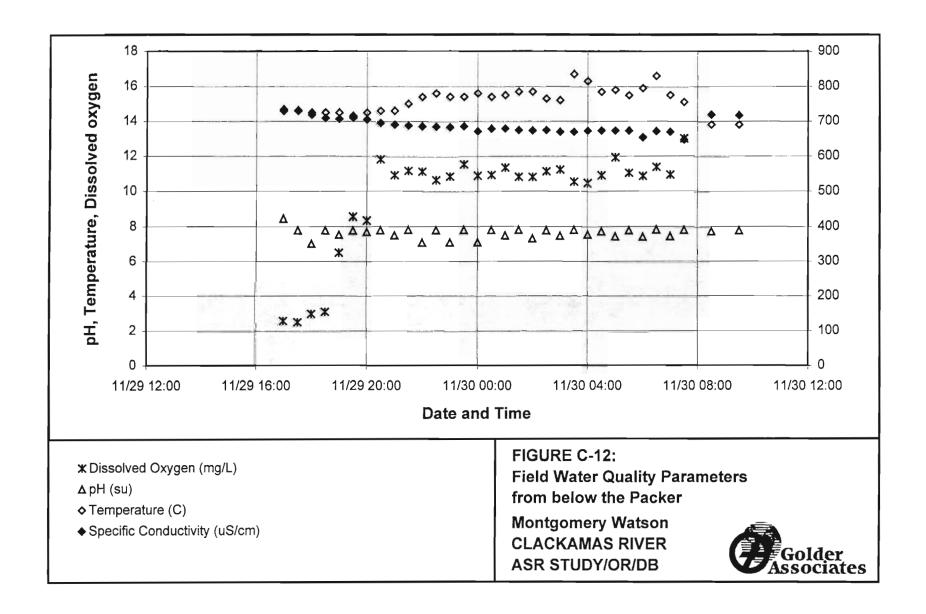














APPENDIX D

MONTGOMERY WATSON WATER QUALITY MEMORANDUM

Golder Associates

MONTGOMERY WATSON WATER QUALITY MEMORANDUM

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MEMORANDUM



MONTGOMERY WATSON

FINDINGS OF WATER QUALITY INVESTIGATIONS

This memorandum presents results of water quality testing performed on waters pertinent to the Clackamas River Water (CRW) ASR system including water from the Columbia River Basalt Aquifer and waters from the potential sources of injection water. The object of the water quality sampling was to characterize ambient groundwater quality and evaluate compatibility between groundwater and recharge water. To evaluate ambient water quality conditions in the basalt aquifer, data was collected from the following three sources:

- Historical data from Clairmont Well No. 1 (CRW-1)
- Historical data from Rossman Landfill Montoring Well No. 1
- Recent data collected as part of an initial ASR feasibility investigation from CRW-1 and four additional nearby wells drawing water from the same aquifer.

Injection water for the ASR system could potentially come from one of three different water treatment plants in the region: Clackamas River WTP, South Fork Water Board WTP and North Clackamas WTP. Historical finished water quality data was collected from each of these three plants to characterize the injection water.

Historical Water Quality Data in the Columbia Basalt Aquifer

Historical water quality data was obtained from CRW and ODEQ for CRW-1 and the Rossman Landfill Monitoring Well #1 (MW1), respectively. The Rossman well is the only monitoring well at the closed landfill that penetrates into the Columbia Basalt aquifer. No other historical water quality data from other wells in the aquifer were identified. The period of record for CRW-1 extends from 1973 to 1999 and 1981 to 1997 for MW1; both wells were sampled intermittently throughout their respective record period. Tables 1 and 2 summarize the available historical water quality data for the two wells.

General Mineral Quality. Historically, TDS levels in MW1 have remained relatively stable ranging from 310 to 365 mg/L. Most of the TDS is comprised of sodium and chloride. TDS levels in CW1 have ranged from 420 to 710 mg/L and again, is largely comprised of sodium and chloride.

Cyanide was detected in one sample at MW1 in 1988 at 0.07mg/L (MCL = 0.2 mg/L).

Metals. Historical iron concentrations at MW1 and CW1 are similar and are generally below the MCL of 0.3 mg/L. Manganese levels are generally above the MCL of 0.05 mg/L at MW1 and are generally slightly above the MCL at CW1. Trace levels of barium and selenium have been detected at CRW1 while trace levels of zinc were detected at MW1.

Organics (SOCs and VOCs). No organics were detected at MW1 over the period of record although only one set of complete VOC analyses have been performed. At CW1, tetracholorethene (PCE) was detected twice at 0.0006 and 0.00078 mg/L. No other organics other than THM species were detected at CRW1.

Radionuclides. No historical data for radon is available for MW1 or CW1. In a single sample, gross alpha was measured at 4 pCi/L at CRW1.

Recent Water Quality Results

During the initial feasibility study, well log data was obtained from Oregon Department of Environmental Quality (ODEQ) to identify wells within a two mile radius of CRW-1 that withdraw water from the basalt aquifer. Though a number of wells were identified, only four wells were currently in operation and accessible for sampling (see Table 3). A single set of water quality samples were collected from each of the wells listed and analyzed for general water quality parameters and volatile organic contaminants (VOCs). The purpose of this sampling was to evaluate spatial variability in general water quality parameters and to identify the presence of any VOCs, in particular, TCE which had been detected previously in CRW-1.

Local Columbia River	Basalt Aquifer	Wells Sampled	During Feas	sibility Study
Well Name	Year Drilled	Diameter (in)	Depth (ft)	Depth to Water (ft)
Senior High School	1976	8	544	236
Odgen Middle School	1965	16	578	165
Lonestar	1966	8	248	13
16200 Oak Tree Terrace	1977	6	455	410
Clairmont Well #1	1973	16	560	20

 Table 3

 Local Columbia River Basalt Aquifer Wells Sampled During Feasibility Study

In addition to sampling at nearby wells, two sets of samples were collected from CRW-1 during the initial feasibility study. The first set of samples collected approximatley 1 hour after initiating a 24 hour drawdown test and the second set was collected at the end of the 24-hour test. Samples were analyzed for the full sweep of contaminants as required under the Oregon Administrative Rules (OAR) for ASR. All samples were collected by Montgomery Watson and Golder staff and analyzed by Mongomery Watson Laboratories. Procedures employed for collecting and handling water quality samples are included in Appendix A. Results of all sampling are shown in Table 4

General Mineral Quality. Mineral levels in each of the wells are relatively high and well above levels in the Clackamas River. Levels of TDS in the two school wells were substantially higher than the other three wells ranging from 900 to 1,000 mg/L. The distribution of the types of minerals in each of the wells varied significantly as well. The two school wells and the Lonestar well contained a significant amount of hardness while the Oak Tree Terrace well contained no hardness. Chloride levels comprised approximately one-half the total dissolved solids in the the

two school wells while only one-third the total in the CRW1. The variation in mineral levels suggests significant variability in aquifer characteristics in the region.

Metals. Three of the five wells contained levels of iron exceeding the MCL of 0.3 mg/L. The Lonestar well contained high levels of both iron and manganese. No other metals were measured at levels of concern.

Organics (SOCs and VOCs). No VOCs were detected in any of the samples except for a trace amount of tetracholorethene (TCE) in the Test 1 sample from CRW1. The reported level of 0.0006 mg/L is below the MCL of 0.005 mg/L.

Radionuclides. Radon is commonly found in the local basalt aquifers and was detected at 220 to 260 pCi/L in Test 1 and Test 2 samples collected at CRW1.

Packer Testing

Subsequent to the initial testing, follow-up water quality testing was conducted during the Packer Testing to compare water quality in the lower and upper portions of the well (above and below the packer). The packer was set at approximately 415 foot elevation. Samples from the upper and lower portions of the well were analyzed for general water quality paramters and VOCs, but not the full sweep of regulated contaminants (Results also in Table 4). General water quality results indicated that the upper region of the aquifer contains significantly lower mineral levels than the lower portion. TDS levels in the upper zone were 330 mg/L above 415 feet and 600 mg/L below 425 feet. In general, levels of individual minerals were approximately twice as high in the lower zone than in the upper zone. Unlike the earlier testing, no VOCs were detected in either the lower or upper portion of the aquifer.

Based on hydrogeological test results, the well will be reconstructed to isolate the lower zone (i.e. exclude the upper zone) for storage and recovery of recharged water; in spite of the lower mineral quality of water in this portion of the aquifer. Thus the water quality results from the lower portion of the well, most represent the water quality of the receiving aquifer for future ASR testing.

Injection Water Quality

CRW-1 is located in the southern portion of the CRW distribution system (CRW South) but is not served by the CRW WTP. Instead, water in this region is served by the South Fork WTP (water purchased by CRW). Eventually, CRW would like to provide their own water to CRW South and are in the planning process to construct additional distribution system transmission mains to service the area. New transmission would allow water from either the CRW or Clackamas County Water Commission WTPs into the area of the well. Thus, each of these three local WTPs were considered potential sources of injection water for the CRW ASR program:

- Clackamas River Water WTP (CRW WTP) Direct Filtration
- South Fork Water Board WTP (SFWB WTP) Conventional Filtration
- Clackamas County Water Commission WTP (CCWC STP) Slow Sand Filtration

All three of the plants treat Clackamas River water. The Clackamas River watershed is generally a sparsely populated and heavily forested with little agricultural activity. Thus, there are currently few sources of potential contaminants in the watershed.

Each of the three WTPs conduct finished water quality sampling for the complete list of constituents required under the Safe Drinking Water Act. A summary of water quality results for each plant is presented in Table 5. As shown in the table, pesticides, herbicides and other organic chemicals have not been found in treated water from any of the three supplies. The water is also low in naturally-occurring organic material as reflected by the low levels of disinfection by-products in the distribution system, in spite of residual disinfection with free chlorine; maximum values for trihaolmethanes and haloacetic acids were 60ug/L and 36ug/L, respectively. In all cases, no potential injection water contained any constituent concentrated above 50% of the MCLs established under OAR requirements. Use of any aforementioned waters for ASR purposes would not require a pretreatment process.

Based on the treated water quality data from each of the three plants, no constituent has been detected at levels above 50% of the corresponding MCL. Thus all three of the proposed source waters for injection meet OAR standards and no additional treatment is required prior to injection.

Table 1CRW1 Historical Water Quality Data

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		Drinking	Water Standards	CRW1	CRW1	CRW1	CRW1	CRW1	CRWI	CRW1
			MCL							
Parameter	Units	Primary	Secondary	06/27/73	08/01/77	09/14/84	06/15/87	08/03/87	09/02/87	11/01/88
Conventional Parameters										
pH			6-8.5	7.8	8.1					
Total Dissolved Solids	mg/L		500	556	710					
Turbidity	NTU	0.5		<1	0.47					
Chloride	mg/L		250	188	266	185	_	144		
Nitrate	mgN/L	10		<0.02		<0.1	0.14			
Nitrite	mgN/L	1		<0.4			1			
Total nitrate and nitrite	mgN/L	10			<0.05					
Sulfate	mg/L		250	0.3	<1					
Fluoride (free)	mg/L	4	2	0.93	0.75	0.822	0.67	1	Sec. Sec.	
MBAS (Surfactants)	mg/L	1.1.1.1	0.5		< 0.05					
Total Alkalinity	mg/L			146	140	112-11-1	102			
Carbonate Alkalinity	mg/L			0	0.0				1.00	1000
Hydroxide Alkalinity	mg/L			0.0	1000					
Bicarbonate Alkalinity	mg/L			146	140					
Total Phosphorus (as P)	mg/L	12400			1					
Color	ACU	1	15	<5	<5	(Second a				· · · · · · · · · · · · · · · · · · ·
Corrosivity		1	Non-Corrosive							S
Odor	TON	12.2	3							
Metals					-		-			-
Aluminum	mg/L	-	0.05-0.2					-		
Antimony	mg/L	0.006	0.03-0.2							-
Arsenic	mg/L	0.05		< 0.002	<0.001	<0.010	< 0.010	_		
Barium	mg/L	2		-0.002	<0.2	<0.2	<0.010			
Beryllium	mg/L	0.004				-0.2	-0.05	-		
Cadmium	mg/L	0.001			< 0.001	< 0.005	<0.005			
Calcium	mg/L			51	64					
Chromium	mg/L	0.1			< 0.05	<0.001	< 0.005			
Copper	mg/L	1.3	1		< 0.05		-0.000	-		
Cyanide	mg/L	0.2	-				-			
Iron	mg/L		0.3	0.28	0.44	0.25				
Lead	mg/L	0.015		0.05	< 0.01	0.071	< 0.010			
Magnesium	mg/L			6.5	8.5					

Table 1CRW1 Historical Water Quality Data

		Drinking W	ater Standards	CRW1	CRW1	CRW1	CRW1	CRW1	CRW1	CRW1
		N	ICL							1
Parameter	Units	Primary	Secondary	06/27/73	08/01/77	09/14/84	06/15/87	08/03/87	09/02/87	11/01/88
Manganese	mg/L		0.05	0.03	0.05					
Mercury	mg/L	0.002	0.05-0.2		<0.0005	0.0006	0.0006			
Nickel	mg/L									
Potassium	mg/L				15					
Selenium	mg/L	0.05			< 0.001	0.004	< 0.005			
Silica (SiO2)	mg/L			68	60.5					
Silver	mg/L	0.05	0.1		<0.05	< 0.010	<0.005			
Sodium	mg/L			125	130		49.6	14.7		
Thallium	mg/L	1.3							22.1	
Total Hardness	mg/L-CaCO3	250		1.41	196		1000			
Zinc	mg/L	0.015	5		<0.05					
Radionuclides				Section 1				19 - 19 - 19 T		
Gross Alpha	pCi/L	15								
Organics										
Benzene	mg/L	0.005			1.1		18-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-			ND
Carbon tetrachloride	mg/L	0.005	21 51							ND
Chlorobenzene	mg/L									ND
1,2-Dichlorobenzene	mg/L	0.6	1							ND
1,4-Dichlorobenzene	mg/L	0.075								ND
1,2-Dichloroethane	mg/L	0.075	0					-		ND
1,1-Dichloroethene	mg/L	50								ND
cis-1,2-Dichloroethene	mg/L	0.07						-		ND
trans-1,2-Dichloroethene	mg/L	0.1								ND
Dichloromethane	mg/L	0.005								ND
1,2-Dichloropropane	mg/L	20000								ND
Ethylbenzene	mg/L	0.7								ND
Styrene	mg/L	0.1								ND
Tetrachloroethene (PCE)	mg/L	0.005								ND
Toluene	mg/L	1								ND
1,2,4-Trichlorobenzene	mg/L	0.07								ND
1,1,1-Trichloroethane	mg/L	0.2								ND
1,1,2-Trichloroethane	mg/L	0.005		1.1.1.1						ND
Trichloroethene (TCE)	mg/L	0.005						1		0.00078

Table 1CRW1 Historical Water Quality Data

		Drinking W	ater Standards	CRW1	CRW1	CRW1	CRW1	CRW1	CRW1	CRW1
			ACL							
Parameter	Units	Primary	Secondary	06/27/73	08/01/77	09/14/84	06/15/87	08/03/87	09/02/87	11/01/88
Vinyl chloride	mg/L	0.002								ND
Xylene (Total)	mg/L	10	200 Contraction of the second se						1	ND
Bromobenzene	mg/L									ND
Bromodichloromethane	mg/L	0.1								ND
Bromoform	mg/L	0.1								ND
Bromomethane	mg/L							1		ND
Chloroethane	mg/L		1000 Barrier (100							ND
Chloroform	mg/L									ND
Chloromethane	mg/L									ND
2-Chlorotoluene	mg/L		Sec. 2							ND
4-Chlorotoluene	mg/L	Ed. Alerei		122. 194.3	Contraction of the	A serie and the series of				ND
Dibromochloromethane	mg/L			1.		and the second				ND
Dibromomethane	mg/L	0.1	Sec. 1. 18							ND
1,3-Dichlorobenzene	mg/L	1220 122				1.1.1				ND
1,1-Dichloroethane	mg/L									ND
1,3-Dichloropropane	mg/L						2			ND
Organics (continued)		C. Sierrare		Difference of the second	HOM I CHART					
2,2-Dichloropropane	mg/L							1.1.1.1.1.1.1		ND
1,1-Dichloropropene	mg/L									ND
1,3-Dichloropropene	mg/L		1011							ND
1,1,1,2-Tetrachloroethane	mg/L		100 - 1						0	ND
1,1,2,2-Tetrachloroethane	mg/L									ND
1,2,3-Trichloropropane	mg/L	0.2		1	1					ND
EDB (Ethylene dibromide)	mg/L	0.00005		23						ND
DBCP	mg/L	0.0002								ND
Hexachlorocyclopentadiene	mg/L	0.05								
Polychlorinated Biphenyls	mg/L				- 1					
2,4-D	mg/L	0.07			<0.05					
Dalapon	mg/L	0.2								
Dicamba	mg/L									
Dinoseb	mg/L	0.007								
Pentachlorophenol	mg/L	0.001								
Picloram	mg/L	0.5								
2,4,5-TP (Silvex)	mg/L	0.05			< 0.005					

Table 1CRW1 Historical Water Quality Data

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		Drinking W	Vater Standards	CRW1	CRW1	CRW1	CRW1	CRW1	CRW1	CRW1
		1	MCL							
Parameter	Units	Primary	Secondary	06/27/73	08/01/77	09/14/84	06/15/87	08/03/87	09/02/87	11/01/88
Alachlor	mg/L	0.002								
Aldrin	mg/L									
Atrazine	mg/L	0.003								
Benzo(a)pyrene	mg/L	0.0002								
Butachlor	mg/L									
Chlordane	mg/L	0.002								
Di(2-ethylhexyl)adipate	mg/L	0.4								
Di(2-ethylhexyl)phthalate	mg/L	0.006								
Dieldrin	mg/L	0.2		1910						
Endrin	mg/L	0.002			<0.0001			1000	A	
Heptachlor	mg/L	0.0004	10 C					195.000		New Street
Heptachlor epoxide	mg/L	0.0002			1					
Hexachlorobenzene	mg/L	0.001		Sec. 1					1.00	
Lindane (gamma-BHC)	mg/L	0.0002		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	<0.002	Scotles Press				1.00
Methoxychlor	mg/L	0.04			<0.05					
Metolachlor	mg/L						2		1	
Metribuzin	mg/L									
Propachlor	mg/L								2 A A A A A A A A A A A A A A A A A A A	
Simazine	mg/L	0.004								
Toxaphene	mg/L	0.003			<0.002					
Aldicarb	mg/L		1 (12)							
Aldicarb sulfone	mg/L									
Organics (continued)										
Aldicarb sulfoxide	mg/L									
Carbaryl	mg/L									
Carbofuran	mg/L	0.04								
3-Hydroxycarbofuran	mg/L									
Methomyl	mg/L								-	
Oxamyl (Vydate)	mg/L	0.2								
Glyphosate	mg/L	0.7								
Endothall	mg/L	0.1								
Diquat	mg/L	0.02								
1,2,3-Trichlorobenzene	mg/L									ND
1,2,4-Trimethylbenzene	mg/L									ND

Table 1CRW1 Historical Water Quality Data

		Drinking W	ater Standards	CRW1	CRW1	CRW1	CRW1	CRW1	CRW1	CRWI
		Ι	MCL							
Parameter	Units	Primary	Secondary	06/27/73	08/01/77	09/14/84	06/15/87	08/03/87	09/02/87	11/01/88
1,3,5-Trimethylbenzene	mg/L									ND
4-Isopropyltoluene	mg/L									ND
Bromochloromethane	mg/L									ND
Dichlorodifluoromethane	mg/L									ND
Hexachlorobutadiene	mg/L							-		ND
Isopropylbenzene	mg/L									ND
n-Butylbenzene	mg/L									ND
n-Propylbenzene	mg/L					and the second				ND
Naphthalene	mg/L			S. /*			č			ND
sec-Butylbenzene	mg/L					1.1		1	0	ND
tert-Butylbenzene	mg/L								ALL STREET	ND
trans-1,3-Dichloropropene .	mg/L									
Trichlorofluoromethane	mg/L		and the second		46.00					ND

Table 1	
CRW1 Historical Water Quality	Data

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CRW1	CRW1	CRW1	CRW1	CRW1
1/16/91	11/19/91	2/12/96	2/28/96	6/29/99
		7.99		7.31
	_	460		420
		170		200
		170		200
	<0.10	ND		ND
				ND
		0.2		ND
N Dates and	0.8	0.6	28401626	0.7
1. C		ND	100 502	ND
1997 - F		130	100 C	150
		ND		2000
		ND		1
		21. A 24.	130	
		1.1	ND	ND
2.2.2.2		ND		7
Ref. and		0.2		-0.45
				ND
	-			
		ND		0.12
		ND		ND
	< 0.002	ND		ND
	<0.020	0.042		ND
		ND		ND
	0.009	ND		ND
		37		
	< 0.005	ND		ND
		ND		ND
		ND		
		0.08		ND
	0.019	ND		ND
		6.8		

	Ta	ble 1	
CRW1	Historical	Water	Quality Data

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				,
CRW1	CRW1	CRW1	CRW1	CRW1
11/16/91	11/19/91	2/12/96	2/28/96	6/29/99
		0.028		0.03
	<0.0005	ND		ND
		ND		ND
	<0.002	ND		ND
	<0.005	ND		ND
	4.78			101
		ND		ND
		120		120
		ND		ND
			4	
ND			ND	ND
ND	11214/17		ND	ND
ND			ND	ND
ND	1		ND	ND
ND	24 T 1 1		ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
0.0009	and the second second		ND	ND

	Ta	ble 1	
CRW1	Historical	Water	Quality Data

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the and the set
	CRW1	CRW1	CRW1	CRW1
1/16/91	11/19/91	2/12/96	2/28/96	6/29/99
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			0.0011	ND
ND			0.0099	ND
ND			ND	ND
ND		and the second	ND	ND
ND			0,0012	ND
-			ND	ND
ND			ND	ND
ND	1		ND	ND
ND	2. 2.		0.0024	ND
ND			ND	ND
ND	1.19	1.1.1	ND	ND
ND		Station and	ND	ND
ND			ND	
ND			ND	ND
ND			ND	ND
			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
ND			ND	ND
			ND	ND

Та	ble 1
CRW1 Historical	Water Quality Data

The first
CRW1	CRW1	CRW1	CRW1	CRW1
11/16/91	11/19/91	2/12/96	2/28/96	6/29/99
			ND	ND
			ND	ND
-			ND	ND
			ND	ND
			ND	ND
7010 TX			ND	ND
			ND	ND
3			ND	ND
	140		ND	
30.5	6		ND	ND
			ND	ND
		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	ND	ND
1.			ND	ND
	- Sinte		ND	ND
			ND	ND
nest Sarden			ND	ND
			ND	ND
ND				ND
ND				ND



Table 1CRW1 Historical Water Quality Data

CRW1	CRW1	CRW1	CRW1	CRW1
11/16/91	11/19/91	2/12/96	2/28/96	6/29/99
ND				ND
ND	· · · · · · · · · · · · · · · · · · ·			ND
ND				
ND		2.2.5		ND

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

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		Drinking	Vater Standards	MW1	MW1	MW1	MW1	MW1	MW1	MW1
			MCL							
Parameter	Units	Primary	Secondary	09/22/81	10/27/81	01/27/82	05/05/82	08/17/82	10/13/83	02/02/84
Conductivity (Field Data)	umhos/cm		-						396	
Specific Conductance	umhos/cm			460	1	575	510	525	450	468
pH			6-8.5	10.3	8.4	8.8	8.9	8.7	9.2	9.1
pH (Field Data)			6.5-8.5						9	
Temperature (Field Data)	oC								12	12
(TDS) Total Dissolved Solids	mg/L		500							
(TSS) Total Suspended Solids	mg/L									
(DO) Dissolved Oxygen	mg/L		250							
(COD) Chemical Oxygen Demand	mg/L			365	13	10	<1	8	10	13
Oxygen Reduction Potential	mV	10.00								
Chloride	mg/L		250	110	96.5	103	136	96.2	100	130
Ammonia	mg N/L								1.03	1.1
Nitrate	mgN/L	10	2							
Nitrite	mgN/L	1	0.5			0			Deservice No.	· · · · ·
Total nitrate and nitrite	mgN/L	10			140.00				10.02	
Sulfate	mg/L		250	9.4	104 IO4	<4.0	<4.	<1.0	4.9	5.3
Fluoride (free)	mg/L	4	2							
(TOC) Total Organic Carbon									4	4
Total Alkalinity	mg/L			88.4	144.63	147.9	90.6	136.4	51	52
Carbonate Alkalinity	mg/L									
Hydroxide Alkalinity	mg/L									
Bicarbonate Alkalinity	mg/L									
Carbon Dioxide (Free)	mg/L									
Total Phosphorus (as P)	mg/L									
Iodide	mg/L									
Color	ACU		15						15	10
Corrosivity	-		Non-Corrosive							
Odor	TON		3							
Calcium	mg/L			25.1		30.8	15.9	30	11	12
Magnesium	mg/L			0.71		6.86	7.04	8.23	2.5	2.9
Potassium	mg/L									
Sodium	mg/L									
Total Hardness	mg/L-CaCO3		250						38	42
Metals										
Aluminum	mg/L		0.05-0.2							
Antimony	mg/L	0.006								

 Table 2

 Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking W	ater Standards	MW1	MW1	MW1	MW1	MW1	MW1	MW1
		1	MCL							
Parameter	Units	Primary	Secondary	09/22/81	10/27/81	01/27/82	05/05/82	08/17/82	10/13/83	02/02/84
Arsenic	mg/L	0.05								
Beryllium	mg/L	0.004		2						
Cadmium	mg/L	0.005								
Chromium	mg/L	0.1								
Copper	mg/L	1.3	1							
Cyanide	mg/L	0.2								
Iron	mg/L		0.3	< 0.05		0.2	0.05	0.12	0.52	< 0.05
Lead	mg/L	0.015					· · · · · · · · · · · · · · · · · · ·			
Manganese	mg/L		0.05				10.			0.03
Mercury	mg/L	0.002		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1						
Nickel	mg/L				and the second second	10.000	States The			
Selenium	mg/L	0.05			3		Bart R. P.	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		
Silver	mg/L	0.05	0.1		14-14-14-14-14-14-14-14-14-14-14-14-14-1	Second States			1.49	1000
Thallium	mg/L	0.002			Sector Parts	1.		A. A. A. A.		
Zinc	mg/L		5	199-11 C (0199-6)			S Sector 13			

 Table 2

 Rossman Landfill Monitoring Well #1 Historical Water Quality Data

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		Drinking W	ater Standards	MW1	MW1	MW1	MW1	MW1	MW1	MW1
			MCL							
Parameter	Units	Primary	Secondary	09/22/81	10/27/81	01/27/82	05/05/82	08/17/82	10/13/83	02/02/84
Organics	2									
Benzene	mg/L	0.005								
Carbon tetrachloride	mg/L	0.005							~~~~	
Chlorobenzene	mg/L	0.1						-		
1,2 -DCA	mg/L									
1,2-Dichlorobenzene	mg/L	0.6								- 11
1,4-Dichlorobenzene	mg/L	0.075								
1,2-Dichloroethane	mg/L	0.005								
1,1-Dichloroethene	mg/L	0.007								
cis-1,2-Dichloroethene	mg/L	0.07								
trans-1,2-Dichloroethene	mg/L	0.1								
Dichloromethane	mg/L	0.005				1.		1.		
1,2-Dichloropropane	mg/L	0.005								
Ethylbenzene	mg/L	0.7							1.1.1	
Styrene	mg/L	0.1								19. 1
Tetrachloroethene (PCE)	mg/L	0.005			1000000					
Toluene	mg/L	1								
Trichlorobenzene	mg/L									
1,2,4-Trichlorobenzene	mg/L	0.07								
1,1,1-Trichloroethane	mg/L	0.2							-	
1,1,2-Trichloroethane	mg/L	0.005		1						
Trichloroethene (TCE)	mg/L	0.005					S			
Vinyl chloride	mg/L	0.002		8					~	
Bromobenzene	mg/L									
Bromodichloromethane	mg/L	0.1								
Bromoform	mg/L									
Bromomethane	mg/L									
Chloroform	mg/L									
Chloromethane	mg/L									
2-Chlorotoluene	mg/L									
4-Chlorotoluene	mg/L									
Dibromomethane	mg/L									
1,3-Dichlorobenzene	mg/L									
1,1-Dichloroethane	mg/L									
1,3-Dichloropropane	mg/L									
2,2-Dichloropropane	mg/L									
1,1-Dichloropropene	mg/L		· · · · · · · · · · · · · · · · · · ·							

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

			Vater Standards	MW1	MW1	MW1	MW1	MW1	MW1	MW1
			MCL							
Parameter	Units	Primary	Secondary	09/22/81	10/27/81	01/27/82	05/05/82	08/17/82	10/13/83	02/02/84
1,1,1,2-Tetrachloroethane	mg/L									
1,1,2,2-Tetrachloroethane	mg/L									
1,2,3-Trichloropropane	mg/L	0.2					1			
Trichlorotrifluoroethane (Freon)	mg/L									
DBCP	mg/L	0.0002								
1,2,4-Trimethylbenzene	mg/L									
1,2-Dibromoethane	mg/L									
1,3,5-Trimethylbenzene	mg/L]				
Bromochloromethane	mg/L									
Hexachlorobutadiene	mg/L									
Isopropylbenzene	mg/L		Si							
n-Butylbenzene	mg/L	1					2. No			
n-Propylbenzene	mg/L	200			é i t			St. 7	18 N 62	
Naphthalene	mg/L	and the second second		- 11		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	1		241 1 2 2 4	
sec-Butylbenzene	mg/L	1999			1 - 2 - 3	100.00		9.1000000	A	
tert-Butylbenzene	mg/L			a har and a second	1		1		2	1.14.1
methylene chloride	mg/L				1000		Here and a second	1965 S. 1997		
ND - Non Detect	CT COLORD			Sec. 1	12018 201		100 100 100		1.44	100 million 100

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

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			Vater Standards	MW1	MW1	MW1	MW1	MW1
			MCL					
Parameter	Units	Primary	Secondary	06/13/84	02/14/85	10/24/85	10/09/86	1988
Conductivity (Field Data)	umhos/cm			565	428	428	530	
Specific Conductance	umhos/cm			590	440	190	566	535
pH			6-8.5	8.3	9.2	7.4	8.3	6.16
pH (Field Data)			6.5-8.5	8.4	8.9	9	8.4	
Temperature (Field Data)	oC			14	13.5	13.5	14	
(TDS) Total Dissolved Solids	mg/L		500					356
(TSS) Total Suspended Solids	mg/L		7					
(DO) Dissolved Oxygen	mg/L		250					
(COD) Chemical Oxygen Demand	mg/L			<5		9	5	6
Oxygen Reduction Potential	mV							
Chloride	mg/L		250	104	1	26		97.8
Ammonia	mg N/L	10		0.57	0.34	0.05	0.61	0.63
Nitrate	mgN/L	10	2		100			<0.5
Nitrite	mgN/L	1	0.5					
Total nitrate and nitrite	mgN/L	10						
Sulfate	mg/L		250	0.9	5.8	3.5	2	<1.0
Fluoride (free)	mg/L	4	2					0.49
(TOC) Total Organic Carbon				<1.0		4	2	
Total Alkalinity	mg/L			130	38	52	131	136
Carbonate Alkalinity	mg/L							
Hydroxide Alkalinity	mg/L							
Bicarbonate Alkalinity	mg/L							
Carbon Dioxide (Free)	mg/L							
Total Phosphorus (as P)	mg/L	20						
Iodide	mg/L				1			
Color	ACU		15	<5	<5	50	5	<5
Corrosivity	-		Non-Corrosive					
Odor	TON		3					
Calcium	mg/L			29	12	13	29	30.4
Magnesium	mg/L			8.3	1.9	4.8	7.7	7
Potassium	mg/L							8.6
Sodium	mg/L						- 1	79
Total Hardness	mg/L-CaCO3		250	110	38	52	100	
letals							L	
Aluminum	mg/L		0.05-0.2	1				
Antimony	mg/L	0.006						<0.5

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking W	ater Standards	MW1	MW1	MW1	MW1	MW1
		N	MCL					
Parameter	Units	Primary	Secondary	06/13/84	02/14/85	10/24/85	10/09/86	1988
Arsenic	mg/L	0.05						< 0.005
Beryllium	mg/L	0.004						< 0.05
Cadmium	mg/L	0.005	· · · · · · · · · · · · · · · · · · ·		1			<0.0005
Chromium	mg/L	0.1						< 0.005
Copper	mg/L	1.3	1					<0.05
Cyanide	mg/L	0.2						0.07
Iron	mg/L		0.3	0.06	<0.05	0.29	0.2	
Lead	.mg/L	0.015						< 0.005
Manganese	mg/L		0.05	0.12	1	0.06	0.1	0.12
Mercury	mg/L	0.002						< 0.0005
Nickel	mg/L							< 0.05
Selenium	mg/L	0.05						< 0.005
Silver	mg/L	0.05	0.1	and the second second				< 0.005
Thallium	mg/L	0.002		30	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	Pie 1		<0.1
Zinc	mg/L		5					0.016

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking W	ater Standards	MW1	MW1	MW1	MW1	MW1
			MCL					
Parameter	Units	Primary	Secondary	06/13/84	02/14/85	10/24/85	10/09/86	1988
Organics								
Benzene	mg/L	0.005						
Carbon tetrachloride	mg/L	0.005	6.00 () () () () () () () () () (
Chlorobenzene	mg/L	0.1						
1,2 -DCA	mg/L							
1,2-Dichlorobenzene	mg/L	0.6						
1,4-Dichlorobenzene	mg/L	0.075						
1,2-Dichloroethane	mg/L	0.005						
1,1-Dichloroethene	mg/L	0.007						
cis-1,2-Dichloroethene	mg/L	0.07	1.1.1					
trans-1,2-Dichloroethene	mg/L	0.1					0	
Dichloromethane	mg/L	0.005						
1,2-Dichloropropane	mg/L	0.005						
Ethylbenzene	mg/L	0.7				1000		
Styrene	mg/L	0.1						
Tetrachloroethene (PCE)	mg/L	0.005						
Toluene	mg/L	1	43 N.					
Trichlorobenzene	mg/L	10.0						
1,2,4-Trichlorobenzene	mg/L	0.07			1			
1,1,1-Trichloroethane	mg/L	0.2						
1,1,2-Trichloroethane	mg/L	0.005						
Trichloroethene (TCE)	mg/L	0.005						
Vinyl chloride	mg/L	0.002						
Bromobenzene	mg/L					1.04	1	
Bromodichloromethane	mg/L	0.1						
Bromoform	mg/L							
Bromomethane	mg/L							
Chloroform	mg/L							
Chloromethane	mg/L							
2-Chlorotoluene	mg/L							
4-Chlorotoluene	mg/L							
Dibromomethane	mg/L							
1,3-Dichlorobenzene	mg/L							
1,1-Dichloroethane	mg/L							
1,3-Dichloropropane	mg/L							
2,2-Dichloropropane	mg/L							
1,1-Dichloropropene	mg/L							

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking W	ater Standards	MW1	MW1	MW1 10/24/85	MW1	MW1
		л	ACL		02/14/85			1988
Parameter	Units	Primary	Secondary	06/13/84		10/24/85	10/09/86	
1,1,1,2-Tetrachloroethane	mg/L							
1,1,2,2-Tetrachloroethane	mg/L							
1,2,3-Trichloropropane	mg/L	0.2						
Trichlorotrifluoroethane (Freon)	mg/L							
DBCP	mg/L	0.0002						
1,2,4-Trimethylbenzene	mg/L							
1,2-Dibromoethane	mg/L							_
1,3,5-Trimethylbenzene	mg/L		10	1				
Bromochloromethane	mg/L							
Hexachlorobutadiene	mg/L							
Isopropylbenzene	mg/L							
n-Butylbenzene	mg/L					1		
n-Propylbenzene	mg/L							
Naphthalene	mg/L							100
sec-Butylbenzene	mg/L							
tert-Butylbenzene	mg/L		No. 19 March 19					
methylene chloride	mg/L							
ND - Non Detect		12			- 10 12 S 15 A.+ 1			1.1

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking	Water Standards	MW1	MW1	MW1	MW1	MW1	MW1	MW1
		Ĭ	MCL							
Parameter	Units	Primary	Secondary	4/1/92	10/1/92	4/1/93	10/1/93	4/1/94	9/20/94	3/1/95
Conductivity (Field Data)	umhos/cm								430	
Specific Conductance	umhos/cm						600	630	670	527
pH			6-8.5						8.1	
pH (Field Data)			6.5-8.5							
Temperature (Field Data)	oC	· · · · · · · · · · · · · · · · · · ·							14.4	
(TDS) Total Dissolved Solids	mg/L	· · · · ·	500	364		356	353	390	335	329
(TSS) Total Suspended Solids	mg/L								<10	
(DO) Dissolved Oxygen	mg/L		250						0.05	
(COD) Chemical Oxygen Demand	mg/L			<7		<7	<7	<25	<25	<25
Oxygen Reduction Potential	mV									
Chloride	mg/L		250	101		117	101	98.7	104	103
Ammonia	mg N/L				0-01					
Nitrate	mgN/L	10	2						<0.02	
Nitrite	mgN/L	1	0.5		15	and the second second		TE DURAN		-
Total nitrate and nitrite	mgN/L	10					1.5.1			
Sulfate	mg/L		250	0.613		0.566	<0.4	<0.5	<0.1	<0.1
Fluoride (free)	mg/L	4	2	1.4.16		2				
(TOC) Total Organic Carbon										
Total Alkalinity	mg/L			134		140	141	143	136	136
Carbonate Alkalinity	mg/L							100000000000000000000000000000000000000		
Hydroxide Alkalinity	mg/L	1000		2						
Bicarbonate Alkalinity	mg/L							10		
Carbon Dioxide (Free)	mg/L									100
Total Phosphorus (as P)	mg/L				× · · · ·					
Iodide	mg/L	2025								
Color	ACU		15							
Corrosivity			Non-Corrosive							
Odor	TON		3							
Calcium	mg/L									
Magnesium	mg/L									
Potassium	mg/L								8.47	
Sodium	mg/L			1			66.9	71.2	69.4	63.5
Total Hardness	mg/L-CaCO3		250						108	
Metals										
Aluminum	mg/L		0.05-0.2							
Antimony	mg/L	0.006								

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking W	Vater Standards	MW1	MW1	MW1	MW1	MW1	MW1	MW1
		1	MCL							
Parameter	Units	Primary	Secondary	4/1/92	10/1/92	4/1/93	10/1/93	4/1/94	9/20/94	3/1/95
Arsenic	· mg/L	0.05			1					
Beryllium	mg/L,	0.004								
Cadmium	mg/L	0.005								
Chromium	mg/L	0.1								
Copper	mg/L	1.3	1					-		
Cyanide	mg/L	0.2						100		
Iron	mg/L		0.3	0.093		0.136	0.0892	0.0943	0.0674	0.0995
Lead	mg/L	0.015								
Manganese	mg/L		0.05				0.114	0.129	0.117	0.116
Mercury	mg/L	0.002			1.1.1.1.1.1.1					
Nickel	mg/L									1.1
Selenium	mg/L	0.05							544.53	
Silver	mg/L	0.05	0.1						1	
Thallium	mg/L	0.002		1. 2.3		1513-5 16-3-5e				
Zinc	mg/L		5	Sec. Sec.				6 T -		

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

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		Drinking W	ater Standards	MW1	MW1	MW1	MW1	MW1	MW1	MW1
			MCL	· · ·						
Parameter	Units	Primary	Secondary	4/1/92	10/1/92	4/1/93	10/1/93	4/1/94	9/20/94	3/1/95
Organics										
Benzene	mg/L	0.005							< 0.001	
Carbon tetrachloride	mg/L,	0.005		transm.metry					< 0.001	
Chlorobenzene	mg/L	0.1							<0.001	
1,2 -DCA	mg/L								< 0.001	
1,2-Dichlorobenzene	mg/L	0.6							< 0.001	
1,4-Dichlorobenzene	mg/L	0.075							< 0.001	
1,2-Dichloroethane	mg/L	0.005					-		< 0.001	
1,1-Dichloroethene	mg/L	0.007							< 0.001	
cis-1,2-Dichloroethene	mg/L	0.07			0. 10	1			< 0.001	
trans-1,2-Dichloroethene	mg/L	0.1		2		1. 1. 1. 2. 2		-	< 0.001	
Dichloromethane	mg/L	0.005							< 0.001	
1,2-Dichloropropane	mg/L	0.005							< 0.001	
Ethylbenzene	mg/L	0.7	C. S. C. A. S. S.						< 0.001	
Styrene	mg/L	0.1	The Lorden	1.					< 0.001	1
Tetrachloroethene (PCE)	mg/L	0.005						1	<0.001	
Toluene	mg/L	1								
Trichlorobenzene	mg/L								< 0.001	
1,2,4-Trichlorobenzene	mg/L	0.07		12. 11.					< 0.001	
1,1,1-Trichloroethane	mg/L	0.2	100						< 0.001	
1,1,2-Trichloroethane	mg/L	0.005	S						< 0.001	
Trichloroethene (TCE)	mg/L	0.005							< 0.001	
Vinyl chloride	mg/L	0.002				<0.001	<0.001		< 0.001	
Bromobenzene	mg/L	1. S. S. S.							< 0.001	
Bromodichloromethane	mg/L	0.1							< 0.001	
Bromoform	mg/L								< 0.001	
Bromomethane	mg/L				-				<0.001	
Chloroform	mg/L								<0.001	
Chloromethane	mg/L								<0.001	
2-Chlorotoluene	mg/L								<0.001	
4-Chlorotoluene	mg/L								<0.001	
Dibromomethane	mg/L								< 0.001	
1,3-Dichlorobenzene	mg/L							1	<0.001	
1,1-Dichloroethane	mg/L								< 0.001	
1,3-Dichloropropane	mg/L								<0.001	1
2,2-Dichloropropane	mg/L						_		<0.001	
1,1-Dichloropropene	mg/L								<0.001	

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking W	ater Standards	MW1	MWI	MW1	MW1	_MW1	MW1	MW1
		N	ACL							
Parameter	Units	Primary	Secondary	4/1/92	10/1/92	4/1/93	10/1/93	4/1/94	9/20/94	3/1/95
1,1,1,2-Tetrachloroethane	mg/L								<0.001	
1,1,2,2-Tetrachloroethane	mg/L								< 0.001	
1,2,3-Trichloropropane	mg/L	0.2							< 0.001	
Trichlorotrifluoroethane (Freon)	mg/L								< 0.001	
DBCP	mg/L	0.0002							< 0.001	
1,2,4-Trimethylbenzene	mg/L	-							< 0.001	
1,2-Dibromoethane	mg/L								< 0.001	
1,3,5-Trimethylbenzene	mg/L		The second second						< 0.001	
Bromochloromethane	mg/L								< 0.001	
Hexachlorobutadiene	mg/L						1	1 m	< 0.001	
Isopropylbenzene	mg/L	342							< 0.001	
n-Butylbenzene	mg/L	All the second						Straight .	< 0.001	
n-Propylbenzene	mg/L	123 5. 15			1 miles				< 0.001	
Naphthalene	mg/L		1 H. S		- Antonio anto		13	and the start	< 0.001	1
sec-Butylbenzene	mg/L	1.5.5			1.22	6-36-24		1.11	< 0.001	and in succession of
tert-Butylbenzene	mg/L			-	and see .			Section 1	< 0.001	
methylene chloride	mg/L	TOUR STREET							< 0.001	
ND - Non Detect						1992				

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

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		Drinking V	Vater Standards	MW1	MW1	MW1	MW1	MW1
			MCL					
Parameter	Units	Primary	Secondary	9/1/95	4/1/96	9/1/96	3/1/97	9/16/97
Conductivity (Field Data)	umhos/cm							
Specific Conductance	umhos/cm			491	428			404
pH			6-8.5					7.9
pH (Field Data)			6.5-8.5					
Temperature (Field Data)	oC							14.3
(TDS) Total Dissolved Solids	mg/L		500	311	239			269
(TSS) Total Suspended Solids	mg/L							
(DO) Dissolved Oxygen	mg/L		250					
(COD) Chemical Oxygen Demand	mg/L			<25			1 V	
Oxygen Reduction Potential	mV	20				-		
Chloride	mg/L		250	116	76.7			66.7
Ammonia	mg N/L							0.5
Nitrate	mgN/L	10	2					< 0.05
Nitrite	mgN/L	1	0.5					
Total nitrate and nitrite	mgN/L	10						
Sulfate	mg/L	2	250	<0.1	1.83			2.43
Fluoride (free)	mg/L	4	2					
(TOC) Total Organic Carbon								
Total Alkalinity	mg/L			140	108	1.1.1.1.1.1.1.1.1	1.	110
Carbonate Alkalinity	mg/L						10 C C C C	<10
Hydroxide Alkalinity	mg/L							
Bicarbonate Alkalinity	mg/L				-			110
Carbon Dioxide (Free)	mg/L							
Total Phosphorus (as P)	mg/L	Same at						
Iodide	mg/L	1		Dell'R Land				
Color	ACU		15					
Corrosivity	- C		Non-Corrosive					
Odor	TON		3					
Calcium	mg/L							24.3
Magnesium	mg/L						1	7.21
Potassium	mg/L							6.98
Sodium	mg/L			68.4	47.1			50.1
Total Hardness	mg/L-CaCO3		250					
letals								
Aluminum	mg/L		0.05-0.2					
Antimony	mg/L	0.006						

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking W	ater Standards	MW1	MW1	MW1	<u>MW1</u> 3/1/97	MW1
		ľ	MCL					
Parameter	Units	Primary	Secondary	9/1/95	4/1/96	9/1/96	3/1/97	9/16/97
Arsenic	mg/L	0.05						
Beryllium	mg/L	0.004	~					
Cadmium	mg/L	0.005						
Chromium	mg/L	0.1						
Copper	· mg/L	1.3	1		1000			
Cyanide	mg/L	0.2						
Iron	mg/L		0.3	0.0891	0.0598			0.173
Lead	mg/L	0.015						
Manganese	mg/L		0.05	0.126	0.117	(0.159
Mercury	mg/L	0.002						
Nickel	mg/L							- S.
Selenium	mg/L	0.05	1.57					
Silver	mg/L	0.05	0.1		1.2.2		20.35	
Thallium	mg/L	0.002						
Zinc	mg/L		5					

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking W	ater Standards	MW1	MW1	MW1	MW1	MW1
			MCL					
Parameter	Units	Primary	Secondary	9/1/95	4/1/96	9/1/96	3/1/97	9/16/97
Organics								
Benzene	mg/L	0.005						
Carbon tetrachloride	mg/L	0.005						
Chlorobenzene	mg/L	0.1						
1, 2 -DCA	mg/L							
1,2-Dichlorobenzene	mg/L	0.6						< 0.001
1,4-Dichlorobenzene	mg/L	0.075						
1,2-Dichloroethane	mg/L	0.005						
1,1-Dichloroethene	mg/L	0.007						
cis-1,2-Dichloroethene	mg/L	0.07				(2)		
trans-1,2-Dichloroethene	mg/L	0.1		S		12	-	
Dichloromethane	mg/L	0.005					The second second	
1,2-Dichloropropane	mg/L	0.005						
Ethylbenzene	mg/L	0.7						
Styrene	mg/L	0.1						
Tetrachloroethene (PCE)	mg/L	0.005						
Toluene	mg/L	1			80 A 1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			
Trichlorobenzene	mg/L							< 0.001
1,2,4-Trichlorobenzene	mg/L	0.07	A	1. 165				< 0.001
1,1,1-Trichloroethane	mg/L	0.2	11 - 11 - 11 - 11 - 11 - 11 - 11 - 11		-			
1,1,2-Trichloroethane	mg/L	0.005						-
Trichloroethene (TCE)	mg/L	0.005						
Vinyl chloride	mg/L	0.002		< 0.001				< 0.001
Bromobenzene	mg/L	M. 192						
Bromodichloromethane	mg/L	0.1						
Bromoform	mg/L	3.0						
Bromomethane	mg/L						-	
Chloroform	mg/L							
Chloromethane	mg/L							
2-Chlorotoluene	mg/L							
4-Chlorotoluene	mg/L							
Dibromomethane	mg/L							
1,3-Dichlorobenzene	mg/L							
1,1-Dichloroethane	mg/L							
1,3-Dichloropropane	mg/L							
2,2-Dichloropropane	mg/L	-						
1,1-Dichloropropene	mg/L							

Table 2Rossman Landfill Monitoring Well #1 Historical Water Quality Data

		Drinking W	ater Standards	MW1	MW1	MW1	MW1	MW1
		MCL						
arameter	Units	Primary	Secondary	9/1/95	4/1/96	9/1/96	3/1/97	9/16/97
1,1,1,2-Tetrachloroethane	mg/L							
1,1,2,2-Tetrachloroethane	mg/L							
1,2,3-Trichloropropane	mg/L	0.2						< 0.001
Trichlorotrifluoroethane (Freon)	mg/L							
DBCP	mg/L	0.0002						
1,2,4-Trimethylbenzene	mg/L							< 0.001
1,2-Dibromoethane	mg/L							< 0.001
1,3,5-Trimethylbenzene	mg/L							
Bromochloromethane	mg/L							
Hexachlorobutadiene	mg/L			-1.1 F				110.000
Isopropylbenzene	mg/L			12 - 12 - A				
n-Butylbenzene	mg/L							
n-Propylbenzene	mg/L				Section 2 and			and the second
Naphthalene	mg/L				1	2		10.00
sec-Butylbenzene	mg/L							
tert-Butylbenzene	mg/L							Sugar Star
methylene chloride	mg/L	19 5 115						

Table 4Initial Feasibility Study Water Quality Results

		Drinking V	Vater Standards	Odgen Middle School	Senior High School	Lonestar	16200 Oak Tree Terrace
			MCL				
Parameter	Units	Primary	Secondary	08/26/99	08/26/99	08/26/99	08/31/99
Conventional Parameters		T					
Conductivity	umhos/cm			1570	1700	640	560
рН			6.5-8.5	7.8	7.8	8.3	8.1
Temperature (Field Data)	oC						
Total Dissolved Solids	mg/L		500	930	1000	380	350
Turbidity	NTU	0.5					
Chloride	mg/L		250	464	506	134	86.9
Nitrate	mgN/L	10		ND	ND	ND	ND
Nitrite	mgN/L	1					
Total nitrate and nitrite	mgN/L	10				San Street	
Sulfate	mg/L		250	ND	ND	ND	ND
Fluoride (free)	mg/L	4	2		and the second second	Strate La State	A summer
MBAs (Surfactants)	mg/L		0.5				
Total Alkalinity	mg/L			129	123	135	150
Carbonate Alkalinity	mg/L			0.644	0.615	2.13	1.49
Hydroxide Alkalinity	mg/L	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	127	0.011	0.011	0.034	0.021
Bicarbonate Alkalinity	mg/L			157	150	164	182
Carbon Dioxide (Free)	mg/L			4.98	4.75	1.64	2.89
Total Phosphorus (as P)	mg/L						
Color	ACU		15				
Corrosivity			Non-Corrosive				
Odor	TON	2.5	3				
Calcium	mg/L	3		108	130	94.5	ND
Magnesium	mg/L			10	11.5	35.6	ND
Potassium	mg/L			18.3	18.6	18.4	2.6
Silica (SiO2)	mg/L			54	54	69	50
Sodium	mg/L			187	185	79	118
Total Hardness	mg/L-CaCO3		250	311	372	382	ND
Microbiological							
Standard Plate Count	cfu/mL						
Total Coliform	#/100 mL	<5% positive sam	ples				+
E. Coli	#/100 mL	<5% positive sam	· · · · · · · · · · · · · · · · · · ·				
Metals							
Aluminum	mg/L		0.05-0.2				
Antimony	mg/L	0.006					

Table 4Initial Feasibility Study Water Quality Results

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		Drinking W	ater Standards	Odgen Middle School	Senior High School	Lonestar	16200 Oak Tree Terrace
· · · · · · · · · · · · · · · · · · ·		and a second sec	ACL				
Parameter	Units	Primary	Secondary	08/26/99	08/26/99	08/26/99	08/31/99
Arsenic	mg/L	0.05					
Barium	mg/L	2					
Beryllium	mg/L	0.004					
Cadmium	mg/L	0.005					
Chromium	mg/L	0.1					
Соррег	mg/L	1.3	1				
Cyanide	mg/L	0.2					
Iron	mg/L		0.3	0.65	0.71	83	ND
Lead	mg/L	0.015			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
Manganese	mg/L		0.05	0.091	0.092	1.6	ND
Mercury	mg/L	0.002					
Nickel	mg/L	ALL ALL SOL					
Selenium	mg/L	0.05					
Silver	mg/L	0.05	0.1				
Thallium	mg/L	0.002				and a later of the	
Zinc	mg/L		5				
Radionuclides							
Gross Alpha	pCi/L	15					
Gross Beta	pCi/L	50					
Radon (Rn-222)	pCi/L						
Iodine-131	pCi/L	3					
Strontium-90	pCi/L	8					
Tritium	pCi/L	20000					
Disinfection By-Products							
Total Haloacetic Acids	mg/L	0.060					
Total Trihaolmethanes	mg/L	0.080					
Organics							
1,1,1-Trichloroethane	mg/L	0.2		ND	ND	ND	ND
1,1,2-Trichloroethane	mg/L	0.005		ND	ND	ND	ND
1,1-Dichloroethene	mg/L	0.007		ND	ND	ND	ND
1,2,4-Trichlorobenzene	mg/L	0.07		ND	ND	ND	ND
1,2-Dichlorobenzene	mg/L	0.6		ND	ND	ND	ND
1,2-Dichloroethane	mg/L	0.075		ND	ND	ND	ND
1,2-Dichloropropane	mg/L	0.005		ND	ND	ND	ND

Table 4Initial Feasibility Study Water Quality Results

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			ater Standards	Odgen Middle School	Senior High School	Lonestar	16200 Oak Tree Terrace
			ICL				
Parameter	Units	Primary	Secondary	08/26/99	08/26/99	08/26/99	08/31/99
1,4-Dichlorobenzene	mg/L	0.075		ND	ND	ND	ND
2,3,7,8-TCDD	mg/L	0.0000003					
2,4,5-TP (Silvex)	mg/L	0.05					
2,4-D	mg/L	0.07					
Alachlor	mg/L	0.002					
Atrazine	mg/L	0.003					
Benzene	mg/L	0.005		ND	ND	ND	ND
Benzo(a)pyrene	mg/L	0.0002					
Carbofuran	mg/L	0.04					
Carbon tetrachloride	mg/L	0.005		ND	ND	ND	ND
Chlordane	mg/L	0.002					
Chlorobenzene	mg/L	0.1		ND	ND	ND	ND
cis-1,2-Dichloroethene	mg/L	0.07		ND	ND	ND	ND
Dalapon	mg/L	0.2				States -	
DBCP	mg/L	0.0002					
Di(2-ethylhexyl)adipate	mg/L	0.4					
Di(2-ethylhexyl)phthalate	mg/L	0.006					
Dichloromethane	mg/L	0.005	/ L.	ND	ND	ND	ND
Dinoseb	mg/L	0.007					
Diquat	mg/L	0.02					
EDB (Ethylene dibromide)	mg/L	0.00005	1 - 1				5
Endothall	mg/L	0.1					
Endrin	mg/L	0.002					
Ethylbenzene	mg/L	0.7		ND	ND	ND	ND
Glyphosate	mg/L	0.7			1		
Heptachlor	mg/L	0.0004					
Heptachlor epoxide	mg/L	0.0002					
Hexachlorobenzene	mg/L	.0.001					
Hexachlorocyclopentadiene	mg/L	0.05		ND	ND	ND	i,⊎D
Lindane (gamma-BHC)	mg/L	0.0002					
Methoxychlor	mg/L	0.04					
Oxamyl (Vydate)	mg/L	0.2					1
Pentachlorophenol	mg/L	0.001					
Picloram	mg/L	0.5				-	
Polychlorinated Biphenyls	mg/L	0.0005					
Simazine	mg/L	0.004					

Table 4Initial Feasibility Study Water Quality Results

		Drinking W	'ater Standards	Odgen Middle School	Senior High School	Lonestar	16200 Oak Tree Terrace
		N	ACL				
Parameter	Units	Primary	Secondary	08/26/99	08/26/99	08/26/99	08/31/99
Styrene	mg/L	0.1		ND	ND	ND	ND
Tetrachloroethene (PCE)	mg/L	0.005		ND	ND	ND	ND
Toluene	mg/L	1		ND	ND	ND	ND
Toxaphene	mg/L	0.003					
trans-1,2-Dichloroethene	mg/L	0.1		ND	ND	ND	ND
Trichloroethene (TCE)	mg/L	0.005		ND	ND	ND	ND
Vinyl chloride	mg/L	0.002	1.00	ND	ND	ND	ND
Xylene (Total)	mg/L	10		ND	ND	ND	ND
1,1,1,2-Tetrachloroethane	mg/L			ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	mg/L			ND	ND	ND	ND
1,1-Dichloropropene	mg/L			ND	ND	ND	ND
1,2,3-Trichlorobenzene	mg/L	a far all the	1	ND	ND	ND	ND
1,2,3-Trichloropropane	mg/L	Second and		ND	ND	ND	ND
1,2,4-Trimethylbenzene	mg/L		1.	ND	ND	ND	ND
1,3,5-Trimethylbenzene	mg/L			ND	ND	ND	ND
1,3-Dichlorobenzene	mg/L			ND	ND	ND	ND
1,3-Dichloropropane	mg/L		1	ND	ND	ND	ND
1,3-Dichloropropene	mg/L			ND	ND	ND	ND
2,2-Dichloropropane	mg/L			ND	ND	ND	ND
2,4-DB	mg/L						
2,4-Dinitrotoluene	mg/L						
2-Butanone (MEK)	mg/L			ND	ND	ND	ND
2-Chlorotoluene	mg/L			ND	ND	ND	ND
3,5-Dichlorobenzoic Acid	mg/L						
3-Hydroxycarbofuran	mg/L						
4-Chlorotoluene	mg/L			ND	ND	ND	ND
4-Isopropyltoluene	mg/L			ND	ND	ND	ND
4-Methyl-2-Pentanone (MIBK)	mg/L			ND	ND	ND	ND
4-Nitrophenol	mg/L						
Acenaphthylene	mg/L						
Acifluorfen	mg/L						
Aldicarb	mg/L						
Aldicarb sulfone	mg/L						
Aldicarb sulfoxide	mg/L						
Aldrin	mg/L						
Alpha-BHC	mg/L						

Table 4Initial Feasibility Study Water Quality Results

		Drinking W	ater Standards	Odgen Middle School	Senior High School	Lonestar	16200 Oak Tree Terrace
			1CL				
Parameter	Units	Primary	Secondary	08/26/99	08/26/99	08/26/99	08/31/99
alpha-Chlorodane	mg/L	8	-31				
Anthracene	mg/L						
Aroclor 1016	mg/L						
Aroclor 1221	mg/L						and the second sec
Aroclor 1232	mg/L						
Aroclor 1242	mg/L		and the second sec				
Aroclor 1248	mg/L						
Aroclor 1254	mg/L						
Aroclor 1260	mg/L						
Baygon	mg/L						Contraction of the second
Bentazon	mg/L						
Benz(a)Anthracene	mg/L		Contraction Near			Contraction of the	1.1.1.1.1.1.7
Benzo(b)Fluorethane	mg/L						
Benzo(g,h,I)Perylene	mg/L	30.00					
Benzo(k)Fluoranthene	mg/L						
Beta-BHC	mg/L						
Bromacil	mg/L						
Bromobenzene	mg/L			ND	ND	ND	ND
Bromochloromethane	mg/L			ND	ND	ND	ND
Bromoform	mg/L			ND	ND	ND	ND
Bromomethane	mg/L			ND	ND	ND	ND
Butachlor	mg/L						
Butylbenzylphthalate	mg/L						
Caffeine	mg/L	and the second					
Carbaryl	mg/L						
Chloroethane	mg/L			ND	ND	ND	ND
Chloroform	mg/L		10-10-10-10-10-10-10-10-10-10-10-10-10-1	ND	ND	ND	ND
Chloromethane	mg/L			ND	ND	ND	ND
Chlorthalonil	mg/L						
Chrysene	mg/L						
DCPA	mg/L						
Delta-BHC	mg/L						
Dibenz(a,h)Anthracene	mg/L						
Dibromochloromethane	mg/L			ND	ND	ND	ND
Dibromomethane	mg/L			ND	ND	ND	ND
Dicamba	mg/L						

Table 4Initial Feasibility Study Water Quality Results

	Units	Drinking Water Standards MCL		Odgen Middle School	Senior High School	Lonestar	16200 Oak Tree Terrace
· · · · · · · · · · · · · · · · · · ·							
Parameter		Primary	Secondary	08/26/99	08/26/99	08/26/99	08/31/99
Dichlorodifluoromethane	mg/L	1 200 - 200		ND	ND	ND	ND
Dichlorprop	mg/L	P					
Dieldrin	mg/L						
Diethylphthalate	mg/L						
Di-isopropyl Ether	mg/L			ND	ND	ND	ND
Dimethoate	mg/L						
Dimethylphthalate	mg/L						_
Di-n-Butylphthalate	mg/L						
Endosulfan I	mg/L				0.50 300 520		
Endosulfan II	mg/L					And the second second	
Endosulfan Sulfate	mg/L						
Endrin Aldehyde	mg/L		1 A 1 A 1 A 1 A 1				
Fluorene	mg/L						
Indeno(1,2,3,c,d)Pyrene	mg/L						1.
Isophorone	mg/L						
Isopropylbenzene	mg/L			ND	ND	ND	ND
Methoicarb	mg/L	1	1				
Methomyl	mg/L						
Metolachlor	mg/L						Personal and a second s
Metribuzin	mg/L						
Molinate	mg/L	1 m +	1.0				
Naphthalene	mg/L	12		ND	ND	ND	ND
n-Butylbenzene	mg/L			ND	ND	ND	ND
n-Propylbenzene	mg/L			ND	ND	ND	ND
p,p' DDD	mg/L						
p,p' DDE	mg/L						
p,p' DDT	mg/L						
Paraquat	mg/L						
Phenanthrene	mg/L						
Prometryn	mg/L						
Propachlor	mg/L						
Pyrene	mg/L						
sec-Butylbenzene	mg/L			ND	ND	ND	ND
tert-Butylbenzene	mg/L			ND	ND	ND	- ND
Thiobencarb	mg/L						
trans-1,3-Dichloropropene	mg/L			ND	ND	ND	ND

Table 4Initial Feasibility Study Water Quality Results

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		Drinking Water Standards		Odgen Middle School	Senior High School	Lonestar	16200 Oak Tree Terrace
		N	ACL			California California	
Parameter	Units	Primary	Secondary	08/26/99	08/26/99	08/26/99	08/31/99
trans-Nonachlor	mg/L	1914					1
Trichlorofluoromethane	mg/L			ND	ND	ND	ND
Trichlorotrifluoroethane (Freon)	mg/L			ND	ND	ND	ND
Trifluralin	mg/L						

Table 4Initial Feasibility Study Water Quality Results

CRW-1 Pre-Pump Test	CRW1 Post- Pump Test	CRW1 Packer Test Upper Zone	CRW1 Packer Test Lower Zone	
08/31/99	09/01/99	11/30/99	11/30/99	
770	860	530	975	
8			8	
470	510	330	600	
1.1	0.1			
167	182	101	273	
ND	ND	ND	ND	
ND	ND		6 m 1	
ND	ND			
ND	ND	ND	ND	
0.67	0.7			
ND	ND			
137	136	141	130	
1.09	1.07	1.76	1.03	
0.017	0.017	0.02	0.017	
167	165	171	158	
3.34	3.3	2.16	3.16	
ND	0.02			
3	5			
0.4	0.4			
1	1	1		
39.3	40.9	26	50.8	
7.2	7.1	5.8	8.2	
12	12.3	9.3	13.9	
49	46	45	45	
101	108	76.9	130	
128	131	88.8	161	
100	2			
>23	<1.1			
<1.1	<1.1			
ND	ND			
ND	ND	_		



Table 4Initial Feasibility Study Water Quality Results

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CRW-1 Pre-Pump Test	CRW1 Post- Pump Test	CRW1 Packer Test Upper Zone	CRW1 Packer Test Lower Zone	
08/31/99	09/01/99	11/30/99	11/30/99	
ND	ND	•		
0.041	0.045			
ND	ND			
ND	ND			
0.0078	0.011	100 and 100 and 100		
ND	ND			
ND	ND			
0.11	0.13	ND	ND	
0.000645	ND			
0.036	0.036	0.024	0.038	
ND	ND	the states		
ND	ND			
0.03	ND			
<3.27	<4.08		-	
<2.88	11.7			
260	220		-	
<3.3	0.306			
<291				
ND	ND			
ND	ND			
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	

Table 4
Initial Feasibility Study Water Quality Results

CRW-1 Pre-Pump Test	CRW1 Post- Pump Test	CRW1 Packer Test Upper Zone	CRW1 Packer Test Lower Zone
08/31/99	09/01/99	11/30/99	11/30/99
ND	ND	ND	ND
ND	ND	ND	ND
ND	ND		
ND	ND		
ND	ND	ND	ND
ND	ND		
ND	ND	ND	ND
ND	ND	ND	ND
ND	ND	2: S.	
ND	ND		All my second
ND	ND		10
ND	ND		
ND	ND	ND	ND
ND	ND		
ND	ND	ND	ND
ND	ND		
ND	ND		
ND	ND		
ND	ND		and the second second
ND	ND	ND	ND
ND	ND		
ND	ND	_	



Table 4					
Initial Feasibility Study Water Quality Results					

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CRW-1 Pre-Pump Test	CRW1 Post- Pump Test	CRW1 Packer Test Upper Zone	CRW1 Packer Test Lower Zone	
08/31/99	09/01/99	11/30/99	11/30/99	
ND	ND	ND	ND	
0.0006	ND	ND	ND	
ND	ND	ND	ND	
ND	ND			
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND			
ND	ND	and the second sec		
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND			
ND	ND			
ND	ND	ND	ND	
ND	ND	ND	ND	· ·
ND	ND	ND	ND	
ND	ND			

Table 4Initial Feasibility Study Water Quality Results

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CRW-1 Pre-Pump Test	CRW1 Post- Pump Test	CRW1 Packer Test Upper Zone	CRW1 Packer Test Lower Zone	
08/31/99	09/01/99	11/30/99	11/30/99	
ND	ND			
ND	ND	1		
ND	ND	Section Section	and the second second	
ND	ND		Contraction of the second	
ND	ND		A SALES	
ND	ND		and the second	
ND	ND	A second second second		
ND	ND			
ND	ND			
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND			
ND	ND			
ND	ND		35"	
ND	ND			
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND			
ND	ND	ND	ND	
ND	ND	ND	ND	
ND	ND			



Table	4
Initial Feasibility Study W	Vater Quality Results

CRW-1 Pre-Pump Test	CRW1 Post- Pump Test	CRW1 CRV Packer Test Packer Upper Zone Lower	
08/31/99	09/01/99	11/30/99	11/30/99
ND	ND	ND	ND
ND	ND		
ND	ND		
ND	ND		
ND	ND	ND	ND
ND	ND		
ND	ND		
ND	ND		
ND	ND		1
ND	ND		A. 9. 5. 19
ND	ND		
ND	ND		
ND	ND		
ND	ND	Service Statistics	
ND	ND		
ND	ND	ND	ND
ND	ND		
ND	ND	ND	ND
ND	ND	ND	ND
ND	ND	ND	ND
ND	ND		
ND	ND	l	
ND	ND		
ND	ND	ND	ND
ND	ND	ND	ND
ND	ND		
ND	ND	ND	ND



Table 4Initial Feasibility Study Water Quality Results

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CRW-1 Pre-Pump Test	CRW1 Post- Pump Test	CRW1 Packer Test Upper Zone	CRW1 Packer Test Lower Zone	
08/31/99	09/01/99	11/30/99	11/30/99	
ND	ND			
ND ND		ND	ND	
ND ND		ND	ND	
ND	ND		195	

Table 6Clackamas River Water - Historical Injection Water Quality

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		Drinking W	Vater Standards	Clacka	mas River Water l	District	Sou	ith For <u>k W</u> ater I
]	MCL	No. of			No. of	
Parameter	Units	Primary	Secondary	Samples	Min	Max	Samples	Min
onventional Parameters								
Chloride	mg/L		250	7	1.8	23	1	10
Color	ACU		15	1	10	10		
Corrosivity			Non-Corrosive					
Fluoride (free)	mg/L	4	2	7	ND	ND	7	ND
MBAS (Surfactants)	mg/L		0.5	7	ND	0.04		
Odor	TON		- 3					
pH			6.5-8.5	7	6.76	7.69	1	6.7
Sulfate	mg/L		250	7	3	5.8	7	ND
Total Dissolved Solids	mg/L		500	7	22	76		
Total Hardness	mg/L-CaCO3		250	7	16	32	1	76
Nitrite	mgN/L	1		7	ND	ND	7	ND
Nitrate	mgN/L	10		7	0.04	0.7	13	ND
Total nitrate and nitrite	mgN/L	10						
Turbidity	NTU	0.5	1					
Calcium	mg/L		and the second	4	4.1	5.7		
Conductivity	umhos/cm			Sec. Sec.			1	
Magnesium	mg/L			3	1.5	1.6		
Potassium	mg/L							
Silica (SiO2)	mg/L							
Sodium	mg/L			6	5.8	6.9	7	4.6
Total Alkalinity	mg/L			6	20	26		
		1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 - 1986 -				-		
icrobiological		1.65						
Total Coliform	#/100 mL	<5% positive san	and the second se	Monthly	0%	2%	Monthly	0%
E. Coli	#/100 mL	<5% positive san	nples		0%	0%		0%
etals								
Aluminum	mg/L		0.05-0.2	7	ND	0.06		
Antimony	mg/L	0.006		7	ND	ND	7	ND
Arsenic	mg/L	0.05		7	ND	ND	7	ND
Barium	mg/L	2		7	0.002	0.003	7	ND
Beryllium	mg/L	0.004		7	ND	ND	7	ND
Cadmium	mg/L	0.005		7	ND	ND	7	ND
Chromium	mg/L	0.1		7	ND	ND	7	ND
Copper	mg/L	1.3	1	7	ND	ND	6	0.1

Table 6Clackamas River Water - Historical Injection Water Quality

			Drinking W	ater Standards	Clack	amas River Water l	District	South Fork Wa		
1			N	ACL	No. of			No. of		
1	Parameter	Units	Primary	Secondary	Samples	Min	Max	Samples	Min	
1	Cyanide	mg/L	0.2		7	ND	ND	7	ND	
1	Iron	mg/L		0.3	7	ND	ND	I	ND	
	Lead	mg/L	0.015		2	ND	ND	6	0.00	
	Manganese	mg/L		0.05	7	ND	0.01	1 ·	ND	
	Mercury	mg/L	0.002		7	ND	ND	7	ND	
	Nickel	mg/L	0.1		7	ND	ND	7	ND	
1	Selenium	mg/L	0.05		7	ND	ND	7	ND	
1	Silver	mg/L	0.05	0.1	7	ND	0.0048			
1	Thallium	mg/L	0.002		7	ND	ND	7	ND	
1	Zinc	mg/L	Contraction of the	5	7	ND	0.06	1	0.02	
Rad	lionuclides							in the second	and the st	
T	Gross Alpha	pCi/L	15					2	ND	
	Gross Beta	pCi/L	50							
	Radon (Rn-222)	pCi/L								
	Iodine-131	pCi/L	3							
	Strontium-90	pCi/L	8		1.					
	Tritium	pCi/L	20000							
Disi	infection By-Products		10000							
T	Total Haloacetic Acids	mg/L	0.060							
	Total Trihaolmethanes	mg/L	0.080		7	0.01732	0.0332	Quarterly	0.014	
Org	ganics									
_	VOCs									
1	1,1,1-Trichloroethane	mg/L	0.2		7	ND	ND	8	ND	
-	1,1,2-Trichloroethane	mg/L	0.005		6	ND	ND	8	ND	
	1,1-Dichloroethene	mg/L	0.007		7	ND	ND	8	ND	
1	1,2,4-Trichlorobenzene	mg/L	0.07		6	ND	ND	8	ND	
-	1,2-Dichlorobenzene (ortho)	mg/L	0.6		7	ND	ND	8	ND	
1	1,4-Dichlorobenzene (para)	mg/L	0.075		7	ND	ND	8	ND	
	1,2-Dichloroethane	mg/L	0.075		7	ND	ND	8	ND	
-	1,2-Dichloropropane	mg/L	0.005		6	ND	ND	8	ND	
-	cis-1,2-Dichloroethene	mg/L	0.07		7	ND	ND	8	ND	
-	trans 1,2-Dichloroethene	mg/L	0.1		7	ND	ND	8	ND	
-	Benzene	mg/L	0.005		7	ND	ND	8	ND	

Table 6Clackamas River Water - Historical Injection Water Quality

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		Drinking W	ater Standards	Clacka	mas River Water	Sou	uth Fork Water	
		N	4CL	No. of			No. of	-
Parameter	Units	Primary	Secondary	Samples	Min	Max	Samples	Min
Carbontetrachloride	mg/L	0.005		7	ND	ND	8	ND
Chlorobenzene (monochlorobenzene)	mg/L	0.1		7	ND	ND	8	ND
Dichloromethane	mg/L	0.005		5	ND	ND	8	ND
Ethylbenzene	mg/L	0.7		7	ND	ND	8	ND
Styrene	mg/L	0.1		7	ND	ND	8	ND
Tetrachloroethene (PCE)	mg/L	0.005		7	ND	ND	8	ND
Toluene	mg/L	1		6	ND	ND ·	8	ND
Toxaphene	mg/L	0.003		6	ND	ND	8	ND
Trichloroethene (TCE)	mg/L	0.005		7	ND	ND	8	ND
Vinyl chloride	mg/L	0.002		7	ND	ND	8	ND
Xylene (Total)	mg/L	10		7	ND	ND	8	ND
SOCs	al call							
2,4,5-TP(Silvex)	mg/L	0.05		5	ND	ND	7	ND
2,4-D	mg/L	0.07		5	ND	ND	7	ND
Alachlor	mg/L	0.002		6	ND	ND	7	ND
Atrazine	mg/L	0.003		6	ND	ND	7	ND
Benzo(a)pyrene	mg/L	0.0002		3	ND	ND	7	ND
Carbofuran	mg/L	0.04		3	ND	ND	7	ND
Chlordane	mg/L	0.002		6	ND	ND	7	ND
Dalapon	mg/L	0.2		3	ND	ND	7	ND
Dibromochloropropane (DBCP)	mg/L	0.0002		6	ND	ND	7	ND
Di(2-ethylhexyl)adipate	mg/L	0.4		4	ND	ND	7	ND
Di(2-ethylhexyl)phthalate	mg/L	0.006		4	ND	ND	7	ND
Dinoseb	mg/L	0.007		3	ND	ND	7	ND
Dioxin (2,3,7,8-TCDD)	mg/L	.00000003			1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -		7	ND
Diquat	mg/L	0.02		3	ND	ND	7	ND
EDB (Ethylenedibromide)	mg/L	0.00005		6	ND	ND	7	ND
Endothall	mg/L	0.1		4	ND	ND	7	ND
Endrin	mg/L	0.002		6	ND	ND	7	ND
Glyphosate	mg/L	0.7		4	ND	ND	7	ND
Heptachlor	mg/L	0.0004		6	ND	ND	7	ND
Heptachlorepoxide	mg/L	0.0002		6	ND	ND	7	ND
Hexachlorobenzene	mg/L	0.001		4	ND	ND	7	ND
Hexachlorocyclopentadiene	mg/L	0.05		1	ND	ND	7	ND
Lindane (gamma-BHC)	mg/L	0.0002		6	ND	ND	7	ND
Methoxychlor	mg/L	0.04		6	ND	ND	7	ND

Table 6Clackamas River Water - Historical Injection Water Quality

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		Drinking Water Standards MCL		No. of		1	No. of	South Fork Wate	
Parameter	Units	Primary	Secondary	Samples	Min	Max	Samples	Min	
Oxamyl (Vydate)	mg/L	0.2		2	ND	ND	7	ND	
Pentachlorophenol	mg/L	0.001		4	ND	ND	7	ND	
Picloram	mg/L	0.5		3	ND	ND	7	ND	
Polychlorinated Biphenyls (PCBs)	mg/L	0.0005	1000	6	ND	ND	7	ND	
Simazine	mg/L	0.004		4	ND	ND	7	ND	

Table 6Clackamas River Water - Historical Injection Water Quality

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	Drini		Vater Standards	rđ	Calackamas Cour	Calackamas County Water Commission WTP		
			MCL		No. of			
Parameter	Units	Primary	Secondary	Max	Samples	Min	Max	
tional Parameters		1					· · ·	
Chloride	mg/L		250					
Color	ACU		15					
Corrosivity			Non-Corrosive					
Fluoride (free)	mg/L	4	2	0.37				
MBAS (Surfactants)	mg/L		0.5					
Odor	TON		3					
pH			6.5-8.5					
Sulfate	mg/L		250	11.2				
Total Dissolved Solids	mg/L	1	500		6			
Total Hardness	mg/L-CaCO3		250	111111111111111	1		18.0	
Nitrite	mgN/L	1		1	1	ND	ND	
Nitrate	mgN/L	1.0		1.0	2	ND	ND	
Total nitrate and nitrite	mgN/L	10			1	ND	ND	
Turbidity	NTU	0.5			Daily	0.19	0.64	
Calcium	mg/L			1. A. C. S. C. S.				
Conductivity	umhos/cm			1.				
Magnesium	mg/L							
Potassium	mg/L							
Silica (SiO2)	mg/L							
Sodium	mg/L			7.3				
Total Alkalinity	mg/L							
iological		-						
Total Coliform	#/100 mL	<5% positive sa	mples	3.3%	Monthly	0%	2%	
E. Coli	#/100 mL	<5% positive sa		0%		0%	0%	
<i>E. Coll</i>	#7100 HL							
Aluminum	mg/L		0.05-0.2					
Antimony	mg/L	0.006			1	ND	ND	
Arsenic	mg/L	0.05			1	ND	ND	
Barium	mg/L	2		0.003	1	0.0022	0.0022	
Beryllium	mg/L	0.004			I	ND	ND	
Cadmium	mg/L	0.005			1	ND	ND	
Chromium	mg/L	0.1			1	ND	ND	
Copper	mg/L	1.3	1	0.39	1	ND	ND	

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Table 6Clackamas River Water - Historical Injection Water Quality

		Drinking W	'ater Standards	rd	Calackamas Cour	Calackamas County Water Commission WTP	
	<u> </u>		ACL		No. of		
Parameter	Units	Primary	Secondary	Max	Samples	Min	Max
Cyanide	mg/L	0.2	-35		1	ND	ND
Iron	mg/L		0.3				
Lead	mg/L	0.015		0.013	1	ND	ND
Manganese	mg/L		0.05				
Mercury	mg/L	0.002			1	ND	ND
Nickel	mg/L	0.1			1	ND	ND
Selenium	mg/L	0.05			1	ND	ND
Silver	mg/L	0.05	0.1	to the original			
Thallium	mg/L	0.002	e		1	ND	ND
Zinc	mg/L		5				
uclides							
Gross Alpha	pCi/L	15	distant.	0.2	2	ND	ND
Gross Beta	pCi/L	50	and the second second		2	1.5	2.1
Radon (Rn-222)	pCi/L						
Iodine-131	pCi/L	3					
Strontium-90	pCi/L	8			Sum State (
Tritium	pCi/L	20000					
ction By-Products	and a start of the		S		-		
Total Haloacetic Acids	mg/L	0.060	-	· ····································	4	0.015	0.036
Total Trihaolmethanes	mg/L	0.080		0.06	4	0.013	0.016
			1		-		
cs				1.2.2			
Cs							
1,1,1-Trichloroethane	mg/L	0.2		ND	1	ND	ND
1,1,2-Trichloroethane	mg/L	0.005		ND	1	ND	ND
1,1-Dichloroethene	mg/L	0.007		ND	1	ND	ND
1,2,4-Trichlorobenzene	mg/L	0.07		ND	1	ND	ND
1,2-Dichlorobenzene (ortho)	mg/L	0.6		ND	1	ND	ND
1,4-Dichlorobenzene (para)	mg/L	0.075		ND	1	ND	ND
1,2-Dichloroethane	mg/L	0.075		ND	1	ND	ND
1,2-Dichloropropane	mg/L	0.005		ND	1	ND	ND
cis-1,2-Dichloroethene	mg/L	0.07		ND	1	ND	ND
trans 1,2-Dichloroethene	mg/L	0.1		ND	1	ND	ND
Benzene	mg/L	0.005		ND	1	ND	ND

Table 6Clackamas River Water - Historical Injection Water Quality

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			ater Standards	rd	Calackamas Coun	Slow Sand	
			ICL		No. of		
Parameter	Units	Primary	Secondary	Max	Samples	Min	Max
Carbontetrachloride	mg/L	0.005		ND	1 1	ND	ND
Chlorobenzene (monochlorobenzene)	mg/ኒ	0.1		ND	1	ND	ND
Dichloromethane	mg/L	0.005		ND	1	ND	ND
Ethylbenzene	mg/L	0.7		ND	1	ND	ND
Styrene	mg/L	0.1		ND	1	ND	ND
Tetrachloroethene (PCE)	mg/L	0.005		ND	1	ND	ND
Toluene	mg/L	1		ND	1	ND	ND
Toxaphene	mg/L	0.003	and the second sec	ND	1	ND	ND
Trichloroethene (TCE)	mg/L	0.005		ND	1	ND	ND
Vinyl chloride	mg/L	0.002		ND	1	ND	ND
Xylene (Total)	mg/L	10		ND	1	ND	ND
5			1.4				
2,4,5-TP(Silvex)	mg/L	0.05	39. 5	ND	1	ND	ND
2,4-D	mg/L	0.07		ND	1	ND	ND
Alachlor	mg/L	0.002		ND	1	ND	ND
Atrazine	mg/L	0,003		ND	1	ND	ND
Benzo(a)pyrene	mg/L	0.0002		ND	1	ND	ND
Carbofuran	mg/L	0.04		ND	1	ND	ND
Chlordane	mg/L	0.002		ND	1	ND	ND
Dalapon	mg/L	0.2		ND	1	ND	ND
Dibromochloropropane (DBCP)	mg/L	0.0002		ND	1	ND	ND
Di(2-ethylhexyl)adipate	mg/L	0.4		ND	1	ND	ND
Di(2-ethylhexyl)phthalate	mg/L	0.006		ND	I	ND	ND
Dinoseb	mg/L	0.007		ND	1	ND	ND
Dioxin (2,3,7,8-TCDD)	mg/L	.00000003		ND	1	ND	ND
Diquat	mg/L	0.02		ND	1	ND	ND
EDB (Ethylenedibromide)	mg/L	0.00005		ND	1	ND	ND
Endothall	mg/L	0.1		ND	1	ND	ND
Endrin	mg/L	0.002		ND	1	ND	ND
Glyphosate	mg/L	0.7		ND	1	ND	ND
Heptachlor	mg/L	0.0004		ND	1	ND	ND
Heptachlorepoxide	mg/L	0.0002		ND	1	ND	ND
Hexachlorobenzene	mg/L	0.001		ND	1	ND	ND
Hexachlorocyclopentadiene	mg/L	0.05		ND	1	ND	ND
Lindane (gamma-BHC)	mg/L	0.0002		ND	1	ND	ND
Methoxychlor	mg/L	0.04		ND	1	ND	ND

Table 6Clackamas River Water - Historical Injection Water Quality

		Drinking Water Standards		rd	Calackamas County Water Commission Slow Sand WTP			
		N	1CL		No. of			
Parameter	Units	Primary	Secondary	Max	Samples	Min	Max	
Oxamyl (Vydate)	mg/L	0.2		ND	1	ND	ND	
Pentachlorophenol	mg/L	0.001		ND	1	ND	ND	
Picloram	mg/L	0.5		ND	1	ND	ND	
Polychlorinated Biphenyls (PCBs)	mg/L	0.0005		ND	1	ND	ND	
Simazine	mg/L	0.004		ND	1	ND	ND	
					1 3			
ND - Non Detect								



Appendix E

APPENDIX E

MIXING ANALYSIS

MIXING ANALYSIS

E-1. GEOCHEMICAL MODELING

Geochemical modeling is a useful tool for evaluating mineral precipitation and dissolution in groundwater systems. With regard to ASR, geochemical modeling is used to assess the potential for clogging of the aquifer by mineral precipitation. The geochemical model applied in this study was PHREEQC (Parkhurst et al. 1990). PHREEQC is an equilibrium mass-balance geochemical model developed by the U.S. Geological Survey that can be used to calculate the aqueous speciation and the stability of solid phases with respect to dissolved constituents. The program performs speciation calculations by simultaneously solving equations representing the formation of ion pairs, complex ions, and solids using an extensive thermodynamic database, in this case the MINTEQ database. The potential for mineral precipitation or dissolution is assessed using a saturation index (SI), which is based on the relation between actual analyte activities (the ion activity product, IAP) and the thermodynamic calculation of the solubility product (K_T). The saturation index of a mineral is determined using the following equation:

 $SI = log_{10}[IAP]/[K_T]$

When SI > 0, the solution is theoretically oversaturated with respect to the solid, and the solid may precipitate. When SI < 0, the solution is theoretically undersaturated with respect to the solid, and, if present in the system, the solid should dissolve. Kinetic effects may result in deviations from dissolution/precipitation behavior predicted solely based on thermodynamic considerations. An advantage of PHREEQC over similar geochemical modeling programs is that it allows mixing of two solutions in varying proportions. This feature is particularly useful for determining the potential effects of aquifer recharge and storage on the existing groundwater characteristics in the aquifer.

E-1.1 Modeling Input

5.4.5 Groundwater

Both historic water quality data and water quality data collected during the course of this study exist for Well No. 1, the proposed injection well. Water quality sampling during the packer test however, illustrated distinct differences in the water quality of the upper and lower aquifer. Because recharge will occur to the lower portion of the aquifer, the water quality sample collected from this zone was considered to be most representative of the groundwater quality that will mix with the recharge water.

Redox potential is an important variable in geochemical modeling as the solubility of potential soil phases, particularly iron-bearing compounds, is sensitive to the redox state of the groundwater. Throughout the packer test, the redox potential of the lower aquifer zone was recorded at 30-minute intervals. Redox measurements over this period ranged from 120 mV to 150 mV. An Eh of 135 mV was therefore assigned to the groundwater for

geochemical modeling. This value falls within the range typically reported for groundwater systems (Appelo and Potsma, 1994). Although dissolved oxygen was also recorded at concentrations up to 11 mg/L, these concentrations are believed to be erroneous due to instrument drift. Dissolved oxygen was not included in modeling as this resulted in Eh adjustments by PHREEQC to values above what typical groundwaters exhibit.

The packer test samples from both the upper and lower aquifer reported iron concentrations below detectable limits (<0.05 mg/L). Historically, iron concentrations for Well No. 1 have ranged from 0.08 mg/L to 0.44 mg/L. Because the precipitation of iron (oxy)hydroxides is possible when oxidized surface water is mixed with less oxidized groundwater containing iron, iron concentrations are an important input in geochemical modeling. Modeling was therefore conducted using two iron concentrations to represent both historical and current conditions, as indicated during the packer test. In the first simulation, an initial groundwater iron concentration equivalent to the concentration that would result from groundwater in equilibrium with ferrihydrite was applied. For the second simulation, an iron concentration equal to the average of the historic concentrations was assigned (0.20 mg/L).

Sulfate was also below detectable limits in the lower zone packer test sample. Sulfate was assumed to be equal to the detection limit (0.1 mg/L) in model simulations. Historically sulfate concentrations have been low (<0.3 mg/L). Nitrate, also below detectable limits (<0.01 mg/L) was not included in model runs. At a redox potential of 135 mV, nitrate would not be expected to be present.

5.4.6 Recharge Water

Annual water quality for the Clackamas River for the period 1995 to 1999 is generally consistent for most reported parameters; however, in 1995 and 1996 aluminum and silver concentrations respectively were higher than previous years. Sulfate values for 1998 and 1999 (10 mg/L) are also four times higher than those from 1995 to 1997 (~ 2.5 mg/L).

Due to the similarity in historical water quality data, the most recent sample for which a compete analysis was available, was used in geochemical modeling. Because calcium and magnesium were not reported in 1998 and 1999, the 1997 sample was chosen.

No Eh data is available for the Clackamas river water samples. A value of 500 mV was therefore assigned; consistent with generalized Eh-pH relationships for surface water in contact with the atmosphere presented in Appelo and Potsma (1994). Iron, copper, manganese and zinc were all below detectable limits in the 1997 Clackamas River sample. Copper, manganese and zinc were set at concentrations equal to their respective detection limits. An iron concentration representative of equilibrium conditions with ferrihydrite was assigned.

E-1.2 Modeling Results and Discussion

5.4.7 Groundwater

For both modeling simulations, groundwater is supersaturated with respect to a number of iron (hydr)oxides and silica minerals. The iron (hydr)oxides include such minerals as goethite (FeOOH), hematite (Fe₂O₃), maghemite (γ -Fe₂O₃), magnetite (Fe₃O₄), and lepidocrocite (γ -FeOOH). However, despite the very low solubilities of these compounds, the role of most of these minerals in equilibrium control of the iron activity in freshwater natural systems is very minor (Hem 1992). Instead, the solubility of iron is usually controlled by the most soluble (hydr)oxide present (Lindsay 1979), which is ferrihydrite (Fe(OH)₃). This compound is known to play a major role in iron-rich aqueous systems such as acid rock drainage (e.g., Nordstrom 1982), and is a familiar cause for well failure by encrustation (e.g., Driscoll 1989). For simulation one, groundwater in equilibrium with ferrihydrite results in an iron concentration of 0.001 mg/L. For the second simulation, an iron concentration of 0.20 mg/L results in supersaturation of ferrihydrite.

The groundwater is also supersaturated with respect to various silica minerals, the only one of relevance being quartz (SiO₂). In general, natural waters are oversaturated with respect to quartz because the rate of attainment of equilibrium between quartz and silicic acid (i.e. dissolved silica) is extremely slow (Stumm and Morgan 1981). This generally implies that the solubility of amorphous silica represents the upper limit of dissolved aqueous silica. Groundwater is slightly undersaturated with respect to amorphous silica. This is in good agreement with the observation made by Hem (1992) that natural waters tend to have dissolved silica concentrations between the quartz equilibrium value and the amorphous silica value. Consequently, clogging through precipitation of silica is unlikely. Other minerals commonly found to clog aquifers or form encrustations in wells such as manganese (hydr)oxides, carbonates, and gypsum are below saturation levels and should not precipitate. Saturation indices indicate that calcite is near equilibrium within the aquifer.

5.4.8 Recharge Water

Recharge water at equilibrium with respect to ferrihydrite results in an iron concentration of 0.005 mg/L. In theory, therefore, under equilibrium conditions dissolved iron cannot be present in measurable concentrations in the recharge water. Historical sampling indicates that concentrations are below 0.05 mg/L. The modeling results show that the recharge water is supersaturated with essentially the same iron oxides as the groundwater: ferrihydrite, goethite, hematite, maghemite, magnetite, and lepidocrocite. It is undersaturated with respect to carbonates, gypsum, and amorphous aluminum hydroxide. Surface water is at equilibrium with gibbsite.

6. MIXING

After injection of the recharge water, at any given time all possible groundwater to recharge water mixing ratios will occur in the aquifer. Immediately following injection, the mixing zone between the two waters will be very narrow, and two discrete water bodies will exist with essentially unaltered compositions. As time progresses, the mixing zone will become broader and an increasing volume of the aquifer will contain mixed groundwater/recharge water in various proportions. To cover this range of possible mixing ratios, the effects of mixing were modeled with PHREEQC using three groundwater to recharge water ratios: 3:1, 1:1, and 1:3.

As the proportion of recharge water mixed with groundwater increases, geochemical modeling indicates that groundwater pH will decline and Eh will demonstrate small increases. Simulation one indicates that this slight decline in pH and increase in Eh will result in slight supersaturation of ferrihydrite. Due to the small concentration of iron assumed to be initially present (0.001 mg/L), precipitation would be minimal.

For simulation two, an initial iron concentration of 0.2 mg/l resulted in supersaturation with respect to ferrihydrite. Supersaturated conditions will persist during mixing with recharge water, despite the influx of water with a lower iron concentration.

Supersaturation with respect to ferrihydrite at an iron concentration of 0.2 mg/L is most likely insignificant in terms of clogging of the aquifer. The following semi-quantitative approach may serve as an example. Consider a worst-case scenario in which virtually all available dissolved iron (0.2 mg/L = 0.0036 mmol/L, $M_{\text{Fe}} = 55.8 \text{ g/mole}$) precipitates as ferrihydrite. Assume a density of approximately 2.4 g/cm³ for ferrihydrite (CRC, 1981), which equates to a molar volume of approximately 45 cm³/mole ($M_{Fe(OH)3} = 106.8$ g/mole). Per liter of groundwater, 0.0036 mmole of ferrihydrite therefore occupies approximately 1.6 x 10⁻⁴ cm³. Assume that the porosity of the interflow zone for the basalt is approximately 15%, representative of a worst case scenario. This equates to approximately 150 cm³ of porewater per 1 liter of aquifer, in which approximately 2.4 x 10^{-5} cm³ ferrihydrite precipitates. This amounts to approximately 1.6×10^{-5} % of the available pore space, which is a negligible reduction in porosity. The reduction percentage as calculated above is constant and independent of actual porosity. Although this calculation contains some considerable uncertainties, it does serve to demonstrate that clogging of the aquifer through precipitation of ferrihydrite is not likely to have a significant impact on groundwater flow and porosity. The above approach is valid for static conditions (i.e. no groundwater movement).

In addition to precipitation through inorganic mechanisms, microbial mediation can also result in formation of ferrihydrite. Various forms of iron bacteria, such as the *Thiobacillus* and *Gallionella* genera, have the capability to oxidize ferrous iron (Driscoll 1989; Nordstrom 1982). This may lead to accumulation of substantial amounts of ferric hydroxide slimes, which can reduce porosity outside the well (biofouling). To prevent this from occurring, iron bacteria can be controlled through a variety of chemical and physical applications, such as addition of oxidizing/acidifying agents as bactericides.

The potential for iron bacteria to adversely affect aquifer properties is difficult to ascertain. The different types of iron bacteria can occur in water with a wide variety of chemical and physical characteristics. However, the low iron content of the groundwater (0.2 mg/L) may be a retardant to growth of these bacteria, as they are typically found in water that has an iron concentration in excess of 1 mg/L (Driscoll 1989). Since mixing of groundwater with recharge water will reduce dissolved iron concentrations even further, it is not anticipated that iron bacteria will be a major concern for the ASR system.

7. REFERENCES

Appelo, C.A.J., Potsma, D., 1994. Geochemistry, Groundwater and Pollution, A.A. Balkema, Netherlands.

Driscoll, F.G. (ed.), 1989. Groundwater and Wells, Second Ed. Johnson Filtration Systems Inc., St. Paul, MN.

Hem, John, D., 1992. Study and Interpretation of the Chemical Characteristics of Natural Water, United States Geological Survey Water-Supply Paper 2254.

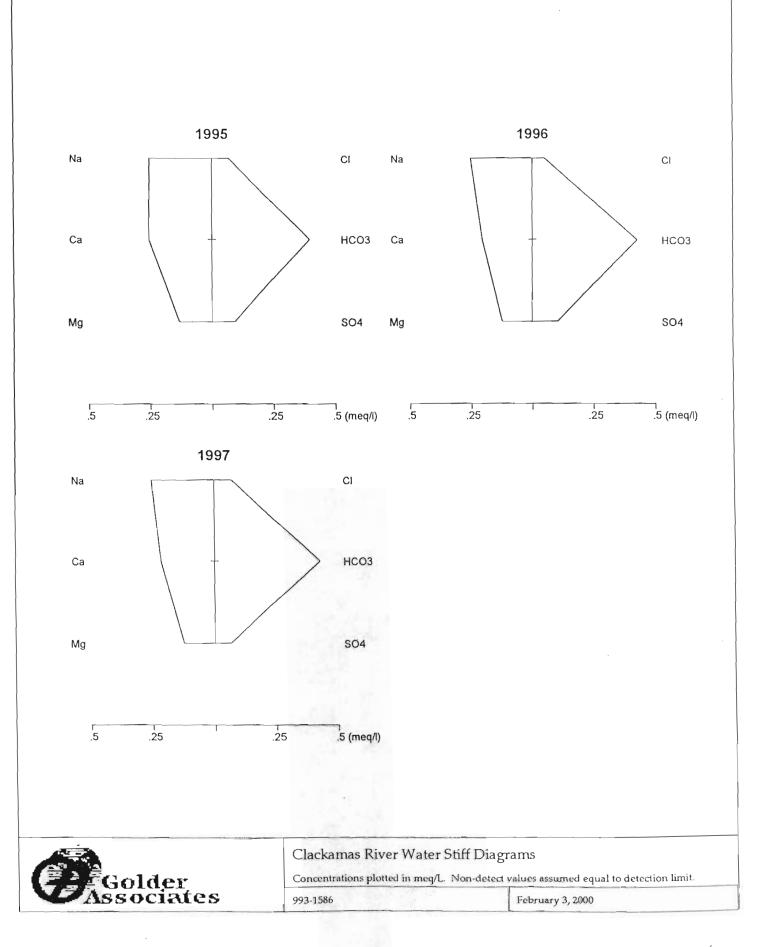
Lindsay, W.L., 1979. Chemical Equilibria in Soils. Wiley-Interscience, New York, NY.

Nordstrom, D.K., 1982. Aqueous Pyrite Oxidation and the Consequent Formation of Secondary Iron Minerals. In: Kittrick, J.A. et al. (eds.) Acid Sulfate Weathering: Proceedings of a Symposium. Soil Science Society of America Press, Madison, WI.

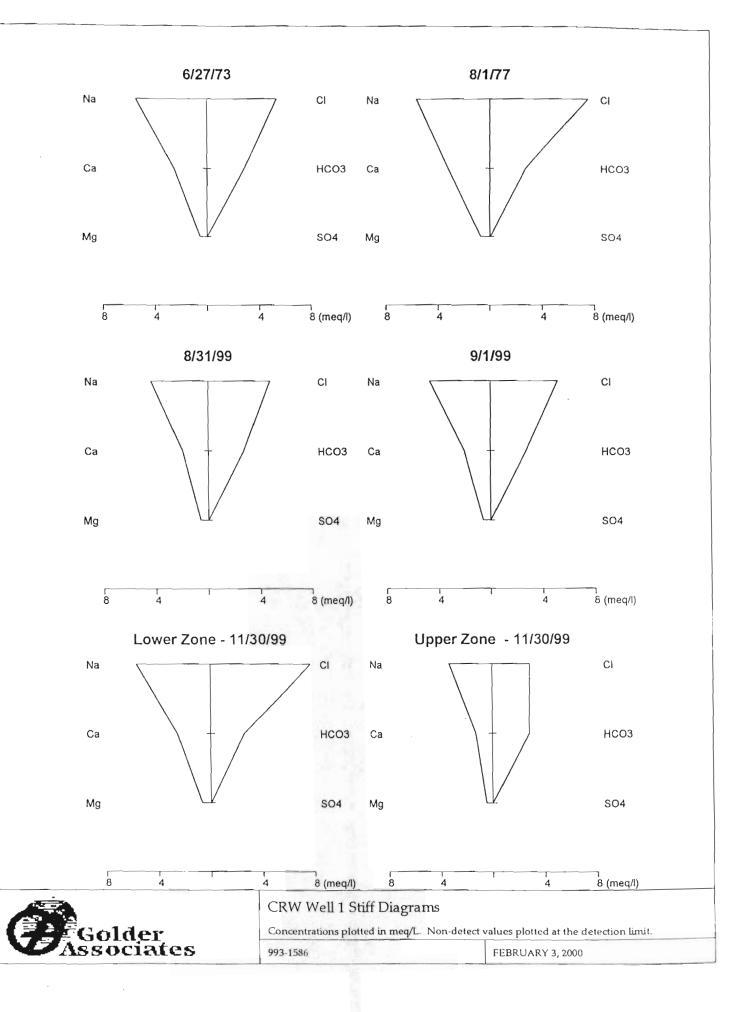
Parkhurst, D.L., D.C. Thorstenson, and L. N. Plummer, 1990. PHREEQC - A Computer Program for Geochemical Calculations. U.S. Geological Survey Water-Resources Investigations Report 80-96. Washington, DC.

Stumm, W. and J.J. Morgan, 1981. Aquatic Chemistry - An Introduction Emphasizing Chemical Equilibria in Natural Waters. Wiley-Interscience, New York, NY.





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