



ROBINSON  
NOBLE

CITY OF PORT ORCHARD  
WELL 11  
CONSTRUCTION AND TESTING REPORT

MARCH 2011

by

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DOUGLAS C. DOW

CITY OF PORT ORCHARD  
WELL 11  
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CITY OF PORT ORCHARD  
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## **Introduction**

The City of Port Orchard (City) contracted Robinson Noble, Inc. to provide hydrogeologic services for the construction and testing of Well 11 located on the McCormick Woods well field property at 5171 St. Andrews Drive, as shown on Figure 1, within the NE4, NW4 of Section 9, Township 23 N, Range 1E in Kitsap County, Washington. This new production well was constructed under water right permit G1-26454 written by the Washington State Department of Ecology (Ecology). Ecology granted the City a permit for 750 gallons per minute (gpm) from Well 11 for municipal supply contingent upon the City's completion of an Ecology approved mitigation plan for area streams.

The Kitsap County Health District (Health) conducted a well site evaluation and approved the location for Well 11. A copy of the site approval letter is included in the Appendix. The site meets the requirements under WAC 246-290-135, Source Protection.

## **Drilling**

Charon Drilling, Inc. (Contractor) of Graham, Washington mobilized its Speedstar Model 72 cable-tool drilling rig and equipment to the site on September 9, 2009. Drilling of Well 11 started with a 24-inch temporary hole drilled to a depth of 20 feet below ground surface (bgs). Twenty-inch casing was installed in the open hole and drilling continued to a depth of 355 feet which was reached on December 7, 2009. The casing size was reduced to 16-inch, and it was advanced to a depth of 597 feet bgs by February 17, 2010. The casing size was reduced again, this time to 12-inch, and it was advanced to 776 feet by May 24. "Quik Grout" bentonite seals (22 sacks each) were placed at the depth of the 16- and 12-inch casing reductions.

A suitable aquifer was not found at the depth of the McCormick Well 4B aquifer, which is screened between 467 and 641 feet in Well 4B located about 4,000 feet south of Well 11. Only 41 feet of gray silty sand that, in our opinion, would not support the withdrawal of 750 gpm was observed between 498 and 539 feet. Consequently, we recommended that an exploratory hole be drilled using fluid-rotary methods to a depth of about 1,000 feet to prove the existence of a deeper aquifer at this location. The City Council approved the change, and Charon Drilling subcontracted Nicholson Drilling, Inc. of Port Orchard to do the work.

Nicholson Drilling mobilized their fluid-rotary drilling equipment to the site during June and started drilling a 6-inch exploratory hole on June 30 to extend the depth of the well to 1,080 feet bgs. Drilling encountered potentially suitable aquifer materials of sand and some layers of gravel and sand between 797 and 950 feet bgs. Robinson Noble hydrogeologists geophysically logged the open 6-inch borehole on July 7. The geophysical log is shown on Figure 2. The geophysical logs indicated the zone appeared to be permeable and water bearing. Based on this information, we designed a completion and well screen assembly that required a 12-inch hole be drilled to a depth of 980 feet.

Nicholson’s crew starting drilling 12-inch open hole on August 31 and finished on September 7. Following drilling, the 8-inch well screen assembly was lowered through the upper casings and open borehole on 6-inch welded steel casing. It was placed at the bottom of the 12-inch borehole on September 14. Our design called for placement of about 200 fifty-pound sacks of Colorado Silica 8 x 12 sand pack around the well screen assembly. Due to the amount of time spent installing the pack sand, Nicholson had problems installing the correct volume of sand. We believe the open annulus around the screen either collapsed or the sand pack bridged after 112 sacks of the estimated 200 sacks of sand needed were placed.

The rotary rig was demobilized by the end of September and the cable-tool rig returned on October 15 to finish installation of the sand pack and complete well development and testing.

## Construction and Development

The well construction meets Ecology’s requirements detailed in Chapter 173-160 WAC, Minimum Standards for Construction and Maintenance of Water Wells. A detailed geologic log for Well 11 is shown on Figure 2 along with the well completion details. A copy of the Water Well Report form for Well 11 is included in the Appendix.

During drilling of Well 11, representative samples of aquifer material were collected approximately every ten feet and at formation changes. Grain-size analyses were completed by Robinson Noble for samples collected from the 498 through 539 foot interval. However, these were not used for the final completion design and, therefore, are not included with this report. Samples collected from the completion zone were not specifically analyzed because fluid-rotary drilled samples are not suitable for detailed sieve analysis. Based on experience completing other wells in this and other similar aquifers, the completion design should provide an efficient, sand-free well. The well is completed with 8-inch pipe-size, Type 304 stainless-steel well screen and mild steel blank pipe. Screen assembly details are listed in Table 1.

**Table 1. Well 11 Screen Assembly Details**

Item	Top (feet BGS)	Bottom (feet BGS)	Comments
Riser 8-inch	713	763	8-inch coupling (right-hand thread)
0.040-slot screen	763	768	Relief screen
Riser 8-inch	768	813	
0.040-slot screen	813	953	
Tailpipe 8-inch	953	963	Plate bottom

Notes: All screens are 8-inch inside diameter.  
 All screens are Type 304 stainless steel, v-wire construction and extra heavy strength.  
 All measurements are referenced to ground surface at the time of well construction.

Initial development was accomplished with the rotary equipment by pumping out the drilling mud from the bottom of the well screen while the sand pack was being placed. Bentonite clay is the primary component of drilling mud. Then the submersible pump used to remove the drilling mud was raised to the top of the well screen at 710 feet and then up to 300 feet to remove most of the bentonite-laden water. The annulus and well screen were then dosed with Baroid’s Aqua Clear PHD (Phosphate Free Dispersant) to reduce the surface tension of the clay particles and allow easier removal during development. Additional development was accomplished with a surge tool operated by the cable-tool rig. Charon used the cable-tool surge to develop in the native sand formation and settle the sand pack until a total of 265 sacks of sand were placed. Surge development was continued until formation sand ceased to enter the well screen and

the pack sand stopped dropping in the annulus. Well screen development was considered complete on December 20 and the well was made ready for testing.

## Testing

Water levels were measured manually at selected intervals in Well 11 during step-rate and constant-rate testing. The manual water level data are included in the Appendix and are shown graphically on Figures 3 and 4. We also employed an electronic data logger, but it failed to collect water level data, so no electronic data are available.

The Contractor installed a line-shaft turbine pump capable of rates up to 1,000 gpm. Pumping rates were measured with a 6-inch orifice plate in an 8-inch tube. The water was discharged into the storm drainage system that discharges into North Lake on the McCormick Woods Golf Course. The pump and two one-inch sounding tubes were set at a depth of about 400 feet bgs. A step-rate test was started on December 22, but had to be shut down after two hours because water was flowing onto a neighboring property. A second, two-hour step-rate test was conducted on December 29 to determine development completion and the pumping rate for the 24-hour, constant-rate test. The well was pumped at rates up to 979 gpm as shown on Figure 3 and listed in Table 2.

The well's specific capacity (gpm pumped divided by the drawdown in feet) declined with increases in pumping rate, as shown in Table 2. Based on the step-test results, a 1,000-gpm rate was selected for the 24-hour test. The 24-hour test was started on January 3 and ended on January 4 after 21.5 hours of testing due to a pump malfunction. Test results are shown on Table 2 and Figures 3 and 4. Test data are included in the Appendix.

**Table 2. Well 11 Pumping Test Results**

Date	Discharge Rate (gpm)	Elapsed Time (hrs)	Drawdown (feet)	Specific Capacity (gpm/ft)
12/22	495	1.00	38.23	12.9
	735	1.00	65.77	11.1
12/29	776	0.50	64.52	12.0
	979	1.50	97.67	10.0
1/3/11	1,000	21.50	133.17	7.5

During the constant-rate test, Well 11 produced 1,000 gpm for 21.5 hours with a drawdown of 133 feet from a static water level of 219.33 feet below the measuring point. The resulting specific capacity was 7.5 gpm/ft. The pump motor failed at the 21.5-hour mark, and the operator was unable to collect sufficient recovery water level data due to a malfunctioning sounder. Therefore, because our electronic data logger also failed to collect data, we have little recovery data.

The few points of manual recovery data that we do have are shown on Figures 3 and 5. The water level did not return to the pre-test static level within the first 24 hours of recovery.

## Transmissivity

Aquifer transmissivity (T) is a measure of the amount of water that can be transmitted horizontally by the full saturated thickness of the aquifer under a hydraulic gradient of one. The T was calculated using the Jacob/Theis, modified, non-equilibrium formula from the pumping rate and the slope of the drawdown graph (Figure 4). Analysis of the test data yielded a T value of 11,000 gallons per day per foot (gpd/ft) for the Well 11 aquifer near the well. Approximately 300

minutes into the test, the slope of the drawdown plot shown on Figure 4 increased. This reflects less permeable conditions in the aquifer or a thinning of the aquifer at distance from the well. The slope of the drawdown plot was stable through the rest of the test. This slope indicates the “average” transmissivity in the aquifer area influenced by the test is approximately 6,600 gpd/ft. While it is not possible to truly calculate a transmissivity from the three observed recovery water levels, the slope made by these points suggests a value in between (9,900 gpd/ft) the near-well and regional values calculated from the drawdown data.

## Hydrogeology

The City’s Well 11 is located on upland south of Sinclair Inlet and west of the City as shown in Figure 1. The geology and hydrogeology of the Port Orchard area has been shaped and re-shaped by several glaciations that ended about 15,000 years ago. During each glacial period, a 3,000- to 5,000-foot thick glacier advanced southward out of Canada; rivers emanating from its face carried and deposited sediments that are identified by geologists as advance deposits. The glacier’s weight reshaped the landscape as it continued south and deposited a compact mixture of unsorted silt, sand, gravel, cobbles and boulders in a tight matrix known as glacial till (also informally known as hardpan) on top of the advance deposits. As the glacier retreated, the rivers reshaped the landscape again and left recessional deposits of sand and gravel on top of the glacial till. Between each of the several glaciations that shaped the geology of the Puget Sound region were interglacial periods of several thousand years, such as we are currently experiencing, where the climate warmed and flora and fauna developed. Normal erosion caused by wind and rain have further reshaped the topography into what we see today.

The City’s wells are located south of Sinclair Inlet and east of Gorst. Water Supply Bulletin No. 18 (WSB-18), *Water Resources and Geology of the Kitsap Peninsula and Certain Adjacent Islands* (1965), show several streams, including Annapolis, Blackjack, and Anderson Creeks, that derive base flow from springs emanating from a shallow aquifer that discharges to several drainages between 200 and 300 feet elevation at the north and west sides of the southern upland. McCormick Wells 1, 2, and 3 are completed in this aquifer.

In the Port Orchard area, an average annual 50 inches (varies by location) of precipitation (WSB 18, 1946 through 1960 average) falls on the southern upland. Most of the upland is thought to have a moderate infiltration potential because of its cap of glacial till. However, its large area and lack of well integrated surface drainage provides a large quantity of recharge to the Shallow Aquifer and subsequently to deeper aquifers. According to WSB 18, about 16 inches is lost through evapotranspiration. The balance of 34 inches provides recharge to shallow aquifers and runoff and base flow to streams. A much smaller portion, probably less than 10 inches, infiltrates through confining layers to the deeper aquifer systems. The deeper aquifers are recharged beneath the upland by diffuse percolation through the intervening aquitards and more localized percolation through windows in the aquitards.

The southern upland is characterized by gently rolling hills at elevations between 300 and 450 feet and is relatively sparsely populated. Consequently, groundwater data are lacking beyond major roads and few data concern the deeper aquifers. Only a few wells penetrate below the Shallow Aquifer. The geologic logs and cross sections generally show irregularly shaped, coarse-grained sedimentary units surrounded by finer-grained units. These units are either discontinuous (and terminate against finer grained units) or rapidly change thickness in a short distance. These changes indicate they were possibly deposited by streams emanating from ad-

vancing or retreating glaciers. If so, they are possibly long and relatively narrow units extending southwestward into the upland.

The **Shallow Aquifer** is found at elevations above 100 feet and is shown in well logs to be between 50 and 150 feet thick. It appears to consist of sand and gravel-filled valleys connected by sheets of sand and gravel. It is utilized by most domestic wells and production wells for Sunnyslope and McCormick Woods water systems. This is the aquifer that supplies McCormick Woods Wells 1, 2, and 3 and provides base flow to the many small streams running north into Sinclair Inlet and northwest into the Gorst Creek watershed. At Well 11, it was logged between 212 and 267 feet bgs. As required by Ecology's water right permit, the three McCormick Shallow Aquifer wells will be decommissioned after Well 11 is put into service.

**Table 3. Selected Well Data for Port Orchard and Bremerton (Anderson Creek)**

Name	Depth (feet)	Elevations			Production Rate (gpm)	Aquifer & Thickness
		Wellhead (feet)	Static W. L. (feet)	Completion Interval (feet)		
<b>Port Orchard</b>						
Well 11	539	420	240	-78 to -119 *	na	SL (40')
Well 11	950	420	217	-394 to -534	750	DAA (140)
Well 10	1,074	14	48.46	- 855 to -1,055	1300	DAA(200)
Well 9	638	230	107	-245 to -402	500	DAA (157)
Well 7	810	20	50	-759 to -784	700 (flow)	DAA(25)
Well 6	805	40	51.13	- 765	230	DAA
Well 4B	709	420	242	-47 to -221	430	SL(170)
<b>Bremerton</b>						
Well 1R	346	100	42	-78 to -241	900	SL(163)
Well 6R	645	96	45	-494 to -549	1400	DAA(55)

\* Observed water-bearing zone, well not completed in this zone.

SL- Sea Level Aquifer

DAA - Deep artesian aquifer

The **Sea Level Aquifer** is found between about 50 to 250 feet below sea level. Layers of gray clay and gray silt separate the Shallow Aquifer from the Sea Level Aquifer. Gray sand is logged at the depth of the Sea Level Aquifer in Well 10. However, it was silty, tight, and did not show any indication of water production capability. At Well 11, the Sea Level Aquifer is found between 78 and 119 feet below sea level and consists of tight, gray silty sand with wood chips.

The **Deep Artesian Aquifer System** (DAA) appears to have several layers in the Port Orchard area as shown by the completion elevations of wells listed in Table 3. Well 9 appears to be in an upper layer of the DAA system with a completion elevation between 245 and 402 feet below sea level. The DAA at Well 11 is below a lower confining unit of gray silt and clay that is 258 feet thick from 119 to 377 feet below sea level. The Well 11 aquifer is found between 797 and 956 feet bgs. The deep aquifer system extends to greater depths as evidenced by the completion elevations of Wells 7 and 10 in Table 3. There are production wells completed at the elevation of Well 10 owned by Westsound Utilities. There is also a 2,000-foot deep well located at the U.S. Navy's Bremerton shipyard on the north side of Sinclair Inlet suggesting the Deep Aquifer does exist under Sinclair Inlet to the north.

Both the SL and DAA exhibit confined aquifer characteristics and are impacted by barometric pressure changes. However, only the DAA is influenced by tide.

## **Water Quality**

The City collected water quality samples for laboratory analysis as required for a new ground-water source. Samples were taken to Twiss Analytical Laboratories, Inc. for inorganic, volatile organic, synthetic organic, bacteriological, and radionuclide analysis. Water quality results are included in the Appendix.

### **Inorganic Test Results**

The water from Well 11 is of excellent quality. Inorganic test results show water of low hardness with all measured parameters to be below Health's maximum contaminant levels (MCL) required for safe drinking water. The water is sand free, has a temperature of 48 degrees Fahrenheit, and a noticeable hydrogen sulfide odor.

### **Volatile Organic Test Results**

Analysis performed by Twiss Analytical Laboratories, Inc. shows all measured parameters to be below the detection level for each compound tested.

### **Synthetic Organic Test Results**

Analysis performed by Twiss Analytical Laboratories, Inc. shows all measured parameters to be below the detection level for each compound tested.

### **Bacteriological Test Results**

Bacteriological analysis results are satisfactory.

### **Radionuclide Test Results**

The radionuclide analysis results show gross alpha and radium 228 are below the MCL.

## **Wellhead Protection Area Preliminary Delineation**

The Department of Health requires a preliminary delineation of the Wellhead Protection Area (WHPA) for all new groundwater sources. In this report, we will provide preliminary capture zone delineations for Well 11. Pertinent information detailing the new source (Well 11) is contained in the completed "Ground Water Contamination Susceptibility Assessment Survey Form" (Version 2.3) in the Appendix.

A WHPA is defined as the surface and subsurface area surrounding a well supplying public water through which potential contaminants are likely to pass and eventually reach the well. This area is known as the well's capture zone. Data are usually insufficient to completely and accurately define the exact size and shape of the capture zone. For this reason, a series of approximation methods are used to delineate a WHPA. These methods, in order of increasing complexity, are:

- Calculated Fixed Radius
- Analytical Models
- Hydrogeologic Mapping
- Numerical Flow/Transport Models

Sufficient hydrogeologic data are available from Well 11 to allow use of an analytical model developed by the US Environmental Protection Agency (EPA). EPA WHPA (Code 2.3) model



GPTRAC (general particle tracking) is used for the delineation illustrated in Figure 6. A numerical groundwater model was generated for this area by Robinson Noble in 2003. However, that model could not be used because its bottom model layer is above the depth of Well 11. GPTRAC is capable of delineating time-related capture zones for a system of pumping and injection wells and accounts for the effects of well interference, stream or barrier aquifer boundaries, and aquifer recharge.

The GPTRAC analytical model was calculated for Well 11 using the production and hydraulic data listed in Table 4. Where a range of values exist for a particular parameter, the reasonable, conservative value was selected. Conservative values are those that result in the largest WHPA. Aquifer thickness and transmissivity are from well logs and test results.

**Table 4. Model Parameters Input into EPA GPTRAC Model**

<b>Model Parameter</b>	<b>Well 11</b>
Aquifer Thickness (ft)	160
Estimated Porosity (%)	20
Transmissivity, ft <sup>2</sup> /day (gpd/ft)	882 (6,600)
Hydraulic Gradient (ft/ft)	0.016
Ambient Upgradient Direction (degrees clockwise from east)	90
Aquifer Type	Confined
Average Daily Discharge, ft <sup>3</sup> /d (gpm)	82,588 (429)
Casing Diameter (ft)	1

Although Well 11 is designed to produce 750 gpm, the model requires a constant pumping rate for the duration of the 6-month and 1-, 5-, and 10-year intervals on which the capture zones are based. The constant rate used for the model was determined by calculating the constant pumping rate required to produce Well 11's annual water right quantity (Qa) of 692 afy. That constant rate is 429 gpm, or 82,588 cubic feet of water per day.

As shown on Figure 6, the capture zone for the 6-month time of travel extends up gradient to the south about 500 feet. The 10-year time of travel capture zone extends up gradient over 3,000 feet from the wellhead. The maximum width of the 10-year capture zone is about 3,000 feet.

The area around the wellhead is mostly single-family residences, all of which are using the City's sewer system. The confining layers existing between the deep aquifer and ground surface make it highly unlikely that surface contamination will reach the aquifer.

## Findings

Drilling of Well 11 identified a gray, coarse sand and gravel aquifer between 797 and 956 feet bgs. The well is completed with 140 feet of stainless-steel well screen placed between 813 and 953 feet bgs in the most productive part of the deep aquifer at this location. The static water level elevation is about 217 feet. Ground surface elevation is about 420 feet. The confined aquifer responds to barometric and possibly tidal change in Sinclair Inlet, although because of the loss of electronic-data-logger water levels, possible tidal impacts could not be determined. Withdrawal of 750 gpm from Well 11 will not have any direct impact to surface water. Well 11 taps the same body of public groundwater as City Wells 6, 7, 9, and 10.

Well 11 was tested at a pumping rate of 1,000 gpm for 21.5 hours, resulting in 133 feet of drawdown and a specific capacity of 7.5 gpm/ft of drawdown. Aquifer transmissivity, calculated

from the pumping rate and change in slope of the drawdown and recovery curves from the 24-hour test, range from 6,600 to 11,000 gpd/ft of aquifer width.

Water quality is very good, and all parameters tested meet drinking water standards. The water is sand free, has a noticeable hydrogen sulfide odor, and a temperature of 48 degrees Fahrenheit. Use of Well 11 will not cause saltwater intrusion.

Well 11 is capable of pumping the 750 gpm that the City is allowed to produce under its water right permit.

## **Recommendations**

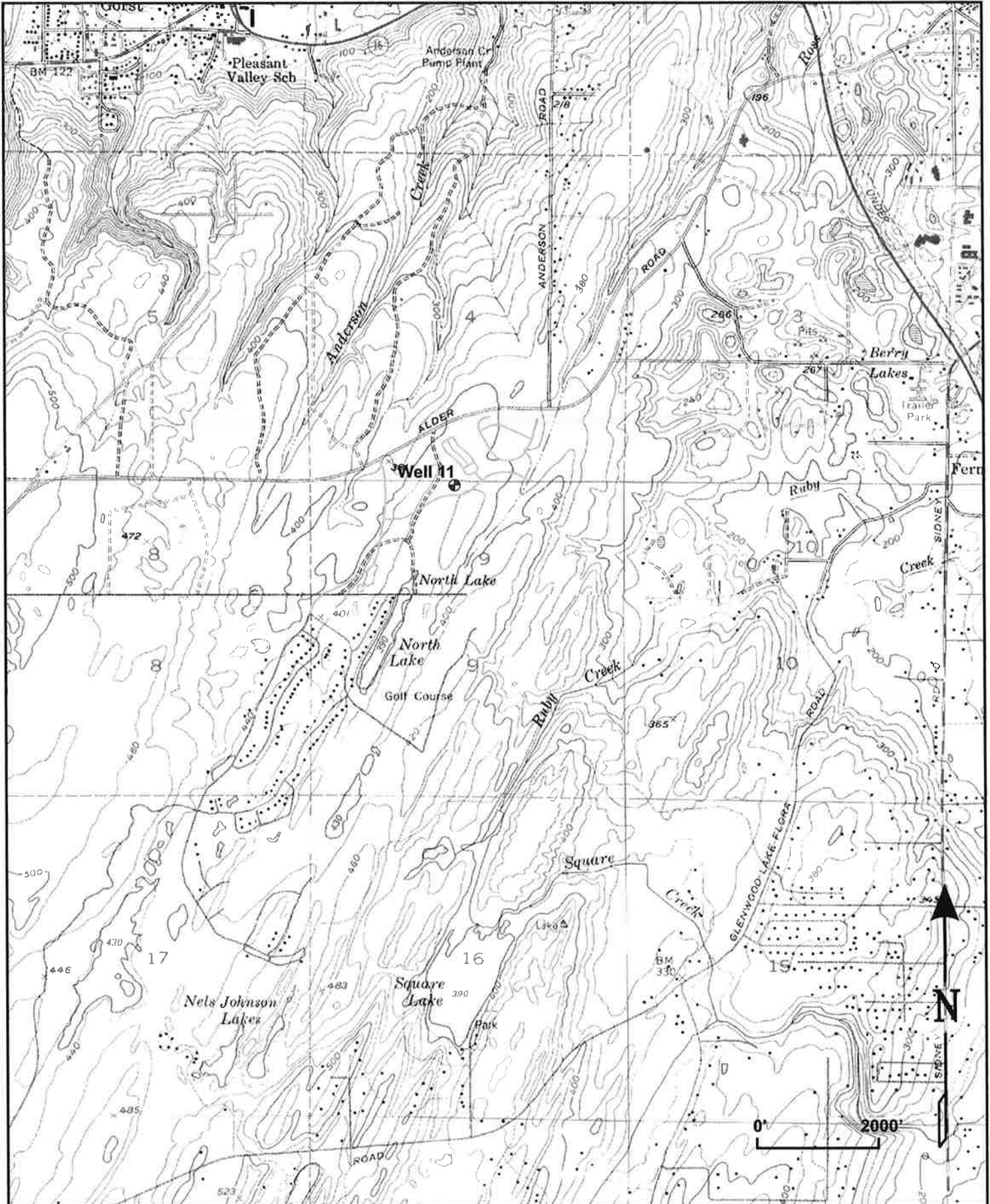
Robinson Noble recommends a pumping rate of 750 gpm for Well 11. We estimate the pumping water level will be about 310 feet after one day and 325 feet after one week of continuous pumping. The pump should be set at a depth of about 420 feet below ground surface. Two one-inch water level sounding tubes should be installed with the pump. The water should be discharged directly into the top of one of the existing water storage tanks in a manner that allows the hydrogen sulfide gas to come out of solution and disperse into the atmosphere. This will greatly reduce the chlorine demand needed to distribute the water to customers.

Based on the drawdown curve and the hydrogeologic setting, this well may experience additional drawdown under stress that is not evident from the well test. Because of this uncertainty, we recommend that static and pumping water levels be measured weekly in Well 11 and recorded along with total production and instantaneous discharge rate. If possible, equip Well 11 with a data logger and transducer to record water-level changes and install a low water cut-off probe as a safety measure until the long-term pumping characteristics of Well 11 are known.

*The statements, conclusions, and recommendations provided in this report are to be exclusively used within the context of this document. They are based upon generally accepted hydrogeologic practices and are the result of analysis by Robinson Noble staff. This report, including any attachments to it, is for the exclusive use of the City of Port Orchard. Unless specifically stated in the document, no warranty, expressed or implied, is made.*

## FIGURES

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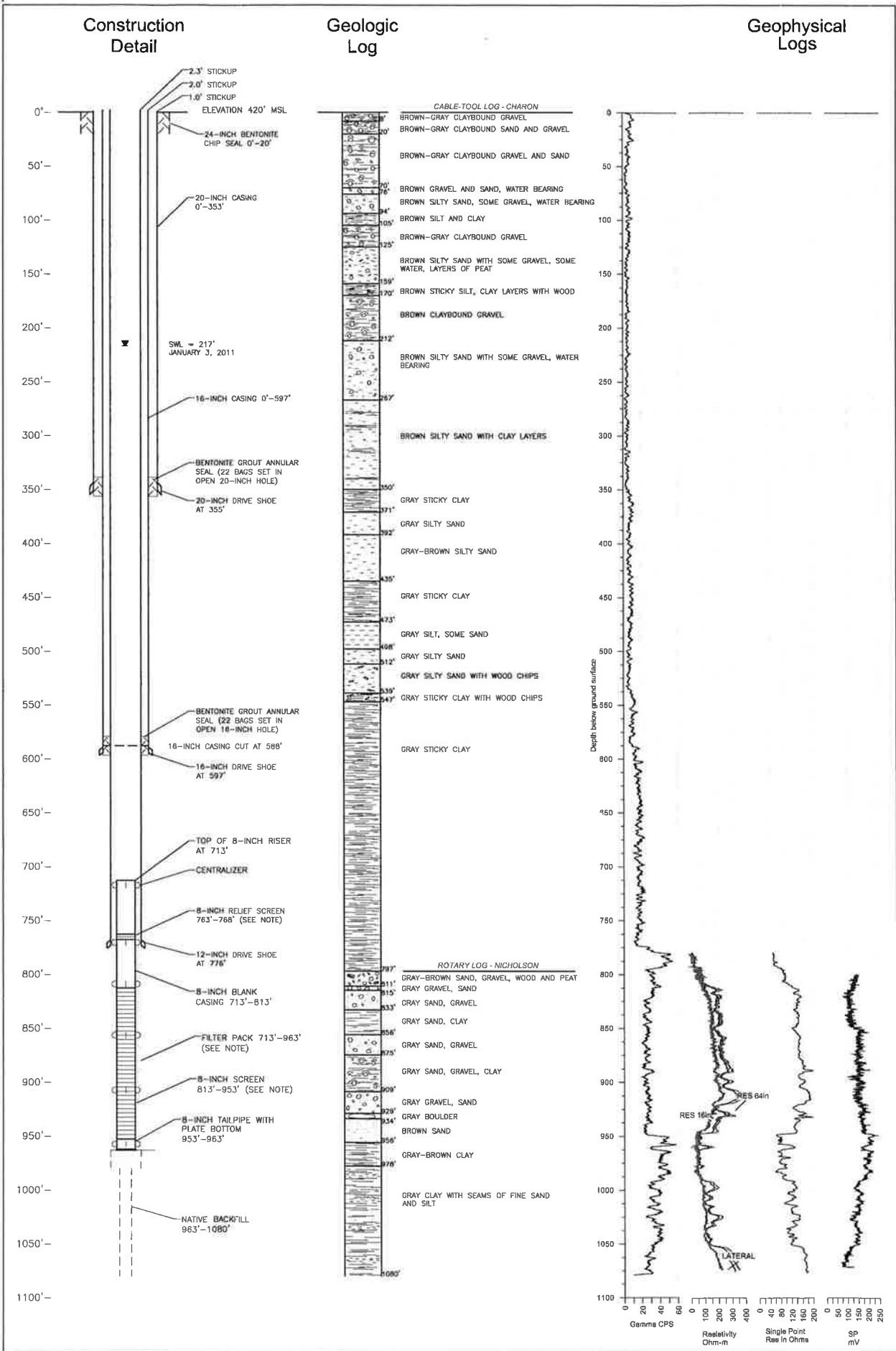
  
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Note: Basemap  
 taken from USGS  
 Burley Quadrangle

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 March 2011  
 1738-007A

Kitsap County  
 T 23 N/R 01 E - 09  
 Scale 1" = 2000'

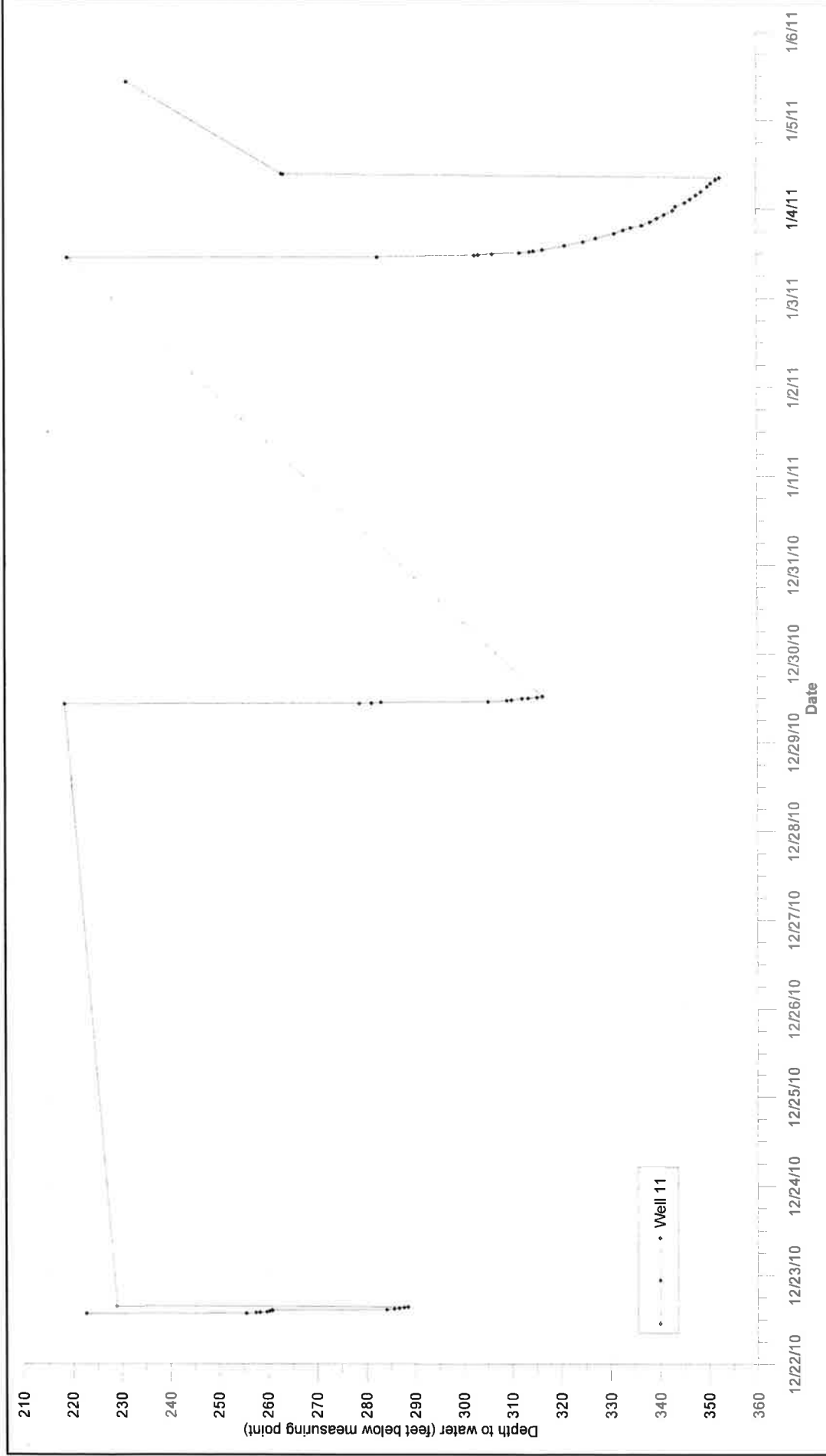
Figure 1  
**Well Location Map**  
 City of Port Orchard: Well 11 Drilling Project



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March 2011  
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Kitsap County

NOTE: Well screens are 8-inch diameter, 40-slot (0.040-inch opening) pipe size stainless steel. Filter pack is 8X12 Colorado Silica Sand product.

Figure 2  
Construction Detail, Geologic and Geophysical Logs for Well 11  
City of Port Orchard: Well 11 Drilling Project

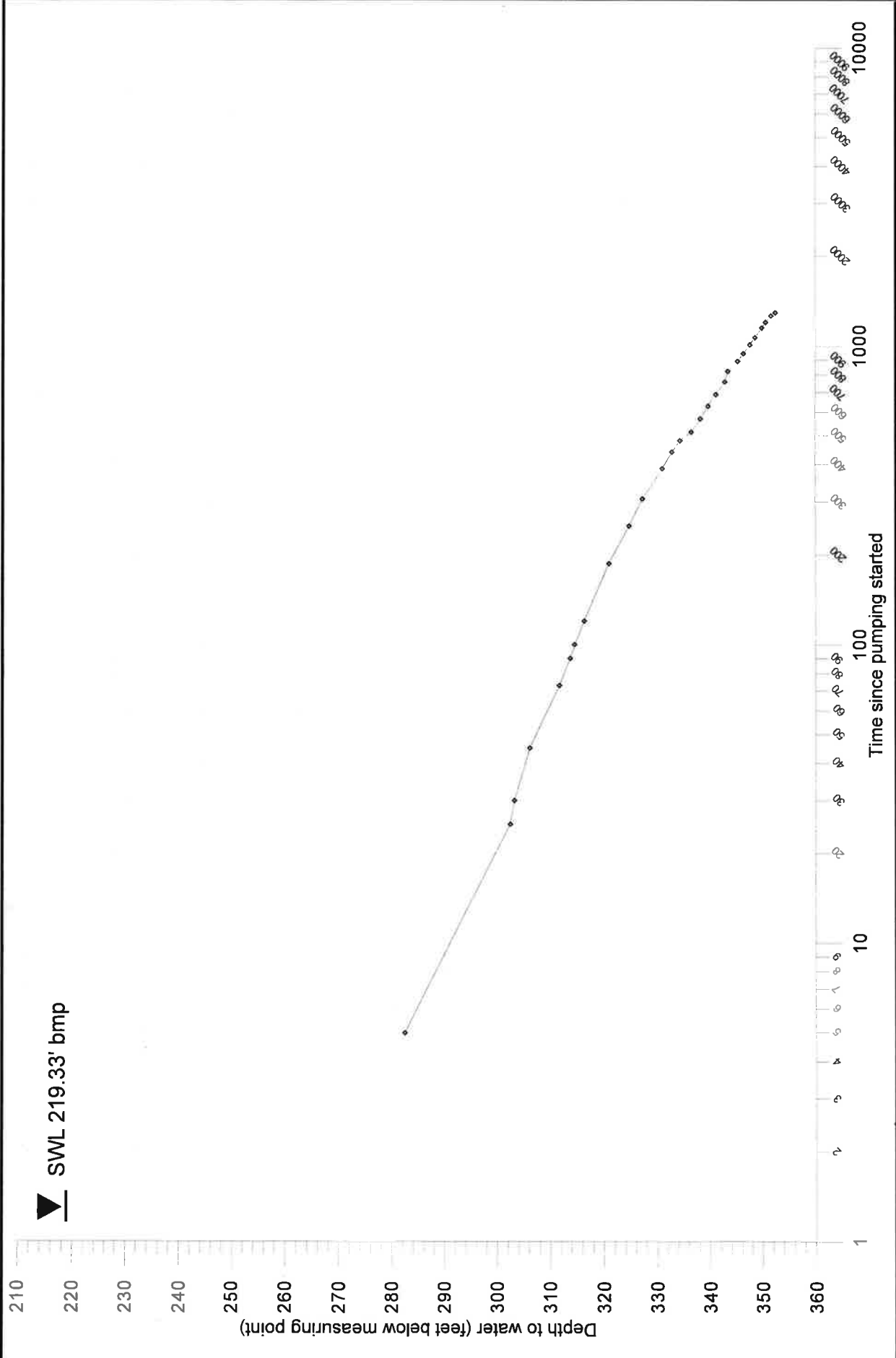


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**Port Orchard Well 11 Hydrograph**

**Figure 3**  
 Well 11 Water Level Hydrograph  
 December 22, 2010 through January 4, 2011  
 City of Port Orchard

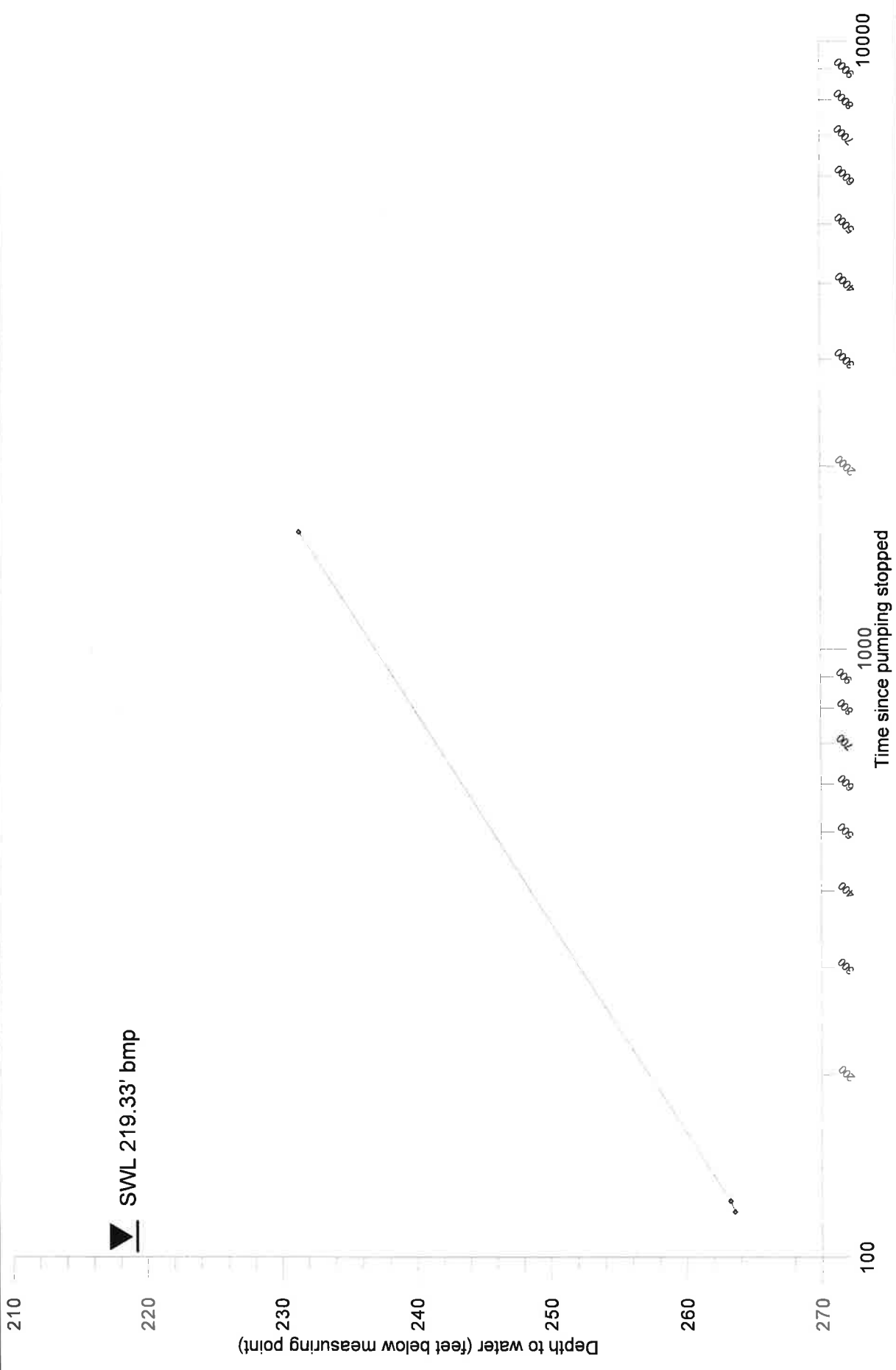


**Figure 4**  
Well 11 Drawdown  
21.5-hour constant-rate test  
City of Port Orchard

Well 11 21.5-hour constant rate test  
1/3/2011 Static water level 219.33' below measuring point  
Average discharge 1,000 gallons per minute (gpm)

Date: Mar. 2011  
Job#: 1738-007A  
PM: DCD





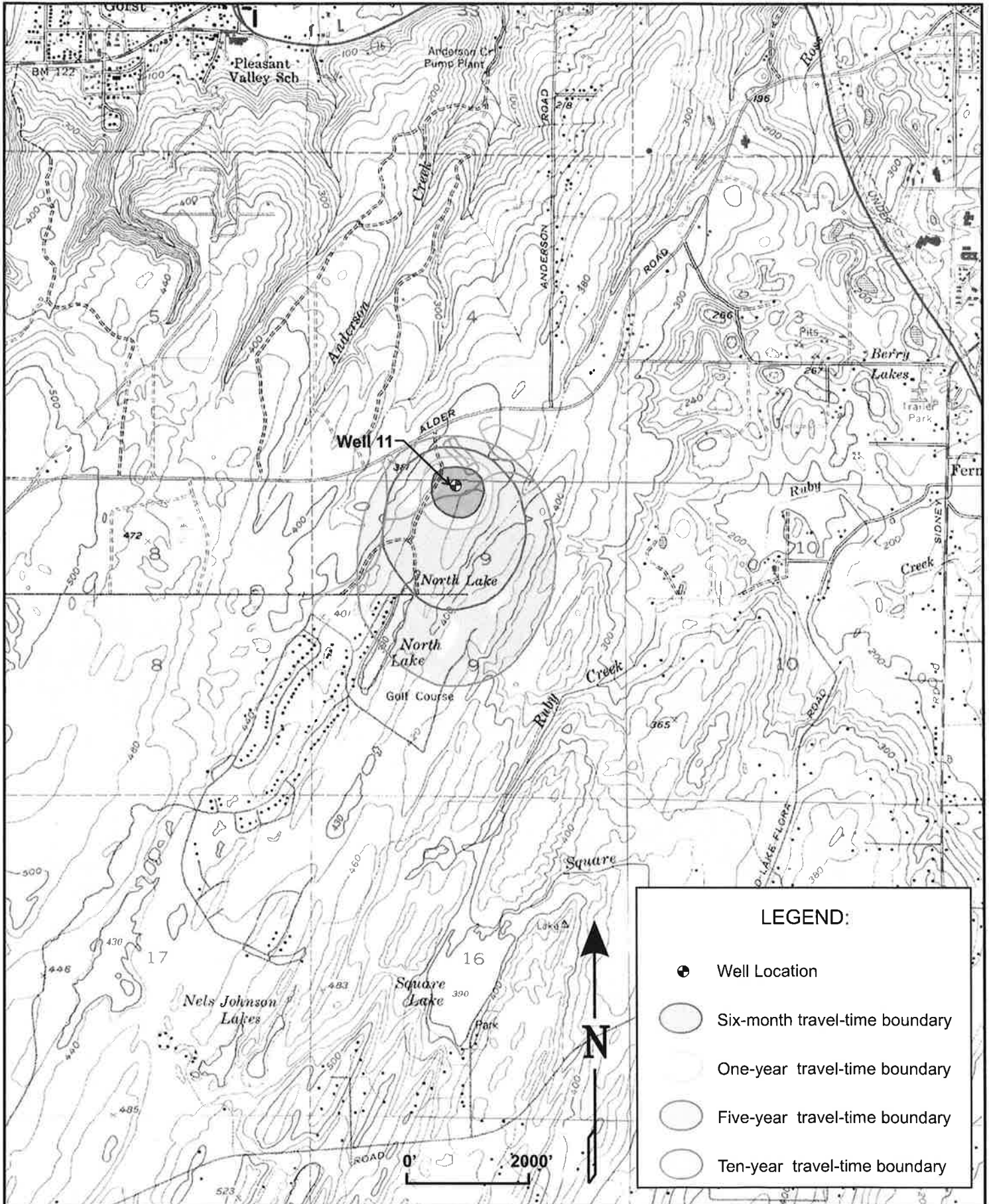
**Figure 5**  
Well 11 Recovery  
21.5-hour constant-rate test  
City of Port Orchard

Well 11 21.5-hour constant rate test  
1/3/2011 Static water level 219.33' below measuring point  
Average discharge 1,000 gallons per minute (gpm)






Date: Mar. 2011  
Job#: 1738-007A  
PM: DCD







**LEGEND:**

-  Well Location
-  Six-month travel-time boundary
-  One-year travel-time boundary
-  Five-year travel-time boundary
-  Ten-year travel-time boundary

## WELL SITE APPROVAL FOR WELL 11

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SCOTT W. LINDQUIST, MD, MPH, DIRECTOR  
345 6<sup>TH</sup> STREET, SUITE 300  
BREMERTON, WA 98337-1866  
(360) 337-5285  
www.kitsapcountyhealth.com

RECEIVED

June 15, 2009

JUN 16 2009

Mark Dorsey, P.E.  
Public Works Direct/City Engineer  
City of Port Orchard  
216 Prospect Street  
Port Orchard, WA 98366

Memo # 403015 CITY OF PORT ORCHARD  
Parcel Location 09230120022003 PUBLIC WORKS

**RE: WELL SITE INSPECTION FOR ADDITIONAL SOURCE, NEW WELL NO. 11,  
MCCORMICK WOODS WELL FIELD, FOR THE CITY OF PORT ORCHARD WATER  
SYSTEM, ID #68900**

Dear Mr. Dorsey:

The Health District has completed a review of the referenced application. The proposed location, as staked and shown on the site plan is approved. The well may be drilled, provided that all other pre-construction requirements of the Department of Ecology and the Department of Health have been met.

After the well is constructed, source approval and engineering modifications must adhere to the State Department of Health requirements, in accordance with WAC 246-290-130. Please contact Virpi Salo-Zieman, Regional Engineer with the Office of Drinking Water at (360) 236-3037, to complete source approval requirements.

The Washington Department of Ecology, under authority of Chapter 18.104, R.C.W. Water Well Construction Act (1971), has delegated to the Kitsap County Health District "the authority to administer and enforce the well tagging, sealing, and decommissioning portions of the water well construction program." Also, Local Board of Health Ordinance 1999-6, Rules and Regulations for Private and Public Water Supplies, requires that all water wells be properly sited and permitted prior to construction. A KCHD inspector will be on site during certain parts of the well drilling process. Site visits may occur during and/or after well construction. Do not start construction of any well or decommission any well without contacting the Health District. Start of any private or public water-well construction, inspection of well sealing activities, and any well decommissioning requires at least 24-hour prior notice to the Health District. Please call the Health District at (360) 337-5235 if you have any questions.

This site approval is valid for a period of two years from the date of this letter, unless an extension is requested in writing. Extensions may be granted on a year-to-year basis for up to a period of two years, at which time a new inspection must be made. Extensions are subject to review by this office and must conform to regulation changes.

If you have any questions, please call me at (360) 337-5220.

Sincerely,

A handwritten signature in black ink, appearing to read 'Melina Knoop', is written over a horizontal line.

Melina Knoop  
Environmental Health Specialist  
Drinking Water Program

cc: Virpi Salo-Zieman, ODW

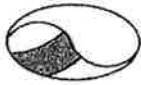
# WATER WELL REPORT FORM

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## WATER LEVEL DATA

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**Robinson & Noble, Inc.**  
 3011 South Huson Street, Suite A  
 Tacoma, WA 98409  
 253-475-7711

**PUMPING TEST DATA**  
*Step Test*

Page: 1 of 1  
 Date: 12-22-10

Project: City of Port Orchard Project Number: 1738-007A  
 Well: 11 Weather Conditions:  
 Static Water Level: 222.63 Measured By: D.C. Dow  
 Stick Up: 2.3' Contractor: Charon Drilling Inc.  
 Reference Point: Top 12-INCH Pump Type: L.S.T.  
 Measurement Device: Elec. Tape Flow Meas. Method: 6x8 Orifice

Time	Elapsed Time	Depth to Water	Drawdown	Flow Meas. Reading	Q (gpm)	Comments
1340	0	222.63	0	0	0	6x8 orifice
	5	255.50			458	8" Very Turbid
	10	257.46			"	H <sub>2</sub> S odor
1400	20	258.27			495	9.5
	30	259.69			"	shots of water
	40	260.24			"	Turbid water
	50	260.80			"	
1440	60	260.86			"	Clearing
1445	65	284.02			744	22 Turbid
1500	80	285.60			735	21.5 Clearing
	90	286.58			"	
	100	287.64			"	
1530	110	288.40			"	Early shutdown
	<i>Recovery</i>					water flowing
1547	12	229.0±	<i>Seawater Problem</i>			on Neighbors property







**Robinson & Noble, Inc.**  
 3011 South Huson Street, Suite A  
 Tacoma, WA 98409  
 253-475-7711

**PUMPING TEST DATA**  
*Step Test*

Page: 1 of 1  
 Date: 12-29-10

Project: City of Port Orchard  
 Well: 11  
 Static Water Level: 218.58  
 Stick Up: 2.8'  
 Reference Point: Top 12" + .5'  
 Measurement Device: \_\_\_\_\_

Project Number: \_\_\_\_\_  
 Weather Conditions: \_\_\_\_\_  
 Measured By: \_\_\_\_\_  
 Contractor: \_\_\_\_\_  
 Pump Type: \_\_\_\_\_  
 Flow Meas. Method: \_\_\_\_\_

Time	Elapsed Time	Depth to Water	Drawdown	Flow Meas. Reading	Q (GPM)	Comments
1025	0	218.67				6x8 orifice
	5	278.76			776	24" Turbid
	10	281.20			798	25.5" H <sub>2</sub> O
	23	283.10			776	24
1050	25	-				Increase Q
	31	305.20			990	41" Turbid
1110	45				979	39.5
	52	309.07				clearing
	60	309.98			967	39
1135	70	BACKWASH	2x			
1140	75	-			979	40
	83	312.14			"	clearing
1155	90	313.37			"	
1210	105	315.20			"	
1225	120	316.25			"	Almost clear
		Shut off Pump				
		Severely Malfunction - No Recovery				



**Robinson & Noble, Inc.**  
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 Tacoma, WA 98409  
 253-475-7711

**PUMPING TEST DATA**

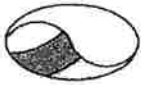
*24-hour*

Page: 1 of 2  
 Date: 1-30-11

Project: City of Port Orchard  
 Well: 11  
 Static Water Level: 219.33  
 Stick Up: 2.8'  
 Reference Point: Top 12" + .5'  
 Measurement Device: \_\_\_\_\_

Project Number: \_\_\_\_\_  
 Weather Conditions: \_\_\_\_\_  
 Measured By: \_\_\_\_\_  
 Contractor: \_\_\_\_\_  
 Pump Type: \_\_\_\_\_  
 Flow Meas. Method: \_\_\_\_\_

Time	Elapsed Time	Depth to Water	Drawdown	Flow Meas. Reading	Q (gpm)	Comments
1100	0	219.33			0	6x8 Orifice
	5	282.50			776	24" Green Water
	15					Sounding wrong
	25	302.5 ±				read correctly
1130	30	303.3 ±			967	39
	45	306.15			949	325
1213	73	311.76			979	40
1230	90	313.80				Satral Probe
	100	314.60			967	35
1300	120	316.40			"	
1407	187	321.00			"	
1510	250	324.77			"	
1608	308	327.30			1000	42
1727	387	331.04			"	Increase Q
1820	440	332.88				
1900	480	334.40				
1936	516	336.60				
2032	572	338.30				
2130	630	339.70				
2230	690	341.20				



**Robinson & Noble, Inc.**  
 3011 South Huson Street, Suite A  
 Tacoma, WA 98409  
 253-475-7711

**PUMPING TEST DATA**

Page: 2 of 2  
 Date: 1-3 to 4-11

Project: Port Orchard Project Number: \_\_\_\_\_  
 Well: 11 Weather Conditions: \_\_\_\_\_  
 Static Water Level: \_\_\_\_\_ Measured By: \_\_\_\_\_  
 Stick Up: \_\_\_\_\_ Contractor: \_\_\_\_\_  
 Reference Point: \_\_\_\_\_ Pump Type: \_\_\_\_\_  
 Measurement Device: \_\_\_\_\_ Flow Meas. Method: \_\_\_\_\_

Time	Elapsed Time	Depth to Water	Drawdown	Flow Meas. Reading	Q (gpm)	Comments	
07340	760	342.90			1000	1/2	
JAN 1	-	-					
0045	825	343.50			1000		
0149	889	345.40					
0244	944	346.50					
0349	1009	347.70					
0446	1066	348.70					
0610	1150	350.00				Clear	
0700	1200	350.70				Water Temp	
0800	1260	351.70				48°F	
0832	1292	352.50	133.17		1000	Q/S = 7.5	
	Pump Motor Failed						@ 21.5 hours
	Sourcerer Malfunction						
0931	119	263.54					
0936	124	263.20					
JAN 5							
1030	1560	231.40					

# WATER QUALITY ANALYSIS

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**TWISS ANALYTICAL LABORATORIES, INC.**

26276 Twelve Trees Lane, Suite C Poulsbo, WA 98370 Telephone (360) 779-5141 FAX (360) 779-5150

**IOC - IOC**

**IOC - IOC by Various EPA Approved Methods**

**Source / Point of Entry - Report of Analysis**

Date Collected:	1/5/2011	Group:	A
System ID No:	40529X	System Name:	McCormick Woods
Lab - Sample #:	01099302	County:	Kitsap
Sample Location:	Well #11	DOH Source No:	
Sample Purpose:	O	Date Received:	1/5/2011
Sample Composition:	S	Date Analyzed:	1/6/2011
Send Report To:	City of Port Orchard 216 Prospect St Port Orchard, WA 98366	Date Reported:	1/21/2011
		Sample Type:	Pre-treatment/Raw
		Collected By:	Alan Rickett
		Phone Number:	360-876-2722
		Bill To:	City of Port Orchard 216 Prospect St Port Orchard, WA 98366

DOH#	Analyte	Results	Units	SRL	Trigger	MCL*	MCL Exceeded	Method (Analyst Init.)
EPA/State Regulated								
4	Arsenic	<(0.003)	mg/L	0.003	0.01	0.01		EPA 200.9 (KW)
5	Barium	<(0.4)	mg/L	0.4	2	2		EPA 200.7 (KW)
6	Cadmium	<(0.002)	mg/L	0.002	0.005	0.005		EPA 200.7 (KW)
7	Chromium	<(0.02)	mg/L	0.02	0.1	0.1		EPA 200.7 (KW)
11	Mercury	<(0.0004)	mg/L	0.0004	0.002	0.002		SM 3112 B (KW)
12	Selenium	<(0.01)	mg/L	0.01	0.05	0.05		EPA 200.9 (KW)
110	Beryllium	<(0.0008)	mg/L	0.0008	0.004	0.004		EPA 200.7 (KW)
111	Nickel	<(0.1)	mg/L	0.1	0.1	0.1		EPA 200.7 (KW)
112	Antimony	<(0.006)	mg/L	0.006	0.006	0.006		EPA 200.9 (KW)
113	Thallium	<(0.002)	mg/L	0.002	0.002	0.002		EPA 200.9 (KW)
116	Cyanide, Total	<(0.1)	mg/L	0.1	0.2	0.2		SM 4500-CN F (JS)
19	Fluoride, F	<(0.5)	mg/L	0.5	2	4		EPA 300.0 (JS)
114	Nitrite-N	<(0.2)	mg/L	0.2	0.5	1		EPA 300.0 (JS)
20	Nitrate-N	<(0.5)	mg/L	2	5	10		EPA 300.0 (JS)
161	Total Nitrate/Nitrite	<(0.5)	mg/L	2	5	10		EPA 300.0 (JS)
8	Iron	0.174	mg/L	0.1	0.3	0.3		EPA 200.7 (KW)
10	Manganese	0.026	mg/L	0.01	0.05	0.05		EPA 200.7 (KW)
13	Silver	<(0.1)	mg/L	0.1	0.1	0.1		EPA 200.7 (KW)
21	Chloride	<(20)	mg/L	20	250	250		EPA 300.0 (JS)
22	Sulfate	<(50)	mg/L	50	250	250		EPA 300.0 (JS)
24	Zinc	<(0.2)	mg/L	0.2	5	5		EPA 200.7 (KW)
14	Sodium	9.41	mg/L	5				EPA 200.7 (KW)
15	Hardness, Total (as CaCO3)	51.0	µg/L as CaCO	10				SM 2340 B (KW)
16	Conductivity	130	µS/cm	70	700	700		SM 2510 B (JS)
17	Turbidity	3.9	NTU	0.1				SM 2130 B (JS)
18	Color	<(15)	PtCo CU	15	15	15		SM 2120 B (JS)
EPA/State Unregulated								
9	Lead	<(0.001)	mg/L	0.001				EPA 200.9 (KW)
23	Copper	<(0.02)	mg/L	0.02				EPA 200.7 (KW)

**TWISS ANALYTICAL LABORATORIES, INC.**

26276 Twelve Trees Lane, Suite C Poulsbo, WA 98370 Telephone (360) 779-5141 FAX (360) 779-5150

**IOC - IOC**

**IOC - IOC by Various EPA Approved Methods**

**Source / Point of Entry - Report of Analysis**

Date Collected:	1/5/2011	Group:	A
System ID No:	40529X	System Name:	McCormick Woods
Lab - Sample #:	01099302	County:	Kitsap
Sample Location:	Well #11	DOH Source No:	
Sample Purpose:	O	Date Received:	1/5/2011
Sample Composition:	S	Date Analyzed:	1/6/2011
Send Report To:	City of Port Orchard 216 Prospect St Port Orchard, WA 98366	Date Reported:	1/21/2011
		Sample Type:	Pre-treatment/Raw
		Collected By:	Alan Rickett
		Phone Number:	360-876-2722
		Bill To:	City of Port Orchard 216 Prospect St Port Orchard, WA 98366

DOH#	Analyte	Results	Units	SRL	Trigger	MCL*	MCL Exceeded	Method (Analyst Init.)
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SRL: (State Reporting Level), indicates the minimum reporting level required by the Washington Department of Health (DOH).  
 Trigger Level: DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.  
 MCL: (Maximum Contaminant Level), If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.  
 NA: (Not Analyzed), in the results column indicates this compound was not included in the current analysis.  
 ND: (Not Detected), in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL  
 < (0.00x): indicates the compound was not detected in the sample at or above the concentration indicated.  
 \* The 0.010 mg/L MCL for Arsenic is for Group A NTNC systems. All other systems should check with their county Health District to determine what level is applicable.

**TWISS ANALYTICAL LABORATORIES, INC.**

26276 Twelve Trees Lane, Suite C Poulsbo, WA 98370 Telephone (360) 779-5141 FAX (360) 779-5150

**VOC - VOC1**  
**VOC - VOC1 by Various EPA Approved Methods**  
**Source / Point of Entry - Report of Analysis**

Date Collected:	1/5/2011	Group:	A
System ID No:	40529X	System Name:	McCormick Woods
Lab - Sample #:	01099401	County:	Kitsap
Sample Location:	Well #11	DOH Source No:	
Sample Purpose:	O	Date Received:	1/5/2011
Sample Composition:	S	Date Analyzed:	1/11/2011
Send Report To:	City of Port Orchard 216 Prospect St Port Orchard, WA 98366	Date Reported:	1/12/2011
		Sample Type:	Pre-treatment/Raw
		Collected By:	Alan Rickett
		Phone Number:	360-876-2722
		Bill To:	City of Port Orchard 216 Prospect St Port Orchard, WA 98366

DOH#	Analyte	Results	Units	SRL	Trigger	MCL*	MCL Exceeded	Method (Analyst Init.)
EPA/State Regulated								
103	1,2-Dibromo-3-Chloropropane	ND	µg/L	0.5	0.5	0.2		EPA 524.2 (TM)
160	Total Xylenes	ND	µg/L	0.5	0.5	10000		EPA 524.2 (TM)
57	T-1,2-Dichloroethene	ND	µg/L	0.5	0.5	100		EPA 524.2 (TM)
60	Cis-1,2-Dichloroethene	ND	µg/L	0.5	0.5	70		EPA 524.2 (TM)
47	1,1,1-Trichloroethane	ND	µg/L	0.5	0.5	200		EPA 524.2 (TM)
48	Carbon Tetrachloride	ND	µg/L	0.5	0.5	5		EPA 524.2 (TM)
49	Benzene	ND	µg/L	0.5	0.5	5		EPA 524.2 (TM)
50	1,2-Dichloroethane	ND	µg/L	0.5	0.5	5		EPA 524.2 (TM)
51	Trichloroethene	ND	µg/L	0.5	0.5	5		EPA 524.2 (TM)
63	1,2-Dichloropropane	ND	µg/L	0.5	0.5	5		EPA 524.2 (TM)
66	Toluene	ND	µg/L	0.5	0.5	1000		EPA 524.2 (TM)
67	1,1,2-Trichloroethane	ND	µg/L	0.5	0.5	5		EPA 524.2 (TM)
68	Tetrachloroethene	ND	µg/L	0.5	0.5	5		EPA 524.2 (TM)
71	Chlorobenzene	ND	µg/L	0.5	0.5	100		EPA 524.2 (TM)
73	Ethyl Benzene	ND	µg/L	0.5	0.5	700		EPA 524.2 (TM)
74	M/P Xylene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
45	Vinyl Chloride	ND	µg/L	0.5	0.5	2		EPA 524.2 (TM)
75	O-Xylene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
76	Styrene	ND	µg/L	0.5	0.5	100		EPA 524.2 (TM)
52	P-Dichlorobenzene	ND	µg/L	0.5	0.5	75		EPA 524.2 (TM)
84	O-Dichlorobenzene	ND	µg/L	0.5	0.5	600		EPA 524.2 (TM)
95	1,2,4-Trichlorobenzene	ND	µg/L	0.5	0.5	70		EPA 524.2 (TM)
46	1,1-Dichloroethylene	ND	µg/L	0.5	0.5	7		EPA 524.2 (TM)
56	Methylene Chloride	ND	µg/L	0.5	0.5	5		EPA 524.2 (TM)

**TWISS ANALYTICAL LABORATORIES, INC.**

26276 Twelve Trees Lane, Suite C Poulsbo, WA 98370 Telephone (360) 779-5141 FAX (360) 779-5150

**VOC - VOC1**  
**VOC - VOC1 by Various EPA Approved Methods**  
**Source / Point of Entry - Report of Analysis**

Date Collected:	1/5/2011	Group:	A
System ID No:	40529X	System Name:	McCormick Woods
Lab - Sample #:	01099401	County:	Kitsap
Sample Location:	Well #11	DOH Source No:	
Sample Purpose:	O	Date Received:	1/5/2011
Sample Composition:	S	Date Analyzed:	1/11/2011
Send Report To:	City of Port Orchard 216 Prospect St Port Orchard, WA 98366	Date Reported:	1/12/2011
		Sample Type:	Pre-treatment/Raw
		Collected By:	Alan Rickett
		Phone Number:	360-876-2722
		Bill To:	City of Port Orchard 216 Prospect St Port Orchard, WA 98366

DOH#	Analyte	Results	Units	SRL	Trigger	MCL*	MCL Exceeded	Method (Analyst Init.)
<b>EPA Unregulated</b>								
58	1,1-Dichloroethane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
59	2,2-Dichloropropane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
86	Bromochloromethane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
62	1,1-Dichloropropene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
104	Dichlorodifluoromethane	ND	µg/L	0.5	0.5	530		EPA 524.2 (TM)
64	Dibromoethane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
65	Cis-1,3-Dichloropropene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
69	Trans-1,3-Dichloropropene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
53	Chloromethane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
70	1,3-Dichloropropane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
72	1,1,1,2-Tetrachloroethane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
87	Isopropylbenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
79	1,2,3-Trichloropropane	ND	µg/L	0.5	0.5	21		EPA 524.2 (TM)
78	Bromobenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
80	1,1,2,2-Tetrachloroethane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
81	O-Chlorotoluene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
88	N-Propylbenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
89	1,3,5-Trimethylbenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
54	Bromomethane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
82	P-Chlorotoluene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
90	Tert-Butylbenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
91	1,2,4-Trimethylbenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
92	Sec-Butylbenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
83	M-Dichlorobenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
93	P-Isopropyltoluene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
94	N-Butylbenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
55	Chloroethane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
97	Hexachlorobutadiene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
96	Naphthalene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
98	1,2,3-Trichlorobenzene	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
85	Trichlorofluoromethane	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
<b>EPA Regulated - Trihalomethanes Program</b>								
31	Total Trihalomethanes	ND	µg/L		60	80		EPA 524.2 (TM)
27	Chloroform	ND	µg/L	0.5	0.5			EPA 524.2 (TM)
28	Bromodichloromethane	ND	µg/L	0.5				EPA 524.2 (TM)
29	Dibromochloromethane	ND	µg/L	1.5				EPA 524.2 (TM)
30	Bromoform	ND	µg/L	0.6				EPA 524.2 (TM)



**TWISS ANALYTICAL LABORATORIES, INC.**

26276 Twelve Trees Lane, Suite C Poulsbo, WA 98370 Telephone (360) 779-5141 FAX (360) 779-5150

**VOC - VOC1**  
**VOC - VOC1 by Various EPA Approved Methods**  
**Source / Point of Entry - Report of Analysis**

<b>Date Collected:</b> 1/5/2011	<b>Group:</b> A,
<b>System ID No:</b> 40529X	<b>System Name:</b> McCormick Woods
<b>Lab - Sample #:</b> 01099401	<b>County:</b> Kitsap
<b>Sample Location:</b> Well #11	<b>DOH Source No:</b>
<b>Sample Purpose:</b> O	<b>Date Received:</b> 1/5/2011
<b>Sample Composition:</b> S	<b>Date Analyzed:</b> 1/11/2011
<b>Send Report To:</b> City of Port Orchard 216 Prospect St Port Orchard, WA 98366	<b>Date Reported:</b> 1/12/2011
	<b>Sample Type:</b> Pre-treatment/Raw
	<b>Collected By:</b> Alan Rickett
	<b>Phone Number:</b> 360-876-2722
	<b>Bill To:</b> City of Port Orchard 216 Prospect St Port Orchard, WA 98366

DOH#	Analyte	Results	Units	SRL	Trigger	MCL*	MCL Exceeded	Method (Analyst Init.)
------	---------	---------	-------	-----	---------	------	--------------	------------------------

**SRL:** (State Reporting Level), indicates the minimum reporting level required by the Washington Department of Health (DOH).  
**Trigger Level:** DOH Drinking Water response level. Systems with compounds detected at concentrations in excess of this level are required to take additional samples. Contact your regional DOH office for further information.  
**MCL:** (Maximum Contaminant Level), If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.  
**NA:** (Not Analyzed), in the results column indicates this compound was not included in the current analysis.  
**ND:** (Not Detected), in the results column indicates this compound was analyzed and not detected at a level greater than or equal to the SRL.  
**< (0.00x):** indicates the compound was not detected in the sample at or above the concentration indicated.  
 \* The 0.010 mg/L MCL for Arsenic is for Group A NTNC systems. All other systems should check with their county Health District to determine what level is applicable.



Burlington WA  
Corporate Office

Bellingham WA  
Microbiology

Portland OR  
Microbiology/Chemistry

1620 S Walnut St - 98233  
800.755.9295 • 360.757.1409

805 Orchard Dr Ste 4 - 98225  
360.671.0688

9150 SW Pioneer Ct Ste W- 97070  
503.682.7802



## SYNTHETIC ORGANIC COMPOUNDS (SOC) REPORT

Client Name: Twiss Analytical Laboratories  
26276 Twelve Trees Lane Ste C  
Poulsbo, WA 98370

Reference Number: 11-00266  
Project: Mc Cormick Woods

System Name: MCCORMICK WOODS  
System ID Number: 40529X  
DOH Source Number: New  
Multiple Sources:  
Sample Type: D - Drinking Water  
Sample Purpose: Investigative or Other  
Sample Location: Hose Bib on New Well #11  
County: Kitsap  
Sampled By: Alan Rickett  
Sampler Phone: 360-876-2722

Field ID: 111995-01  
Lab Number: 046-00570  
Date Collected: 1/5/11 12:00  
Date Extracted: 525\_110111  
Date Analyzed: 01/11/11  
Report Date: 1/27/11  
Analyst: CO  
Peer Review: *YP*

### EPA Method 525.2 For State Drinking Water Compliance

DOH#	COMPOUNDS	RESULTS	UNITS	SRL	Trigger	MCL	COMMENT
<b>EPA Regulated</b>							
33	ENDRIN	ND	ug/L	0.02	0.05	2	
34	LINDANE (BHC - GAMMA)	ND	ug/L	0.04	0.04	0.2	
35	METHOXYCHLOR	ND	ug/L	0.2	10	40	
117	ALACHLOR	ND	ug/L	0.4	0.4	2	
119	ATRAZINE	ND	ug/L	0.2	0.5	3	
120	BENZO(A)PYRENE	ND	ug/L	0.04	0.04	0.2	
122	CHLORDANE, TECHNICAL	ND	ug/L	0.4	0.4	2	
124	DI(ETHYLHEXYL)-ADIPATE	ND	ug/L	1.3	1.3	400	
125	DI(ETHYLHEXYL)-PHTHALATE	ND	ug/L	1.3	1.3	6	
126	HEPTACHLOR	ND	ug/L	0.08	0.09	0.4	
127	HEPTACHLOR EPOXIDE	ND	ug/L	0.04	0.1	0.2	
128	HEXACHLOROBENZENE	ND	ug/L	0.2	0.5	1	
129	HEXACHLOROCYCLO-PENTADIENE	ND	ug/L	0.2	0.5	50	
133	SIMAZINE	ND	ug/L	0.15	0.15	4	
134	PENTACHLOROPHENOL	ND	ug/L	0.4	0.2	1	screening only / compliance by 515.4
<b>EPA Unregulated</b>							
118	ALDRIN	ND	ug/L	0.2			
121	BUTACHLOR	ND	ug/L	0.4			
123	DIELDRIN	ND	ug/L	0.2			
130	METOLACHLOR	ND	ug/L	1.0			
131	METRIBUZIN	ND	ug/L	0.2			
132	PROPACHLOR	ND	ug/L	0.2			
233	4,4-DDE	ND	ug/L	0.2			
	*ACETOCHLOR	ND	ug/L	0.1			
208	EPTC	ND	ug/L	0.3			
218	MOLINATE	ND	ug/L	0.1			
190	TERBACIL	ND	ug/L	0.2			

**NOTES:**

If a compound is detected  $\geq$  or = to the State Reporting Level, SRL, specified increased monitoring frequencies may occur per DOH.  
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; a blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.  
ND (Not Detected): indicates that the parameter was not detected above the State Reporting Limit (SRL).

\* In front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

These test results meet all the requirements of NELAC, unless otherwise stated in writing, and relate only to these samples.  
If you have any questions concerning this report contact Lawrence Henderson at the above phone number.



Reference Number: 11-00266  
 Lab Number: 046-00570  
 Report Date: 1/27/11 8:02

## SYNTHETIC ORGANIC COMPOUNDS (SOC) REPORT

DOH#	COMPOUNDS	RESULTS	UNITS	SRL	Trigger	MCL	COMMENT
	<b>State Unregulated - Other</b>						
179	BROMACIL	ND	ug/L	0.2			
254	FLUORENE	ND	ug/L	0.2			

**NOTES:**

If a compound is detected > or = to the State Reporting Level, SRL, specified increased monitoring frequencies may occur per DOH.  
 MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; a blank MCL value indicates a level is not currently established.  
 Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.  
 ND (Not Detected): indicates that the parameter was not detected above the State Reporting Limit (SRL).  
 N in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

These test results meet all the requirements of NELAC, unless otherwise stated in writing, and relate only to these samples.  
 If you have any questions concerning this report contact Lawrence Henderson at the above phone number.

FORM: SOC

### RADIONUCLIDE ANALYSIS REPORT

System ID No.: <b>40529X</b>		System Name: <b>McCormick Woods</b>	
Lab/Sample No: <b>142-64001</b>		Date Collected: <b>01/05/2011</b>	DOH Source No:
Multiple Source Nos:		Sample Type: <b>No Treatment</b>	Sample Purpose: <b>Compliance</b>
Date Received: <b>01/12/2011</b>		Date Reported: <b>02/09/2011</b>	Supervisor: <b>Dave Poelstra, Branch Mgr</b>
		Date Analyzed: <b>See Below</b>	Analyst: <b>See Below</b>
County: <b>Kitsap</b>			Group: <b>A</b>
Sample Location: <b>Hose Bib on New Well #11</b>			
Send Report To: <b>Twiss Analytical, Inc.</b> <b>26276 Twelve Trees Lane, Suite C</b> <b>Poulsbo, WA 98370</b>		Bill To: <b>Twiss Analytical, Inc.</b> <b>26276 Twelve Trees Lane, Suite C</b> <b>Poulsbo, WA 98370</b>	

DOH #	ANALYTES	LAB MDA	RESULTS	UNITS	DATE ANALYZED	MCL	(ANALYST'S INITIALS) & METHOD USED
<i>EPA/STATE REGULATED (These analyses should be performed in order as listed)</i>							
165	Gross Alpha		-3	pCi/L	1/20/2011	15	JB / E900.0
166	Radium 228		0.4	pCi/L	1/27/2011	5	PLJ / RA-05
<i>Determine Radium 226 activity if Gross Alpha is greater than 5.0 pCi/L*</i>							
39	Radium 226*			pCi/L			
<i>Determine Uranium activity if Gross Alpha is greater than 15.0 pCi/L**</i>							
105	Uranium** (mass)			µg/L		30	
105	Uranium** (activity)			pCi/L		20**	
<i>Depending on the foregoing data determine the following (must be completed if data is available):</i>							
40	Radium 226 + 228			pCi/L			
40	Gross Alpha*** + Radium 228			pCi/L		5	
41	Gross Alpha minus Uranium			pCi/L		15	
<i>Do the following only if specifically requested by the client or the state</i>							
42	Gross Beta****			pCi/L		50	
43	Tritium****			pCi/L		20,000	
44	Strontium 90****			pCi/L		8	
107	Cesium 134****			pCi/L		***	
108	Iodine 131****			pCi/L		***	

**MCL (Maximum Contaminant Level):** If the contaminant amount exceeds the MCL, immediately contact your regional DOH office.

**MDA: Minimum Detectable Amount.**

**NA (Not Analyzed):** use in the results column for compounds not included in the current analysis.

**ND (Not Detected):** use in the results column for compounds analyzed and not detected at a level greater than or equal to the MDA.

\* **If Gross Alpha is less than , or equal to, 5 pCi/L,** it may be assumed that the Alpha activity is entirely due to Radium 226 (i.e., Radium 226 would not need to be run). The Alpha activity is then added to the Radium 228 activity (i.e., Beta activity) for MCL determinations. If the sum of the Alpha activity plus the Radium 228 activity is greater than 5 pCi/L, Radium 226 activity must then be determined for water system compliance purposes (i.e., Radium 226 + Radium 228 activity)

\*\***Uranium's MCL is given in mass terms (µg/L).** When Uranium is determined by mass methods, it must be converted to activity levels (pCi/L) for calculation of the MCL (Gross Alpha less Uranium). A conversion factor of 0.67 pCi/l per µg/L should be used. Uranium needs to be determined only when the Gross Alpha exceeds 15 pCi/L.

\*\*\* Use Gross Alpha in lieu of Radium 226 when the Gross Alpha is less than, or equal to, 5.0 pCi/L

\*\*\*\* **The MCL for beta particle and photon radioactivity from man-made radionuclides** is the average annual concentration which shall not produce an annual dose equivalent to the total body or any internal organ greater than four millirem/yr.

Comments: Use back of page for comments



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Corporate Office

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805 Orchard Dr Ste 4 - 98225  
360.671.0688

9150 SW Pioneer Ct Ste W- 97070  
503.682.7802



## CARBAMATES IN DRINKING WATER

Client Name: Twiss Analytical Laboratories  
26276 Twelve Trees Lane Ste C  
Poulsbo, WA 98370

Reference Number: 11-00266  
Project: Mc Cormick Woods

System Name: MCCORMICK WOODS  
System ID Number: 40529X  
DOH Source Number: New  
Multiple Sources:  
Sample Type: D - Drinking Water  
Sample Purpose: Investigative or Other  
Sample Location: Hose Bib on New Well #11  
County: Kitsap  
Sampled By: Alan Rickett  
Sampler Phone: 360-876-2722

Field ID: 111995-01  
Lab Number: 046-00570  
Date Collected: 1/5/11 12:00  
Date Extracted: 531\_110119  
Date Analyzed: 01/19/11  
Report Date: 1/27/11  
Analyst: HY  
Peer Review: *MP*

### EPA Method 531.2 For State Drinking Water Compliance

DOH#	COMPOUNDS	RESULTS	UNITS	SRL	Trigger	MCL	COMMENT
<b>EPA Regulated</b>							
148	OXYMAL	ND	ug/L	4.0	4.0	200	
146	CARBOFURAN	ND	ug/L	1.8	1.8	40	
<b>EPA Unregulated</b>							
144	ALDICARB SULFOXIDE	ND	ug/L	1.0	1.0		
143	ALDICARB SULFONE	ND	ug/L	1.6	1.6		
147	METHOMYL	ND	ug/L	1.0	1.0		
141	3-HYDROXYCARBOFURAN	ND	ug/L	2.0	2.0		
142	ALDICARB	ND	ug/L	1.0	1.0		
145	CARBARYL	ND	ug/L	2.0	2.0		
<b>State Unregulated - Other</b>							
326	PROPOXUR (BAYGON)	ND	ug/L	1.0			
327	METHIOCARB	ND	ug/L	4.0			

**NOTES:**

† a compound is detected > or = to the State Reporting Level, SRL, specified increased monitoring frequencies may occur per DOH.

MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; a blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the State Reporting Limit (SRL).

†n \* in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

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360.671.0688

9150 SW Pioneer Ct Ste W- 97070  
503.682.7802



## HERBICIDES IN DRINKING WATER

Client Name: Twiss Analytical Laboratories  
26276 Twelve Trees Lane Ste C  
Poulsbo, WA 98370

Reference Number: 11-00266  
Project: Mc Cormick Woods

System Name: MCCORMICK WOODS  
System ID Number: 40529X  
DOH Source Number: New  
Multiple Sources:  
Sample Type: D - Drinking Water  
Sample Purpose: Investigative or Other  
Sample Location: Hose Bib on New Well #11  
County: Kitsap  
Sampled By: Alan Rickett  
Sampler Phone: 360-876-2722

Field ID: 111995-01  
Lab Number: 046-00570  
Date Collected: 1/5/11 12:00  
Date Extracted: 515.4\_110110b  
Date Analyzed: 01/19/11  
Report Date: 1/27/11  
Analyst: BCV  
Peer Review: *JP*

### EPA Method 515.4 For State Drinking Water Compliance

DOH#	COMPOUNDS	RESULTS	UNITS	SRL	Trigger	MCL	COMMENT
<b>EPA Regulated</b>							
37	*2,4 - D	ND	ug/L	0.5	0.2	70	
38	*2,4,5 - TP (SILVEX)	ND	ug/L	1.0	0.4	50	
134	*PENTACHLOROPHENOL	ND	ug/L	0.2	0.08	1	
137	*DALAPON	ND	ug/L	5	2	200	
139	*DINOSEB	ND	ug/L	1.0	0.4	7	
140	*PICLORAM	ND	ug/L	0.5	0.2	500	
<b>Other</b>							
138	*DICAMBA	ND	ug/L	0.2	0.2		
225	*DCPA (ACID METABOLITES)	ND	ug/L	0.1	0.1		
135	*2,4 DB	ND	ug/L	1.0	1.0		
136	*2,4,5 T	ND	ug/L	0.4	0.4		
220	*BENTAZON	ND	ug/L	0.5	0.5		
221	*DICHLORPROP	ND	ug/L	0.5	0.5		
223	*ACIFLUORFEN	ND	ug/L	2.0	2.0		
226	*3,5 - DICHLOROBENZOIC ACID	ND	ug/L	0.5	0.5		

**NOTES:**

If a compound is detected > or = to the State Reporting Level, SRL, specified increased monitoring frequencies may occur per DOH.  
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; a blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the State Reporting Limit (SRL).

\*n \* in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

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## SYNTHETIC ORGANIC COMPOUNDS (SOC) REPORT

Client Name: Twiss Analytical Laboratories  
26276 Twelve Trees Lane Ste C  
Poulsbo, WA 98370

Reference Number: 11-00266  
Project: Mc Cormick Woods

System Name: MCCORMICK WOODS  
System ID Number: 40529X  
DOH Source Number: New  
Multiple Sources:  
Sample Type: D - Drinking Water  
Sample Purpose: Investigative or Other  
Sample Location: Hose Bib on New Well #11  
County: Kitsap  
Sampled By: Alan Rickett  
Sampler Phone: 360-876-2722

Field ID: 111995-01  
Lab Number: 046-00570  
Date Collected: 1/5/11 12:00  
Date Extracted: 508\_110111  
Date Analyzed: 01/11/11  
Report Date: 1/27/11  
Analyst: EM  
Peer Review: *MP*

### EPA Method 508.1 For State Drinking Water Compliance

DOH#	COMPOUNDS	RESULTS	UNITS	SRL	Trigger	MCL	COMMENT
	<b>PCBs/Toxaphene</b>						
153	PCBS (Total Aroclors)	ND	ug/L	0.2		0.5	
173	AROCLOR 1221	ND	ug/L	100			
174	AROCLOR 1232	ND	ug/L	2.5			
175	AROCLOR 1242	ND	ug/L	1.5			
176	AROCLOR 1248	ND	ug/L	0.5			
177	AROCLOR 1254	ND	ug/L	0.5			
178	AROCLOR 1260	ND	ug/L	1			
180	AROCLOR 1016	ND	ug/L	0.4			
36	TOXAPHENE	ND	ug/L	1	1	3	

**NOTES:**

† a compound is detected > or = to the State Reporting Level, SRL, specified increased monitoring frequencies may occur per DOH.  
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; a blank MCL value indicates a level is not currently established.

Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.

ND (Not Detected): indicates that the parameter was not detected above the State Reporting Limit (SRL).

†n \* in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

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If you have any questions concerning this report contact Lawrence Henderson at the above phone number.

FORM: SOC



### COLIFORM BACTERIA ANALYSIS

Date Sample Collected <b>1 15 11</b> Month Day Year	Time Sample Collected <b>12.30</b> <input type="checkbox"/> AM <input checked="" type="checkbox"/> PM	County <b>KITSAP</b>
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Type of Water System (check only one box)

Group A Public       Private Household  
 Group B Public       Other

Group A and Group B Systems – Provide from Water Facilities Inventory (WFI):

ID# **4 0 5 2 9 X**

System Name: ~~Gravel Port Orchard~~ **Mc Cormick Woods**

Contact Person: **JAY COOKSON**

Day Phone: **(360) 876-2722** Cell Phone: ( )

Eve. Phone: ( ) FAX: ( )

Send results to: (Print full name, address and zip code)  
**CITY OF PORT ORCHARD**  
**216 PROSPECT ST.**  
**PORT ORCHARD WA 98366**

#### SAMPLE INFORMATION

Sample collected by (name): **ALAN RICKETT**

Specific location where sample collected (address or sample site, and type of faucet):  
**HOSE BIB ON NEW WELL #1**

Special instructions or comments:  
**NEW WELL - NO TREATMENT**

Type of Sample (must check only one box of #1 through #4 listed below)

<p><input type="checkbox"/> <b>Routine Distribution Sample</b>          Provide information below.          Chlorinated: Yes _____ No <b>X</b>          Chlorine Residual: Total _____ Free _____</p>	<p><input type="checkbox"/> <b>Repeat Sample (follow-up to an unsatisfactory sample)</b>          Provide information below.          Unsatisfactory routine lab number: _____          Unsatisfactory routine collect date: _____          Chlorinated: Yes _____ No _____          Chlorine Residual: Total _____ Free _____</p>
<p><input type="checkbox"/> <b>Raw Water Source Sample</b>          Required for Surface Water, GWI, and some Spring Sources</p> <p><b>S</b>        </p> <p><small>Public Systems must provide Source Number from (WFI)</small></p>	

**Sample Collected for Information Only**  
 Construction \_\_\_\_\_ Repairs \_\_\_\_\_ Private Residence \_\_\_\_\_ Other **New Source**

#### LAB USE ONLY DRINKING WATER RESULTS LAB USE ONLY

<input type="checkbox"/> <b>Unsatisfactory</b> Total Coliform Present and <input type="checkbox"/> E.coli present <input type="checkbox"/> E.coli absent <input type="checkbox"/> Fecal coliform present <input type="checkbox"/> Fecal coliform absent	<input checked="" type="checkbox"/> <b>Satisfactory</b>
--	---



GROUNDWATER CONTAMINATION  
SUSCEPTIBILITY ASSESSMENT SURVEY FORM

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**Ground Water Contamination  
Susceptibility Assessment Survey Form  
Version 2.3**

**IMPORTANT!** Please complete one form for each ground water source (well, well in wellfield, spring, spring in springfield) used in your water system. Photocopy as necessary

**PART I: System Information**

Well owner / manager: City of Port Orchard

Water System Name: City of Port Orchard

County: Kitsap

Water System Number: 68900 Source Number: New

Well Depth: 980 (ft) (From WFI form)

Source Name: Well 11

WA well identification tag number: APP - 308 Well not tagged

Number of connections: 4,457 Population served: 10,410

Township: 23N Range: 1E

Section: 9 1/4 1/4 Section: NE, NW

Latitude / longitude (if available) \_\_\_\_\_ / \_\_\_\_\_

How was lat. / long. determined?

Global Positioning device  Survey  Topographic Map  
 Other: Parcel No. 092301-2-002-2003

\* Please refer to Assistance Packet for details and explanations of all the questions in Parts II through V

**PART II: Well Construction and Source Information**

1) Date well originally constructed: 01 / 07 / 2011 (month/day/year)

last reconstruction: \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ (month/day/year)

Information unavailable



**PART III: Hydrogeologic Information**

1) Depth to top of open interval: [check one]

(less than) 20ft     20 - 50ft     50 - 100ft     100 - 200ft  
 (greater than) 200ft     Information unavailable

2) Depth to ground water (static water level)

(less than) 20ft     20 - 50ft     50 - 100ft     (greater than) 100ft  
 Flowing well spring (artesian)     Depth to Ground water unknown

How was water level determined?

Well log     Other: \_\_\_\_\_     Unknown

3) If source is a flowing well or spring, what is the confining pressure:

\_\_\_\_\_ psi (pounds per square inch)  
or  
\_\_\_\_\_ feet above wellhead

4) If source is a flowing well or spring, is there a surface impoundment, reservoir, or catchment associated with the source?

YES     NO

5) Wellhead elevation (height above mean sea level): \_\_\_\_\_ 420 (ft)

How was elevation determined?

Topographic map     Drilling / Well Log     Altimeter  
 Other: \_\_\_\_\_  
 Information unavailable

6) Confining layers: (This can be completed only for those sources with a drilling log, well log or geologic report describing subsurface conditions. Please refer to assistance package for example.)

Evidence of a confining layer in well log  
 No evidence of a confining layer in well log

If there is evidence of a confining layer, is the depth to ground water more than 20 feet above the bottom of the lowest confining layer?

YES     NO  
 Information Unavailable

7) Sanitary setback:

(Less than) 100ft\*     100 - 200ft     120 - 200ft     (greater than) 200ft

\* if less than 100 ft describe the site conditions:

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8) Wellhead construction:

- Wellhead enclosed in a wellhouse
- Controlled access (describe below in comments):
- Other uses for wellhouse (describe below in comments):
- No wellhead control

Wellhead construction comments

Located within fenced area

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9) Surface seal:

- 18 ft
- (less than) 18ft (No Department of Ecology approval)
- (less than) 18ft (Approved by Ecology, include documentation)
- (greater than) 18 ft
- depth of seal unknown
- no surface seal

10) Annual rainfall (inches per year)

(less than) 10 in/yr     10 - 25 in/yr     (greater than) 25 in/yr



**PART V: Assessment of Water Quality**

1) Regional sources of risk to ground water:

Please indicate if any of the following are present within a circular area around your water source having a radius up to and including the five year ground water travel time:

	<u>6 Mo</u>	<u>1 Yr</u>	<u>5 yrs</u>	<u>Unknown</u>
Likely pesticide application .....				X
Stormwater injection wells .....				X
Other injection wells .....				X
Abandoned ground water well .....				X
Landfills, dumps, disposal areas .....				X
Known hazardous materials clean-up site .....				X
Water system(s) with known quality problems .....				X
Population density (greater than) 1 house / acre .....	X	X	X	
Residences commonly have septic tanks .....				X
Wastewater treatment lagoons .....				X
Sites used for land application of waste .....				X

Mark and identify on map any of the risks listed above which are located within the 6 month time of travel boundary. (Please include a map of the wellhead and time of travel areas with this form. Please locate and mark any of the following)

If other recorded or potential sources of ground water contamination exist within the ten year time of travel circular zone around your water supply, please describe:

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2) Source specific water quality records:

Please indicate the occurrence of any test results since 1986 that might meet the following conditions: (Unless listed on assessment, MCLs are listed in assistance package.)

A. <u>Nitrate:</u> (Nitrate MCL = 10 mg/l)	<u>YES</u>
Results greater than MCL .....	_____
(less than) 2 mg/liter nitrate .....	<u>  X  </u>
2 - 5 mg/liter nitrate.....	_____
(greater than) 5 mg/liter nitrate.....	_____
Nitrate sampling records unavailable .....	_____
 B. <u>VOCs:</u> (VOC detection level 0.5 ug/l or 0.0005 mg/l)	<u>YES</u>
Results greater than MCL or SAL .....	_____
VOCs detected at least once .....	_____
VOCs never detected .....	<u>  X  </u>
VOC sampling records unavailable .....	_____
 C. <u>EDB/DBCP:</u> (EDB MCL = 0.05 ug/l or 0.00005 mg/l) (DBCP MCL = 0.2 ug/l or 0.0002 mg.l)	<u>YES</u>
EDB/DBCP detected below MCL at least once .....	_____
EDB/DBCP detected above MCL at least once .....	_____
EDB/DBCP never detected .....	_____
EDB/DBCP test required but not yet completed .....	_____
EDB/DBCP tests not required .....	_____
 D. <u>Other SOCs (Pesticides):</u>	<u>YES</u>
Other SOCs detected .....	_____
(pesticides and other synthetic organic chemicals)	
Other SOC tests performed but none detected .....	_____
(List test methods in comments)	
Other SOC tests not performed .....	_____

If any SOCs in addition to EDB/DBCP were detected, please identify and date. If other SOC tests were performed, but no SOCs detected, list test methods here:

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E. Bacterial contamination: NEW SOURCE - SATISFACTORY YES

Any bacterial detection(s) in the last 3 years in samples taken from the source (not distribution sampling records) .....       

Has source (in past 3 years) had a bacteriological contamination problem found in distribution samples that was attributed to the source .....       

Source sampling records for bacteria unavailable .....       

**Part VI: Geographic or Hydrological Factors Contributing to a Non-Circular Zone of Contribution**

The following questions will help identify those ground water systems which may not be accurately represented by the calculation fixed radius (CFR) method described in Part IV. For these sources, the CFR areas should be used as a preliminary delineation of the critical time of travel zones for the sources. As a system develops its Wellhead Protection Plan for these sources, a more detailed delineation method should be considered.

1) Is there evidence of obvious hydrological boundaries within the 10 year time of travel zone of the CFR? (Does the largest circle extend over a stream, river, lake up a steep hillside and/or over a mountain or ridge?)

  X   YES                             NO                             Unknown

Describe with references to map produced in Part IV:

North Lake, Anderson Creek

2) Aquifer Material:

a) Does the drilling log, well log or other geologic / engineering reports identify that the well is located in an area where the underground conditions are identified as fractured rock and/or basalt terrain?

       YES                        X   NO                             Unknown

b) Does the drilling log, well log or other geologic / engineering reports identify that the well is located in an area where the underground conditions are primarily identified as coarse sand and gravel?

       YES                        X   NO                             Unknown

3) Is the source located in an aquifer with a high horizontal flow rate? (These can include sources located on flood plains of large rivers, artesian wells with high water pressure, and/or shallow flowing wells and springs)

       YES                        X   NO                             Unknown

4) Are there other high capacity wells (agricultural, municipal, and/or industrial) located within the CFRs?

  X   YES                             NO                             Unknown

a) Presence of ground water extraction wells removing more than approximately 500 gal/min within...

	YES	NO	Unknown
6 Month travel time	<u>      </u>	<u>  X  </u>	<u>      </u>
6 Month - 1 yr travel time	<u>      </u>	<u>  X  </u>	<u>      </u>
1 - 5 year travel time	<u>      </u>	<u>  X  </u>	<u>      </u>
5 - 10 year travel time	<u>      </u>	<u>  X  </u>	<u>      </u>

b) Presence of ground water recharge wells (dry wells) or heavy irrigation within....

	YES	NO	Unknown
1 year travel time	<u>      </u>	<u>      </u>	<u>      </u>
1 - 5 year travel time	<u>      </u>	<u>      </u>	<u>      </u>
5 - 10 year travel time	<u>  X  </u>	<u>      </u>	<u>      </u>

Please identify or describe additional hydrological or geographic conditions that you believe may affect the shape of the zone of contribution for this source. Where possible, reference them to locations on the map produced in Part IV

Irrigation of McCormick Woods Golf Course

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This form and instruction packet are still in the process of development. Your comments, suggestions and questions will help us upgrade and improve this assessment form. If you found particular sections confusing or problematic please let us know. How could this susceptibility assessment be improved or made clearer? How much time did it take you to complete the form? Were you able to complete the assessment without additional/outside expertise? Do you feel the assessment was valuable as a learning experience? Any other comments or constructive criticisms you have would be

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