CITY OF UMATILLA, OREGON

WATER SYSTEM MASTER PLAN

2008

EXPIRES 12-31-08
SIGNED

ANDERSON·PERRY & ASSOCIATES, INC.

Civil Engineers

La Grande, Oregon
Walla Walla, Washington

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EXECUTIVE SUMMARY

This Executive Summary briefly outlines the results of the Water System Master Plan prepared for the City of Umatilla by Anderson·Perry & Associates, Inc. The issues facing Umatilla that prompted the development of this study were operational problems with their supply, distribution, and telemetry systems. Over the period that this Master Plan was developed, the City completed many upgrades and improvements to the system such that current demands are met and the system is efficiently operated. Recommendations for future growth outlined hereafter have been developed in cooperation with the Umatilla city staff.

The focus of this study has been on the overall water system, including the water supply, storage, and distribution systems. The study includes an analysis of the existing system and its performance, evaluation of system needs, evaluation of improvement alternatives, prioritization of improvements, and development of an implementation schedule. Included in this Executive Summary is a brief discussion of the existing water system, recommendations to meet future demands on the water system, a summary of costs to implement the recommended improvements, an evaluation of the current financial status of the Water Department, and a preliminary implementation schedule. For a more detailed discussion of the information presented in this Executive Summary, please refer to the individual chapters of this Master Plan.

EXISTING WATER SUPPLY AND WATER RIGHTS

Water Supply Facilities. The City of Umatilla currently obtains its drinking water from four deep basalt wells. Three wells are located in the West McNary area in the eastern portion of town and one (the McFarland Well) is west of the Umatilla River at the west edge of the city.

The McFarland Well is the oldest source in use, having been drilled in 1947 to a depth of 785 feet. Located southeast of the Grant Street/McFarland Avenue intersection, it is the primary source for the Coyote and Powerline High Level Systems and the secondary source for the Low Level System. The well is located in the Buttercreek critical groundwater area, which has limits on the amount of water that can be withdrawn annually. With a pump replaced in 1997 and a telemetry system installed in 2002, the facility provides 560 gallons per minute (gpm) for a maximum of 250 acre-feet per year.

In the eastern side of town, the Intertie Well is located a block west and two blocks south of the U.S. Highway 395/U.S. Highway 730 intersection. Constructed in 1979 to a depth of 1,138 feet, this well produces 760 gpm from what is believed to be the Grande Ronde aquifer, which originates in the Blue Mountains. The discharge is into the Intertie Reservoir and the well is the primary source for the Low Level System. The current pump was installed in 1995 and is operated by a starter control panel and telemetry system install in 2002. After dealing with declining water levels in the well, the drawdown level has stabilized at approximately 560 feet below ground surface.

The McNary High Level System is provided water from the Golf Course and Port Wells, which are both believed to draw from the Grande Ronde aquifer. Adjacent to Draper Road in the Port of Umatilla Industrial Park, the Golf Course Well was constructed in 1978. Drilled to a depth of 989 feet, the well produces approximately 1,950 gpm using a pump installed in 1995. Operated alternately with the Port Well and sharing primary source responsibility for the McNary High Level System, the discharge is into the McNary Reservoir.

The Port Well is used by the City of Umatilla under a 40-year lease from the Port of Umatilla. Constructed 400 feet south of the Columbia River around 1966, the 850-foot deep well produces 2,000 gpm. The City installed the current pumping equipment in 2002 and configured the system to discharge into the McNary Reservoir. The lease will be up for renewal in the year 2040.

All four wells are equipped with chlorine disinfection treatment systems with contact time accomplished in the reservoir at each site.

Water Rights. The City of Umatilla holds water rights issued by the State of Oregon for its three groundwater sources, and operates the Port Well with an approved change of use held by the Port of Umatilla. Additionally, the City holds a surface water right for the appropriation of 23 cubic feet per second (cfs) from the Columbia River. The water rights are summarized as follows:

Source	Priority Date	Rate (cfs)	Status	Holder
McFarland Well	December 24, 1963	1.25	Perfected	City
Intertie Well	December 28, 1977	8.9	CBU* for 1.69 cfs	City
Golf Course Well	December 28, 1977	8.9	CBU for 4.45 cfs	City
Port Well	August 10, 1966	4.46	CBU for 4.46	Port lease to City
Columbia River	October 5, 1976	23.0	Pending development	City

* CBU = Claim of Beneficial Use filed with the Oregon Water Resources Department, pending receipt of certificate

The pending certificates for the Intertie and Golf Course Wells will not perfect the full permitted rate of these wells. This is due to the limited capacity of the well source and pumping equipment. To maintain the priority date for the remaining portion of these water rights, the City will need to file for an extension.

EXISTING WATER STORAGE

The City has six water storage reservoirs distributed among the four service areas. Moving from east to west, the McNary and Port Reservoirs service the McNary High Level System. The McNary Reservoir is a 1.8 million gallon (MG), welded steel ground-level reservoir constructed in 1995 adjacent to the Golf Course Well. It was constructed with an internal 90,000-gallon chlorine contact chamber for disinfection purposes. The Port Reservoir is an elevated 125,000-gallon steel tank transferred to the City from the Port of Umatilla in 1995. The elevated reservoir provides pressure to the system by gravity, but if necessary, the Golf Course Booster Pump Station can supply flow and pressure with the reservoir out of the system.

The Intertie Reservoir was constructed in 1978 adjacent to the Intertie Well. It provides 1.5-MG of storage in a welded steel, ground-level reservoir with gravity flow to the Low Level System. Sitting with an overflow elevation approximately 15 feet higher than the McFarland Reservoirs which service the same pressure zone, an altitude valve is situated to allow the transfer of water through the system while preventing overflow of the lower storage facilities.

Two reservoirs provide storage at the McFarland Well site. An older concrete, ground-level reservoir believed to have been built around 1935 has a 150,000-gallon capacity. A 500,000-gallon ground-level welded steel reservoir was added to the facility in 1954.

Parker

The Coyote Reservoir is located on Spud Road approximately 1-1/4 miles south of the McFarland Well and Reservoirs. Constructed in 1978, this ground-level welded steel reservoir provides 700,000 gallons of storage capacity that gravity feeds the Coyote High Level System and is the water source for the booster pump station servicing the Powerline High Level System.

All the reservoirs were inspected in 1997 and are believed to be in good condition. The City is scheduling another round of inspections beginning with two reservoirs in 2008.

EXISTING DISTRIBUTION SYSTEM

The City's distribution system has an assortment of pipe types and sizes through the four pressure zone service areas. Changes in materials and size standards occurred as development progressed over the years and some areas were acquired from other water providers such as the Corps of Engineers and the Port of Umatilla. A majority of the system consists of cast iron pipe with more polyvinyl chloride (PVC) used in later developments. Small quantities of steel, asbestos cement (AC), and galvanized pipe are found in various areas of the system.

The McNary High Level System consists of the McNary residential area; the Port of Umatilla industrial area, which includes the Two Rivers Correctional Institution (TRCI) facilities; and a small area just south of U.S. 730. The area generally has minimum 6-inch diameter water main lines and 12-inch diameter transmission lines and is of

relatively recent construction. Reconstruction of a significant residential area was completed in 1995 with industrial park expansion and improvements following in 2000 and service line replacements in 2007.

The Low Level System consists of the area west of U.S. 395, between the Columbia River and an elevation of approximately 400 feet above mean seal level (MSL). This is generally the older portion of the City including the downtown area and the surrounding residential area. This distribution system is composed mostly of cast iron pipe ranging from 2 to 8 inches in diameter. A 16-inch transmission line from the Intertie facilities and an 18-inch transmission line from the McFarland Well and Reservoirs provide the backbone of the system.

The Coyote High Level System services the area south of the Umatilla River between the elevations of 400 and 550 feet above MSL. The mix of neighborhoods includes PVC and ductile iron pipes ranging from 6 to 16 inches in diameter. PVC is the standard as new development occurs.

The Powerline High Level System was constructed in the last 10 years with 6- to 8-inch PVC distribution lines.

In general the system is well looped with few dead-ends and is believed to be in good condition. The system is fully metered at the sources and all services. Water audits for the last several years have indicated water losses are within acceptable tolerance levels.

Four booster pump stations are operated within the City's water system. The Golf Course Booster Pump Station is located near the Golf Course Well and McNary Reservoir. Constructed in 1995, it draws from the McNary Reservoir and discharges to the McNary High Level System and elevated Port Reservoir. It consists of three electrical motor driven pumps, a diesel-driven fire pump, and controls. One pump is driven by a variable frequency drive (VFD) so operation can maintain a constant pressure in the distribution system during varying demands with the Port Reservoir out of service.

The Coyote Reservoir is supplied water from the McFarland Booster Pump Station. Operating with two electric motor driven pumps, it draws water from the McFarland Reservoirs. An improvement project completed in 2001 allows the system to operate one pump on a VFD so the Coyote Reservoir can be out of service for maintenance and the Coyote and Powerline High Level Systems can still be supplied.

In 2000 the Coyote Booster Pump Station was constructed to serve the Powerline High Level System. With automatic operation of four pumps drawing from the Coyote Reservoir, system pressures are maintained during varying demands. VFD operation provides flows from 0 gpm to fire flow quantities at the desired system pressure.

The fourth booster pump station provides emergency backup supply to the McNary High Level area. The McNary Emergency Booster Pump Station, drawing from

the Low Level System, is capable of moving 750 to 1,000 gpm to the McNary High Level System depending on the water level in the Port Reservoir. Additionally, transfers from the McNary High Level System to the Low Level System are possible via a 12-inch transmission line and an automatic intertie valve and flowmeter.

The City has emergency generators and automatic transfer switches located at key areas of the water system. These backup systems ensure water sources are available and system pressures are maintained in the event of a utility power outage. A generator is set up to operate the Golf Course Well and Booster Pump Station, sustaining a water source and water levels in the Port Reservoir for pressure in the McNary High Level System. Additionally, a diesel-driven fire pump is fully operational during a power outage if fire flows are necessary. The Low Level System has a generator at the McFarland Well site and Booster Pump Station. This maintains a source for the Low Level System and the ability to continue supplying water to the Coyote Reservoir for the Coyote and Powerline High Level Systems. The City's third water system generator is located at the Coyote Booster Pump Station. It provides emergency power to operate pumps that maintain system pressure and fire flow capacity for the Powerline High Level System during an outage.

SUMMARY OF SYSTEM NEEDS

Due to the City's ongoing maintenance and water system expansion to meet demands, there are no immediate pressing needs for the system. However, based on projected growth, anticipated future issues will need to be addressed before the end of the 20-year period covered in this Water System Master Plan. The water system needs identified in this Plan are briefly summarized hereafter. The reader is encouraged to refer to the text of this Plan for a more detailed discussion of the improvements.

Water Supply. Additional water sources may be necessary as soon as the year 2015, depending on growth rates. The two most promising water supply alternatives for these future demands are summarized below.

- **Columbia River Pump Station.** Using the existing Columbia River water right, the City would construct an intake structure on the bank of the river, set up a package filtration plant with chlorine disinfection, and install a transmission pipeline to the McNary Reservoir to achieve chlorine contact time before distribution into the water system. The initial treatment capacity could be sized for 1,000 gpm with future expansion by adding treatment modules as demands increase over time.

- **Shallow Well Field.** With a transferred point of diversion for the Columbia River water right, the City would plan for a shallow well field near the marina where previous test wells were drilled. If tests confirm adequate water quality such that full treatment and filtration is not required, then two to four wells would be developed and placed into service, a chlorine system would be added, and a chlorine contact chamber constructed. As future water demands increase, additional shallow wells would be constructed and

connected to the system, allowing expansion of the facility to the limits of the water right.

Water Storage. Additional storage capacity is recommended in the Powerline High Level System in the next 10 to 20 years as the area grows. The most cost effective alternative at this time is summarized below.

- **Coyote Reservoir Expansion.** Constructing a new ground-level reservoir adjacent to the existing Coyote Reservoir would meet increasing storage requirements. The current operating configuration of the Coyote Booster Pump Station would be maintained with capacity improvements installed as demands in the service area grow.

Water Distribution System. Recommended water distribution system improvements include replacing undersized water mains to improve fire flows in selected areas of the Low Level System and the addition of fire hydrants near the weigh station and businesses adjacent Interstate 82. The proposed improvements are presented below.

A. **B Street and 7th Street to I Street.** Install a new 8-inch diameter transmission line from the 6-inch diameter line in Highway 730, down B Street around on 7th Street connecting to the 12-inch diameter line in D Street. Then replace the existing 4-inch diameter water line with an 8-inch diameter line continuing down 7th Street connecting with lines in E, F, and G Streets, and terminating with the connection to the 6-inch diameter line in I Street. This will improve looping and fire flow capacity to the hydrants in this part of town.

B. **L Street and 7th Street to Randall Avenue.** Replace the 4-inch diameter line with a new 8-inch diameter water line from the 18-inch diameter line in Highway 730, down L Street to 7th Street. Make the connection to a new 8-inch diameter water line in 7th Street replacing the 4-inch diameter line extending from L Street, past the front of the school, to Randall Avenue. This will improve fire flow capacity in the area of the school and the southeast corner of the low level system.

C. **2nd and 3rd Streets with Quincy and Oliver Avenues.** Replace the existing substandard water line with new 8-inch diameter water line in a loop from 3rd Street at Oliver Avenue, north to 2nd Street, along 2nd Street to Quincy Avenue, then south to 3rd Street, and along 3rd Street ending near Patterson Avenue. This will improve fire flow capacity to the hydrants in this area of apartments.

D. **Fire Hydrant Improvements.** Install additional fire hydrants in the truck stop and weigh station area of Highway 730 and Brownell Boulevard. This will improve fire hydrant access and reduce the potential of obstructing key east/west traffic through the area on Highway 730 during a fire event.

OPERATION AND MAINTENANCE RECOMMENDATIONS

As the City of Umatilla continues to develop and expand its water system, the operation and maintenance (O&M) of the various system components will be critical to providing a reliable water system that is optimally operated. Combined with the City's continued exercising and maintenance of equipment as recommended by the manufacturers, one of the most valuable tools in analyzing present trends and projecting future needs of a water system and for general equipment upkeep is to have accurate and complete records. Well-kept records are a tremendous asset to the City in operating and maintaining the water system. Refer to Chapter 6 for a discussion on recommended O&M activities and their recurrence intervals.

COST SUMMARY

The year 2008 estimated costs for the improvements presented in this Executive Summary are detailed in the appropriate chapters of this Master Plan. The overall estimated project costs for the water system improvements are summarized in Chapter 6 and briefly summarized hereafter. Improvements are listed in the order and timeframe they are anticipated to be needed. Changes in growth rates and the pattern of growth experienced will dictate adjustments to this outline.

Timeframe	Description of Improvement	Estimated Project Cost
2008	Distribution system and fire hydrant improvements	$ 847,000
2014	Water supply improvements using a shallow well field or Columbia River pump station and treatment	$ 1,900,000 to $ 2,600,000
2020	Powerline or Coyote water storage reservoir expansion	$ 800,000
2023	Water supply expansion with the addition of shallow wells or addition of surface water treatment modules	$ 400,000

CURRENT FINANCIAL STATUS

The annual cost of operating and maintaining the Umatilla water system is summarized in Table 7-1 in Chapter 7 and shown graphically in Figure 7-1 in Chapter 7. The costs presented were obtained from the City's annual audit reports and financial statements and include all costs for the water system, such as operation, maintenance, and replacement (OM&R), staff payroll, capital outlay, and debt service.

Historical and Projected Budget Trends. The City's Water Department revenues (without interest, taxes, and miscellaneous income) have both exceeded and

fallen below annual expenditures over the period from 2000 through 2007, as shown in Table 7-1. When expenditures have exceeded revenues, miscellaneous income, or the cash carryover from previous years, has been used to pay the excess expenditures. Figure 7-1 includes an OM&R Expenditure Trend Line to highlight the City's OM&R costs for the reviewed period. The labor and material costs are growing at a rate of about 3.5 percent per year while revenues are only increasing at about 2 percent per year. This may warrant a rate increase in the near future. Without such an increase, the City may see a slow depletion of reserve funds as the ability to replenish the funds is reduced.

Existing Debt. The City currently services two outstanding bonds used for water system improvements in 1978 and 1994. The 1978 project is anticipated to be paid off in 2019 with payments totaling $62,912 annually. The 1994 loan requires an annual payment of $171,549 with an expected payoff in 2015. Fees charged the industrial park users, combined with property tax revenue, are applied to paying off these debts.

IMPLEMENTATION OF IMPROVEMENTS

The first water system related action that should be completed by the City at this time does not involve an improvement to the water system. The City needs to file an extension on the remaining unperfected portion of the Golf Course and Intertie Well water right. A Claim of Beneficial Use has been filed with the Oregon Water Resources Department for these wells at the current rate of water production. However, in order to maintain the priority date for the unused permitted volume, an extension needs to be filed.

The City is in a good position for completing improvements to the water system. By making small adjustments in water rates and using reserve funds, the City is in a position to pay for water system improvements as they are needed to meet growing demands. By avoiding unnecessary borrowing and debt, the City will allow water rates to remain as low as possible.

Beginning with the recommended distribution system improvements, the City could initiate a systematic approach of water line replacement as funds accumulate and City staff and local contractors can accommodate. The timing of the remaining improvements presented in this Water System Master Plan depends on the rate and type of growth that occurs in the City and how it affects water demand. Adjustments to water rates should be made as necessary to ensure expenses are covered and buildup of reserves should continue to cover the cost of anticipated improvements as demands require. The City will have to work closely with its citizens to keep them informed of the system needs and the necessity for adequate water rates.

Approximately three years before demand makes an additional water source necessary, preparation of a Preliminary Engineering Report on water supply alternatives should be initiated. The report should assess the alternatives available at that time including cost estimates and any relevant funding opportunities. Improvement projects should then be selected and initiated to increase capacity just in time to meet demand.

The water system improvements outlined in this Water System Master Plan will maintain a reliable, quality water system that meets the growing demands of the City. The system, with improvements as outlined, is anticipated to meet the needs of the City through the planning period and beyond, unless an unanticipated regulatory change impacts the City's system in the future.

CHAPTER 1

INTRODUCTION

PURPOSE OF THE STUDY

This Water System Master Plan represents the results of a study authorized by an agreement between the City of Umatilla, Oregon, and Anderson·Perry & Associates, Inc.

The purpose of the study and the resulting Water System Master Plan is to thoroughly evaluate the existing water system to determine system deficiencies and the improvements needed to correct them. More importantly, the Plan includes recommendations for system improvements that will be required to meet the increasing water demand that will be placed on the system by community growth through the year 2027.

Specifically, the study will accomplish the following:

1. Delineate the basic design and planning criteria such as existing and future water demand; present and future service areas; growth patterns and population projections; and supply, storage, and distribution system requirements.

2. Analyze the present system to determine its capability to meet present and future requirements.

3. Identify system deficiencies and delineate improvements required to remedy these deficiencies.

4. Develop a prioritized schedule and cost estimates for the recommended improvements.

5. Summarize the financial status of the system and identify potential funding options.

DESCRIPTION OF THE COMMUNITY

The City of Umatilla is a rural eastern Oregon community with a population of approximately 6,440 (2007). Figure 1-1, Location and Vicinity Maps, shows the location of the City relative to surrounding cities. The City is located on Interstate 82 on the south side of the Columbia River, adjacent to the McNary Dam, approximately 25 miles south of the Tri-Cities, Washington, and 5 miles north of the City of Hermiston, Oregon. The economy of the community is primarily based on agriculture. The development of manufacturing and industrial facilities and the Two Rivers Correctional Institution at the Port of Umatilla in the McNary area contribute to the diversification of the area's economy.

ENVIRONMENT

The climate of the area is arid, as is typical of much of the north-central Oregon and south-central Washington portion of the Columbia Basin. Total annual precipitation is only approximately 9 inches, of which only about 4 inches fall during the irrigation season from May to November. Temperatures during the summer can exceed 100°F.

TRANSPORTATION

Interstate 82 and U.S. Highway 395 join at the City of Umatilla before crossing the Columbia River into Washington. These major highways are intersected by U.S. Highway 730, which parallels the Columbia River. A Union Pacific rail line provides rail access to the City's industrial area, and the Columbia River is a major transportation route for barge traffic. With a combination of highway, rail, and river transportation methods, the City of Umatilla is easily accessed from both north-south and east-west corridors as shown in Figure 1-1.

RECREATION

Major recreational opportunities available in the immediate vicinity of Umatilla include fishing, hunting, boating, and golf.

The Columbia River and its impoundments offer fishing for various spiny-ray species such as walleye, smallmouth and largemouth bass, and perch. The white sturgeon grows to giant size in the river, though catch-and-keep fishing for them is strictly regulated. Anadromous fish such as salmon and steelhead also inhabit the river.

The Umatilla Golf and Country Club is located in the McNary area. It provides an 18-hole golf course as well as a restaurant and motel. Several other golf courses are also located in the region.

The surrounding areas are inhabited by resident populations of upland birds such as pheasant, quail, and Chukar and Hungarian partridges. There are large populations of migratory water fowl in the area in the fall and winter months. Several species of ducks and geese pass through the area on their migration through the flyway.

WATER SYSTEM HISTORY

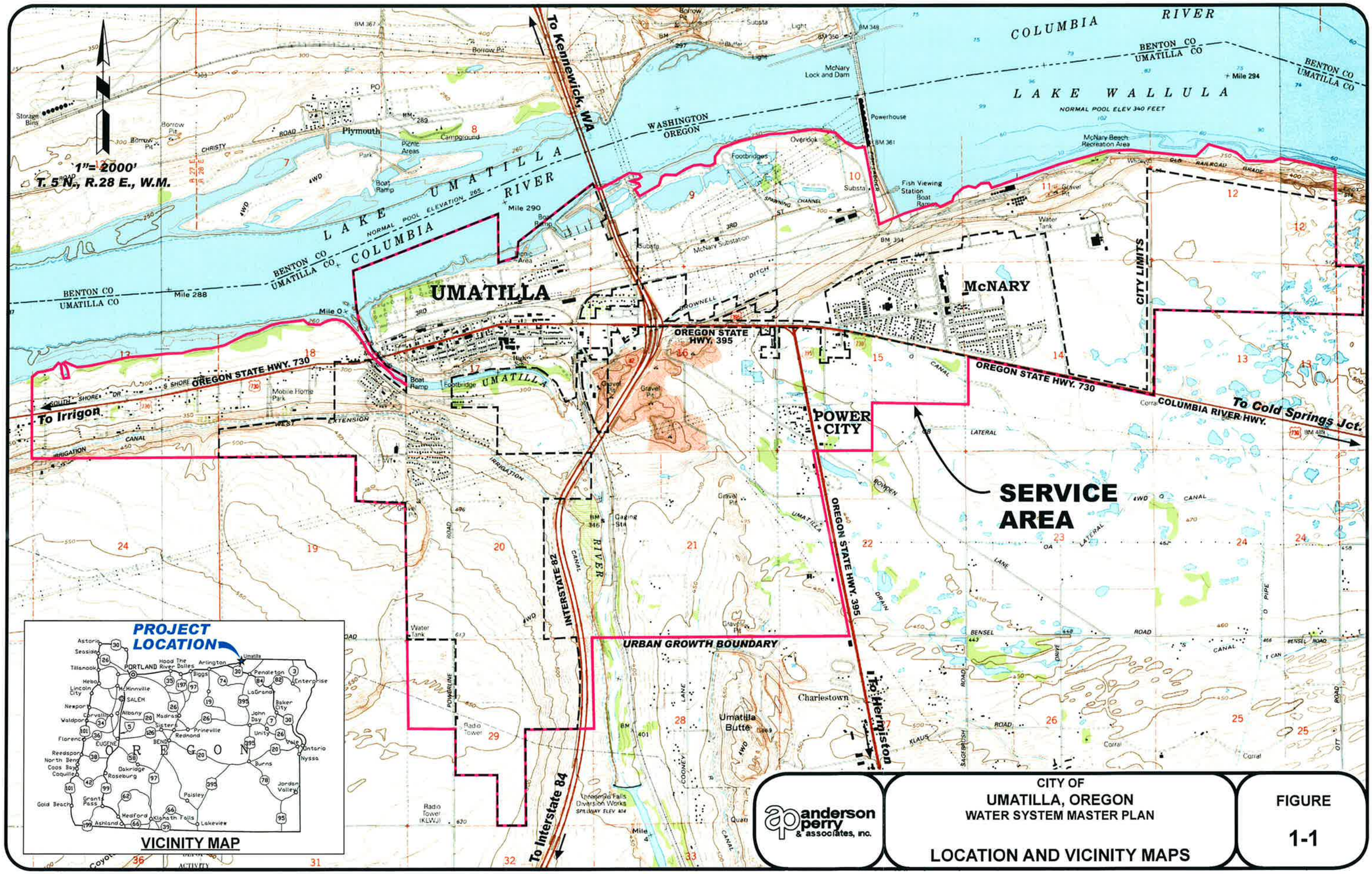
The original water system was constructed somewhere between 1935 and 1943. The original water supply well was constructed at an unknown date, presumably around 1935. It is reported that the original McFarland Reservoir was constructed in 1935. In 1943, the well referred to as the "River Well" was constructed. Four years later, in 1947, the existing McFarland Well was constructed adjacent to the McFarland Reservoir. In 1954, a ground-level steel reservoir was added near the McFarland Well and Reservoir.

The McNary area system was constructed when McNary Dam was being constructed by the Corps of Engineers. It included a distribution system, elevated Port reservoir, and a couple of wells located near the dam. A portion of this system was turned over to the Port of Umatilla. In 1975-76, the City of Umatilla took over a portion of the Corps' system, mainly the town site distribution system. In 1994, the City took over a portion of the Port of Umatilla's water system. This included the elevated reservoir and distribution system. In 2001, the Port Well, which was drilled in 1967, was transferred to the City with a 40-year lease.

In 1977-78, a major water system improvements project added the Intertie Reservoir, Coyote Reservoir, and McFarland Booster Pump Station. This major improvement project also included the installation of a number of water distribution lines within the City. In 1978, the Golf Course Well was drilled and added to the system. The Intertie Well was completed in May 1979.

In 1995-96, the City made major improvements to their water system in the McNary residential and Port Industrial areas. The Golf Course Well was refurbished and a 1.8 MG reservoir constructed. A major booster pump station was constructed to serve the area. All of these facilities are backed up for emergency use by diesel generators and motors. As part of the 1995-96 project, new distribution piping, valves, and fire hydrants were installed, and the old McNary Township distribution system was replaced. Additionally, all users were metered.

Beginning in 1999, in the early phases of preparing this Master Plan, additional improvements were made to the City's water system. An automatic intertie valve and flowmeters were constructed at the McNary Booster Pump Station, connecting the McNary High Level System with the Low Level System. The Coyote Booster Pump Station was constructed in 2000 to serve a new Powerline High Level System pressure zone. In 2001 the City installed new booster pumps and emergency generator upgrades to the McFarland Booster Pump Station. At that time, they also installed a new telemetry control and monitoring system at each pump station and reservoir.



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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

LOCATION AND VICINITY MAPS

FIGURE
1-1

CHAPTER 2

WATER SYSTEM REQUIREMENTS

INTRODUCTION

This chapter of the Water System Master Plan reviews land use and identifies the location of the study area. The current population and the projected growth are discussed. The system design criteria such as past, present, and future domestic and fire demands and the various storage components are analyzed. Federal and state regulations and other design parameters are also presented.

SERVICE AREA AND LAND USE

The service area of the City of Umatilla water system contains four separate pressure zones and is defined by the Urban Growth Boundary shown in Figure 2-1. The City is currently served by four intertied water systems: the McNary High Level System, the Low Level System, the Coyote High Level System, and the Powerline High Level System. The pressure zones are defined on Figure 2-2.

There are also two small water systems within the City's Urban Growth Boundary that are not owned or operated by the City. The first is the Corps of Engineers system. It serves the area of the dam. This system consists of two deep basalt wells, a reservoir just west of the golf course, and some distribution piping going to the dam. The second system is the Power City system. It serves the small community of Power City just west of Highway 395. This system consists of a well, small reservoir, and small booster pump station.

The McNary High Level System primarily serves the area east of U.S. Highway 395. The majority of the area served lies north of U.S. Highway 730 and includes the McNary residential area and the Port of Umatilla's McNary Industrial Park. The Two Rivers Correctional Institution (TRCI) is located in this service area on the east side of the industrial park. The majority of the industrial facilities in the City are located within this area.

The Low Level System provides service to the downtown area and some of the residential areas to the south and east of the City center. In general, this system encompasses properties west of Interstate 82 and properties north of Grant Street to the Columbia River. The City center is primarily commercial, with an interspersing of residential and community service facilities.

The Coyote High Level System serves a residential area from Tyler Drive south to Jackson Street and on each side of Powerline Road from approximately Elevation 450 to 550 feet. This area is referred to as the South Hill area.

The Coyote Booster Pump Station serves the Powerline High Level System. This pressure zone ranges from Elevation 550 to Elevation 670 feet on each side of

Powerline Road within the Urban Growth Boundary. The Coyote Booster Pump Station draws water from the Coyote Reservoir providing flow and pressure to the system. Additional discussion of the City's four pressure zones and the distribution system is included in Chapter 5.

POPULATION

The 1990 Census established the population of the City of Umatilla at 3,046 residents. The 2000 Census placed the population at 4,978 residents of which 699 were of the first phase of occupants in the TRCI. The net population of the City for the year 2000 was 4,279 residents, which represents a 40 percent increase for the 10 years between censuses. This is an annual growth rate of 3.46 percent.

In the 1997 Wastewater Facilities Plan, the City adopted a population growth rate of 2.6 percent for projecting long-term population increases. This was based on anticipated projects that would create growth in the community. Shortly after that time, several major projects with job creation were under construction in Umatilla County. These included the TRCI within the City, the Wal-Mart Distribution Center in Hermiston, a major expansion of the Union Pacific Railroad yard at Hinkle, and the Umatilla Army Depot Chemical Weapons Incinerator. An estimated 2,200 permanent jobs were created by the new facilities, with 550 of these in Umatilla at the TRCI.

To establish a representative growth estimate for planning purposes, the City reviewed the Hermiston, Umatilla, Echo, and Stanfield (HUES) Growth Impact Study prepared by Benkendorf Associates Corporation and the Umatilla County Alternative Population Forecasts prepared by David Evans & Associates, Inc. To predict annual average growth, the studies presented the convergence method and the convergence method modified to HUES communities. The first method presented a calculated average annual rate of growth to be 3 percent and the second to be 3.6 percent. In 2001 the City Administrator and the Water Committee selected a 3.6 percent growth rate to be used for water system planning. Accounting for actual growth since that time, the rate is applied to the 2007 City population estimate for future populations as graphically shown in Figure 2-3.

The Portland State University Center for Population Research and Census estimates the 2007 population of the City of Umatilla to be 6,440 residents. This includes 1,754 occupants of the TRCI and 4,686 residents of the City. In spite of all the recent growth, the potential for future expansion of the TRCI facility and development within the McNary Industrial Park and other areas in the region is strong. There continues to be significant pressure for residential development and commercial growth in Umatilla and surrounding communities. Therefore, the projected annual population growth of 3.6 percent is appropriate for planning purposes through the period of this Plan. With this growth rate applied to the City's population estimate and full occupation of the TRCI, the projected population for the year 2027 including TRCI is 11,318 persons. This number will be used for design and planning purposes.

FEDERAL AND STATE REQUIREMENTS

The City of Umatilla's water system comes under the jurisdiction of the Oregon Department of Human Services - Drinking Water Program (DWP). The DWP assumed primacy (responsibility) from the U.S. Environmental Protection Agency (EPA) in February 1986 for enforcement of the Federal Safe Drinking Water Act (SDWA). Therefore, the City of Umatilla is currently, and in the future will be, dealing principally with the DWP as the regulating agency with regard to their water system.

Regulatory History. The Federal "Interim Primary Drinking Water Regulations" went into effect in 1977 as a result of the Safe Drinking Water Act of 1974 (Public Law No. 93-523). The primary regulations address requirements concerning elements, trace minerals, compounds, and micro-organisms that may affect the health of water consumers. The Act provides for monitoring, testing requirements, reporting, recordkeeping, and public notification procedures in the event of non-compliance. These regulations have necessitated the revision and upgrading of many water systems to meet the requirements of the Act.

1986 Amendments to the Safe Drinking Water Act. The United States Congress first enacted the Safe Drinking Water Act in 1974. In 1986, amendments became effective that required the EPA to develop additional rules for drinking water with which water purveyors must comply. As the new rules were developed, the Drinking Water Program has been adopting them. The following describe the impacts of the EPA Administrative Rules:

1. Considerably increased the number of samples and tests the City will have to perform for regulated and unregulated contaminants.

2. Required continuous disinfection of surface water supplies and groundwater supplies when used in conjunction with surface water.

3. Required filtration of most surface water sources.

4. Initiated expanded monitoring for all systems.

5. Changed current public notification requirements.

6. Ensured more aggressive enforcement on the part of the EPA.

Prior to the 1986 amendments, maximum contaminant levels (MCLs) had been set by the EPA for 22 regulated contaminants. The 1986 amendments contain a list of 83 contaminants to be regulated. These include volatile organic compounds (VOCs), synthetic organic chemicals (SOCs), trihalomethanes (THMs), 6 contaminants related to microbiology and turbidity forms, 18 inorganic contaminants, 40 organic contaminants, and 5 radionuclides. A majority of these contaminants were regulated by the EPA as of June 1989 and the state adopted the regulations in 1991.

In the 1986 amendments, congress directed the EPA to add 25 contaminants to the list every three years. The 1996 reform bill (discussed later in this section) changed this requirement, allowing the EPA to consider adding only five contaminants to the list every five years. Therefore, the list of contaminants the City will have to test for may not expand as rapidly as before, but will likely continue to expand in the future. Additionally, amendments for disinfection requirements will be adopted in the future. With the growing list of regulated contaminants, communities will be faced with the responsibility of more sampling and testing in order to remain in compliance.

The EPA has developed regulations that will provide for different types and frequency of public notification of violations based on the frequency and severity of the violation. The revised public notification requirements included in the 1986 amendments, which took effect in April 1989, require water systems to notify the persons they serve when the following instances occur:

1. When a violation of a National Primary Drinking Water Regulation or its monitoring requirements occurs.

2. When variances or exemptions are in effect.

3. When the water system does not comply with any schedule associated with a variance or exemption.

The DWP has responsibility for administering the public notification system for public water systems in Oregon. They work closely with public water systems to make sure public notification is made in accordance with regulatory guidelines, when required.

The 1986 amendments also forbid the use of pipe, solder, or flux that is not "lead-free" in public water systems or any plumbing connected to a public water system after June 1988. Lead-free is defined as 8 percent or less lead for pipes and fittings and 0.2 percent or less lead for solder and fluxes. This requirement is not intended to affect any pipe, fittings, etc., already in place. However, those systems with lead materials in their distribution systems must provide notice to "persons that may be affected by lead contamination of their drinking water." This notice must be provided even if lead concentrations in the water do not violate allowable concentrations. This provision does not apply to leaded joints necessary for the repair of cast iron pipes.

Safe Drinking Water Act Reform Bill. On August 6, 1996, the Safe Drinking Water Act reform bill was signed. The SDWA amendments of 1996 gave the EPA new ranking orders for developing rules to ensure the safety of public water supplies. The law emphasizes controlling the greatest risks at the best price, preventing contamination of source water, informing consumers annually of contaminant levels and health effects, and providing states with new flexibility to implement regulations and small systems compliance relief and assistance. Some of the key items of the reform bill that have already been passed into law are summarized below.

1. **Operator Certification**, which requires every water supplier to employ an operator to supervise the water system. The operator is required to be

certified at a grade equal to the classification of the water system. Roger Frances is currently the City's certified operator.

2. **Consumer Confidence Report (CCR)**, which requires community water systems serving 15 or more year-round customers to prepare an annual CCR to provide customers with information about the quality of their drinking water. Annual CCR reports were first due in October 1999 and the City has distributed reports annually, as required.

3. **The Arsenic Rule**, which became effective in March 2001, lowers the maximum contaminant level (MCL) for arsenic allowed in a community water system from 50 parts per billion (ppb) to 10 ppb. Testing in 2003 and 2005 resulted in no detection of arsenic.

4. **The Disinfectants/Disinfection By-product Rule (D/DBPR)**, which reduces levels of disinfectants and DBPs in drinking water supplies to provide public health protection from exposure to trihalomethanes, haloacetic acids, chlorite, and bromate. This rule applies to community water systems that treat their water with a chemical disinfectant, such as chlorine, for either primary or residual treatment. Required sampling was completed in 2007 and submitted to the DWP.

5. **The Groundwater Rule**, which specifies the appropriate use of disinfection while addressing other components of groundwater systems to ensure public health protection. This rule became a law in October 2006. The law requires groundwater systems to be evaluated on a case-by-case basis to determine if the system is susceptible to fecal contamination and whether or not disinfection is necessary. Source water monitoring may be required if coliform test results indicate a presence of coliforms.

6. **Radionuclides Rule**. Regulations for radionuclides in drinking water were first discussed in 1976 as interim regulations under the authority of the 1974 SDWA. The 1986 and 1996 SWDA amendments revised the rule, and the revised Radionuclides Rule was published on December 7, 2000. The Radionuclides Rule sets standards for beta and photon emitters, radium (radium-226 and radium-228), gross alpha radiation, and uranium.

   The DWP accepted radionuclide data collected prior to December 8, 2003, to substitute for the Initial Compliance Monitoring required by the rule. Water systems had to monitor once at each supply point to the water system for gross alpha, combined radium-226/228, and uranium by December 8, 2003, in order to avoid the four consecutive quarterly samples. The City of Umatilla conducted this testing on October 23, 2003, and no radionuclides were detected.

Another key item of the 1996 reform bill that is not yet law, but is anticipated to be law in the near future, is the following:

The Radon in Drinking Water Rule, which attempts to reduce airborne and waterborne radon concentrations to limit exposure levels. This rule will apply to community water systems serving 25 or more people that use groundwater or mixed ground and surface water.

Public Health Security and Bioterrorism Preparedness and Response Act of 2002. The Safe Water Drinking Act requires that communities with water systems serving greater than 3,300 people conduct assessments of the vulnerability of their systems to terrorist attacks or other intentional acts to disrupt water delivery to the community. In addition to the vulnerability assessments, the Act addresses Emergency Response Plans. Oregon Administrative Rule (OAR) 333-061-0064 has been developed by the DWP to implement the measures prescribed in the federal act. This rule requires all public water systems to develop Emergency Response Plans by June 30, 2005. The City of Umatilla has completed an Emergency Response Plan and notified the DWP of its completion. The Emergency Response Plan should be reviewed and updated at least every five years.

Regulatory Violations. The City of Umatilla has good water quality with a well run water system operation meeting federal and state water quality criteria. The DWP has issued two violations against the City in the past five years related to consumer confidence report reporting. Corrective action was taken and the City is in compliance. These violations are documented in the DWP's Water Quality Summaries presented in Appendix A.

Regulatory Requirements Summary. In summary, many regulations affect operation of the City of Umatilla's water system. The information presented herein is intended to provide the City with a brief summary of the regulations and possible future regulations that will likely affect operation of the City's water system. In general, it appears the City is keeping up to date with water testing and reporting requirements. Water system regulations continue to expand and will require careful attention to maintain future compliance. It is recommended that the City of Umatilla consult with the DWP in Pendleton, Oregon, if any regulatory questions or issues arise.

SANITARY SURVEY

The DWP conducts sanitary surveys of communities to assist in identifying potential contamination sources that may impact water quality. These surveys are generally scheduled to occur every five years.

The City of Umatilla's latest sanitary survey was conducted on April 29, 2004. The primary finding of the survey was that the asbestos monitoring sample was not current, and notification that annual disinfection byproduct sampling would be starting the same year. The City performed the necessary asbestos and disinfection byproduct sampling in August 2004. The result of the asbestos test was "no detect" and the once-every-nine-year monitoring requirement is satisfied. The disinfection byproduct sample resulted in detection of haloacetic acids and trihalomethanes significantly below the maximum contaminant level. As stated earlier, additional D/DBPR sampling and

reporting was completed in September 2007. A copy of the full 2004 Sanitary Survey is included in Appendix B.

WATER DEMAND

Water demand projections are used in this planning process to determine and plan for future water system development requirements. Demand projections are based on and determined by water usage history and population projections. They are usually stated as volumes of water consumed per period of time. Commonly used demand descriptions are average daily demand (ADD), peak daily demand (PDD), and peak hourly demand (PHD). Others such as peak month daily demand (PMDD) are used for comparative purposes.

The ADD is a measure of the overall annual average rate of consumption in a system. It is derived by dividing the total water produced during the year by the average annual population. Adjustments are sometimes necessary because of large water volumes that may be used by agricultural processing plants or, in the case of Umatilla, the TRCI. The ADD is stated in gallons per capita per day (gpcd) and can be converted to flow rates of gallons per minute (gpm) for use in analyzing source and storage facility requirements.

The PDD is a measure of water used during the highest single day's consumption of the year. The volume of water used is measured by source meters and usually occurs during the peak month of the year. It is stated in gpcd and is determined by dividing the peak day water production by the total number of people served at that time.

The PHD is the maximum flow occurring during a one-hour period. It is the highest hour of the year and is also measured in gpcd. It is based on flowmeter readings or estimated rates derived by multiplying the PDD by a factor of 2.0 to 2.5. The PHD, when converted to a flow measured in gpm, is a prime factor in the sizing of transmission lines and distribution system piping.

The City of Umatilla's most recent demand figures were obtained by analyzing production records compiled through source meter readings for all City wells for the period 2001 through 2007. Figure 2-4 presents the monthly total water production from all wells for the years 2001 through September 2007. It graphically illustrates the typical pattern of high summertime and low wintertime water usage.

The fiscal year of highest metered water usage on record is 2003-04, with 442,495,000 gallons used, for an ADD of 1.212 million gallons (MG). Due to the significant difference of water use by city residents and residents of the TRCI, water demands are calculated separately based on metered use at the TRCI. Reviewing the last five years of data results in water demand characteristics as presented in Table 2-1. Analysis of the City's daily flowmeter records determined that the PDD can be represented as 2.3 times the ADD. This results in the peak daily demands also shown in Table 2-1.

The five-year averages for the City and TRCI average and peak demands appear to be representative of water use in the community. For design purposes, the averages have been adjusted to an average daily demand of 210 gpcd and 100 gpcd, respectively, for the City's and TRCI's demands. Peak daily demands of 483 gpcd and 230 gpcd are used for this study.

Applying these design values to the 2007 population indicates that the average daily flow (ADF) necessary today is 805 gpm with a peak day flow (PDF) of 1,850 gpm. Projecting these design values to the 2027 population provides a basis for future water system demands. With growth as projected, the City will require an ADF of 1,510 gpm, a PDF of 3,480 gpm, and must be able to support peak hour flows (PHF) of 8,700 gpm.

Table 2-2, Summary of Design Criteria - Supply, lists all existing and projected demand data. Table 2-3, Summary of Design Criteria - Storage, lists existing storage and requirements projected through 2027. Chapter 4 outlines the development of the City's water storage criteria.

DISTRIBUTION OF WATER USAGE

An estimation of the distribution (location) of water usage within the overall Umatilla water system should be made because this usage (demand) will change during the design period. The McNary High Level System presently uses a certain percentage of the total water production in the system. That percentage will probably change by the end of the design period in the year 2027. The reason is that growth within the City will not occur uniformly within each pressure zone.

For the year 2006-07, the McNary High Level System used 53 percent of the total quantity of water produced by the City. Though there were minor transfers from the McNary system to the Low Level System, the 53 percent figure is believed to be representative of system usage. Records of the McFarland and Coyote Booster Pump Stations identify the distribution of 15 percent and 2 percent water to the Coyote and Powerline High Level Systems, respectively. This means the Low Level System accounts for the remaining 30 percent of total annual water production. The table below is a tabulation, by system, of the percentage of the total annual production and the volume of water used within each system.

System	2007 Consumption	
	% of Total	Volume of Water
McNary High Level	53%	232.5 MG
Low Level	30%	131.6 MG
Coyote High Level	15%	65.8 MG
Powerline High Level	2%	8.8 MG
TOTALS	**100%**	**438.7 MG**

PROJECTION TO THE YEAR 2027

The percentages previously derived for distribution of demand will most likely change considerably by the year 2027. With a predicted population growth of nearly 4,900 from the year 2007 to 2027, the location of the growth must be considered. Residential growth will be a significant factor. The McNary area is expected to experience the majority of industrial growth, while the area served by the Low Level System should have the majority of the commercial growth. The South Hill area, served by the Coyote and Powerline High Level Systems, should have the highest percentage of residential growth.

For purposes of evaluating water supply and storage, the following distribution of demand growth will be used.

System	% of 2007 Demand	% of Design Period Growth	% of 2027 Demand
McNary High Level	53%	20%	38%
Low Level	30%	15%	23%
Coyote High Level	15%	30%	22%
Powerline High Level	2%	35%	17%
TOTALS	**100%**	**100%**	**100%**

The total water demand for the year 2027 has been projected to be 794.7 MG. Therefore, the growth over and above the 2007 total demand is 356.1 MG. Applying the growth percentages listed in the previous table to the 356.1 MG results in the increased consumption for each system. The following table totals the expected demands for the year 2027.

System	2027 Consumption (projected)	
	% of Total	Volume of Water
McNary High Level	38%	303.7 MG
Low Level	23%	185.0 MG
Coyote High Level	22%	172.6 MG
Powerline High Level	17%	133.4 MG
TOTALS	**100%**	**794.7 MG**

DESIGN CRITERIA

In establishing design standards for a water system, primary consideration must be given to state and federal rules and regulations governing water quality and construction standards for water systems. These regulations, as previously stated, are set by both the U.S. Environmental Protection Agency and the Oregon DWP. In addition to these public health and safety requirements, there are many other factors that control the design parameters for municipal water systems. The City must evaluate many other factors such as financial feasibility, philosophy and policies of the City Council, past system performance and service, and expectations of the water users. All of these factors are important and can influence the standards by which water system improvements are made.

Tables 2-2 and 2-3 present a summary of the water system design criteria used in evaluating the existing water system and developing improvements to satisfy present and anticipated future needs. The application of these criteria is discussed further in the specific chapters that address the water supply, storage, and distribution system facilities. The tables present design criteria, based on the present service population of 6,440, present estimated average and maximum daily demands, as well as the year 2027 design criteria based on a 3.6 percent growth per year in the City. Storage volumes are derived from calculations in Chapter 4. The design criteria presented in Tables 2-2 and 2-3 are used as base information in later chapters for evaluating the City's existing and future system needs and capability.

Water Demand

Fiscal Year	Population		System Demand			City Demand			TRCI Demand		
	City	TRCI	Annual (MG)	ADD (MG)	PDD[1] (MG)	Annual (MG)	ADD (GPCD)	PDD (GPCD)	Annual (MG)	ADD (GPCD)	PDD (GPCD)
2002-03	4,438	1,632	404.0	1.11	2.55	341.1	211	484	62.9	106	243
2003-04	4,518	1,752	442.5	1.21	2.79	373.8	227	521	68.7	107	247
2004-05	4,618	1,752	408.7	1.12	2.58	352.3	209	481	56.4	88	203
2005-06	4,631	1,754	382.9	1.05	2.41	322.6	191	439	60.3	94	217
2006-07	4,686	1,754	438.7	1.20	2.76	367.2	215	494	71.5	112	257
5-Year Average			415.4	1.14	2.62	351	210	484	64	101	233

Notes:
1. PDD calculated as 2.3 times ADD based on flowmeter records analysis.

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

WATER DEMAND

TABLE
2-1

Summary of Design Criteria - Supply

		2007 (Design Value)			2027		
		Design Population					
		City	TRCI	Total	City	TRCI	Total
		4,686	1,754	6,440	9,506	1,812	11,318
Average Daily Demand (ADD)	gpcd	210	100		210	100	
Average Day Flow (ADF)	gpm	685	120	805	1,385	125	1,510
Peak Day Demand (PDD)	gpcd	483	230		483	230	
Peak Day Flow (PDF)	gpm	1,570	280	1,850	3,190	290	3,480
Peak Hour Demand (PHD)	gpcd	1,208	575		1,208	575	
Peak Hour Flow (PHF)	gpm	3,930	700	4,630	7,975	725	8,700

Fire Demand	Rate of Flow	Duration
Residential	750 gpm	2 hours
Commercial and Industrial	3,000 gpm	3 hours

Minimum Residual Pressure under Maximum Demand plus Fire Flow = 20 psi

Factors Used: 2.3 ADD = PDD
2.5 PDD = PHD

Abbreviations
gpcd = gallons per capita per day
gpm = gallons per minute
psi = pounds per square inch
gal = gallons

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CITY OF
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WATER SYSTEM MASTER PLAN
SUMMARY OF DESIGN CRITERIA - SUPPLY

TABLE
2-2

Summary of Design Criteria - Storage

Component	2007 Requirements (gallons)				2027 Requirements (gallons)			
	McNary High Level	Low Level	Coyote/ Powerline High Level	System Wide	McNary High Level	Low Level	Coyote/ Powerline High Level	System Wide
Fire Suppression Storage	540,000	540,000	180,000	1,260,000	540,000	540,000	180,000	1,260,000
Emergency Reserve	637,000	360,500	204,400	1,202,000	832,100	506,800	838,400	2,177,300
Operating Storage	587,000	350,000	383,000	1,320,000	587,000	350,000	383,000	1,320,000
Equalizing Storage	96,500 [1]	102,000 [2]	- [3]	235,500 [4]	213,300 [1]	189,500 [2]	307,300 [3]	819,500 [4]
Total Storage Requirement	1,860,500	1,352,500	767,400	4,017,500	2,172,400	1,586,300	1,708,700	5,576,800
Storage Available	1,925,000	2,150,000	700,000	4,775,000	1,925,000	2,150,000	700,000	4,775,000
Source Contribution[5]	1,080,000 [6]	800,000 [7]	- [8]	-	1,080,000 [6]	800,000 [7]	- [8]	-
Storage Surplus (Shortage)	1,144,500	1,597,500	(67,400)	757,500	832,600	1,363,700	(1,008,700)	(801,800)

1. Based on the top producing well in the pressure zone being off line
2. Based on the Intertie Well production capacity
3. Based on the McFarland Booster Pump Station production capacity with one pump off line
4. Based on the top producing well in the system being off line
5. Additional effective storage capacity available with a transfer from another pressure zone
6. McNary Emergency Booster Pump Station at 750 gpm
7. McFarland Well or McNary Intertie Valve at 555 gpm
8. The McFarland Booster Pump Station is the sole source to the Coyote and Powerline High Level Systems, which is included in the value for Equalizing Storage

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CITY OF
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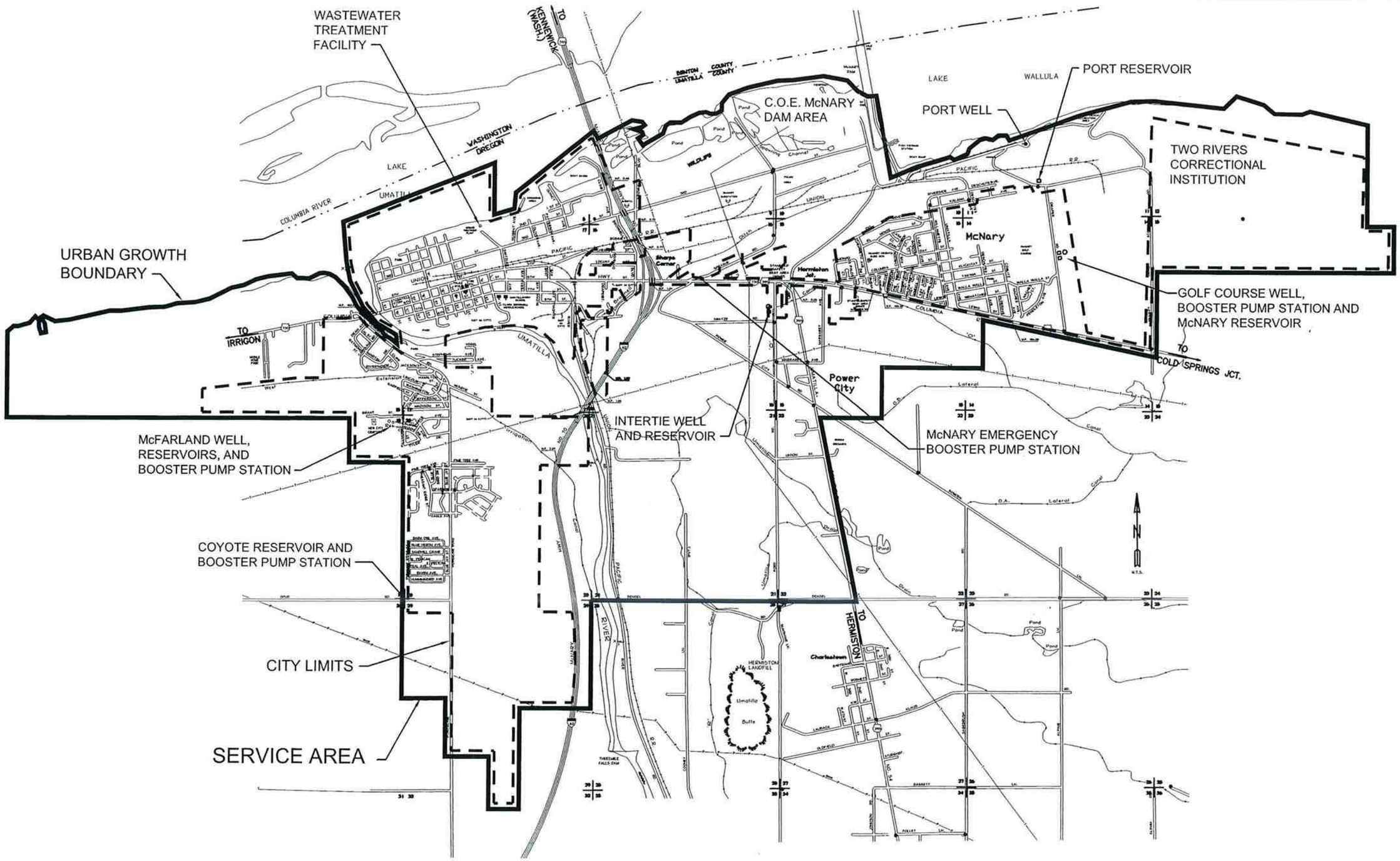
WATER SYSTEM MASTER PLAN
SUMMARY OF DESIGN CRITERIA - STORAGE

TABLE
2-3



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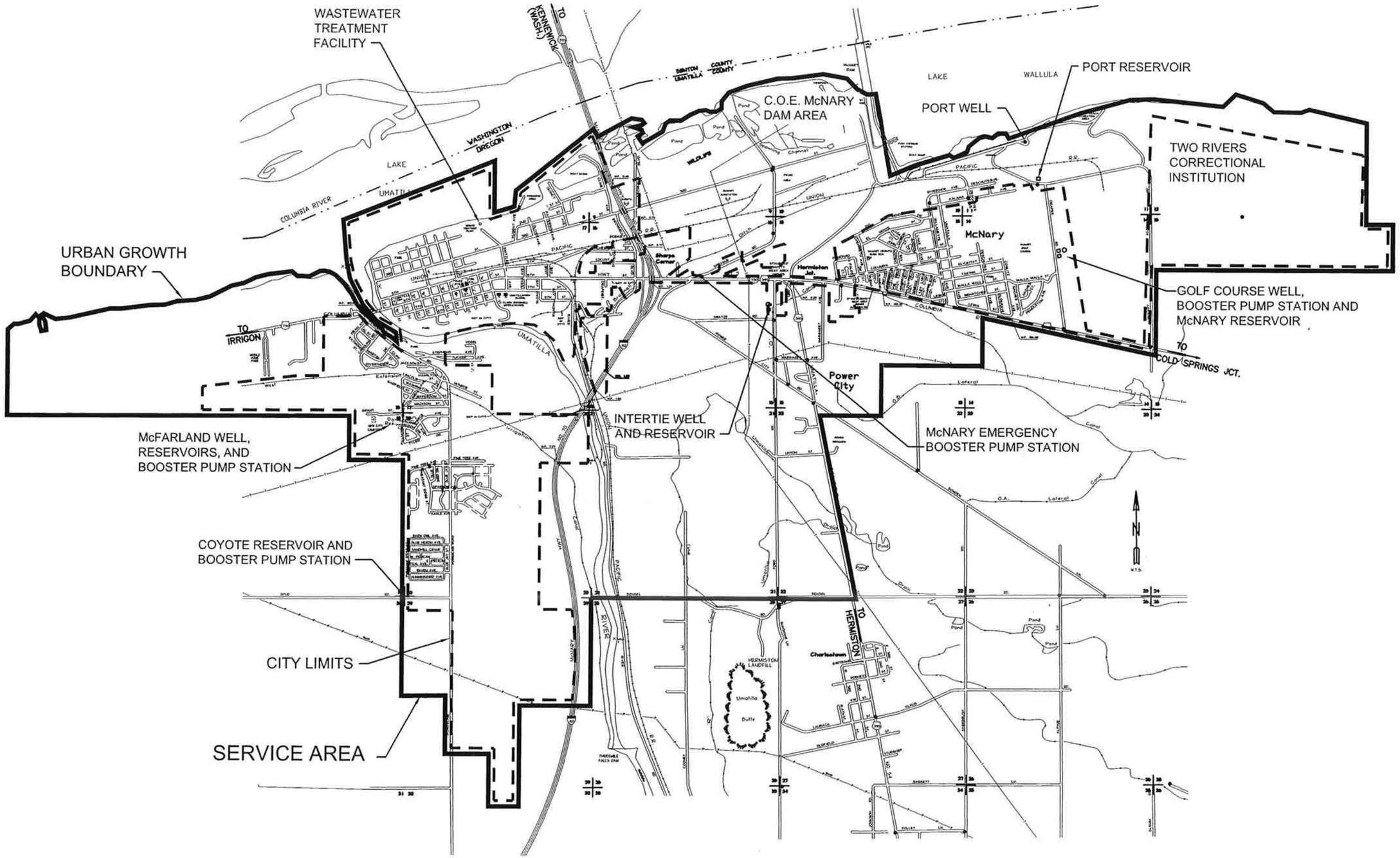
CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

SERVICE AREA

FIGURE
2-1



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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

SERVICE AREA

FIGURE
2-1

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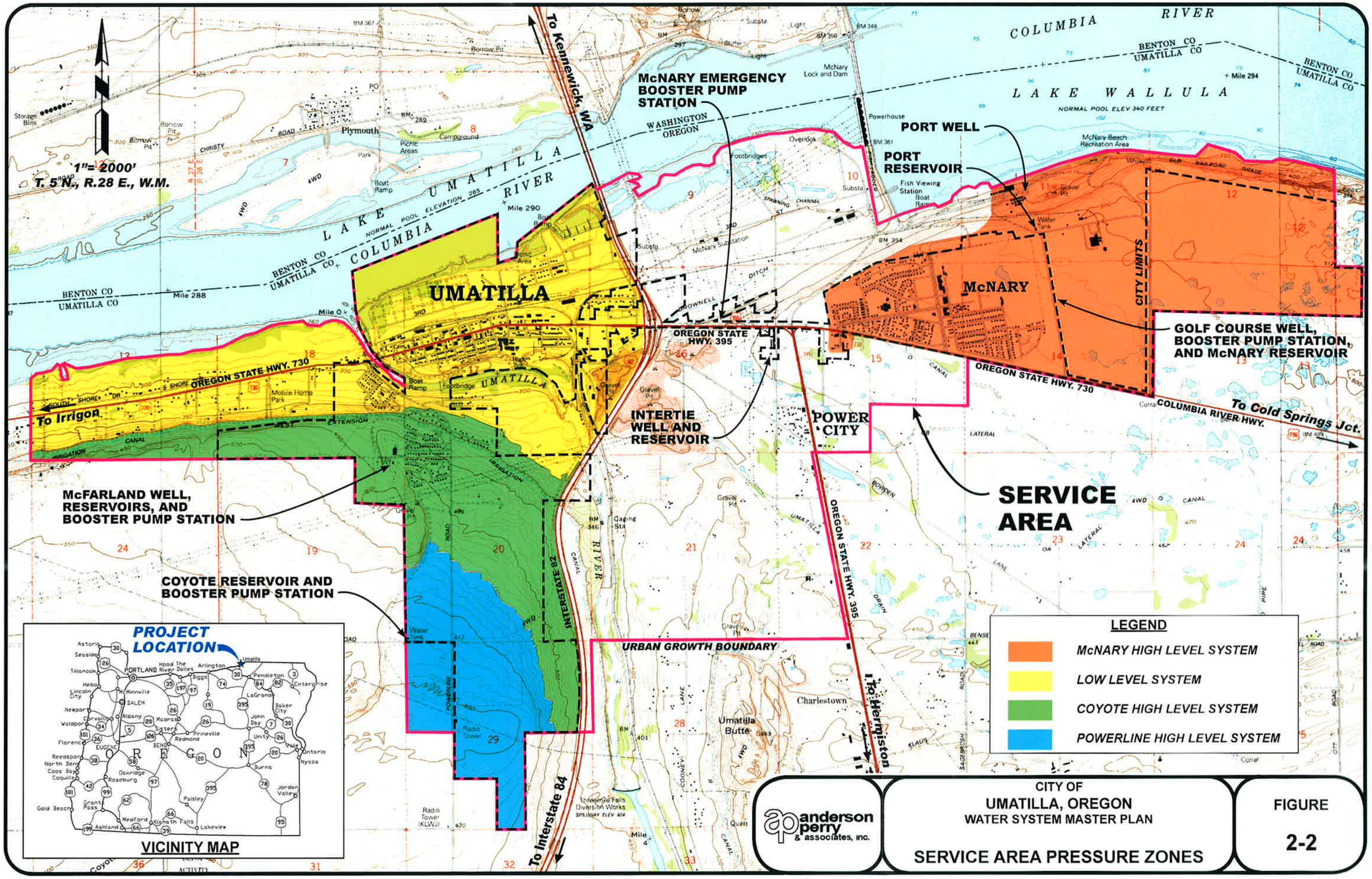

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CITY OF
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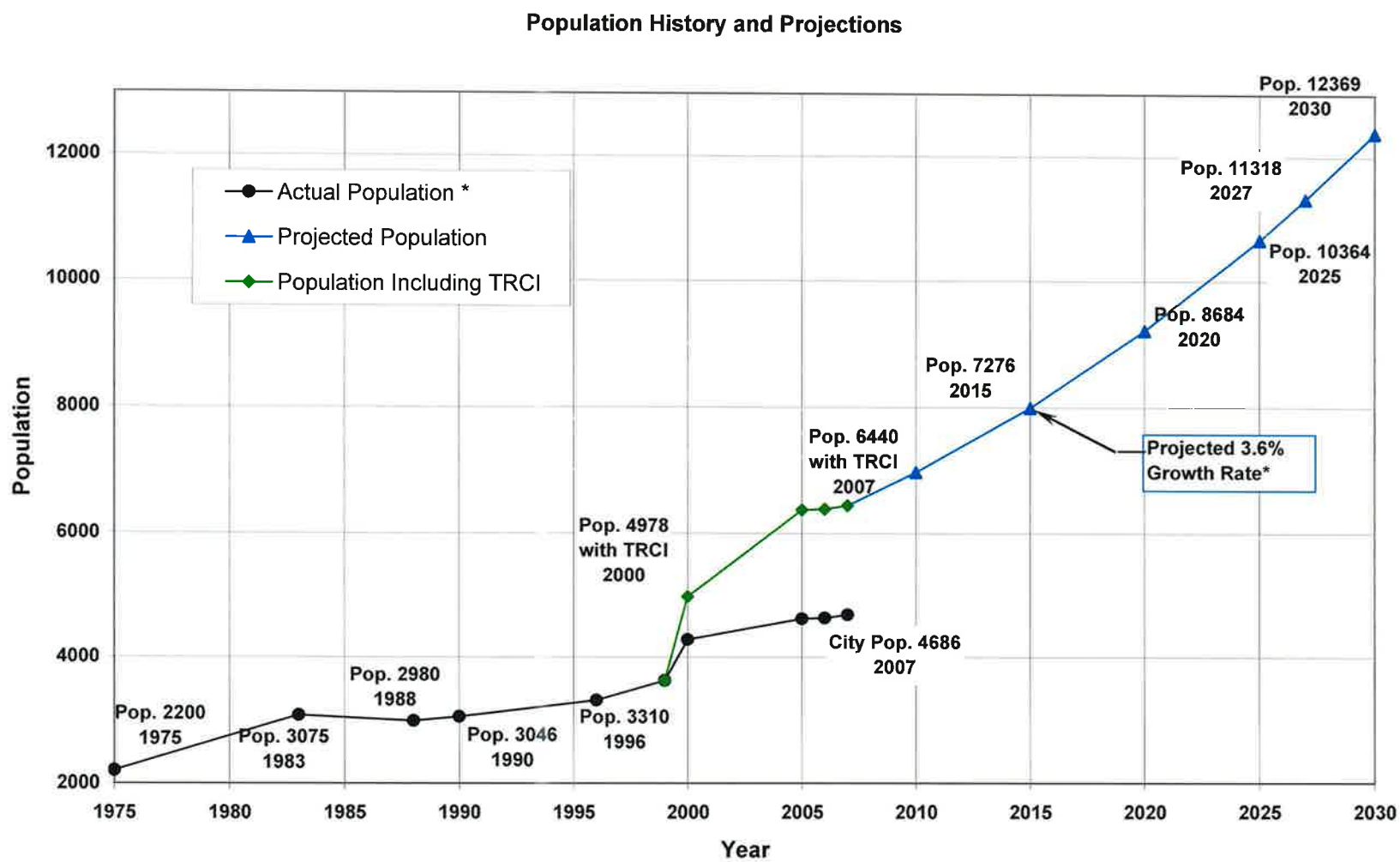
WATER SYSTEM MASTER PLAN

SERVICE AREA PRESSURE ZONES

FIGURE
2-2



* Does not include TRCI population

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CITY OF
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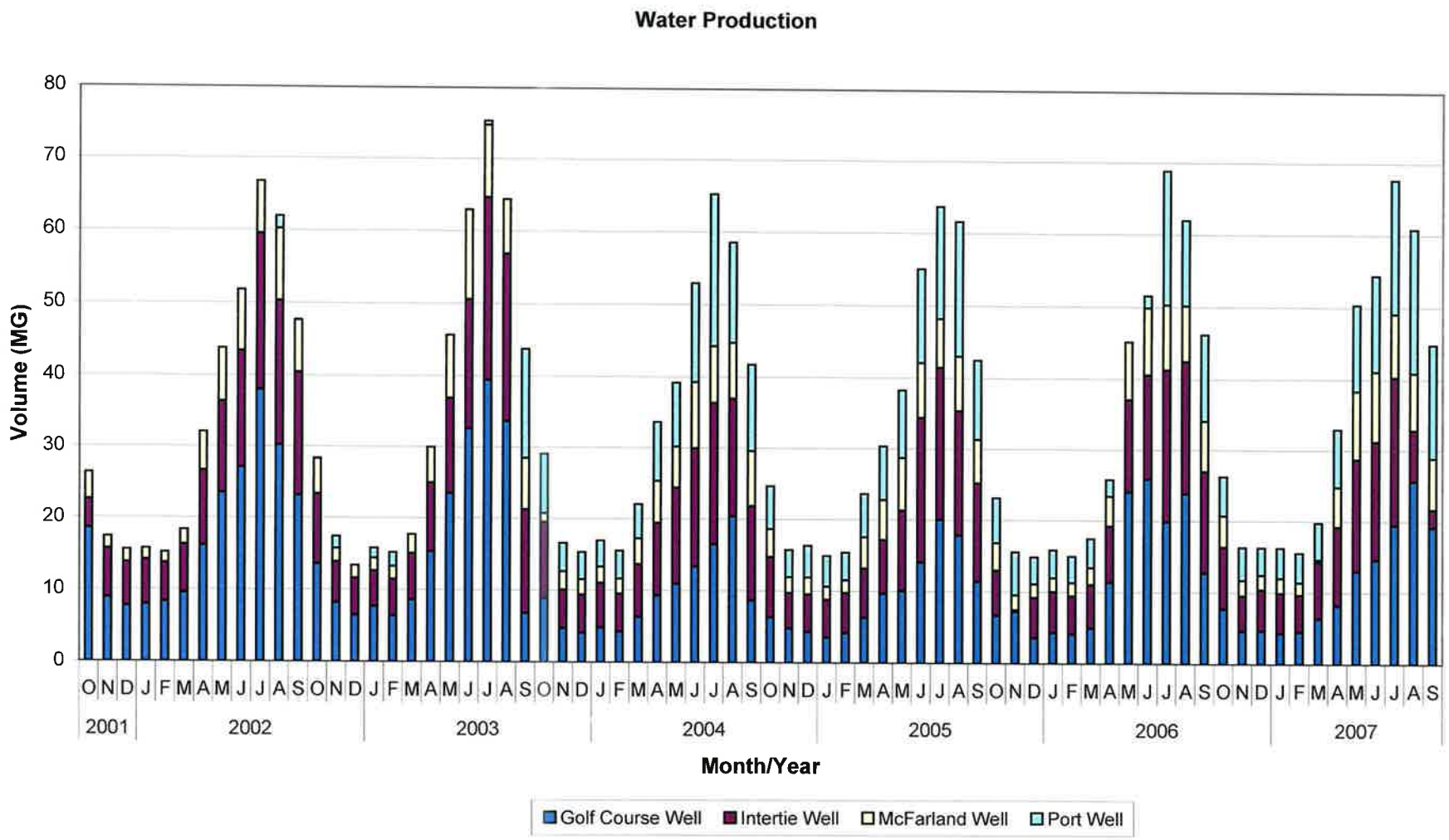
WATER SYSTEM MASTER PLAN
POPULATION HISTORY
AND PROJECTIONS

FIGURE
2-3



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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

WATER PRODUCTION

FIGURE
2-4

CHAPTER 3

WATER SUPPLY

INTRODUCTION

This chapter describes the City's existing water supply system. Recent improvements are outlined and the capability of the system to meet present and future water demand is discussed. Deficiencies are outlined and alternatives to resolve shortcomings are proposed.

EXISTING WATER SUPPLY FACILITIES

The City currently has four water supply sources in operation. They are the McFarland Well, the Intertie Well, the Golf Course Well, and the Port Well. Each will be discussed separately. The location of the wells is shown on Figure 2-1. Schematics of the wells are shown in Figures 3-1 and 3-2; this information includes elevations of all wells and wellheads.

McFarland Well. The McFarland Well is the primary supply for the Coyote and Powerline High Level Systems and is a secondary water supply well for the Low Level System. It is located just southeast of the Grant Street/McFarland Avenue intersection. It is reported to have been drilled in 1947 and is 785 feet deep. The well is only partially cased and has several different diameters and gaps between the casings. The hole configuration includes 165 feet of 16-inch casing, 67 feet of 15-inch diameter open hole, 71 feet of 12-inch diameter open hole, 49 feet of 9-1/2-inch casing, 180 feet of 8-inch casing, and 247 feet of open hole to the bottom of the well. It was videoed and callipered in March 1997 to establish the casing length and diameter. The driller's well log is not available for this well. However, other well information available through the Oregon Water Resources Department (OWRD) is included in Appendix C. This well is located in the Buttercreek critical groundwater area as determined by the OWRD. Therefore, the City has limits on the amount of water it can withdraw.

An earlier line shaft turbine pump was replaced in 1997 with a 500-gpm submersible pump. This new pump is an American Turbine Model 10-L-20, designed for 284 feet of total discharge head. Power is provided to the well by Pacific Power. A new motor starter panel was installed during the 1997 project. In 2002, a new telemetry system was installed that allows monitoring of well functions from the City Shops.

The static level in this well has varied from 155 feet to 216 feet below ground surface from the period 1998 to May 2000. The pumping level varied from 215 feet to 264 feet at 550 gpm during the same period.

Intertie Well. The Intertie Well and Reservoir are located a block west and two blocks south of the U.S. Highway 395/U.S. Highway 730 intersection. The well discharges directly into the Intertie Reservoir, and its operation is controlled by fluctuations in the water level in the Intertie Reservoir. The Intertie Well is the primary

source of supply for the Low Level System. It can also provide water to the McNary High Level System through the McNary Booster Pump Station and to the McFarland Reservoirs through an altitude valve.

The Intertie Well was constructed in 1979. It is drilled to a depth of 1,138 feet. A 20-inch casing extends to 500 feet below the surface. From 500 feet to the bottom of the well is a 12-inch diameter open rock hole. The wellhead is at an elevation of 455 feet above MSL. The static water level when the well was new was approximately 156 feet below the surface. The present static level is 150 feet below the surface and the pumping level is 560 feet below the surface when pumping 760 gpm. The well log with other water right information from OWRD is included in Appendix C.

A new pump was installed in the well in 1995, a Fairbanks-Morse vertical line shaft turbine designed to produce 850 gpm at a total design head of 680 feet. It was installed on 602 feet of 8-inch column pipe with a 1-11/16-inch shaft diameter. The pump's intake was set at 617 feet. Due to a continuing decline in pumping level, the pump was lowered to 650 feet at the top of the bowls in 1998. At that time the well pump, motor, line shaft, bearings, and other components were reported to be in good condition. Since lowering the intake level, the pumping level appears to have stabilized at approximately 560 feet below ground surface.

In 2002 a new starter panel and controls were installed with a new telemetry system that relays information to the central station located at the City Shops.

Golf Course Well. The Golf Course Well is located in the Port of Umatilla Industrial Park along Draper Road. This well discharges either into the McNary Reservoir or into the McNary Booster Pump Station when the reservoir is bypassed. It was constructed in 1978. The well is 989 feet deep, has 20-inch diameter casing to 500 feet below the surface, and is open rock hole to the bottom. The wellhead is at an elevation of 490 feet above MSL. The well log with other information from OWRD is included in Appendix C.

Although a 1,000 gpm pump was originally installed in the well, a new 2,000 gpm water lubed line shaft deep well vertical turbine pump replaced this original pump in 1995. The intake is set at 470 feet, and the pump has a 12-inch diameter discharge column. New bronze bearing retainers and rubber bearings were also installed at that time. The shafting from the previous installation was reinstalled. The pump is powered by a 300 Hp, 480 volt electric motor. The well pump operates alternately with the Port Well as the lead and lag pump automatically, based on the water level in the 1.8 MG McNary Reservoir. It can also be controlled manually. Actual production varies from 1,800 to 1,900 gpm depending on the time of the year and the water level in the well and reservoir.

A diesel-driven emergency generator is installed in the well house to power the well pump, booster pumps, and controls in case of failure of the primary power source. Additionally, there is a diesel-driven pump in the booster pump station. Power is provided under normal conditions to this installation by Pacific Power. The Golf Course Well is one of two sources of supply for the McNary area. The McNary area can also

supply water to the Low Level System by use of a bypass and pressure reducing vault adjacent to the McNary Booster Pump Station.

The static water level in this well varies from a high of 192 feet in the winter to a low of 212 feet during the summer. The well draws down approximately 140 to 160 feet when pumping at 1,900 gpm. This makes the pumping level approximately 350 feet below ground surface. The drawdown to the Golf Course Well pump has shown to be quite stable.

Port Well. The Port Well is the second supply source of the McNary area. The City holds a 40-year lease from the Port of Umatilla that gives rights to the property and the well for municipal use of the water. A copy of the lease, which expires in February 2040, is in Appendix D. The well is located about 400 feet south of the Columbia River, below the elevated Port Reservoir, as shown on Figure 2-1.

The Port Well is a deep basalt well with Permit No. G3112 and a priority date of August 10, 1966. It is permitted for 4.46 cubic feet per second (cfs) or 2,000 gpm. The permitted usage is municipal and industrial. A copy of the well log and other information from OWRD is located in Appendix C.

The well is 850 feet deep with a 24-inch steel casing from the wellhead down to 109 feet and 20-inch casing from 99 feet down to 345 feet. From 345 feet to 850 feet it is a 12-inch open rock hole. The well has a cement grout surface seal down to 109 feet.

Although situated close to the Columbia River, the Port Well is not hydraulically connected to the surface water source. The McNary pool elevation is approximately 44 feet below the wellhead, yet the static level in the well is 101 feet below ground surface. The Port, Intertie, and Golf Course Wells are all believed to be pumping from the Grande Ronde aquifer, which originates in the Blue Mountains.

After securing the current lease on the well, work began to incorporate the source into the City's water system. The existing motor, pump, and column pipe were removed from the well. A pump test was performed that indicated the well could be pumped at 2,000 gpm from a depth of approximately 160 feet below ground surface and the rate of recovery was very fast.

In 2002 a submersible turbine pump on a 10-inch diameter discharge column was installed with the intake set at 225 feet. The pump is powered by a 250 Hp, 460 volt, three-phase electric motor. The discharge pipes directly to the 1.8 MG McNary Reservoir, which controls pump operation based on water level. Automated controls alternate the Port and Golf Course Wells as the lead and lag supply for the system. Manual control of the pump is also possible. Production of the well is 2,000 gpm.

Cost of Water. In operating a water system, it is advantageous to know the pumping costs of the various water sources in order to maximize operating efficiency. These costs are based on the work required to lift the water from its source (from the depth in the well) to the service elevation with sufficient system pressure (the top of a gravity feeding reservoir or equivalent pressure elevation). The costs are calculated

using the pumping rate and total discharge head (TDH) assuming moderate pump (75 percent) and motor efficiencies (90 percent) and electrical costs of $0.10 a kilowatt hour. These cost estimates are just the pumping costs based on typical equipment efficiencies and power rates for comparison purposes only. Age, wear, and the type of equipment installed will affect the actual costs experienced by the City.

The resulting cost per 1,000 gallons pumped is presented below for each source and booster pump station.

Source	TDH (ft)	Rate (gpm)	Cost per 1,000 gal	Service Area
McFarland Well	239	560	$ 0.11	Low Level System
Intertie Well	626	760	$ 0.29	Low Level System
Golf Course Well	384	1,950	$ 0.18	McNary Reservoir
Port Well	299	2,000	$ 0.14	McNary Reservoir

Booster Pump Stations	TDH (ft)	Rate (nominal gpm)	Cost per 1,000 gal	Service Area
McNary	131	1,000	$ 0.06	McNary High Level System
McFarland	195	1,300	$ 0.09	Coyote High Level System
Coyote	54	300	$ 0.03	Powerline High Level System
McNary Emergency	164	750	$ 0.08	McNary High Level System

From these tables one can see the most cost effective water is from the McFarland Well servicing the Low Level System at $0.11 per 1,000 gallons. The same water pumped to serve the Coyote High Level System and Powerline High Level System costs $0.20 and $0.23 per 1,000 gallons, respectively, due to additional pumping through the McFarland and Coyote Booster Pump Stations. Water from the Port Well costs $0.20 per 1,000 gallons in the McNary High Level System while the Golf Course Well costs $0.24 per 1,000 gallons in the same service area. The highest cost source at this time is the Intertie Well at $0.29 per 1,000 gallons in the Low Level System. If this water is pumped for use in the McNary High Level System, the cost increases to $0.35 and if it is pumped to the Powerline High Level System, the total cost is $0.41 per 1,000 gallons.

Treatment. Currently, the City provides disinfection treatment to well water from each source with chlorine. Chlorine gas supplied in 150-pound bottles are connected to metering control systems at the McFarland, Intertie, and Port Wells and in the booster pump station at the Golf Course Well. Chlorine is injected into the well water before discharge into the reservoir at each site. Contact time is achieved in the reservoir to meet the requirement for water treatment. The water then flows into the distribution systems where a minimum chlorine residual of 0.5 milligrams per liter (mg/L) is maintained.

Water Supply Taste/Odor. There are no reported problems with taste or odor from the Golf Course, Port, or Intertie Wells. However, there is hydrogen sulfide odor associated with the McFarland Well. With the addition of chlorine, iron and manganese are oxidized and the odor problem has been controlled in recent years.

WATER SUPPLY ANALYTICAL TESTING

The City of Umatilla provided analytical data for the McFarland, Intertie, Port, and Golf Course Wells for samples obtained in 1996 and 2002. The wells have been sampled for the constituents required by the Oregon Drinking Water Program (DWP), including total and fecal coliform, volatile organic compounds (VOCs), synthetic organic compounds (SOCs), seven pesticides, gross alpha, nitrate, nitrate/nitrite, nitrite, sulfate, total cyanide, fluoride, and 11 metals including antimony, arsenic, barium, cadmium, chromium, mercury, nickel, selenium, sodium, and thallium. The analytical data reports for the well samples are presented in Appendix A.

McFarland Well. Most of the constituents were not detected in samples obtained from the McFarland Well. Of those detected, the concentrations were significantly less than their corresponding EPA Primary Drinking Water Maximum Contaminant Levels (MCLs). Constituents detected in the McFarland Well samples at low concentrations include barium, sodium, fluoride, nitrate, nitrate/nitrite, and sulfate. Based on the sample analytical results, the McFarland Well groundwater does not contain bacteriological or chemical constituents at concentrations greater than the corresponding EPA Primary Drinking Water MCLs.

Intertie Well. Most of the constituents were not detected in samples obtained from the Intertie Well. Of those detected, the concentrations were significantly less than their corresponding EPA Primary Drinking Water MCLs. Constituents detected in the well samples at low concentrations include barium, sodium, fluoride, and sulfate. Based on the sample analytical results, the Intertie Well groundwater does not contain bacteriological or chemical constituents at concentrations greater than the corresponding EPA Primary Drinking Water MCLs.

Golf Course Well. Most of the constituents were not detected in samples obtained from the Golf Course Well. Of those detected, the concentrations were significantly less than their corresponding EPA Primary Drinking Water MCLs. Constituents detected in the well samples at low concentrations include barium, sodium, fluoride, and sulfate. Based on the sample analytical results, the Golf Course Well groundwater does not contain bacteriological or chemical constituents at concentrations greater than the corresponding EPA Primary Drinking Water MCLs.

Port Well. Most of the constituents were not detected in samples obtained from the Port Well. Of those detected, the concentrations were significantly less than their corresponding EPA Primary Drinking Water MCLs. Constituents detected in the well samples at low concentrations include barium, sodium, fluoride, and sulfate. Based on the sample analytical results, the Port Well groundwater does not contain bacteriological

or chemical constituents at concentrations greater than the corresponding EPA Primary Drinking Water MCLs.

WATER RIGHTS

The City of Umatilla holds groundwater rights for three deep basalt wells and one surface water right to the Columbia River. The Port of Umatilla holds the groundwater right for the Port Well. All of the water rights are issued by the OWRD for municipal use. The groundwater rights are at various stages of being perfected with all available water from the wells being put to beneficial use. The surface water permit has a pending extension request and no water is presently being withdrawn from the river.

The McFarland Well has a certificate of water right for 1.25 cfs (560 gpm) with a priority date of 1963. This well is located in the Buttercreek critical groundwater area. Presently, the City is limited to an annual withdrawal of 250 acre-feet, which is subject to change in the future. With the present pump, the well can produce 570 gpm.

The Intertie and Golf Course Wells are both permitted on the same permit at 8.9 cfs (3,944 gpm) each. The priority date is December 1977. A Claim of Beneficial Use and Site Report (CBU) was submitted to the OWRD in 2003 to perfect the wells at the incremental rate of 4.45 cfs (2,000 gpm) for the Golf Course Well and 1.69 cfs (760 gpm) for the Intertie Well. The limiting factor identified for both wells is the size and capacity of the pumps. The issuance of a certificate may take some time as the OWRD processes CBUs in the order they are received with a processing time of several years. To maintain the priority date on the remaining unperfected portion of the water right, an application for extension of time needs to be submitted to the OWRD.

The Port of Umatilla holds the groundwater right for the Port Well, for which the City has a 40-year lease to use and operate. On July 29, 2002, an order approving a change in place of use was issued to include the City of Umatilla and the area inside the Urban Growth Boundary. An extension of time to demonstrate beneficial use was also issued in 2002 with a completion date of October 1, 2029. In January 2003, a CBU was submitted for the full water right rate of 4.46 cfs (2,000 gpm). As previously stated, the time necessary for OWRD to process the certificate may delay the receipt of a final order by several years. No further action is necessary for this water right.

The City's surface water right allows for the appropriation of 23 cfs (10,230 gpm) from the Columbia River. While testing of shallow infiltration type wells adjacent to the Columbia River has been completed in assessing alternatives to exercise this water right, the City presently does not have any facilities constructed that can utilize any of the right. Over the years, the City has applied for and received extensions on putting this water to beneficial use. The last extension requesting a completion date in 2055 was received at OWRD on March 19, 2003. It is pending at this time.

In 2005 a rule change occurred that requires the OWRD to coordinate with the Oregon Department of Fish and Wildlife (ODFW) to assure agreements or required actions are in place to maintain the persistence of listed fish species in the portions of waterways affected by water use under the permit [OAR 690-315-0080 (1)(f)]. The

OWRD has stated that permit extensions are being processed by basin with a low priority assigned to the mid Columbia River permits. It could be some time before a response is issued to this extension request. They also stated that over=appropriation of the Columbia River in this stretch is not a concern at this time and no problems are anticipated with issuance of the extension.

A summary of the City's present water rights is as follows:

City of Umatilla Water Rights

Water Source	Permit Number	Certificate	Permit Volume (cfs / gpm)	Priority Date
McFarland Well	G-2560	76316	1.25 / 560	12/24/63
Intertie Well	G-8042	CBU submitted for 1.69 cfs	8.9 / 3,990	12/28/77
Golf Course Well	G-8042	CBU submitted for 4.45 cfs	8.9 / 3,990	12/28/77
Port Well	G-3112	CBU submitted for the full 4.46 cfs	4.46 / 2,000	8/10/66
Columbia River	S-41444		23 / 10,320	10/5/76

Needed Actions. Most necessary actions for the City's water rights at this time are required of the OWRD. The City is currently waiting on certificates for the Intertie, Golf Course, and Port Wells, and an order extending the period of development of the surface water right. However, the City does need to submit an application for extension of time to perfect the remainder of the permitted municipal water right for Permit G-8042, which is associated with the Intertie and Golf Course Wells.

CONTROLS AND TELEMETRY

Over the past 10 to 15 years the City has progressively updated their pumps, motors, and motor controls and in 2002 completed an extensive replacement of the entire telemetry system.

In 1995 the Golf Course Well and Booster Pump Station received new motor controls followed in 1997 with replacement of the McFarland Well pump, motor, and starter panel. The Coyote Booster Pump Station was constructed in 2000 with new pumps, motors and controls, and the older McFarland Booster Pump Station was then retrofitted with new pumps, motors, and controls in 2001. Also in 2001, the Intertie Well received new motor controls to replace its aging system. In 2002 the Port Well had a new pump, motor, and starter panel installed to bring it on-line as a supply for the City. This equipment all meets current electrical code requirements and is in good condition at this time.

Also completed in 2002 was a project that replaced all of the City's water system telemetry systems. Programmable logic controllers (PLCs) were installed at each location including the Golf Course Booster Pump Station, Intertie Well (the master site),

McFarland Well and Booster Pump Station, Coyote Reservoir and Booster Pump Station, City Shops (master monitoring panel), and four sewage lift stations. A redundant design approach provides reliability with a small inventory of spares so downtime is minimal if a failure occurs. Communication between the facilities and the master panel is via Federal Communications Commission (FCC) licensed radio signals. This telemetry system provides information on all water system pumps, flowmeters, and reservoirs, displaying status on the master panel located at the City Shops. Using modular components, it is possible to expand the system for additional monitoring tasks as the water system grows.

WATER SUPPLY DESIGN CRITERIA

As presented in Chapter 2, the planning period for this Water System Master Plan extends to the year 2027 The estimated population of Umatilla, as of July 1, 2007, was 6,440, and the projected population for the year 2027 is 11,318, including the population at the TRCI facility. The peak daily water demand is estimated to be 3,480 gpm (5.01 MGD) in the year 2027, and the current peak daily demand was determined to be 1,850 gpm (2.66 MGD), including the TRCI demands.

Water supply facilities (wells) are normally designed to meet peak daily demands. To avoid stressing equipment and over-pumping a well, wells should be sized to supply the peak daily demand without 24-hour service. It is preferred that well pumps operate a maximum of 18 hours per day, if possible.

Current total production of the City's wells is 5,230 gpm, which can meet the current estimated peak daily demand of 1,850 gpm (2.66 MGD) by operating 8.5 hours per day. However, in order to meet the year 2025 estimated demand with sufficient backup capacity when the primary well source is inoperable, new water supply sources need to be developed. The peak daily demand in the year 2025 is estimated to be 3,264 gpm (4.70 MGD). The present wells operating approximately 15 hours a day can meet this estimated year 2025 demand. However, if the Port Well was not operable, the demand could not be met. With a design based on the preferred 18-hour-per-day operation, an additional water supply should be operational before 2015. Based on the projected rate of growth, development of a new water supply source should be initiated as early as 2013.

It should be noted that future changes in the City's projected population, water use characteristics, and/or available supply could affect these assumptions. The City should periodically review this information to ensure additional water supply beyond that recommended in this Master Plan is not needed sooner than anticipated to meet the City's demands.

The reliability of the water supply is one of the most important aspects of any water system. Because the health and safety of the community depends upon a reliable water source, high priority should be given to ensure a municipal water system always has the ability to meet the water needs of its customers. A number of factors, such as mechanical failures, power outages, primary water transmission line failures, etc., can affect the reliability of a water supply. It is nearly impossible to ensure 100

percent reliability of any system. However, having proper system components can help ensure reliability over time.

The City has standby power with automatic transfer switches (ATS) at three locations in the water system that can maintain water supplies and operation of the system during a power outage. The generator and ATS at the Golf Course Well and McNary Booster Pump Station keep the primary well operational and provide power to the booster pumps to maintain the water level in the elevated Port Reservoir and water pressure in the McNary High Level System. During a high flow event, such as required to fight a fire, an engine-driven booster pump is also available in the McNary Booster Pump Station to maintain the reservoir water level and system pressure.

The McFarland Well and Booster Pump Station standby generator operates the well to maintain a water source for the Low Level System and also powers the booster pump station to provide water to the Coyote Reservoir for the Coyote and Powerline High Level Systems. To maintain system pressures in the Powerline High Level System, the third standby generator operates the Coyote Booster Pump Station.

The City also has the ability to transport water from one pressure zone to another if a problem occurs with a water source. The Port Well and Golf Course Well/Booster Pump System supplies water to the McNary High Level System. It can also supply water to the Intertie Reservoir and McFarland Reservoirs through a system intertie valve. This would address demands of the Low Level, Coyote High Level, and Powerline High Level Systems if problems occurred with the Intertie or McFarland Wells. Conversely, the McNary Emergency Booster Pump Station can provide approximately 750 gpm of water to the McNary High Level System from the McFarland and Intertie Wells and Reservoirs via the Low Level System. This allows the system to accommodate temporary operational issues with the Port or Golf Course Well.

One weakness with the City's ability to transfer water to where it is needed is the McFarland Booster Pump Station. It is the sole water source for the Coyote and Powerline High Level Systems. If a significant failure were to occur in this facility, the two high level systems dependent on the source would be completely out of water when the Coyote Reservoir runs dry. The current average daily demand could deplete the stored capacity in 1-1/2 days.

Many communities in eastern Oregon rely upon wells as their primary water source, and wells have proven to be dependable and reliable in most instances. Whenever possible, it is recommended that each community have sufficient wells to meet peak system demands and an additional well to provide backup capability and to help offset peaking demands. In Umatilla's case, three wells generally meet current peak demands with the fourth well providing backup capacity and needed supply to meet increasing system demands.

Over time as water demands grow in the community, the fourth well will be needed to meet the increased demand and a new source will be needed for backup and growth. As stated earlier, to provide sufficient backup when the City's primary source is off-line and to maintain pump operation at less than 18 hours per day as recommended

for the remaining pumps, a new water source should be connected to the system in 2015.

WATER SUPPLY RESOURCES

There are generally five options available to the City for obtaining additional water supply capacity. The options are outlined hereafter followed by a discussion of the advantages and disadvantages of each option.

- Increase the pumping capacity of existing wells.
- Drill a new deep basalt well.
- Drill a new radial collector well or a series of shallow wells. Treatment of this water may also be needed.
- Columbia River Pump Station and Water Treatment Plant
- Connect to the Hermiston regional water supply pipeline and construct a water treatment plant.

Increase the Pumping Capacity of Existing Wells. One option for additional supply is to draw more water from the existing wells by increasing the pumping capacity of the equipment. This could be done by installing new pumps deeper in the wells if well construction is satisfactory.

As was previously mentioned, the pump in the Intertie Well was lowered in 1998. Due to what appears to be an unstable open rock hole, it is not recommended to set the pump any deeper in this well. Any attempts to pump this well at a higher rate will cause the water level to drop below the pump intakes.

The pump in the Golf Course Well was lowered during a 1995 water system improvements project. It presently pumps approximately 2,000 gpm. The permitted rate is 8.9 cfs or 3,994 gpm. The existing pump motor is 300 Hp and the pump is set at 470 feet below ground surface. The existing casing extends to 500 feet below ground surface, and the well is an open rock hole below. The current pumping level is approximately 350 feet below ground surface.

It would be possible to install a new pump, motor, motor control center (MCC), etc., and increase the yield from the Golf Course Well. By properly sizing the pump, motor, MCC, etc., and setting a new pump at 500 feet below ground surface, the City could gain an additional ±1,200 gpm. However, it should be noted that the deeper the pumping level, the more horsepower required and, thus, the electric power costs per 1,000 gallons pumped increases.

The City's McFarland Well is in the Buttercreek critical groundwater area and the amount of water that can be pumped from the well is governed by the OWRD. The City

has a permitted right of 1.25 cfs (560 gpm), which is the capacity of the equipment currently installed. However, OWRD procedures require the user to request the amount of water to be used each year. Each year the Public Works Director asks for 1,448 acre-feet. For the last several years, the OWRD has limited the amount that can be pumped to 250 acre-feet. Based on this limitation, the well has been typically operated 3-1/2 to 4 hours a day. A more practical total volume would be to pump the well 10 to 18 hours a day. However, this was done in July 2000 and resulted in drawing the well pumping level down to the pump bowls. It appears the well could sustain a volume of only approximately 300,000 gallons per day at 500 gpm. This would result in operating the well a maximum of 10 hours per day. Without a change in OWRD's policy limiting the source to 250 acre-feet per year, the City cannot gain additional capacity from the McFarland Well.

With the exception of the Golf Course Well, the City does not have the option of increasing the capacity of the existing wells. The work on the Golf Course Well would require initial cost to replace the pumping equipment, ongoing increased power costs to pump from deeper depths, and result in only modest gains in production capacity.

Deep Basalt Wells. As previously discussed, the City is using four existing deep basalt wells that provide 100 percent of the present supply. In order to evaluate the potential of drilling additional successful wells, Dick Gullixson, a geologist, was retained to perform a "Geology and Groundwater Study" of the Umatilla area. A copy of his study is attached in Appendix E.

Based upon the geologist's investigation, the aquifers in Umatilla penetrated by the deep basalt wells originate in the Blue Mountains in the strata of the Grande Ronde Formation. These aquifers receive the water directly from the snow pack or the stream run-off high on the Blue Mountain slopes. Once the water enters the strata, it is confined and is controlled by the rock structure. As the Grande Ronde Formation declines in elevation, it reaches the toe section of the mountain and crosses the valley created by the folding of the Rieth Anti-cline. This valley is part structural and part erosional. Where the strata are cut through (eroded), no water transmission is possible. Where the strata are folded down but still continuous, water is transmitted in confined aquifers. The confined water in the Grande Ronde aquifer is found at an elevation of approximately 300 to 400 feet in the Umatilla area. The City's existing Intertie and Golf Course Wells, and the leased Port Well, draw water from the Grande Ronde aquifer.

If the City elects to drill a new deep basalt well, the Groundwater Study recommends the location to be near the south quarter corner of Section 12. This location is east of the Golf Course Well as shown on Figure 2-1.

In order to incorporate a new deep basalt well into the City's water system, there are several elements to consider. The City would first have to obtain land for the well site and right-of-way for a transmission line from the well to the McNary Reservoir. A well would have to be successfully drilled and developed. A pump station and transmission line would then have to be constructed.

Land should be available near the recommended location from either the Oregon Department of Corrections (DOC) or the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). A separate transmission line from this new well to the McNary Reservoir should be constructed. Right-of-way should be available from the DOC, CTUIR, and Port of Umatilla as may be required. The proposed well location should not encounter a restricted aquifer, so obtaining a permit to appropriate groundwater should not present a problem.

Table 3-1 presents the estimated costs associated with the deep basalt well supply option. It is estimated that a new deep basalt well, complete with pump station, chlorination system, telemetry system, and transmission line would cost approximately $1,600,000.

Radial Collector Well or Shallow Wells. In the winter of 1998 and the spring of 1999 an aquifer test was conducted for the City of Umatilla to determine the feasibility of developing an infiltration type water supply by means of a shallow radial collector well constructed adjacent to the Columbia River. The work was carried out under a contract between the Ranney Division of Layne Christensen Company (Ranney) and the City of Umatilla. IRZ Consulting of Hermiston provided general engineering supervision for the City during the study. A copy of the "Hydrogeologic Survey, Phase 2 - Detailed Aquifer Test, City of Umatilla, Oregon" is included in Appendix F.

The site of the investigation was on the south bank of the Columbia River, near the marina, approximately two miles downstream from McNary Dam as shown in Figure 3-3. Conducted in phases, the first was an 8-inch diameter exploratory test well (TW-1) drilled to determine the depth and character of the alluvial deposits. The test well was located at the west end of Marina Park, approximately 120 feet from the river's edge. The results of a brief step rate pumping test were presented in a letter-report by Ranney dated January 22, 1999.

Phase 2 performed a detailed aquifer test consisting of two 6-inch diameter observation wells (MPOB-2 and MPOB-3) and one 12-inch diameter test pumping well (MPW). The wells were located on a line approximately parallel to the shore of the Columbia River as shown in Figure 3-4. Two short duration step rate tests were conducted at different pumping depths. According to the Phase 2 report, "the test results show that the transmissivity and hydraulic conductivity of the aquifer are high, suggesting a favorable potential collector well yield."

In the study, two different yield conditions were evaluated using the design parameters. The potential yield of the collector well was calculated to be 7,915 gpm. However, a late summer minimum yield occurs when the river stage is low. This condition is of interest because it may occur when water demands are typically greater. The potential minimum summer yield of the collector was calculated to be 2,850 gpm.

Water sample analyses show that the water from the test well is of good quality with all of the chemical concentrations below the established maximum contaminant levels (MCLs). The water is classified as "hard" and iron and manganese were not detected. After a collector well is constructed and infiltration from the river is fully

established, the water will become a blend of ground and surface water, moderating the level of hardness and lowering levels of nitrate.

Ranney stated that, "Based on our knowledge of the site and experiences at the Cities of Boardman and Kennewick, which both have collector wells adjacent to the Columbia River, we believe it is extremely unlikely that additional treatment beyond disinfection will be required."

Ranney further stresses advantages of this type of system stating, "...the City should also consider that a collector well offers environmental and public health safety advantages over direct surface water intakes. Because all construction takes place onshore, there is no disturbance of the river during the construction process. Being an onshore installation, the well is not a hazard to navigation and is not subject to damage by floods and debris. Perhaps the most important environmental advantage of the collector well is that it has no effect on fish or other aquatic life."

The report wraps up with the following: "In summary, a collector well constructed at the Marina park test site will provide the City of Umatilla with a naturally-filtered water supply during summer minimum yield conditions of approximately 2,850 gpm. The water is anticipated to be suitable for all municipal, industrial, and irrigational uses without treatment, except for preventive disinfection."

An option to construction of a radial collector well would be to construct a series of smaller shallow wells. This could have a number of benefits to the City. First, drilling individual shallow wells would have lower initial costs as compared to the initial cost of constructing a radial collector well. The City of Boardman bid a radial collector well in 2001 for $1 million without pumping equipment or a chlorine contact chamber. Second, drilling and test pumping a single shallow well would allow the City to evaluate whether or not filtration would be required. Third, the City could develop wells over a period of time as water demands increased, thereby spreading the construction cost over time in stages.

A radial collector type well, complete with pumps/motors, controls, chlorination equipment, etc., is estimated to cost approximately $3,500,000. This cost breakdown is shown in Table 3-2. The estimated cost also includes a chlorine contact chamber and a transmission line.

The estimated cost for constructing four shallow wells complete with pumps, motors, control building, etc., is approximately $1,900,000 as shown in Table 3-3. This includes a chlorine contact chamber and distribution system piping.

Columbia River Pump Station. Surface water pumping facilities could be constructed to withdraw water from the Columbia River. If the City chose to construct a river pump station, it would also have to install or construct a water treatment plant to treat the raw surface water in order to meet DWP surface water treatment regulations. In addition to the initial capital cost, operation and maintenance costs associated with a pumping station and treatment facility will need to be considered with this option at the time development of additional water sources is necessary.

The point of diversion would be proposed on the bank of the Columbia River near the Port Well in accordance with the existing surface water right. The City would need to purchase land and construct a structure for the pumps and intakes. Sufficient land would be needed to site the treatment facility with right-of-way connecting a water line to the McNary Reservoir.

A surface water pumping facility with a package treatment plant and connections to the existing water system is estimated to cost approximately $2,600,000 as shown in Table 3-4.

Regional Water Supply Pipeline. The Port of Umatilla, City of Hermiston, and some private industries have constructed surface water pumping facilities on the Columbia River. These facilities pump water in a 42-inch diameter pipeline from the Port to the City of Hermiston. During design of these facilities, the City of Umatilla was invited to participate. However, the City felt the cost to purchase water from the project was too high and, consequently, declined to participate.

However, as a supply option, the City could probably purchase water from the regional water system. If the City chose to do so, it would have to construct a full treatment plant to treat the raw surface water. Due to the initial capital cost of a water treatment plant, the operation and maintenance costs of treating the water, and the high cost of the raw water, this option is not investigated further in this study. If other supply options are not successful, then the City may want to fully investigate the regional water supply option.

COMPARISON OF WATER SUPPLY OPTIONS

The water supply options for the City of Umatilla to consider for meeting their current and future water supply needs have been presented herein. For comparison purposes, the following table briefly outlines advantages and disadvantages for each option.

Comparison of Water Supply Options

Option	Advantages	Disadvantages
Increase pumping capacity of existing Golf Course and McFarland Wells	Known quality and quantity.	Cost to change out equipment. Water right issues on McFarland. Increased cost per 1,000 gallons. Limited additional amount available.
Drill Deep Basalt Well	Good water quality. The City would own the source.	Unknown quantity. May involve water right limitations. Pipeline to system and land acquisition is required.
Radial Collector Well	Tests show quantity available. The City would own the source.	Final quality is unknown. High initial cost. Chlorine contact basin is required as a minimum, and land acquisition is required.

Option	Advantages	Disadvantages
Shallow Wells	Initially, similar cost as basalt well. Tests show quantity available. Can develop wells as need arises. The City would own the source.	Final quality is unknown. Chlorine contact basin is required as a minimum, and land acquisition is required.
Columbia River Pump Station	Known source and quantity. Point of diversion meets existing water right. Solid water right standing.	Initial cost for constructing river pump station and treatment plant. Ongoing operation and maintenance cost. Pipeline to system and land acquisition required.
Regional Water Supply	Known source and quantity.	Cost per 1,000 gallons is high. High cost for constructing and operating treatment plant. Pipeline to system and land acquisition required. Long time frame required.

As discussed with City staff, the most promising alternatives are a shallow well field or a Columbia River pump station. In approximately five years, based on current demand growth rate, the City should initiate a Preliminary Engineering Report to select the preferred alternative and begin land acquisition and operational tests. With either system, wells or additional water treatment modules could be constructed or added to the system as demands increase over time.

DESIGN STANDARDS

In establishing design standards for a water system, one of the primary considerations is compliance with federal and state regulations that govern public water systems. These regulations are set and enforced by both the U.S. Environmental Protection Agency and the State of Oregon Drinking Water Program. In addition to governmental agencies, American Water Works Association publications concerning materials construction and performance standards are available from which purveyors can select specific criteria they wish to use within their own system.

The local government philosophies, previous established policies, financial status, local environmental and historical considerations, and water user expectations must also be considered when determining standards to be used within a specific system.

WATER SUPPLY ANALYSIS

Water Quality. The City's water system has no outstanding or recurring water quality problems. Water sample analyses for the numerous metals, compounds, and

conventional parameters have not detected any contamination that approaches the maximum contaminant level.

Water Quantity. At present, the City's existing wells, including the leased Port Well, can produce a total of approximately 5,230 gpm. This varies slightly up or down depending on seasonal water table levels.

The design peak day flow (PDF) in 2007 was estimated at 1,850 gpm for a 2.66 MG day. This included the City and TRCI water demand. The projected PDF for the year 2027 is 3,480 gpm for a 5.01 MG day, which is within the current system capacity providing all sources are operational and operate 16 hours per day.

To ensure a level of water supply security, a water system is designed to meet peak day demands with the largest producing well off line and the remaining wells operating a maximum of 18 hours per day. Under these conditions the current system capacity is de-rated to 3,230 gpm for a 3.49 MG day. Current estimates indicate that the peak day demand will exceed the existing supply capacity defined by this margin of safety in the year 2016 if growth occurs as projected and all sources remain unchanged.

Another factor must be considered when making this projection. Production from a well decreases as the water level drops. It is not unusual for water levels in the aquifers to decline with use. This can be caused by a number of factors including lower static water levels in the aquifer or a change of flow characteristics in the aquifer during pumping.

The static level in the McFarland Well has dropped approximately 50 feet since 1988 while the pumping level has declined about 25 to 35 feet during heavy use periods. The Golf Course Well static level has remained nearly the same. The drawdown has remained fairly constant even though a larger pump has been installed in the well. The Intertie Well has the most severe issues. Though the static water level has remained nearly constant, the pumping level declined nearly 200 feet in the late 1990s. However, since the pump was last lowered in August 1998, the pumping level in the well appears to have stabilized. Since the Intertie Well remains a critical supply to the system, the City should closely monitor the pumping level for future decline.

As future water demands increase, the City will need to secure and develop additional water sources. The timing of system expansion can be influenced by the growth rate and the existing water supply stability. Current projections indicate the City should initiate the preparation of a Preliminary Engineering Report about 2013. The report would need to investigate the water source alternatives in further detail with cost estimates based on the water right, land, construction costs, and technology at the time.

The City should continue to monitor the issues affecting the supply/demand balance and prepare to add sources in order to maintain adequate reserve and emergency supplies.

SUMMARY

The City's present supply capacity can meet the existing system demands. However, in the next five to ten years, should the Port Well fail during the heavy use summer months, the level of safety in system reserve capacity would be compromised. With the Port Well inoperable, the projected peak day demand in the year 2016 will require the remaining operational wells to run more than the desired 18 hours per day. Without an additional water source by 2025, the City's wells operating without the Port Well will not be able to meet peak demands while running 24 hours a day. In the year 2013, the City should initiate analysis and preparation of a Preliminary Engineering Report that compares the alternative water sources available, contrasting costs and other pertinent issues in effect at the time. Depending on actual growth rates and water demand growth, any necessary land purchases and demonstration tests should be completed so a new water supply is added to the system before the peak demand months of 2016.

ESTIMATED COST
DEEP BASALT WELL SUPPLY OPTION

NO.	ITEM	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization	LS	$ 56,000	All Req'd	$ 56,000
2	Temporary Surface Casing	LS	35,000	All Req'd	35,000
3	Drilling for 16-inch Casing	LF	260	500	130,000
4	Furnish and Install 16-inch Casing	LF	80	500	40,000
5	Drilling for 12-inch Casing	LF	200	500	100,000
6	Furnish and Install 12-inch Casing	LF	70	510	35,700
7	Perforations	LF	20	500	10,000
8	Well Development	LS	7,000	All Req'd	7,000
9	Test Pump Installation	LS	8,000	All Req'd	8,000
10	Pump Test	HR	180	36	6,480
11	Miscellaneous	LS	14,000	All Req'd	14,000
12	12-inch PVC Transmission Line (Well to 1.8 MG Reservoir)	LF	50	6,300	315,000
13	Rock Excavation	CY	90	1,000	90,000
14	12-inch Valves	EA	1,500	6	9,000
15	Connection to Existing	LS	7,000	All Req'd	7,000
16	Well Pump Station (Site Work, Building, Piping, Valves, Electric, MCC, Pump Motor, Column, Pitless Unit, etc.)	LS	250,000	All Req'd	250,000
17	Chlorination System	LS	17,000	All Req'd	17,000
18	Telemetry	LS	20,000	All Req'd	20,000
19	Land Acquisition	LS	30,000	All Req'd	30,000
				Estimated Construction Costs	**$ 1,180,180**
				Contingencies, Legal, Administrative, Engineering, etc. (35%)	413,060
				Estimated Total Cost - Deep Basalt Well Supply Option (Year 2008)	**$ 1,593,240**

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN
ESTIMATED COST -
DEEP BASALT WELL SUPPLY

TABLE
3-1

ESTIMATED COST
RADIAL COLLECTOR WELL SUPPLY OPTION

NO.	ITEM	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization	LS	$ 122,000	All Req'd	$ 122,000
2	Collector Well Caisson (50 feet Deep, Laterals at 44 feet Deep)	LS	790,000	All Req'd	790,000
3	Collector Well Laterals (5 @165 feet)	LS	525,000	All Req'd	525,000
4	Pump Testing and MPA Testing	LS	35,000	All Req'd	35,000
5	Control Building/Chlorination Facility (with Electrical, VFDs, Motor Starter Panels, Controls, Flowmeter, Piping, Chlorination Equipment, etc.)	LS	352,000	All Req'd	352,000
6	Pumps, Motors, Discharge Heads, and Bases	EA	35,000	3	105,000
7	Discharge Piping	LS	30,000	All Req'd	30,000
8	Chlorine Contact Chamber	LS	350,000	All Req'd	350,000
9	18-inch Distribution System Piping	LF	70	1,800	126,000
10	Railroad Bore	LS	35,000	All Req'd	35,000
11	Valves	LS	14,000	All Req'd	14,000
12	Connection to Existing Piping	LS	7,000	All Req'd	7,000
13	Telemetry	LS	56,000	All Req'd	56,000
14	Land Acquisition	LS	14,000	All Req'd	14,000
				Estimated Construction Costs	**$ 2,561,000**
				Contingencies, Legal, Administrative, Engineering, etc. (35%)	896,350
				Estimated Total Cost - Radial Collector Well Supply Option (Year 2008)	**$ 3,457,350**

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN
ESTIMATED COST - RADIAL COLLECTOR WELL SUPPLY

TABLE 3-2

ESTIMATED COST
SHALLOW WELL FIELD SUPPLY OPTION

NO.	ITEM	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
Four 50-foot Deep Wells					
1	Preliminary Investigation including Long-Term Pump Test and Quality Analysis of First Well	LS	$ 70,000	All Req'd	$ 70,000
2	Mobilization (Well Only)	LS	11,500	All Req'd	11,500
3	Drilling for 12-inch Casing	LF	200	200	40,000
4	Furnish, Install, and Remove Temporary 12-inch Casing	LF	70	200	14,000
5	Furnish and Install 10-inch Casing	LF	90	160	14,400
6	Furnish and Install 10-inch Well Screen	LF	180	40	7,200
7	10-inch Stainless Steel Weld Rings	EA	200	8	1,600
8	Filter Pack	LF	70	120	8,400
9	Grout Seal	LF	70	80	5,600
10	Well Development	HR	250	80	20,000
11	Test Pump Installation	LF	65	180	11,700
12	Pump Test	HR	150	96	14,400
13	Standby Time	HR	100	20	2,000
14	Hourly Work	HR	200	48	9,600
15	MPA Testing	LS	14,000	All Req'd	14,000
	Subtotal - Well Construction (Four 50-foot Deep Wells)				$ 244,400

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN
ESTIMATED COST -
SHALLOW WELL FIELD SUPPLY

TABLE
3-3

NO.	ITEM	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
Pumping and Piping Facilities					
16	Mobilization	LS	$ 54,000	All Req'd	$ 54,000
17	Pitless Units	EA	14,000	4	56,000
18	Pumps, Motors, Column Pipe, Air Line, etc.	EA	28,000	4	112,000
19	Discharge Piping, Valving, etc.	LS	28,000	All Req'd	28,000
20	Control Building/Chlorination Facility (with Electrical, Motor Starter Panels, Controls, Flowmeter, Piping, Chlorination Equipment, etc.)	LS	280,000	All Req'd	280,000
21	Chlorine Contact Chamber	LS	350,000	All Req'd	350,000
22	18-inch Distribution System Piping	LF	70	1,800	126,000
23	Railroad Bore	LS	35,000	All Req'd	35,000
24	Valves	LS	14,000	All Req'd	14,000
25	Connection to Existing Piping	LS	7,000	All Req'd	7,000
26	Telemetry	LS	56,000	All Req'd	56,000
27	Land Acquisition	LS	14,000	All Req'd	14,000
				Subtotal - Pumping and Piping Facilities	$ 1,132,000
				Estimated Construction Costs	**$ 1,376,400**
				Contingencies, Legal, Administrative, Engineering, etc. (35%)	481,740
				Estimated Total Cost - Shallow Well Field Supply Option (Year 2008)	**$ 1,858,140**

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CITY OF
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WATER SYSTEM MASTER PLAN
ESTIMATED COST -
SHALLOW WELL FIELD SUPPLY

TABLE
3-3
CONT'D

ESTIMATED COST
COLUMBIA RIVER PUMP STATION SUPPLY OPTION

NO.	ITEM	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization	LS	95,000	All Req'd	95,000
2	Intake Structure with Screen, Piping, Vertical Turbine Pump	LS	40,000	All Req'd	40,000
3	Filter Building (30' x 60')	LS	360,000	All Req'd	360,000
4	Package Plant Treatment System	LS	800,000	All Req'd	800,000
5	Site Piping	LS	30,000	All Req'd	30,000
6	Electrical	LS	60,000	All Req'd	60,000
7	Chlorination System	LS	17,000	All Req'd	17,000
8	Finish Water Pump Station	LS	40,000	All Req'd	40,000
9	16-inch PVC Transmission Line to McNary Reservoir	LF	60	4,250	255,000
10	Wastewater Pump Station	LS	14,000	All Req'd	14,000
11	4-inch Wastewater Force Main	LF	35	3,750	131,250
12	Telemetry	LS	56,000	All Req'd	56,000
13	Land Acquisition	LS	30,000	All Req'd	30,000
				Estimated Construction Costs	**$ 1,928,250**
				Contingencies, Legal, Administrative, Engineering, etc. (35%)	674,890
				Estimated Total Cost - Columbia River Pump Station Supply Option (Year 2008)	**$ 2,603,140**

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CITY OF
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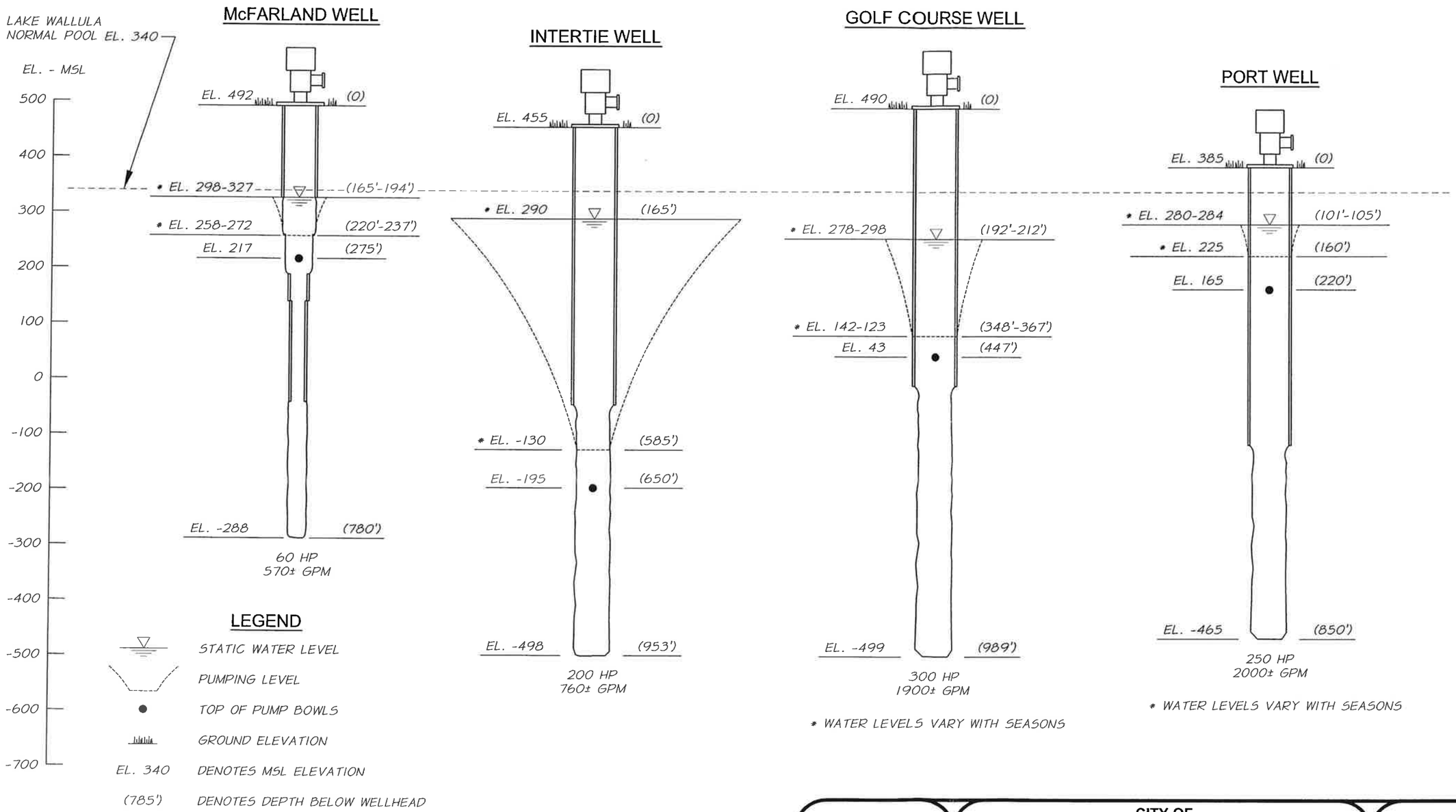
WATER SYSTEM MASTER PLAN
ESTIMATED COST - COLUMBIA RIVER PUMP STATION SUPPLY

TABLE 3-4



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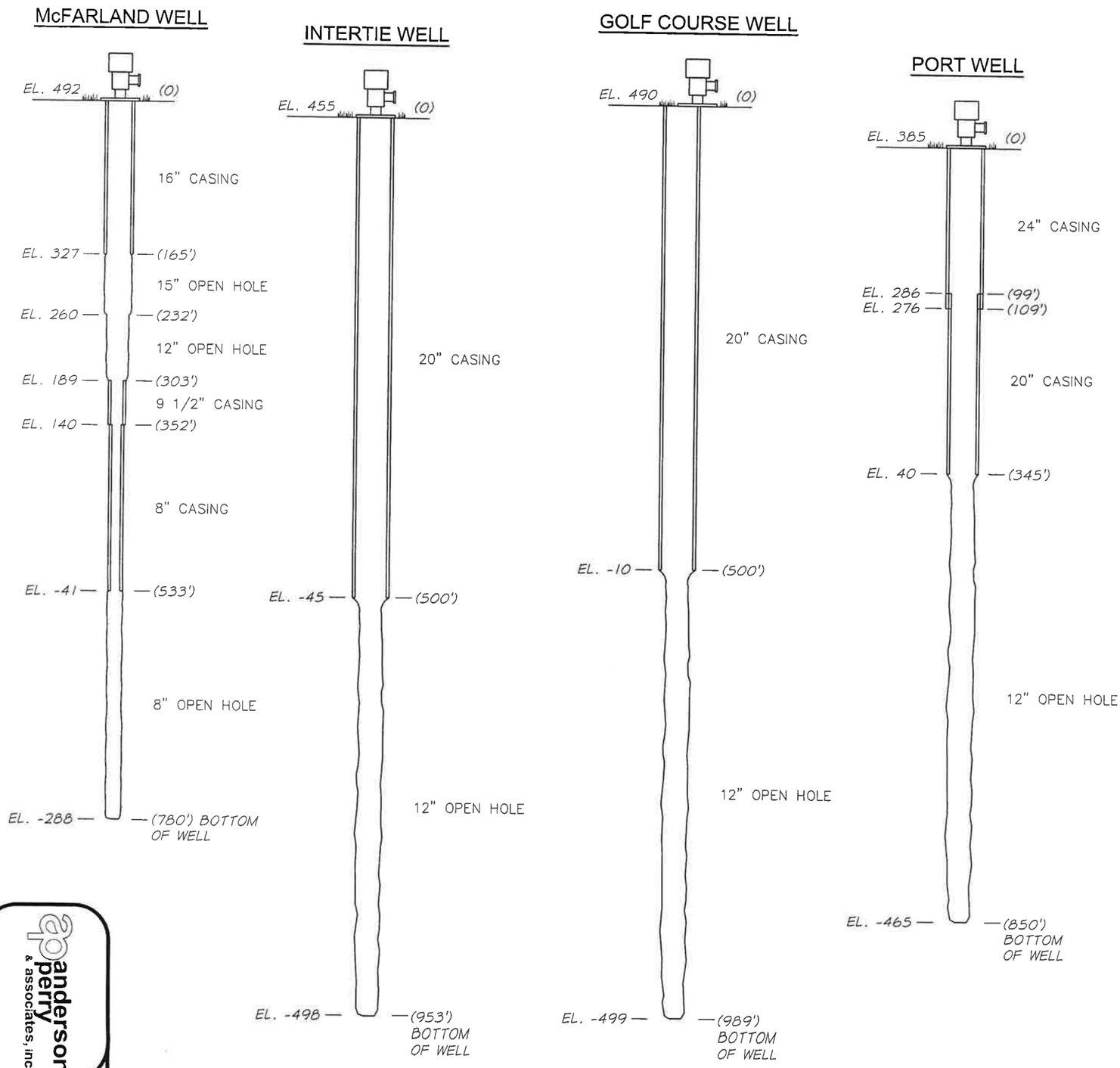
CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

WELL PUMP SETTINGS & WATER LEVELS

FIGURE
3-1

S:\UMATCITY ER\water-up\um-NATSF.dwg, NAT3-1, 5/15/2008 1:47:06 PM, mussen



(EL. 327) DENOTES MSL ELEVATION

(165') DENOTES DEPTH BELOW WELLHEAD

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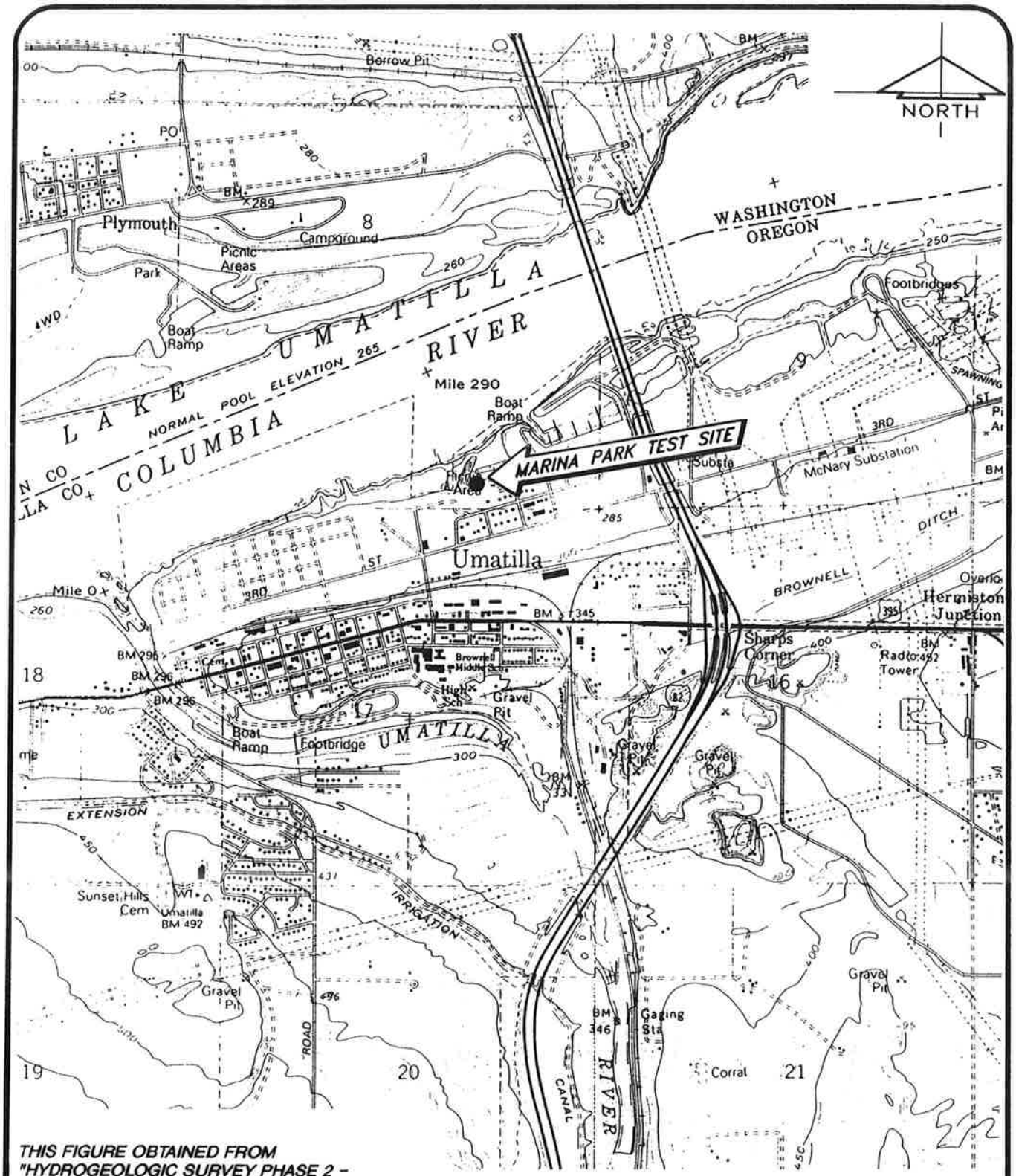
CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

WELL BORING CONFIGURATION

FIGURE
3-2



THIS FIGURE OBTAINED FROM "HYDROGEOLOGIC SURVEY PHASE 2 - DETAILED AQUIFER TEST" REPORT PREPARED BY LAYNE CHRISTENSEN COMPANY, JUNE 1999.

2000 0 2000

SCALE, FEET

June 1999

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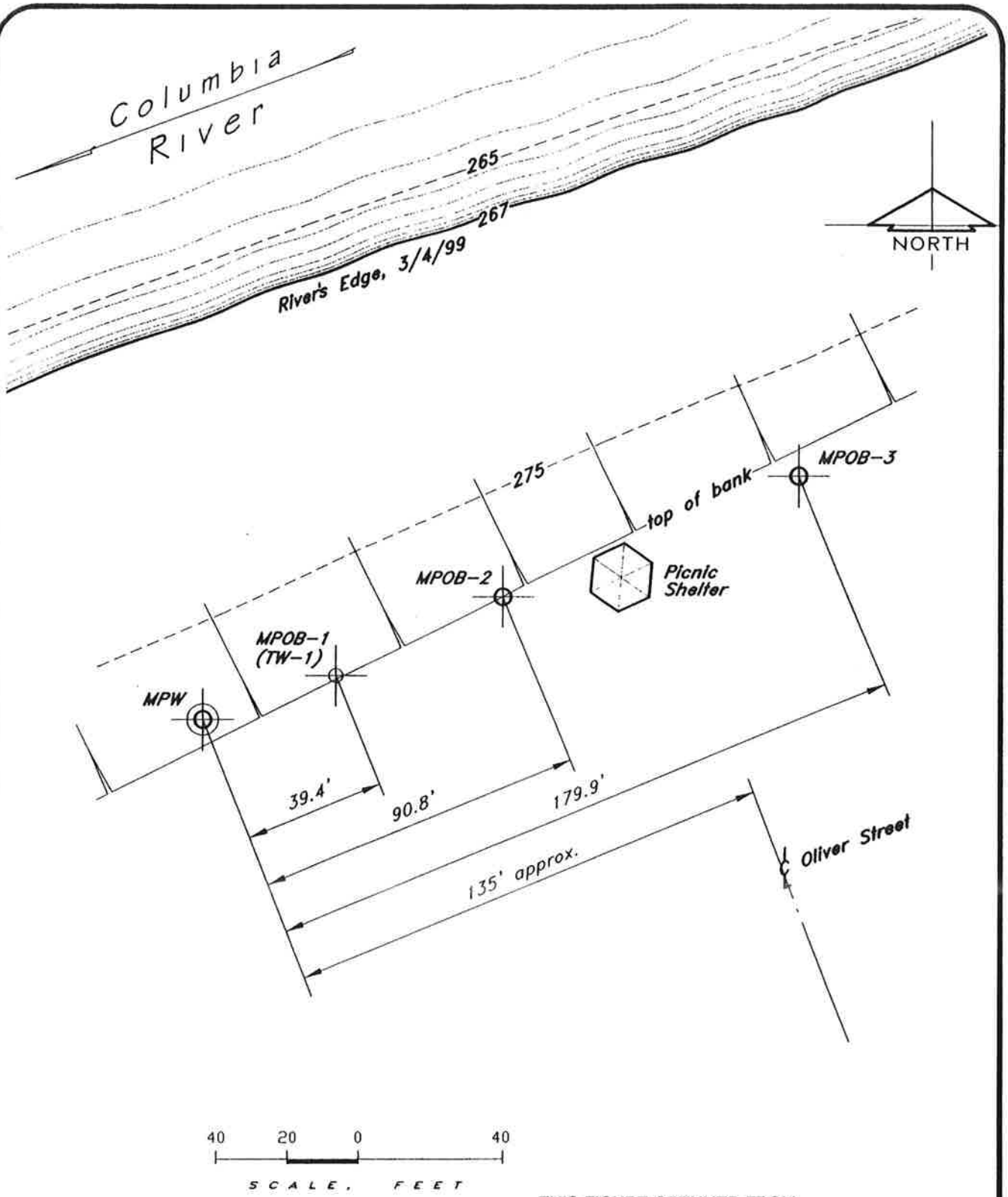
CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

AQUIFER TEST SITE

FIGURE
3-3

130659



June 1999

THIS FIGURE OBTAINED FROM "HYDROGEOLOGIC SURVEY PHASE 2 - DETAILED AQUIFER TEST" REPORT PREPARED BY LAYNE CHRISTENSEN COMPANY, JUNE 1999.

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

TEST WELL LOCATIONS

FIGURE
3-4

130659

CHAPTER 4

WATER STORAGE

INTRODUCTION

Chapter 4 describes the City's existing storage facilities. It discusses the various components of storage required for a municipality. The City's existing storage capacity is compared with the design criteria and the difference is analyzed.

GENERAL

Water storage facilities are constructed to meet several purposes. First, storage reservoirs are often used to provide control for well operation. When a reservoir drops a few feet or more from the full level, the water level can be used as a control for well pump activation. The amount of storage required for this type of control is called "operating storage." Second, stored water must be available to supply water during periods in which the demand for water exceeds the available water supply (wells). This reserve is called "equalization storage." Third, reserve storage is usually provided to supply unusually large demands such as fire flows. This is referred to as "fire reserve." Finally, reserve storage is often provided for emergencies that may arise and interfere with production from water supply sources. Such emergencies could be created by power outages, mechanical equipment failure, or sudden water contamination. The amount of storage to be provided for an emergency depends on the likelihood and the impact of such an occurrence. The amount of emergency storage provided usually becomes a balance between what is needed and what can be afforded. This storage allowance is usually called "emergency reserve."

Storage facilities can be located at approximately the same elevation as the entrance to the water distribution system. Storage facilities of this type require continuous operation of a booster pump system to maintain distribution system pressure. Storage facilities can also be elevated, in which case the water is stored at an elevation considerably above the distribution system in order to generate adequate system pressures. For example, a water elevation of 120 feet above a distribution system would be required to generate a distribution system static pressure of approximately 50 psi. Reservoirs may be elevated by locating them on natural ground high enough above the service area, or by construction on top of a steel support frame.

Storage reservoirs are generally constructed of either steel or reinforced or prestressed concrete. The choice is usually based on an economic analysis made for the particular installation. Reservoirs may be constructed either above ground or buried, with the choice made on cost, location, and community acceptance. The remainder of this chapter reviews the City's existing storage facility, presents a discussion of future storage needs, and provides alternatives for satisfying those needs.

EXISTING STORAGE FACILITIES

The City currently has six individual storage reservoirs. The McNary High Level System has two reservoirs and the Coyote High Level System has one reservoir. The Low Level System has three reservoirs: two at the McFarland Well site and one at the Intertie Well site. The reservoirs provide a total of 4.775 MG of storage volume when full. Each facility is addressed separately in this narrative. Figure 4-1 illustrates the existing reservoirs in each system.

McNary Reservoir. The McNary Reservoir, sited adjacent to the Golf Course Well, is a 1.8 MG welded steel ground reservoir constructed in 1995. It has a wall height of 32 feet and is approximately 100 feet in diameter. It was constructed with an internal 90,000-gallon chlorine contact (CT) chamber for disinfection purposes. The reservoir is filled directly from the Golf Course Well and Port Well, which are controlled by the water level within the reservoir.

This facility provides storage capacity mainly for the McNary residential and Port industrial areas but can also provide water to the Low Level System through a bypass at the McNary Emergency Booster Pump Station. This reservoir is in good condition and no maintenance needs to be performed.

Port Reservoir. The Port Reservoir is an elevated steel tank with a capacity of 125,000 gallons when full. It was originally a part of the Corps of Engineers' water system. The City of Umatilla obtained ownership from the Port of Umatilla in 1994. The ground elevation at the base of the reservoir is approximately 488 feet above MSL. The bottom of the tank is at 628.5 feet and the overflow is at 654.5 feet.

The Port Reservoir has had numerous repairs over the years. The reservoir was epoxy coated in 1989 and the overflow pipe was replaced in 1995. Presently, the reservoir is in good condition; however, it may require additional repairs and painting in the next 20 years. Should that occur, the booster pump station can supply flow and pressure to the McNary area and meet system demands while repairs are made to the elevated tank.

The elevated Port Reservoir is filled by the Golf Course Booster Pump Station through an inlet/outlet pipe. The booster pumps are set to operate as follows:

Water Level Falling	Pump "ON"
645	Pump No. 1 or 3 "on"
640	Pump No. 2 "on"
635	Pump No. 1 or 3 "on"
632	Pump No. 4 "on"

Water Level Rising	Pump "OFF"
637	Pump No. 4 "off"
640	Pump No. 1 or 3 "off"
645	Pump No. 2 "off"
654	Pump No. 1 or 3 "off"

Intertie Reservoir. The Intertie Reservoir was constructed in 1978 as part of a major water system improvements project. It is a welded steel ground reservoir located next to the Intertie Well a few hundred feet southeast of the U.S. Highway 395/U.S. Highway 730 intersection. It is 63 feet in diameter and is 65 feet high, with a storage capacity of 1.5 MG. The floor elevation is at 456 above MSL and the overflow is at 521 feet.

The Intertie Reservoir is typically filled by the Intertie Well. The water level in the reservoir controls the well pump via on/off set points. This reservoir can also be filled with water from the High Level McNary/Port system. The water passes through an automatic intertie valve and flowmeter station located at the McNary Booster Pump Station adjacent to the intersection of Highway 730 and Sprague Road.

Water from the Intertie Reservoir is provided by gravity flow to the Low Level System through a 16-inch diameter pipe. To utilize the entire 1.5-MG storage, the water level in the Intertie Reservoir is higher than the operating level in the McFarland Reservoirs. Water level in the McFarland Reservoirs is controlled by an altitude valve to prevent overflow.

The Intertie Reservoir exterior appears to be in fair to good condition with only minor small rust spots, which should be primed and painted. The interior was inspected in 1997 and found to be in good condition. It is recommended the City hire a diving company to inspect and clean the interior of the reservoir in the next 5 to 10 years.

McFarland Reservoirs. The McFarland Reservoirs can serve both the Coyote High Level System and the Low Level System. The facility consists of a 150,000-gallon ground-level concrete reservoir and a 500,000-gallon ground-level welded steel reservoir. There are no records of the construction of the concrete reservoir, but it was probably built about 1935. There are no plans on file, so the exact diameter and depth of the facility are unknown. The steel reservoir was constructed in 1954.

The elevations of the floors and the overflows of the reservoirs are thought to be the same. The floor elevation is approximately 471.7 feet above MSL and the overflow is at approximately 495.5 feet above MSL.

These reservoirs were also inspected by divers in 1997 and found to be in satisfactory condition. As with the Intertie Reservoir, it is recommended that another inspection be scheduled in the next 5 to 10 years.

The McFarland Reservoirs are typically filled by the McFarland Well. The reservoirs are connected to the low level system via an altitude valve. If the McFarland Reservoirs are low and the McFarland Well cannot meet demands, then water can flow from the Intertie Reservoir through the distribution system, altitude valve, and into the McFarland Reservoirs.

The basic Low Level System pressure is determined by the water level in the Intertie Reservoir. Since this is approximately 30 feet higher than the McFarland reservoirs, an altitude valve is used to control their water level and keep them from overflowing.

Coyote High Level Reservoir. The Coyote High Level Reservoir is located approximately 1-1/4 miles south of the McFarland Well and Reservoirs. It supplies water to the South Hill area by gravity flow. The McFarland Booster Pump Station lifts water from the McFarland Reservoirs to fill the Coyote Reservoir.

The Coyote Reservoir actually serves two separate high level pressure zones. The Coyote High Level System is served by gravity flow and extends from Elevation ±420 to Elevation ±550. The Coyote Booster Pump Station draws suction from the Coyote Reservoir and provides flow and pressure to the Powerline pressure zone. This zone ranges in elevation from ±550 feet to ±670 feet.

The Coyote Reservoir is a ground-level welded steel reservoir with a floor elevation of approximately 622.6 feet above MSL and an overflow elevation of approximately 686.0 feet. It is 54 feet in diameter and 64 feet high with a capacity of 700,000 gallons. The combination inlet/outlet pipe is 12 inches in diameter. The reservoir was constructed in 1978, inspected by divers in 1997, and is reported to be in good condition.

STORAGE REQUIREMENTS

Water storage is usually provided for several purposes. Various methods are used to calculate the volumes of each type of storage component required. Most involve a rational approach to estimating the volume of each storage component consisting of operational, equalization, emergency, and fire reserve. The decision can then be made as to which component controls and storage volumes will actually be necessary. For example, the decision may be made to provide storage for operational, equalization, and fire reserve only, assuming any emergency storage would be available from the fire reserve. If this option were selected, there may not be adequate fire storage available if there is a sustained power outage or if a well pump is out of service for some reason at the time water is needed from fire storage.

Reserve Storage. Reserve storage for fire suppression is usually determined from either the Insurance Services Office (ISO) recommendations or the fire flow recommended by the City's fire chief. Based upon a fire flow of 3,000 gpm for a duration of three hours, the required fire reserve is 540,000 gallons. This is the amount of fire reserve recommended for the McNary High Level System and the Low Level System.

The Coyote/Powerline Pressure Systems typically serve residential areas at the present time. The present zoning for the future development of the area is mainly for residential. There is one small area zoned for commercial but no industrially-zoned areas. Therefore it is assumed that a two-hour, 1,500 gpm fire flow will provide adequate fire reserve for the Coyote/Powerline High Level Systems. These fire flows are shown in Table 2-3.

Emergency Storage. Emergency storage is usually provided for a minimum of one to three days average demand in the event of a power outage, mechanical failure, or other problems that would interrupt the supply of water. In most cases this would be the minimum amount of time to repair or replace a well pump or other equipment.

The City has emergency generator power to operate the Golf Course Well and McNary Booster Pump Station. Additionally, water can be "wheeled" through the distribution system from the McNary High Level System to the Intertie and McFarland Reservoirs. The City also has an emergency generator at the McFarland Booster Pump Station to power the booster pumps during a power outage. The McFarland booster pumps can draw water from the McFarland Reservoirs and fill the Coyote Reservoir. Therefore, the City's water system has great flexibility and reliability for emergency situations.

Given the above elements, the minimum one day of emergency storage should be adequate for the City of Umatilla's system. For the year 2007, the average daily demand was 1.20 MGD and for the year 2027 it is projected to be 2.18 MGD. These values must be properly proportioned for each pressure zone according to present and projected use as was discussed earlier in Chapter 2. The emergency storage requirements are presented in Table 2-3.

Operating Storage. Operating storage is provided to facilitate operation of the City's wells. Each well is controlled by the water level in the reservoir adjacent to it. When the water level in the reservoir drops to a preset "set point," a well is called to start and the reservoir fills. When it reaches a stop "set point," the well stops pumping. The volume of water in the respective reservoir in between the start and stop set points is referred to as operating storage. For the McNary High Level System, this volume is 587,000 gallons. For the Low Level System this volume is 350,000 gallons. For the Coyote and McFarland Reservoirs the operating volume is 383,000 gallons. These figures are presented in Table 2-3.

Equalization storage. Equalization storage must be provided to balance out the difference between peak hour demands and water supply capacity during peak day demand periods. An empirical method for estimating the required equalizing storage uses the difference between the peak hour flow and the peak water supply available for a specified number of peak hours per day. Based on 2.5 peak hours during a peak day, the City's current equalization storage needs are estimated to be 96,500 gallons for the McNary System, 102,000 gallons for the Low Level System, and 36,900 gallons for the Coyote/Powerline System. These figures are based on the distribution of demand presented in Chapter 2 of this study and the pumping capacity of the existing wells that service the respective system reservoir(s). For the McNary System and for the system

total analysis, the worst case scenario of the top producing well being off line was assumed.

With the same assumptions regarding well sources for each pressure zone and the demands projected for the year 2027, the equalizing storage needs are 213,300 gallons for the McNary High Level System, 189,500 gallons for the Low Level System, and 416,800 gallons for the Coyote/Powerline High Level Systems.

It should be realized that additional sources will be added to the water system in the future. These new supplies will reduce the amount of equalizing storage in a given pressure system. Additionally, water can be transferred from the McNary High Level System to the Intertie and McFarland Reservoirs. The McFarland Booster Pump Station provides water to the Coyote Reservoir, drawing from the other systems. Therefore, there is some flexibility to the amount of equalizing and operating storage required. Table 2-3 takes into account some of this flexibility of combined storage and supply between the different pressure systems by factoring in source contribution. To ensure system transfers are not over-allocated, leaving the City short of storage at a critical time, Table 2-3 also looks at the necessary storage components system-wide.

From a strictly storage standpoint, the four storage components indicate a total of approximately 4,017,500 gallons of storage is needed system-wide to meet present demands. Approximately 5,576,800 gallons of storage is needed system-wide to meet the year 2027 needs if storage transfers (source contributions) are not taken into consideration. The present total system storage is 4,775,000 gallons.

As shown in Table 2-3 on a pressure system basis, the McNary High Level System appears to have adequate storage capacity through the year 2027 while relying on a small portion of the source contribution of the McNary Emergency Booster Pump Station. The Low Level System, with its three reservoirs, has plenty of storage capacity beyond the year 2027. Storage capacity for the Coyote and Powerline High Level Systems requires the source contribution of the McFarland Booster Pump Station now and dependence will increase in the future as growth and demand occur in the area. By the year 2027, without any changes in the system, the McFarland Booster Pump Station will be heavily relied upon to maintain storage quantities in the Coyote Reservoir. The shortage of storage without source contribution water transfers is apparent when looking at the system-wide analysis, with a storage capacity shortage of over 800,000 gallons.

With future development projected to occur in the Coyote and Powerline High Level service areas and the storage capacity shortage in this area, the logical location for future expansion of storage capacity would be this southwest portion of the city.

STORAGE RESERVOIR ALTERNATIVES

Types of Reservoirs. Several alternatives are available to the City to meet design storage needs, operational storage needs, and reliability concerns. Alternatives include the following:

1. Construction of a ground-level type storage reservoir near the existing Coyote Reservoir and upgrading the existing booster pump system. This alternative would result in the need to continue operating the Coyote booster pump system continuously to maintain pressure in the Powerline High Level System.

2. Construction of a standpipe type reservoir at a higher base elevation near the service area. This alternative would provide distribution system pressure from the upper portion of the reservoir by gravity flow, but would require a booster pump system to provide system pressure when the reservoir water level dropped too low.

Typically, standpipe reservoirs are more expensive for the same storage volume when compared to ground-level type reservoirs. Storage from the lower portion of a standpipe type reservoir is not always available by gravity flow and often requires booster pumps to maintain distribution system pressures. From an operational standpoint, it is preferable to have the entire storage volume available by gravity flow, but this is not possible with a ground-level reservoir close enough to serve the Powerline High Level System.

Reservoir Materials. Storage reservoirs may be constructed of either steel, reinforced concrete, or prestressed concrete. The choice is usually based on an economic analysis made for the particular installation. For smaller ground-level type reservoirs, steel reservoirs are usually less expensive to construct when compared to concrete reservoirs, but the two can be comparable in cost when storage volumes exceed one million gallons. There are two primary types of steel reservoirs: bolted steel reservoirs with glass-fused-to-steel or epoxy coatings, and welded steel reservoirs coated with a paint system. Glass-fused bolted steel reservoirs are usually more expensive to install when compared to epoxy coated steel reservoirs, but are comparable in cost to a welded steel reservoir with a paint system. When comparing life-cycle costs that include maintenance, such as re-coating, the glass-fused-to-steel bolted steel reservoir typically results in less overall maintenance cost because sandblasting and recoating is not required. For cost estimating purposes, it was assumed the City would install a ground-level glass-fused bolted reservoir or a painted welded steel reservoir since they are typically comparable in cost.

Reservoir Location. When considering sites for a proposed reservoir, it is important to evaluate desired system pressures. To maintain distribution system pressures in the Powerline High Level System similar to those currently provided by the booster pump system, the bottom of the normal operating water elevation of the proposed reservoir would need to be at least 740 feet above Mean Seal Level (MSL). There is no nearby ground that is higher than the service area. The highest elevation is in the southwest portion of the service area at approximately 660 feet above MSL. Placing a standpipe ground-level reservoir at this site could achieve the desired pressures in the service area and increase the storage capacity in the southwest portion of the City. The discussion hereafter provides two storage reservoir alternatives: one at this location with gravity feed for system pressurization and a second adjacent to the Coyote Reservoir utilizing the existing booster pump station for system pressurization.

ANALYSIS OF BOOSTER PUMP SYSTEM OPTION

The existing Coyote Booster Pump Station was installed in 2000. It is meeting system demands and, as pumps begin to exceed their service life, replacement pumps can be sized according to system demands at that time. However, the City may desire to provide system pressure by constructing a new storage reservoir at a higher elevation, which will provide more reliable water system pressure (pressure is available by gravity flow when the power is out). Thus, to maintain minimum distribution system pressures, the existing booster pump system could be taken off continuous use and configured for system pressurization during an emergency when water levels in the new reservoir are lower than required. The reservoir improvement options for a reservoir at a higher elevation site are discussed in the next section of this chapter.

The following table presents some of the differences of the reservoir and operation of the Coyote Booster Pump Station depending on the selected location of a new reservoir.

	Reservoir at Coyote Site	**Reservoir at Elevated Location**
Reservoir Size	Same	Same
Reservoir Configuration	Standard ground-level geometry	Standpipe geometry
Booster Pump Operation	Continuous	Emergency only (low water level in reservoir)
Booster Pump Station	Existing system	Reconfigure existing station at current location
Emergency Power	Existing	Existing
Fire Pump	Existing	Emergency only (low water level in reservoir)

Locating a new storage reservoir at the peak elevation in the Powerline High Level service area includes installing a 12-inch diameter transmission line from the reservoir to the existing Coyote Reservoir site. This would provide adequate flow capacity to the booster pump station if required to maintain pressures for fire flow and the water surface elevation drops below the necessary service level. The advantage of placing a standpipe reservoir in this fashion is the ability to gravity feed the pressure zone without the continuous operation of booster pumps with the associated power, maintenance, and manpower cost. The cost difference of a standpipe reservoir and approximately 2,500 feet of transmission pipeline versus continuous operation of the booster pump station would be the determining factor for the desired option.

RECOMMENDED STORAGE RESERVOIR IMPROVEMENTS

Reservoir Adjacent to the Coyote High Level Reservoir. This option involves the construction of a ground surface reservoir at the Coyote Reservoir and Booster Pump Station site. Minimal piping changes would be needed to connect the reservoirs in series for water circulation and no operational changes would be needed with the

booster pump station. Both reservoirs would serve the Coyote and Powerline service areas as they currently do, providing storage and reserve. The Coyote Booster Pump Station would continue to draw from the Coyote reservoir, supplying water and pressure to the Powerline High Level System. The cost estimate for this alternative is approximately $805,000 as presented in Table 4-1.

Standpipe Reservoir at a Higher Base Elevation. This option assumes the construction of a standpipe ground surface reservoir located near the radio tower adjacent to Powerline Road. A 12-inch diameter transmission pipeline would need to run from the existing Coyote Reservoir approximately 2,500 feet to the new reservoir location. To provide the desired system pressure, the reservoir at a base elevation of 660 feet will need to be at least 90 feet tall to have a minimum operating water surface elevation of about 740 feet. This minimum operating water surface elevation would provide distribution system pressures approximately equal to those currently experienced by water system users in the service area. A 750,000-gallon reservoir that is 90 feet tall would need to be at least 39 feet in diameter. This type of reservoir (taller and narrower) results in significant foundation requirements as well as increased construction effort. These items result in higher costs when compared to more typical ground-level type reservoirs.

The storage in the lower portion of a standpipe reservoir is not available at adequate pressure by gravity flow so booster pumps are required to maintain distribution system pressures when the reservoir level is low. Normal operation of the reservoir would occur with water levels high enough for gravity flow. The existing Coyote Booster Pump Station would be reconfigured to supplement system pressure when operating levels drop below the desired minimum. The construction cost estimate for this water storage option, including the transmission line to the system, is approximately $2,127,000 as shown in Table 4-2.

EXISTING RESERVOIR MAINTENANCE

A routine inspection and maintenance schedule is recommended for existing storage reservoirs so they continue to provide reliable service. The City's existing storage reservoirs are believed to be in good condition with inspections and cleanings completed approximately 10 years ago. To ensure continued trouble-free operation, it is recommended that the City initiate another round of cleanings beginning this year (2008).

SUMMARY

It appears the total storage volume available in Umatilla's water system is adequate to meet present demands, relying on a portion of the emergency backup source from the McFarland Booster Pump Station for the Coyote and Powerline High Level Systems. For the year 2027, the McNary High Level System would rely a little on emergency source contribution, but the Low Level System appears to have adequate storage without considering the emergency sources. However, the Coyote and Powerline High Level Systems would experience shortages of storage capacity if problems were experienced with the only source of water, the McFarland Booster Pump

Station. With the two electric-powered booster pumps and emergency generator at the booster pump station, the existing storage of Coyote Reservoir could be adequate until the year 2027. Overall, the water system has exceptionally good flexibility and reliability when considering storage needs. The ability to transfer water from one pressure system to another during a major fire or other emergency greatly enhances the ability of the system to meet demands. However, the City should consider adding storage capacity in the future to the Coyote/Powerline High Level System. This system has the least amount of storage, yet it will be experiencing the largest growth rate of any of the pressure systems. The most cost effective alternative at this time would be construction of additional storage capacity adjacent to the existing Coyote Reservoir.

ESTIMATED COST
COYOTE RESERVOIR EXPANSION

NO.	ITEM	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization (5%)	LS	$ 28,000	All Req'd	$ 28,000
2	Site Work, including Excavation, Base Rock, Fencing, Site Piping, etc.	LS	8,000	All Req'd	8,000
3	750,000-gallon Steel Reservoir	LS	525,000	All Req'd	525,000
4	Pressure Transducer, Vault, Telemetry System, etc.	LS	15,000	All Req'd	15,000
5	Land Acquisition	LS	20,000	All Req'd	20,000
				Estimated Construction Cost	**$ 596,000**
				Contingencies, Legal, Administrative, Engineering, etc. (35%)	208,600
				Estimated Total Cost - Coyote Reservoir Expansion (Year 2008)	**$ 804,600**

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN
ESTIMATED COST - COYOTE RESERVOIR EXPANSION

TABLE
4-1

ESTIMATED COST
POWERLINE HIGH LEVEL RESERVOIR IMPROVEMENTS

NO.	ITEM	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization(5%)	LS	$ 75,000	All Req'd	$ 75,000
2	Site Work, Including Excavation, Base Rock, Fencing, Site Piping, etc.	LS	8,000	All Req'd	8,000
3	12-inch Transmission Pipeline	LF	50	2,500	125,000
4	750,000-gallon Standpipe Type Steel Reservoir	LS	1,312,500	All Req'd	1,312,500
5	Booster Pump Station Control Revisions	LS	10,000	All Req'd	10,000
6	Pressure Transducer, Vault, Telemetry System, etc.	LS	15,000	All Req'd	15,000
7	Land Acquisition	LS	30,000	All Req'd	30,000
				Estimated Construction Cost	**$ 1,575,500**
				Contingencies, Legal, Administrative, Engineering, etc. (35%)	551,430
	Estimated Total Cost - Powerline High Level Reservoir Improvements (Year 2008)				**$ 2,126,930**

Average Annual O&M

Booster Pump Station Operation (per year)	$ 3,000
40-year Present Worth @ 6%	**$ 45,000**
TOTAL YEAR 2008 PRESENT WORTH	**$ 2,171,930**

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CITY OF
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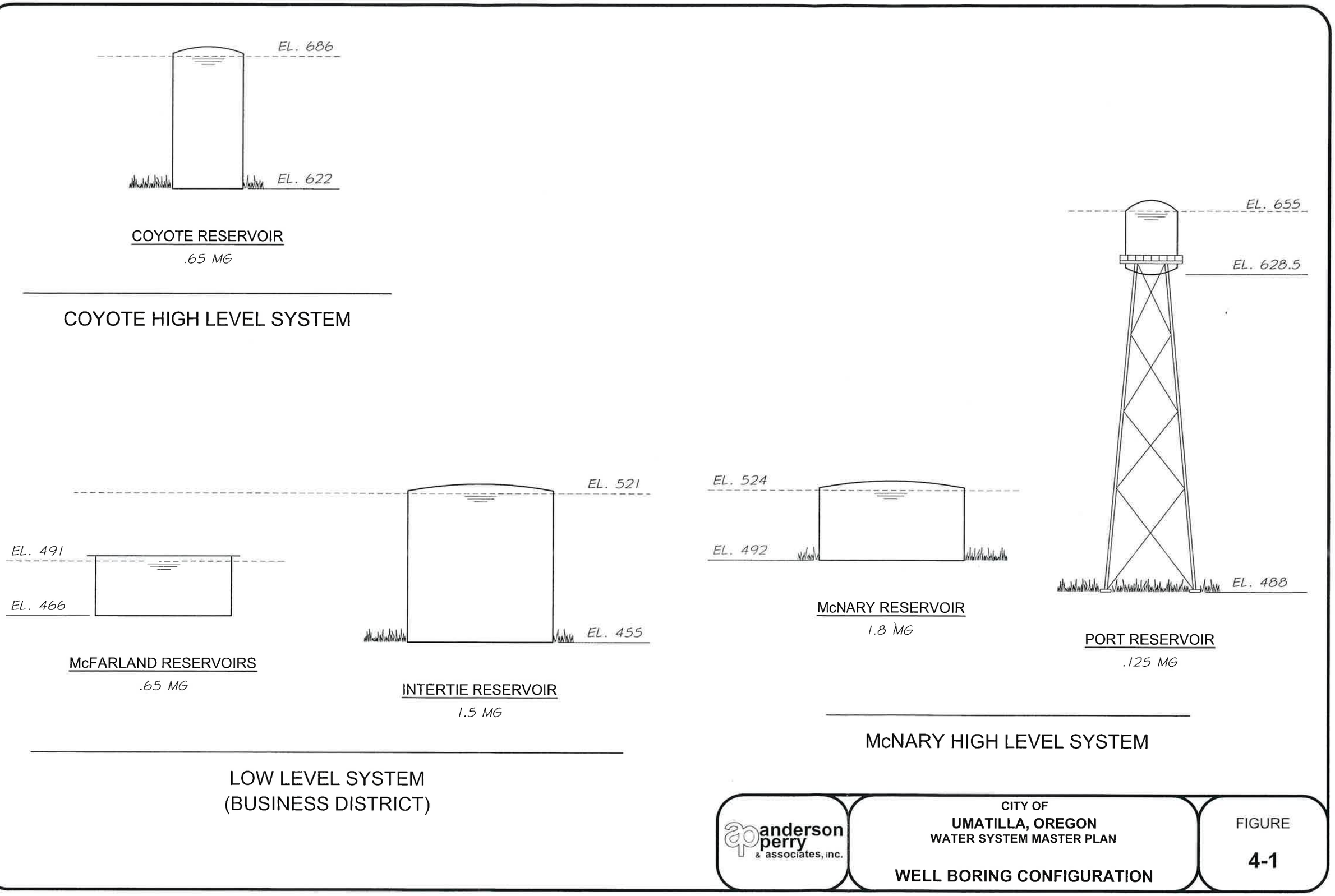
WATER SYSTEM MASTER PLAN
ESTIMATED COST - POWERLINE
HIGH LEVEL RESERVOIR

TABLE
4-2



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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

WELL BORING CONFIGURATION

FIGURE
4-1

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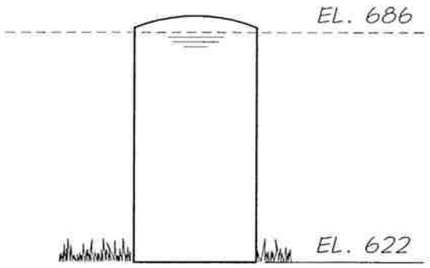
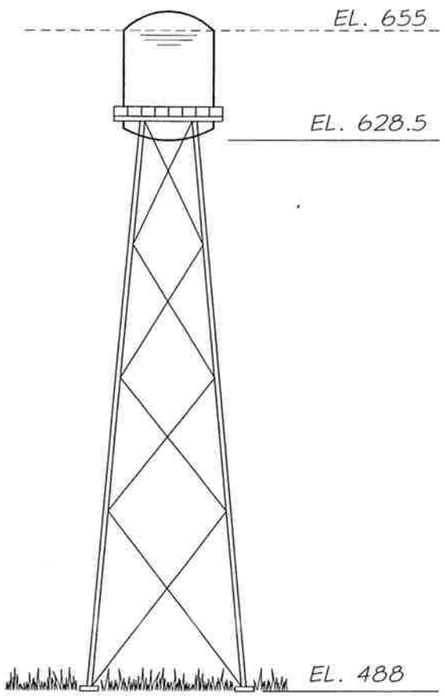


COYOTE RESERVOIR

.65 MG

COYOTE HIGH LEVEL SYSTEM

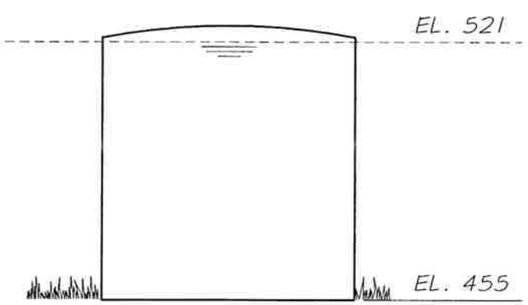


PORT RESERVOIR

.125 MG

McFARLAND RESERVOIRS

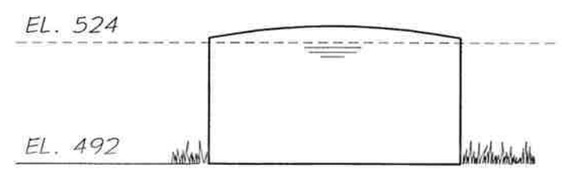
.65 MG



INTERTIE RESERVOIR

1.5 MG

LOW LEVEL SYSTEM
(BUSINESS DISTRICT)



McNARY RESERVOIR

1.8 MG

McNARY HIGH LEVEL SYSTEM

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

WELL BORING CONFIGURATION

FIGURE
4-1

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CHAPTER 5

DISTRIBUTION SYSTEM

INTRODUCTION

This chapter discusses the purpose of a distribution system in general and the City of Umatilla's system specifically. It presents requirements of a system such as minimum pipe sizes, pressure requirements, and flow requirements.

GENERAL

A distribution system consists of both transmission and distribution pipelines. It may have additional facilities such as booster pump stations, pressure reducing vaults, fire hydrants, service lines, and other components. The purpose of a distribution system is to move water from a source or storage facility to the places where it will be used. The pipes in the system must be capable of carrying enough water to meet all demands put on the system including domestic, commercial, industrial, and fire demands. Pump stations are provided to lift water from areas of lower elevation to areas of higher elevation at different pressures. Pressure reducing vaults allow water to flow from the higher pressure areas to the lower pressure areas.

The system should not lose water through leakage or allow contamination into the system through cross-connections with potential sources of dangerous organisms or materials. Lines should be looped to allow flow from more than one direction to points of withdrawal and to prevent stagnation. The system should be capable of maintaining a minimum residual pressure of 20 psi at any location in the system that could be influenced by fire flow during a fire event. Transmission mains must be capable of carrying enough water to meet fire flow requirements in addition to peak hour demand.

In general, for smaller distribution systems, the pipe around the outside of the localized distribution grid should be a minimum of 8 inches in diameter. According to Oregon Drinking Water Program (DWP) regulations, pipes within the grid should never be smaller than 6 inches in diameter and should be looped to provide multidirectional flows when necessary.

EXISTING DISTRIBUTION SYSTEM

The existing distribution system was developed over a period of years to keep up with expansion of the City's population growth. The majority of the system is made up of cast iron pipe, though more PVC pipe has been used in later developments. There are small quantities of other types of pipe such as steel, AC, and galvanized. Sizes range from 2 inches to 18 inches in diameter. Figures 5-1, 5-2, 5-3, and 5-4 are maps of the existing distribution system.

The McNary High Level Distribution System consists of the McNary residential area, the Port of Umatilla industrial area, which includes the TRCI facilities, and a small area just south of U.S. 730. The distribution system generally has a minimum pipe size of 6 inches in the distribution grids and up to 12-inch transmission mains. Much of the system is of relatively recent construction. A significant portion of the McNary residential area distribution system was reconstructed in 1995. During expansion to service the TRCI facilities, 12-inch mains were constructed in the Port industrial area. Additional improvements in selected residential areas became necessary when problems with water service lines initiated a project that replaced approximately 300 service lines. This project was completed in early 2008.

The McNary High Level System is connected to the Low Level System by a 12-inch transmission main. Water can be lifted from the Low Level System to the McNary High Level System through the McNary Emergency Booster Pump Station. An automatic intertie valve and flowmeter vault at the pump station allows water to be transferred from the McNary High Level System to the Low Level System.

The Low Level Distribution System consists of the area west of U.S. 395, north of U.S. 730 to the Columbia River, and south of U.S. 730 to approximately elevation 400 feet -- in other words, the older portion of the City including the downtown area and surrounding residential area. The distribution system consists mostly of cast iron pipe ranging from 2 inches to 8 inches in diameter. The Low Level Distribution System receives water from the Intertie Well and Reservoir through a 16-inch transmission line and from the McFarland Well and Reservoirs through an 18-inch transmission line. Generally, the system receives water from the Intertie Reservoir; however, it can also be fed by gravity from the McFarland Reservoirs.

Though the Low Level System has a few smaller and older water lines, these deficiencies are not creating operational or service problems at this time, nor have they been a subject of complaint from the fire department. Distribution lines smaller than 6-inch diameter located south of Sixth Street do need to be upgraded with larger lines. Furthermore, the DWP requires pipelines serving fire hydrants to be 6-inch or larger. The recommended distribution system improvements are shown in Figure 5-5. Cost estimates for these improvements are presented and discussed in Chapter 6.

The Coyote/Powerline Distribution System serves the area south of the Umatilla River from elevation 400 feet to elevation 660 feet. This system is made up of two pressure zones: the Coyote High Level System, which serves from elevation 400 feet to elevation 550 feet, and the Powerline High Level System, which serves from elevation 550 feet to elevation 660 feet. These pressure zones are shown on Figure 2-2 and Figures 5-1 through 5-3.

The McFarland Booster Pump Station draws suction from the McFarland Reservoirs and lifts water up to fill the Coyote Reservoir. The Coyote Reservoir provides gravity flow and pressure to the Coyote High Level pressure zone. The Coyote Booster Pump Station draws suction from the Coyote Reservoir and pumps provide flow and pressure to the Powerline High Level pressure zone.

The transmission line connecting the McFarland Booster Pump Station to the Coyote Reservoir is only a 12-inch diameter pipe rather than a 16-inch pipe as previously believed. The 12-inch pipe is adequate to meet residential demands to the service area until the year 2027. However, careful planning and design will be required for sizing new pipelines for the area as it develops.

The existing Coyote High Level Distribution System piping consists of 16-, 12-, 10-, 8-, and 6-inch piping. The majority of the older piping is 6-inch PVC or ductile iron. As new subdivisions are being constructed, PVC pipe is typically being used as the City standard. Generally, the piping is adequately sized for residential fire flow. The system is well looped with only a few dead ends that need to be looped as the system expands. Piping and valving improvements made on interconnections with the low level system over the years have resulted in a more flexible, reliable system. Overall, the existing Coyote/Powerline High Level Distribution System is in good condition.

BOOSTER PUMP STATIONS

There are four booster pump stations in the distribution system. The Golf Course Well Booster Pump Station is located on Draper Road adjacent to the Golf Course Well and McNary Reservoir. This booster pump station draws suction from the McNary Reservoir and discharges into the McNary High Level System and elevated Port Reservoir. The McFarland Booster Pump Station, located adjacent to the McFarland Reservoirs on Grant Street, pumps water from the McFarland Well and Reservoirs to the Coyote High Level Reservoir. The Coyote Booster Pump Station draws suction from the Coyote Reservoir and provides flow and pressure to the Powerline High Level Pressure System. It is located near the intersection of Powerline Road and Radar Road. The McNary Emergency Booster Pump Station pumps water from the Low Level System to the McNary High Level System. It is located just east of the Sprague Road/U.S. Highway 730 intersection on the north side of the highway.

Golf Course Well Booster Pump Station. The Golf Course Well Booster Pump Station was constructed in 1995. It is adjacent to the Golf Course Well and McNary Reservoir. It consists of three electric motor driven pumps, a diesel-driven fire pump, and controls. There is also a telemetry system that sends status data to the monitoring panel at City Hall.

There are three 1,000 gpm pumps in the pump station. Two pumps are constant speed and one pump is driven by a variable frequency drive. The pumps draw suction out of the 1.8 million gallon McNary Reservoir, discharge into the McNary High Level System, and fill the elevated Port Reservoir. The controls call the pumps to start/stop based upon the water level in the Port Reservoir. There is also a 3,000 gpm diesel-driven fire pump for use in emergencies.

If the Port Reservoir is out of service for any reason, the booster pumps and controls are set up to maintain a constant pressure in the system even with varying demands. Additionally, the entire pump station has a diesel-driven emergency generator that will provide power if utility power is out. This same generator also provides power to the Golf Course Well.

With the completion of telemetry system upgrades in 2001, the controls and pump system in good condition. Everything is functioning properly at the station and only ongoing general maintenance is required.

McFarland Booster Pump Station. An improvements project was completed on the McFarland Booster Pump Station in 2001. This project installed two 1,300 gpm, 100 Hp booster pumps that together can discharge over 2,000 gpm, exceeding the year 2027 peak day demands. The installation included a new motor control center with one VFD and one solid state starter. One pump operates on a VFD so the Coyote Reservoir can be out of service for maintenance and the Coyote and Powerline High Level Systems can still be supplied.

As part of the project a new 230 kilowatt (Kw) diesel-driven emergency generator and automatic transfer switch was installed. In case of a utility power outage, the generator will start and emergency power will be automatically transferred to the MCC to power the booster pumps and the McFarland Well pump.

Coyote Booster Pump Station. Constructed in 2000, the Coyote Booster Pump Station draws suction from the Coyote Reservoir. It provides flow and pressure to the Powerline High Level System via four booster pumps. Three of these pumps are equipped with variable frequency drives. A 10 Hp pump provides flows from 0 to 150 gpm. Pumps No. 2 and 3 are 30 Hp pumps designed to provide flows from 150 gpm to 600 gpm each or 1,100 gpm combined flow. Pump No. 4 is a fire pump designed to provide up to 2,000 gpm.

The Coyote Booster Pump Station controls are designed to monitor and maintain a set system pressure during varying demand periods. As system demands increase or decrease, the VFDs ramp the pump motors up or down to maintain a set pressure. The booster pump station is equipped with an emergency generator and automatic transfer switch so the station is operable even during a utility power outage.

McNary Emergency Booster Pump Station. The McNary Emergency Booster Pump Station provides the capability of pumping water from the Low Level System to the McNary High Level System in case of a water shortage in the McNary High Level System area. This booster pump is a 60 Hp pump capable of moving 750 to 1,000 gpm, depending on the water level in the Port Reservoir. The unit sits in a pre-built, buried steel vault that extends a few feet above ground level with ventilation to dissipate heat generated by the pump motor and controls.

While able to meet current peak day demands with both the Golf Course and Port Wells inoperable, peak hour demands could exceed the capacity of the system if the reservoirs are out of service. Any water source changes for this service area should include an assessment of system demands and the possibility of constructing a larger emergency booster pump to serve the McNary area.

INTERTIE VALVE AND FLOWMETER VAULT

Located adjacent to the McNary Emergency Booster Pump Station is an underground concrete vault that contains an automatic valve and a flowmeter. This piping/valving provides an intertie connection between the McNary High Level System and the Low Level System. This can allow water to transfer from the McNary High Level System to the Low Level System and keep the Intertie and McFarland Reservoirs full.

The automatic valve is a combination pressure reducing, backpressure sustaining, and solenoid controlled valve. It can be adjusted to open automatically based upon the water level or pressure from the Intertie Reservoir. When the valve opens, water flows into the Low Level System at a set rate based upon the backpressure setting. In this manner, water can be transferred without "draining" the McNary High Level System or creating low pressure in it.

The flowmeter measures and records the flow of water being transferred from one system to the other. This meter provides data so the City can monitor the overall water usage in each pressure system.

ALTITUDE VALVE VAULT

An altitude valve vault is located near the McFarland Reservoirs in Grant Street. This valve connects the Intertie Reservoir, which is higher in elevation, to the McFarland Reservoirs. When the City wants to fill the McFarland Reservoirs with water from the Low Level System (Intertie Reservoir), they open an isolation valve near the vault. The altitude valve opens to allow water to flow into the McFarland Reservoirs and the valve automatically closes when the reservoirs are full. The altitude valve keeps the reservoirs from overflowing.

DISTRIBUTION SYSTEM WATER QUALITY

The City obtains routine samples from the distribution system for analysis of total and fecal coliform. The City randomly obtains seven routine samples per month. Over the past ten years or more, the test results have been negative. There have been a few isolated instances where a test result came back positive; however, all retests have been negative.

The City also obtains random samples from the distribution system for chemical analysis of total lead and total copper. Samples over the last several years have contained extremely low amounts of lead and copper and have been below the EPA action level. Because of this, the City now only samples at three-year intervals.

FIRE PROTECTION

The City reports that the water supply, storage, and distribution systems provide good fire protection. Although there are not system-wide fire flow records, the City feels

that generally the fire flows are adequate. The fire department is responsible for the fire hydrant testing and flushing program. It is recommended that all fire hydrants in the system be flushed and properly tested. This will identify any areas that do not meet required standards.

FIRE HYDRANT SPACING

The City's existing fire hydrants, as shown on Figures 5-1 through 5-3, are typically spaced about 600 to 800 feet apart. The 1998 edition of the Oregon Uniform Fire Code outlines maximum recommended fire hydrant spacing depending on several factors, such as fire flow requirements of the area, the number of fire hydrants in the area, if the area is on a dead-end street or has limited access, etc. As recommended by the Uniform Fire Code, the maximum spacing between any two hydrants is generally 500 feet. The maximum recommended distance from any point of a street or road frontage to a hydrant is 250 feet.

In discussion of the desired hydrant spacing with the City of Umatilla fire chief, he suggested a broader spacing would be appropriate. He indicated that each of the City's fire trucks is equipped with 1,200 feet of 5-inch hose for connection to the fire hydrants. If a fire truck needed to set up in front of a structure located around a corner from a hydrant, the reach would be approximately 800 feet. Therefore, 800-foot radius spacing was used for analysis of the City's hydrant coverage.

To assist with the fire hydrant spacing analysis, 800-foot radius circles were placed around each hydrant on the Water System Map shown in Figures 5-6 through 5-8. Areas with limited fire hydrant coverage become readily apparent on the map.

In general, with the fire department's ability to set up at such a distance from a hydrant, the City has relatively adequate fire coverage for most developed areas inside the City Limits. The primary areas of inadequate fire hydrant coverage are just outside the City Limits in areas serviced by city water.

One area indicated by the fire chief as an area of concern is on Highway 730 (6th Street) at Brownell Boulevard near Interstate 82. The area is populated with fueling stations, convenience stores, restaurants, and the weigh station. Only one fire hydrant serves this area and a fire on the south side of Highway 730 will require closing the road to traffic so water lines can run where needed. This high traffic area and primary east-west route through town would benefit by one or more additional fire hydrants. The cost estimate for this improvement is presented and discussed in Chapter 6.

WATER LOSS

One important monitoring activity performed by the City is to conduct a periodic audit of the volume of water supplied to the system versus the volume of water that is being metered and used by its customers. The difference between billed water use and total water supplied is termed "unaccounted for water." A system that has tight controls on its water consumption generally maintains at least 90 percent accountability for all water. That is, 90 percent of the water supplied to the system can be accounted for in

usage through services meters, etc. Systems that have a water accountability of less than 90 percent should look for the cause of the water usage discrepancies and make corrections where possible.

The City of Umatilla has all sources and interties between service areas metered and has all users metered so the City can perform a water audit every year to determine the amount of unaccounted for water. This helps determine if major leaks develop in the system. It is additionally recommended that large flowmeters in the system on the users' end be periodically checked for accuracy.

The last 6 years of water audits have consistently shown supplied quantities of water and metered use have been within about 4 percent of each other. Water losses experienced in the mid 1990s were resolved after retaining a leak detection consultant in 1997 to perform a leak survey. The leak survey was done with sonic detection equipment utilizing a transducer and a sophisticated amplifier. A thorough visual inspection was also performed on tanks, pump packings, and other above-ground facilities, as well as for wet areas in streets and on the ground. Three large leaks were located during the leak detection survey. Additionally, the Public Works Department located a leak that was losing a significant amount of water. An analysis of water production from before and after the leak repairs indicated that the total loss from the leaks was approximately 112 gpm. The significance of the losses becomes more apparent when converted to an annual volume of nearly 60,000,000 gallons.

MAINTENANCE RECORDS

One of the important operational functions for the City's distribution system is to keep accurate records of various system components. These records become invaluable as time passes in terms of planning future improvements and replacing old or deteriorated components. It is recommended that the City keep accurate records on all water meters installed so that, in the future, these meters can be periodically pulled, checked for accuracy, and replaced as appropriate. The distribution system evaluation in this Water System Master Plan did not include determining existing fire hydrant and valve condition. It would be wise for the City to keep accurate records on all hydrants, valves, and other distribution system components, such as pipes. Hydrants should be checked, at least annually, for proper operation, and all water valves should be exercised, at least annually, with records kept on their operating condition, location, etc.

WATER MANAGEMENT AND CONSERVATION PLAN

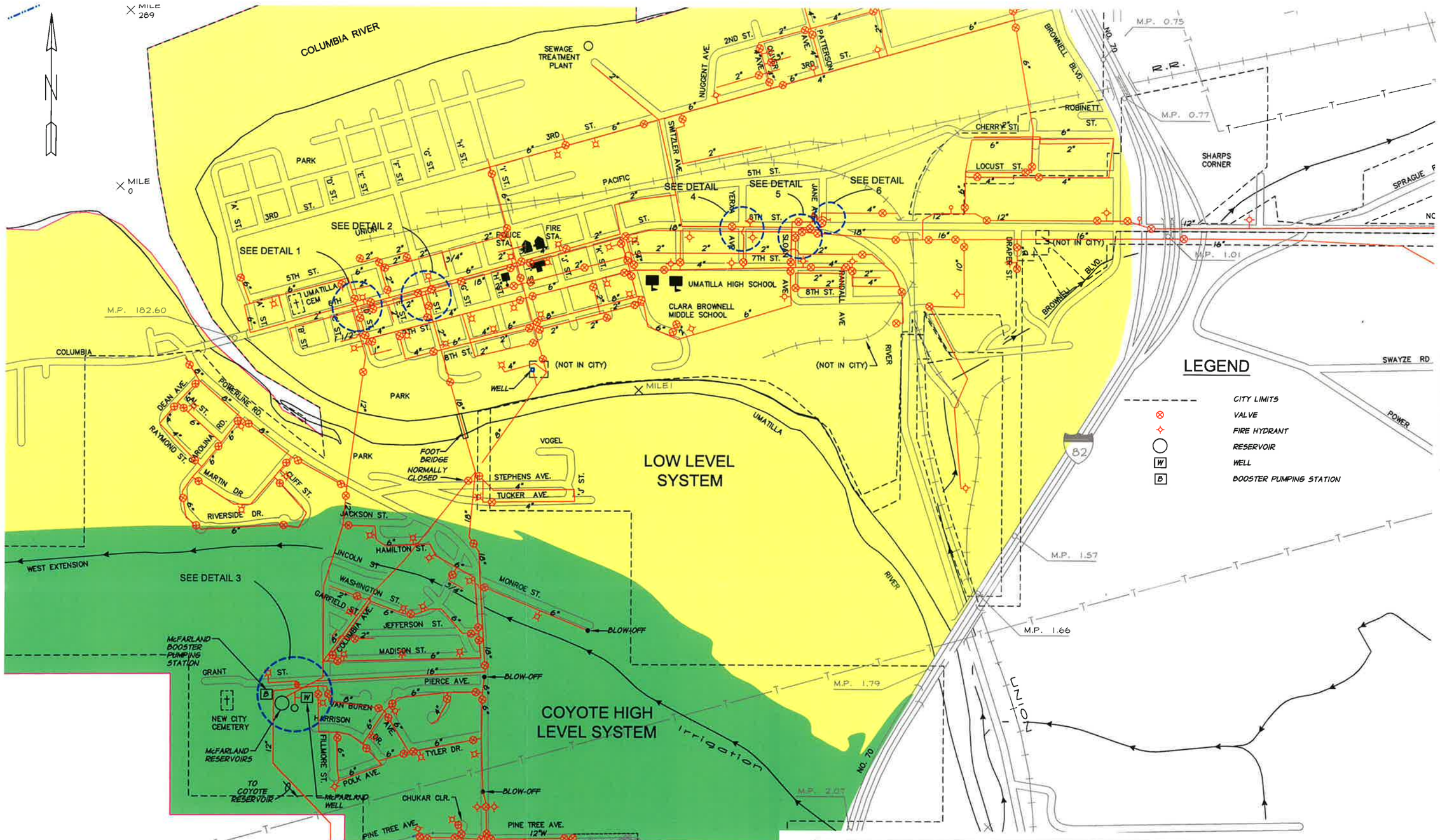
One method available to cities to reduce possible water loss and help conserve water is to complete a Water Management and Conservation Plan (WMCP). These plans are required by the Oregon Water Resources Department as outlined in Oregon Administrative Rule Chapter 690 Division 86. Completion of a WMCP is usually required when a city applies for a new water right or extension of an existing right from OWRD.

The City of Umatilla has prepared and submitted a WMCP in conjunction with this WSMP. With many conservation measures in place, there has been a reduction in

water use by industrial clients, the TRCI, and the City's use for median landscaping and wastewater treatment.

SUMMARY AND RECOMMENDATIONS

In general, the City's distribution system provides good fire protection and, in most cases, is adequately looped. The distribution system layout has relatively few dead-end lines. Some water main line improvements are recommended to enhance system reliability and hydraulic capacity and, where practical, eliminate dead-end lines. These improvements, as outlined in this chapter, include installing new water main lines in a few key areas to improve looping, circulation, and fire flow capacity, and the addition of a couple of fire hydrants. The presentation of costs and further discussion of the proposed improvements are included in Chapter 6, Recommended System Improvements.



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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

EXISTING WATER SYSTEM

FIGURE
5-1

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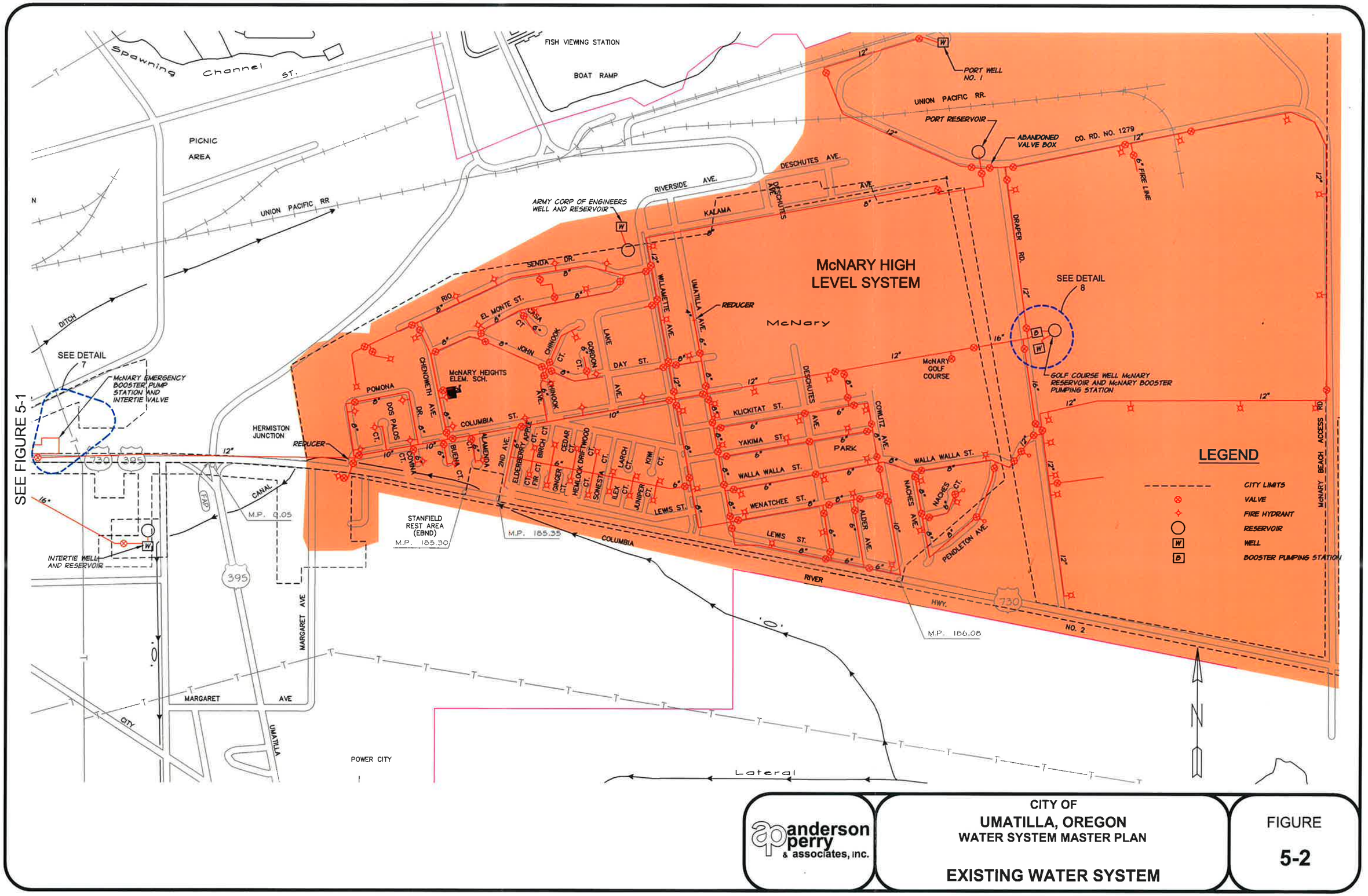

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

EXISTING WATER SYSTEM

FIGURE
5-2

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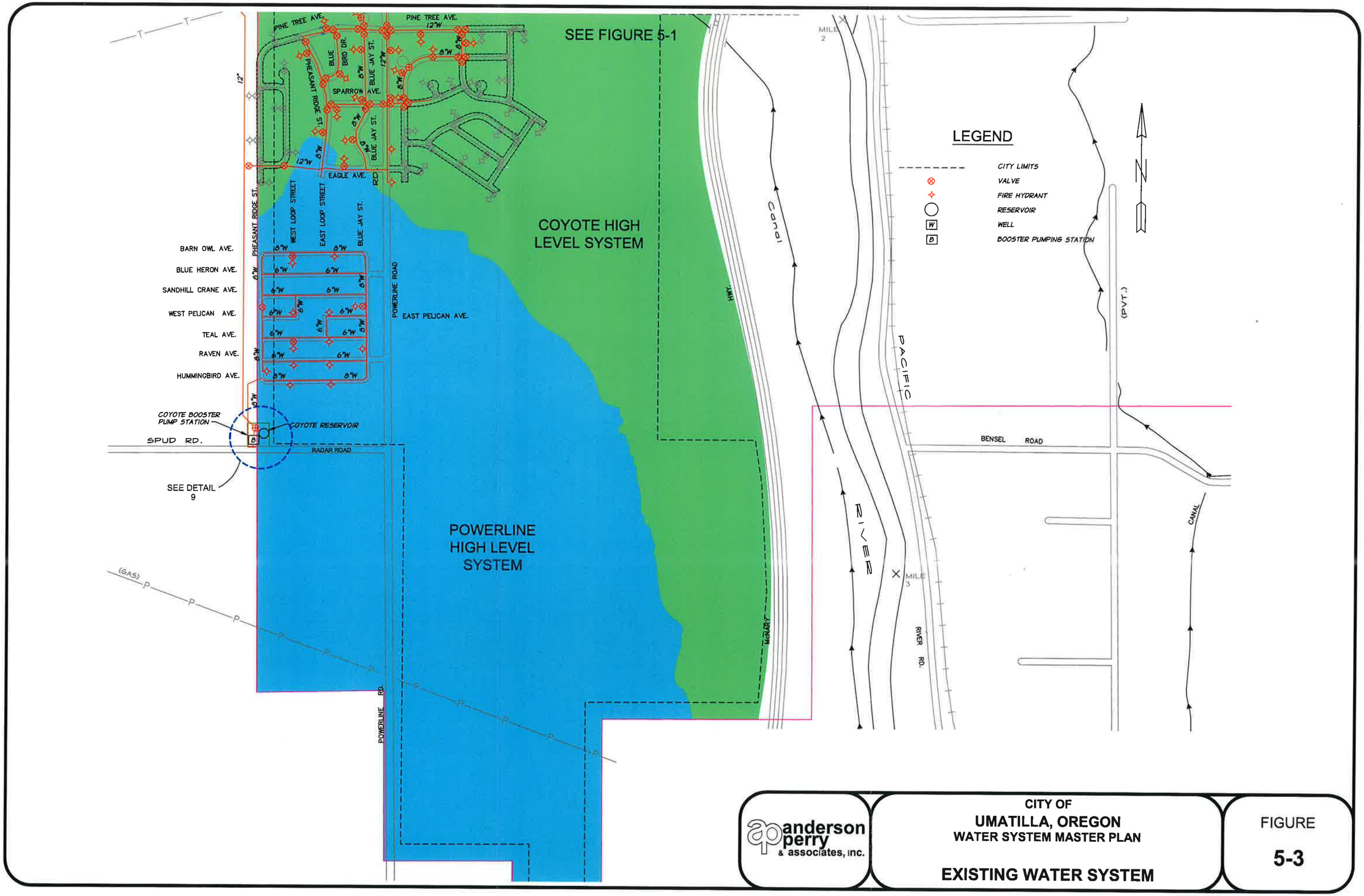

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

EXISTING WATER SYSTEM

FIGURE
5-3

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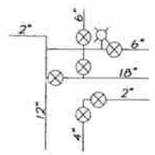

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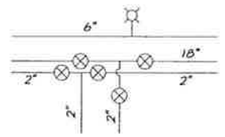

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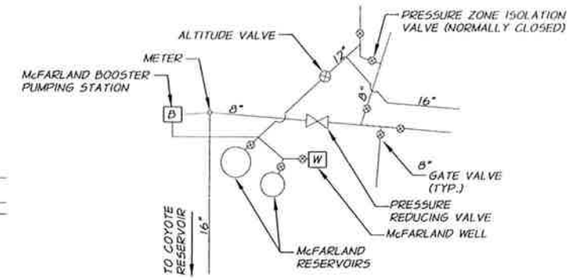

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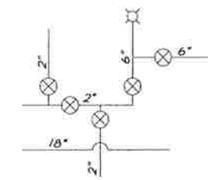

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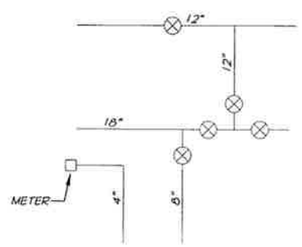

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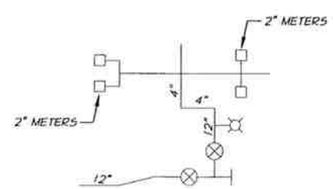

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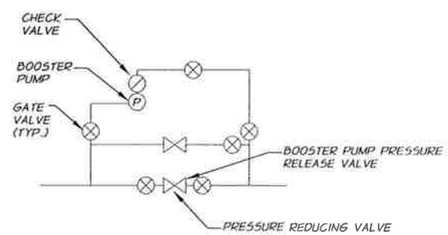

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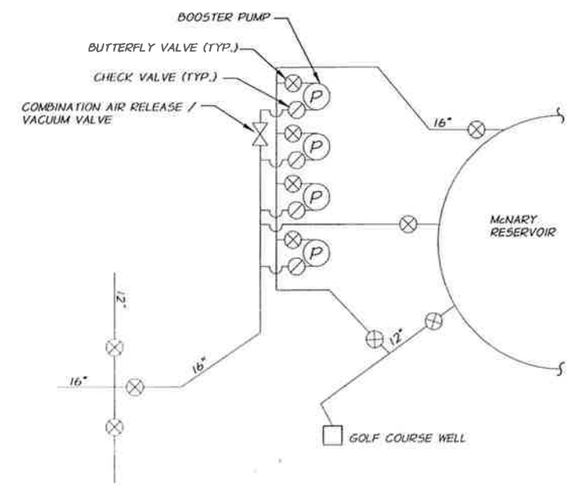

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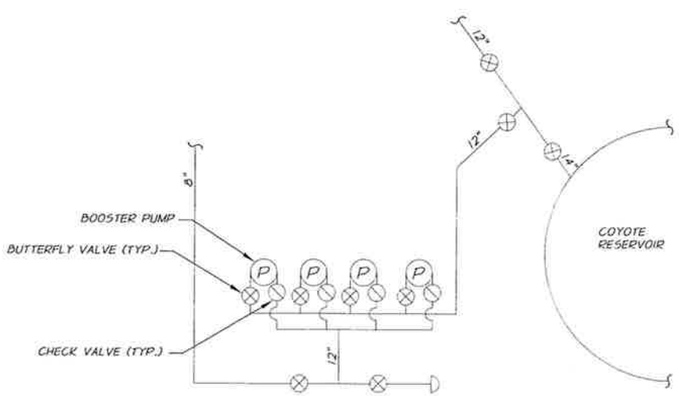

DETAIL 9
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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

EXISTING WATER SYSTEM

FIGURE
5-4

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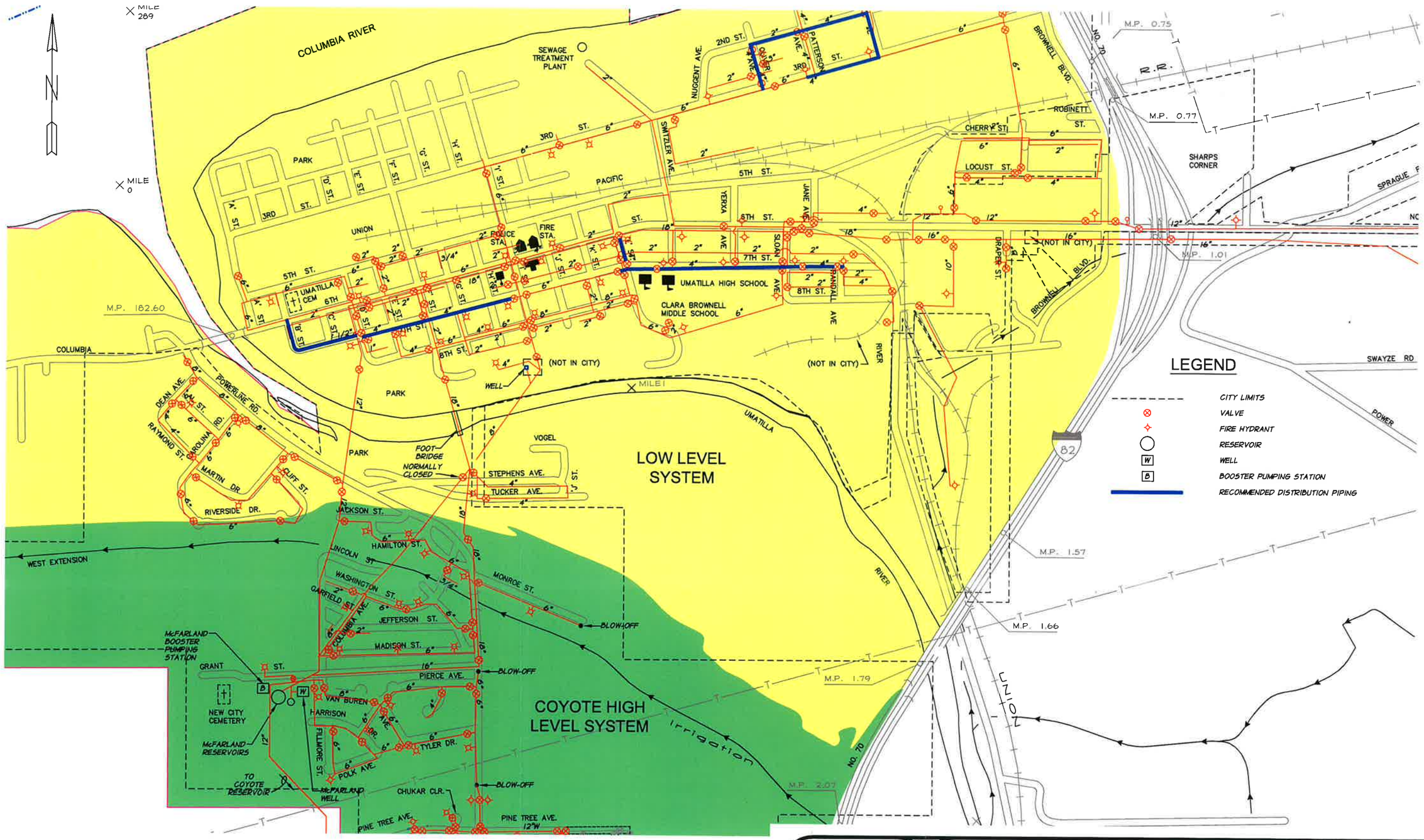

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

RECOMMENDED DISTRIBUTION SYSTEM IMPROVEMENTS

FIGURE
5-5

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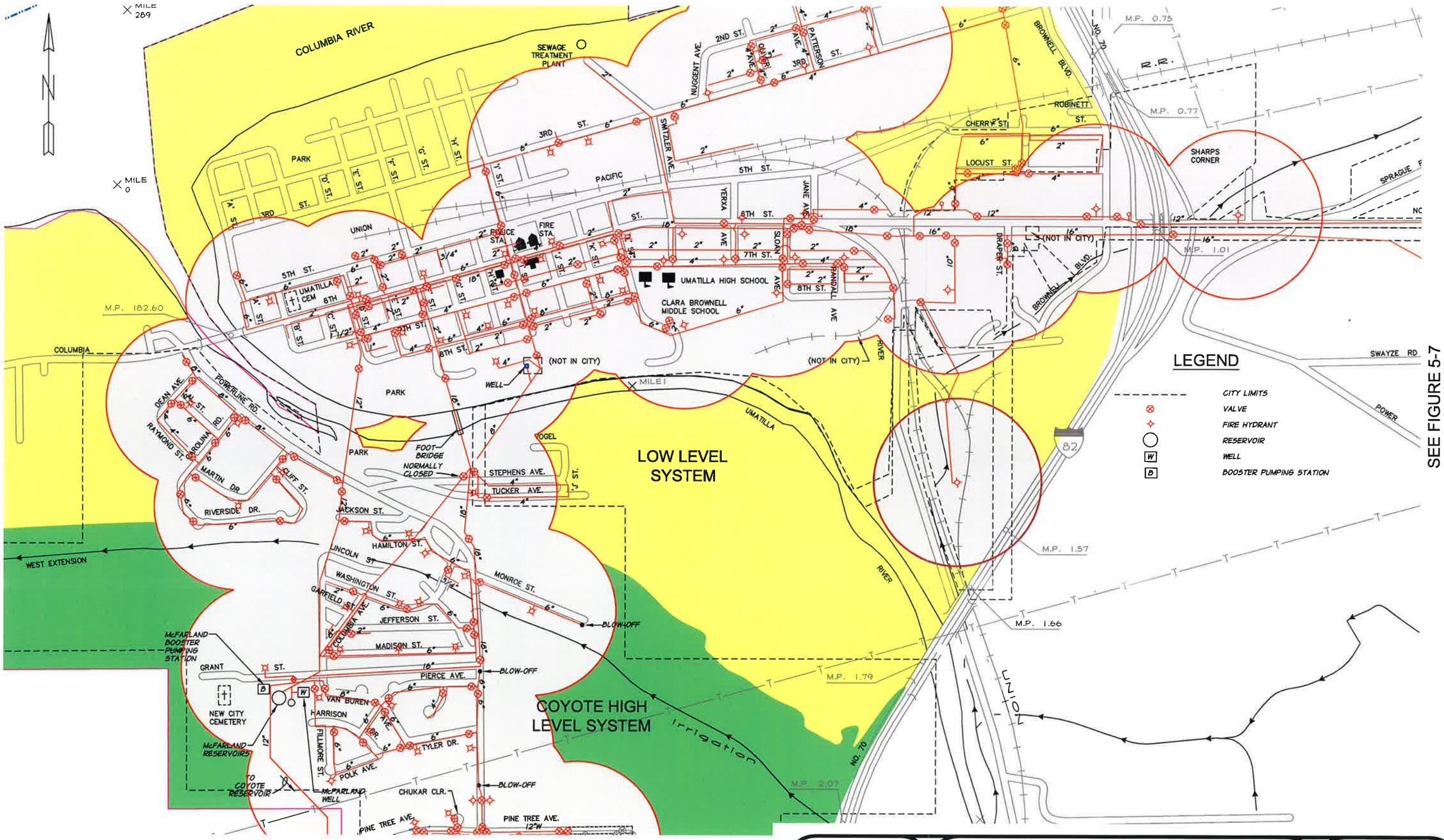

SEE FIGURE 5-7

SEE FIGURE 5-8

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

FIRE HYDRANT COVERAGE MAP

FIGURE
5-6

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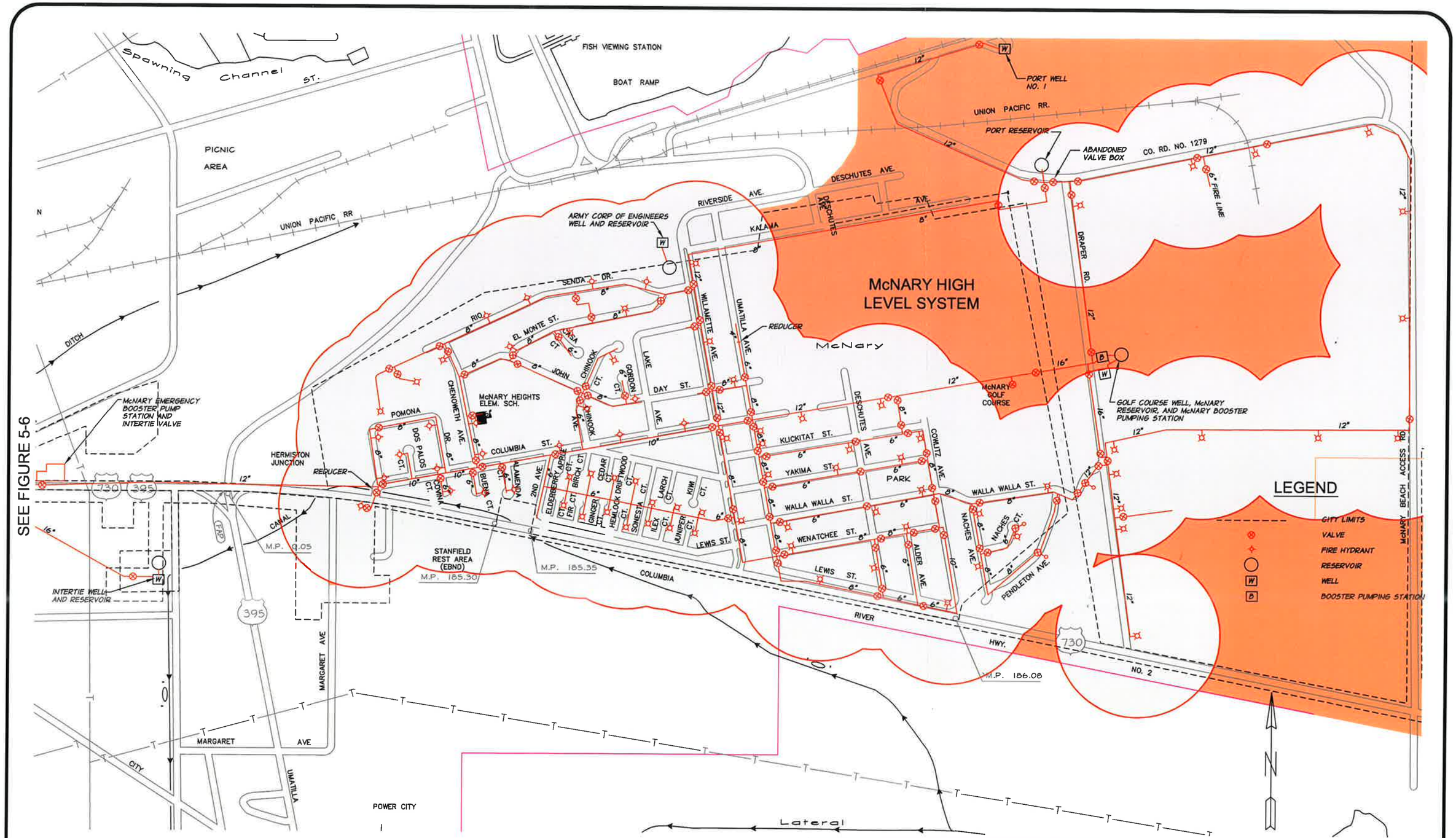

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

FIRE HYDRANT COVERAGE MAP

FIGURE
5-7

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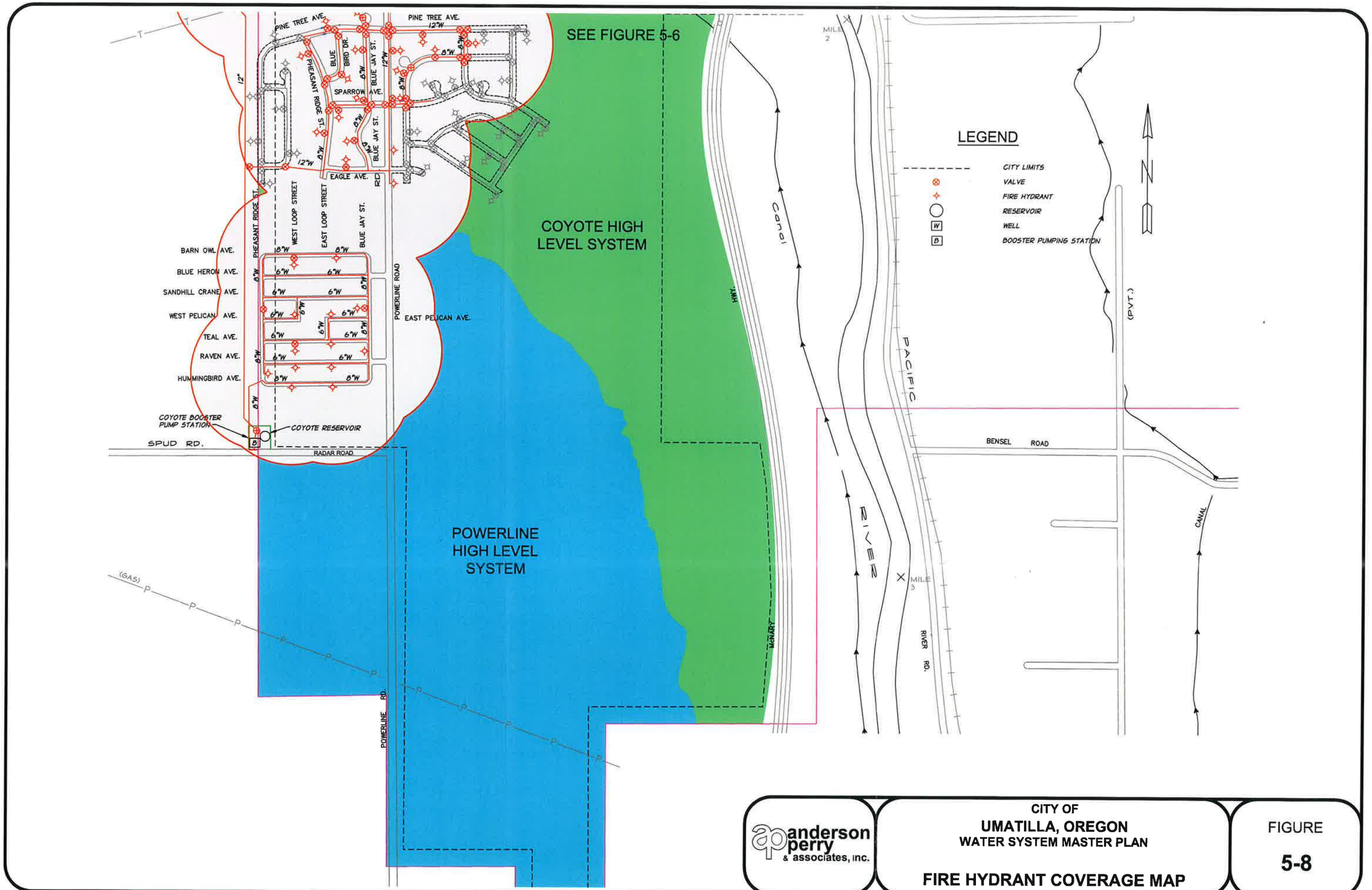

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN

FIRE HYDRANT COVERAGE MAP

FIGURE
5-8

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CHAPTER 6

RECOMMENDED SYSTEM IMPROVEMENTS

INTRODUCTION

This chapter of the study summarizes the recommendations of the Water System Master Plan and outlines the estimated costs of the proposed water system improvements. Detailed descriptions of the proposed improvements for the water supply, water storage, and distribution systems are presented in Chapters 3, 4, and 5.

SUMMARY OF PROPOSED IMPROVEMENTS

As outlined in the preceding chapters, a number of system improvements were identified for the City of Umatilla's water system. Because of the nature of the City's needs, some improvements are considered to be a higher priority than others, with those addressing the increase of water demand dependent on the rate of the City's growth over time. All of the proposed improvements are summarized hereafter.

Water Supply Improvements. The proposed water supply improvements address the increased water demand projected for the year 2016. It is proposed that a detailed engineering study of the water supply alternative be initiated in 2013. The Preliminary Engineering Report should focus on the water demands experienced at the time, assess the alternatives and their applicability to the need, and compare costs. The most promising water supply alternatives at this time include the following:

- **Columbia River Pump Station.** The most direct method of using the existing Columbia River surface water right would be the construction of an intake structure and setting up a package filtration facility with chlorine disinfection. The City needs to procure land adjacent to the Columbia River near the Port Well at the designated point of diversion. The intake and treatment facility could be set up on the site with a transmission pipeline routed to the existing pipeline at the Port Well. The initial package treatment plant would be sized for approximately 1 MGD (1,000 gpm for 18 hours operation per day), with future expansions sized to increase capacity incrementally as demands increase over time. The treated water would be discharge into the McNary Reservoir to allow the necessary chlorine contact time prior to distribution into the water system. The estimated cost to set up such a surface water facility for 1,000 gpm of supply is approximately $2,600,000, as shown in Table 3-4.

- **Shallow Well Field.** In order to increase system reliability and provide for increasing demands, it is recommended the City start to develop a shallow well field. The City needs to obtain an option to purchase land near the marina where previous evaluation test wells were drilled. Once an option to purchase is obtained, a test pump well should be drilled, or an existing well

may possibly be utilized for a test pump. A long duration (30 to 60 days) test pump should be conducted to evaluate whether or not full treatment and filtration of the water will be required. If only disinfection of the water is required, then the City should purchase land for development of a shallow well field.

It is recommended that, initially, two to four wells be developed and placed into service depending upon yield. This work would include drilling and development of the wells, pitless units, pumps, motors, piping, valving, control building with disinfection equipment, a chlorine contact chamber, and distribution system piping. The estimated cost to develop a shallow well field with four wells is approximately $1,900,000, as detailed in Table 3-3.

Water Storage Improvements. Additional water storage capacity is recommended in the Powerline High Level Distribution System in the next 10 to 20 years. This area, combined with the Coyote High Level service area, is anticipated to experience the most growth as Umatilla continues to grow. The flexibility of the distribution system allows each of the pressure zones in the City to supplement another if operational or supply issues arise. However, the Coyote Reservoir is currently operating with about 10 percent less storage capacity than desired, and the McFarland Booster Pump Station is the only source of water to the high level water systems served by the reservoir. The most cost effective reservoir alternative presented in Chapter 4 is the Coyote Reservoir Expansion, as summarized below:

- **Coyote Reservoir Expansion.** Placing a new reservoir adjacent to the existing Coyote Reservoir provides the needed capacity in the existing operating configuration. The Coyote Booster Pump Station would continue to operate with pump capacity improvements completed as demands in the Powerline High Level service area require. The estimated cost for the reservoir is approximately $800,000, as shown in Table 4-1, and operational costs of the booster pump station would continue similar to current expenses.

Distribution System Improvements. Recommended distribution system improvements are related to improving low pressure areas and fire flow limitations as discussed in Chapter 5. The improvements are generally within existing paved rights-of-way. Work that encroaches onto Highway 730 will require a "Permit to Occupy or Perform Operations on a State Highway" from the Oregon Department of Transportation (ODOT). The year 2008 estimated costs for the distribution system improvements are summarized on Table 6-1. The recommended distribution system improvements are summarized hereafter.

A. **B Street and 7th Street to I Street.** Install a new 8-inch diameter transmission line from the 6-inch diameter line in Highway 730, down B Street around on 7th Street, connecting to the 12-inch diameter line in D Street. Then replace the existing 4-inch diameter water line with an 8-inch diameter line continuing down 7th Street connecting with lines in E, F, and G Streets, and terminating with the connection to the 6-inch diameter line in I Street. This will improve looping and fire flow capacity to the hydrants in this part of

town. The estimated cost for this water line installation and replacement is approximately $280,000.

B. **L Street and 7th Street to Randall Avenue.** Replace the 4-inch diameter line with a new 8-inch diameter water line from the 18-inch diameter line in Highway 730, down L Street to 7th Street. Make the connection to a new 8-inch diameter water line in 7th Street replacing the 4-inch diameter line extending from L Street, past the front of the school, to Randall Avenue. This will improve fire flow capacity in the area of the school and the southeast corner of the low level system. The estimated cost for this water line replacement is approximately $290,000.

C. **2nd and 3rd Streets with Quincy and Oliver Avenues.** Replace the existing substandard water line with new 8-inch diameter water line in a loop from 3rd Street at Oliver Avenue, north to 2nd Street, along 2nd Street to Quincy Avenue, then south to 3rd Street, and along 3rd Street ending near Patterson Avenue. This will improve fire flow capacity to the hydrants in this area of apartments. The estimated cost for this water line replacement is approximately $265,000.

D. **Fire Hydrant Improvements.** Install additional fire hydrants in the truck stop and weigh station area of Highway 730 and Brownell Boulevard. This will improve fire hydrant access and reduce the potential of obstructing key east/west traffic through the area on Highway 730 during a fire event. The estimated cost for two hydrants is about $12,000.

COST ESTIMATE ASSUMPTIONS

The estimated costs for the improvements presented in this Water System Master Plan were prepared assuming the improvements would be undertaken using a public bid process with 2008 dollars. The estimates include design and construction engineering, permitting, legal and other services, and a 10 percent construction contingency. It is understood that many of the projects will be conducted as water system demands increase in the future. Therefore, it is recommended that the cost estimates be increased by an annual inflation rate to account for increases in project costs.

PRIORITY OF IMPROVEMENTS

The water system improvements summarized in this chapter include those that should be addressed as soon as it is feasible (distribution and fire protection improvements) and those that will be necessary over time to meet the growing needs of the City into the year 2027 (water supply and storage capacity). The following table lists the anticipated improvements in the order they are likely to be necessary. The rate and pattern of growth in the City will affect project timing and possibly the order of events, as will the options available for funding at the time of the need.

Timeframe	Description of Improvement	Estimated Project Cost
2008±	Distribution system and fire hydrant improvements	$ 847,000
2014±	Water supply improvements using a shallow well field or Columbia River pump station and treatment	$ 1,900,000 to $ 2,600,000
2020±	Powerline and Coyote High Level System water storage reservoir expansion	$ 800,000
2023±	Water supply expansion with the addition of shallow wells or addition of surface water treatment modules	$ 400,000

GENERAL OPERATION AND MAINTENANCE RECOMMENDATIONS

As the City of Umatilla continues to develop and expand its water system, the operation and maintenance of the various system components will be critical to providing a reliable water system that is operated efficiently. One of the most valuable tools in analyzing present trends and projecting future needs of a water system and for general equipment upkeep is to have accurate and complete records. Data should continue to be kept by the City on such items as daily flows from master meters, water quality tests, as-built records on all underground piping, service line and tap locations, etc. Methodically kept records are a tremendous asset to the City in operating and maintaining the water system.

The following recommendations are intended to provide general guidance to the City and are not intended to provide a comprehensive list of operation and maintenance activities related to the City's water system. The recommended O&M activities and suggested recurrence intervals are listed below.

- Obtain water quality tests as required by regulations and submit the results to the DWP.
- Record daily water meter readings at every supply well, booster pump station, and metered intertie valve. Try to record the readings at the same time of day so the data from each well are comparable over equal time periods.
- Record daily chlorine consumption to track chlorine use relative to water flow data.
- Keep maintenance cards on all valves, fire hydrants, and miscellaneous system components in the City.

- Exercise fire hydrants once per year and record information on their condition.

- Exercise valves once per year and record operation data and any problems experienced.

- Develop a replacement schedule for individual service meters in the system.

- Exercise pumps per the manufacturer's recommendations.

- Clean and inspect the reservoirs every five to ten years, or as often as required.

- Annually review water loss to identify potential leaks or improperly operating water meters.

Implementation and continued practice of these measures, many of which the City of Umatilla already completes, should help the City's water system to continue to serve the community for many years to come.

ESTIMATED COST
DISTRIBUTION SYSTEM IMPROVEMENTS

NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
A.	**B Street and 7th Street to I Street**				
1	Mobilization (5%)	LS	All Req'd	$ 9,500	$ 9,500
2	8-inch Water Line	LF	2,300	40	92,000
3	8-inch Valves	EA	4	1,000	4,000
4	6-inch Valves	EA	2	800	1,600
5	4-inch Valves	EA	1	600	600
6	Connection to Existing Fire Hydrant with New Auxiliary Valve	EA	3	1,400	4,200
7	Potholing to Locate Existing Lines	EA	4	200	800
8	Connection to Existing Line	EA	9	700	6,300
9	Asphalt Surface Restoration*	SY	1,700	45	76,500
10	State Highway Asphalt Surface Restoration	SY	50	55	2,750
11	Gravel Surface Restoration	SY	50	15	750
12	Water Service Connections	EA	23	300	6,900
13	Water Service Line	LF	110	15	1,650
				Subtotal Construction Costs	**$ 207,550**
				Administration, Legal, Engineering, and Contingency (35%)	72,600
				Total Year 2008 Estimated Cost (A)	**$ 280,150**

Note: *Assumes 6-foot width of roadway surface for water main repair that must be repaved. Water main may be located in shoulder to reduce cost when design proceeds.

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN
ESTIMATED COST - DISTRIBUTION SYSTEM IMPROVEMENTS

TABLE
6-1

NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
B.	**L Street and 7th Street to Randall Ave**				
1	Mobilization (5%)	LS	All Req'd	$ 8,300	$ 8,300
2	8-inch Water Line	LF	2,300	40	92,000
3	8-inch Valves	EA	5	1,000	5,000
4	6-inch Valves	EA	5	800	4,000
5	4-inch Valves	EA	1	600	600
6	Connection to Existing Fire Hydrant with New Auxiliary Valve	EA	5	1,400	7,000
7	Potholing to Locate Existing Lines	EA	8	200	1,600
8	Connection to Existing Line	EA	8	700	5,600
9	Asphalt Surface Restoration*	SY	1,700	45	76,500
10	State Highway Asphalt Surface Restoration	SY	50	55	2,750
11	Gravel Surface Restoration	SY	50	15	750
12	Water Service Connections	EA	23	300	6,900
13	Water Service Line	LF	110	15	1,650
				Subtotal Construction Costs	**$ 212,650**
				Administration, Legal, Engineering, and Contingency (35%)	74,400
				Total Year 2008 Estimated Cost (B)	**$ 287,050**

Note: *Assumes 6-foot width of roadway surface for water main repair that must be repaved. Water main may be located in shoulder to reduce cost when design proceeds.

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CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN
ESTIMATED COST - DISTRIBUTION SYSTEM IMPROVEMENTS

TABLE
6-1
CONT'D

NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
C.	**2nd Street, 3rd Street, Quincy Avenue, and Oliver Avenue**				
1	Mobilization (5%)	LS	All Req'd	$ 7,500	$ 7,500
2	8-inch Water Line	LF	2,200	40	88,000
3	8-inch Valves	EA	4	1,000	4,000
4	4-inch Valves	EA	2	600	1,200
5	Connection to Existing Fire Hydrant with New Auxiliary Valve	EA	3	1,400	4,200
6	Potholing to Locate Existing Lines	EA	9	200	1,800
7	Connection to Existing Line	EA	9	700	6,300
8	Asphalt Surface Restoration*	SY	1,700	45	76,500
9	Gravel Surface Restoration	SY	50	15	750
10	Water Service Connections	EA	17	300	5,100
11	Water Service Line	LF	90	15	1,350
				Subtotal Construction Costs	**$ 196,700**
				Administration, Legal, Engineering, and Contingency (35%)	68,800
				Total Year 2008 Estimated Cost (C)	**$ 265,500**

Note: *Assumes 6-foot width of roadway surface for water main repair that must be repaved. Water main may be located in shoulder to reduce cost when design proceeds.

NO.	ITEM	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
D.	**Fire Hydrant Replacement / Additions**				
1	Mobilization (5%)	LS	All Req'd	$ 350	$ 350
2	Replace Existing Hydrant and Auxiliary Valve; Connect to Existing Line	EA	2	3,500	7,000
				Subtotal Construction Costs	**$ 7,350**
				Administration, Legal, Engineering, and Contingency (35%)	5,100
				Total Year 2008 Estimated Cost (D)	**$ 12,450**

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CITY OF
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WATER SYSTEM MASTER PLAN
ESTIMATED COST - DISTRIBUTION SYSTEM IMPROVEMENTS

TABLE 6-1 CONT'D

CHAPTER 7

PROJECT FINANCING AND IMPLEMENTATION

INTRODUCTION

This chapter evaluates the financial status of the City's Water Department and outlines alternatives for financing Umatilla's water system improvements. A summary of state and federal funding programs is presented, including a review of options available to the City for securing loans. In order to construct the proposed improvements, a financing plan that is acceptable to the citizens of Umatilla must be developed to complete the improvements.

Although a detailed analysis of Umatilla's current water rate structure is beyond the scope of this study, some discussion of the existing rate structure, and current and future water system budgets, is included. As a general rule, most utility rate structures include funding for periodic minor system improvements and maintenance items, payroll costs for staff, and a set-aside for future improvements.

CURRENT WATER USE RATES AND REVENUE

The operation and maintenance of the existing water system is financed through the City's annual budget. Revenue is obtained primarily from water user fees and system development charges. The current monthly water rates at the time of this report are presented below.

The water rates for residential, apartments, motels, offices, RV parks, etc., are as follows per meter size, with an additional charge of $1.00 per 1,000 gallons of water metered.

Meter Size	Base Rate (per month)
3/4-inch and smaller	$9.75
1-inch	$11.44
1-1/2-inch	$15.14
2-inch	$19.19
3-inch	$27.61
4- and 6-inch	$38.23

Therefore, a typical residential customer using 7,500 gallons per month would pay a water bill of $17.75 per month. The above base rates are doubled for services outside the City limits.

In addition to the monthly water rate, the City currently has a property tax assessment to repay water system debt. For the 2007-08 tax year, the rate was $1.72 per $1,000 assessed value. In the 2000 Census, the median home value for the City

was $94,000 for an annual tax of $162 per year, or approximately $13.50 per month. This results in a total monthly cost to the typical residential water user of $31.25.

Water rates for the Port Industrial Park are as follows:

Meter Size	Base Rate (per month)
3/4-inch and smaller	$42.39
1-inch	$60.40
1-1/2-inch	$100.00
2-inch	$143.22
3-inch	$233.24
4- and 6-inch	$346.68

There is an additional charge of $1.00 per 1,000 gallons of water metered.

As of October 2007, the City of Umatilla had the following number of water service accounts that were metered and billed:

Account Type	Number of Accounts
City:	
3/4-inch and smaller	1,476
1-inch	94
1-1/2-inch	30
2-inch	32
3-inch	4
4- and 6-inch	3
Port:	
3/4-inch and smaller	4
1-inch	2
1-1/2-inch	1
2-inch	2
3-inch	3
4- and 6-inch	1
Fire Flow Protection	4
Miscellaneous:	
3/4-inch (Outside City Limits)	44
2-inch (Outside City Limits)	2
Usage Only	25
TOTAL:	**1,729**

The revenue generated from the City's water rates, interest income, and connections fees collected over the period from years ending June 2000 through June 2007 is presented in Table 7-1. Revenues show a steady growth for the period as the population and water use have increased. Material and personal costs have also increased as production and staffing changes have been made to keep up with

increasing service demand. A small amount of capital outlays are reflected in the Water Department budget; however, most capital expenditures are recorded under the Water Reserve Fund that the City maintains for that purpose. In addition to the Water Reserve Fund, transfers are made to the Building Reserve, Capital Reserve, and Debt Service Funds as discussed below. The larger transfers occurring in fiscal years ending 2000 and 2001 were on account of larger capital improvement projects completed in that timeframe.

CURRENT FINANCIAL STATUS

The annual cost of operating and maintaining the Umatilla water system as summarized in Table 7-1 is shown graphically in Figure 7-1. The costs presented were obtained from the City's annual audit reports to include all costs for the water system, such as operation, maintenance, and replacement (OM&R), staff, payroll, capital outlay, and debt service.

Historic and Projected Budget Trends. The City's Water Department revenues have both exceeded and fallen below annual expenditures over the period from 2000 through 2007, as shown in Table 7-1. In years when expenditures have exceeded revenues, cash carryover from previous years has been used to pay the excess expenditures.

A significant component of the City's total water system expenditures is the operations, maintenance, and replacement (OM&R) expenditures. OM&R costs reflect personal services (such as staff labor payments, staff benefits, office supplies, etc.), materials and services, and capital outlay. Figure 7-1 includes an OM&R expenditures trend line to highlight the City's OM&R costs for the reviewed period. The labor and materials costs are growing at a rate of about 3.5 percent per year while revenues are increasing at only about 2 percent per year. This may warrant a rate increase in the near future. Without such an increase, the City may see a slow depletion of the reserve funds as the ability to replenish the funds is reduced.

Transfers to Other Funds. On an annual basis the City makes transfers to a Capital Reserve Fund, Building Reserve Fund, Water Reserve Fund, and Debt Service Fund. The Debt Service Fund is discussed below. The Water Reserve Fund is maintained to pay for capital improvements to the water system. Over the period reviewed, the fund has maintained a fairly steady balance and funded some fairly substantial improvement projects. In recent years, the Water Department has made an annual transfer of approximately $54,000 to this fund. The Building Reserve Fund receives an annual transfer of about $36,000 to cover billing and records overhead expenses. The Capital Reserve Fund receives approximately $20,000 per year from the water budge for vehicles, computers, and other overhead type expenses.

Existing Debt. The City handles water debt through the Debt Service Fund mentioned above. This fund currently services debt for two outstanding bonds used for water system improvements that occurred in 1978 and 1994. The 1978 project is anticipated to be paid off in 2019 with two equal payments per year totaling $62,912 annually. The 1994 loan requires an annual payment of $171,549 with an expected

payoff in 2015. Higher water rates charged the Port Industrial Park users are applied toward the debt with a transfer to the Debt Fund in the amount of approximately $21,000 per year. This, combined with annual property tax revenue that is deposited directly into the Debt Service Fund, covers the annual payments totaling $234,611. This fund appears to be functioning adequately at this time but should be reevaluated in 2015 when the 1994 Public Works loan is paid off.

Summary of Current Financial Status. The City's Water Utility Fund is running smoothly at this time and has for the last several years. As previously stated, the City should consider plans to adjust water rates to keep in step with increasing labor and materials costs related to inflation. The City should continue to track revenue and expenditure trends in future years to determine if further water rate increases or reductions in expenditures are needed.

WATER SYSTEM IMPROVEMENTS FUNDING

In order to accomplish the water system improvements discussed in Chapter 6, the City may consider outside funding assistance. There are a number of state and federal grant and loan programs that can provide assistance on municipal improvement projects to utility districts, cities, and counties. These programs offer various levels of funding aimed at different types of projects. These include programs administered by Rural Development (RD) under the U.S. Department of Agriculture, the U.S. Economic Development Administration (EDA), the Oregon Economic and Community Development Department (OECDD), and others. These agencies can provide low-interest loan funding and possibly grant funding for assisting rural communities on public works projects. Most of these agencies require increases in existing water rates to support loans for system improvements both as a condition of receiving monies and prior to being considered for grant funds. Some of the funding programs provide funding only if the improvements address documented water quality compliance issues.

As many of the proposed system improvements will be constructed several years in the future, it is likely changes will occur in funding availability and selection criteria. The following is provided to show the current state of the programs and the nuances of funding available now. Funding alternatives should be reevaluated in the early phases of a project that is ready to be initiated.

SUMMARY OF STATE AND FEDERAL GRANT AND LOAN PROGRAMS

The following section briefly summarizes the primary funding programs available to assist the City with a water system improvements project. The first two are loan programs without a particular water system quality problem needed to qualify for the funding, with the remaining funding sources having such stipulations required. As the City's projects are generally not based on a water quality issue, funding from these latter sources is not likely unless the City's situation changes or a water quality issue arises. However, the information is presented for the possibility of future applicability to the City's needs.

(1) The Oregon Economic and Community Development Department is the administrator of the ***Special Public Works Fund*** program, which is funded by monies from the Oregon Lottery. Funds from this program can be made available for either the purpose of improving public facilities or enabling the community to be in a position to serve additional commercial and industrial businesses. Loan funds are normally available through this program to be utilized by cities and counties for public utility improvements. The interest rate for loans through this program is generally tied to the Oregon Bond Bank, as discussed below. The program also offers grant funds once specific loan capacity limits are met, and when economic growth and the creation of new jobs or retention of jobs can be tied to the project. Unless a project can be tied directly to the creation of new family wage jobs or the retention of existing jobs, a project will not be in a competitive position to receive grant funds under this program with the limited funds that are available.

(2) The State of Oregon has developed the ***Oregon Bond Bank*** as a loan source available to cities for improvement projects. The OECDD also uses the Bond Bank as the source of loan funds for the Water/Wastewater and Special Public Works Fund programs, which are discussed below. Periodically, the State of Oregon sells bonds, using the state's credit rating, to maintain a pool of money that the State can, in turn, loan out to cities, counties, and special districts. The State pays the bonding costs and buys down the interest rate a small amount. Interest rates for loans from the Bond Bank are typically around 5 to 6 percent. Local government agencies can finance a loan obtained from the Oregon Bond Bank based on either a local general obligation bond election or a local revenue bond authorization; either way the interest rate is the same. Applications for loans through the Oregon Bond Bank are accepted at any time by the state. This loan source is attractive to small communities because of the slightly lower interest rate and because the local government is not faced with expensive bonding costs. This program is not as appealing as financing through other programs with potential grants or low interest loans, but the improvements necessary for Umatilla at this time do not generally fit these other funding programs.

(3) Another potential funding source is the ***U.S. Department of Agriculture, Rural Development (RD)*** program (formerly known as Farmers Home Administration). This agency can provide financial assistance to communities through both loans and direct grants. Under the loan program, the agency purchases local bonds. The interest rate for these bonds is dependent on the median household income (MHI) of the community and other factors, and varies from year to year based on other national economic factors. Application for this type of funding is a fairly lengthy process involving pre-application, final application, environmental review, etc.

The grant fund eligibility under the agency's current rules is dependent upon the City's MHI in comparison with the 2000 Oregon non-metropolitan MHI. Currently, RD is using a non-metropolitan MHI of $41,230 as the basis for grant fund eligibility. The City's current (2000 Census) MHI is $35,916. When comparing

the City's MHI with the non-metropolitan MHI, Umatilla would likely qualify for grant funding through RD. However, RD's grant funds are limited and generally very competitive to obtain. Based on the funding environment and the competition for funds, RD adjusts the limit on the maximum amount of loan dollars a community can request. The interest rate for RD loans typically varies between 4.0 and 4.5 percent with a repayment period based on the service life of the improvement, but not to exceed 40 years.

The equivalent monthly water rate must provide sufficient revenue to pay for all system operation and maintenance costs, any existing debt service, and the local debt service incurred as a result of the project. Project costs above this level may be paid for by grant funds, which is typically a maximum of $1,000,000. A general rule is that RD requires 20 percent of the project to be funded through other sources. The objective of the RD loan/grant program is to keep the cost for utilities in small rural communities at a level meeting RD's definition of affordable and similar to what other communities are paying. Currently RD requires a monthly water rate of approximately $44.00 to 46.00 per month to be eligible to receive grant funds.

Another of the agency's requirements is that loan recipients establish a reserve fund of 10 percent of the bond repayment. If the City does not have these reserves available, they can be established during the first 10 years of the project, effectively making the net interest rate a little higher. The RD program also requires cities to establish either revenue or general obligation bonds to guarantee the loan. These bonds are typically purchased for a period of 40 years. The RD program also allows project costs previously incurred by the City, interest paid on interim financing during construction and, in some cases, existing debt to be financed as part of the project.

RD is considered a potential source of funding for the City's full water system improvements project. However, RD would likely serve only as a loan source to fund a portion of the project.

(4) The OECDD also administers the ***Water/Wastewater*** financing program. This program also uses Oregon Lottery funds to help municipalities make improvements to their drinking water and wastewater systems. Project eligibility is generally limited to those projects necessary to ensure compliance with drinking water quality standards administered by the Drinking Water Program (DWP) or water quality statutes, rules, orders, or permits administered by the Department of Environmental Quality (DEQ). A project may also be eligible for funding from this program to assist in bringing the system into compliance with requirements proposed to take effect within the next two years or if the DWP indicates there is a high probability that the system owner will soon be notified of non-compliance.

Funding from this program can be in the form of loans and/or grants. Determination of the final amount of financing available for a specific project, and the loan/grant mix, is based on several factors including the financial strength of

the municipality, per capita income of the applicant, existing water and sewer rates as compared to a statewide average, and more.

For reduced rate loans and grants, this program requires that the recipient has a monthly residential rate for 7,500 gallons of water of at least 1.48 percent of the 2000 statewide MHI. Based on the 2000 Census, the MHI in Umatilla is $35,916. A monthly residential water fee corresponding to 1.48 percent of this MHI would be approximately $41.75 per month. The City's current monthly residential water fee (combining the base rate and water use fee of $17.75 and the $13.50 property tax of the average home that is applied to the water bond payment) is $31.25. This is approximately $10.50 under where it would need to be to establish rates at 1.48 percent of the MHI. An increase of nearly 34 percent would be necessary to meet the threshold rate requirement. Therefore, the City does not currently qualify for low interest loans and/or grant funds. It is possible this criteria could be met in the future due to rate increases that may be necessary to cover rising OM&R costs and/or repay additional loans the City may incur to finance water system improvements.

If the City were to become eligible for grants under the above criteria, the current grant awards allow a maximum $750,000 grant for communities with an MHI less than the statewide MHI.

Since Umatilla's 2000 MHI ($35,916) is less than the statewide MHI ($41,662), the maximum amount of grant funds the City could qualify for is $750,000. However, if the City is eligible for a grant through this program, the grant award is usually split 50/50 with the loan amount maximized to the target water rate so the loan typically exceeds 50 percent of the project cost. Typically, these loans are tied to the Oregon Bond Bank, as previously discussed.

Funding from this program would require a proposed project that is associated with a documented compliance issue, which is not the case at this time.

(5) The OECDD is also responsible for administering the ***Oregon Community Development Block Grant (OCDBG)*** program. Funding for this program is provided on an annual basis by the U.S. Department of Housing and Urban Development.

At this time the City of Umatilla does not have 51 percent or greater low to moderate income residents to qualify for this funding program. However, the 2000 Census indicated 49.6 percent low to moderate income residents and, depending on how growth occurs and what areas are serviced by improvements, the City could possibly qualify in the future.

Projects that qualify under the Public Works category of the OCDBG program include municipal sewer and water system improvement projects that are user-rate dependent. The community must be primarily residential in nature and the proposed project must primarily benefit City residents. The funds available from this program are limited to $1,000,000 per community per project or $20,000 per

permanent residential connection benefited by the project, whichever is less. Those projects necessary to ensure compliance with drinking water quality standards administered by the DWP or water quality statutes, rules, orders, or permits administered by the DEQ are given highest priority under this program. The OECDD considers factors such as the ability of the users to fund the project locally, the urgency of the area's need, the cost in grant dollars per person benefited by the project, and how well the project is targeted toward meeting the national objective of primarily benefiting persons of low to moderate income.

The OECDD, through its OCDBG program, gives water improvement projects that address documented health problems highest priority for funding. The agency does not fund projects that are targeted toward water quantity problems or growth related problems.

As with the Water/Wastewater financing program, to qualify for this funding source the average residential water rates must be at least 1.48 percent of the 2000 MHI. As previously discussed, the current rate would need to be increased $10.50 to approximately $41.75 per month.

(6) The final applicable funding source administered by OECDD in conjunction with the DWP is the ***Safe Drinking Water Revolving Loan Fund (SDWRLF)***. This program receives a federal funding allocation each year. Although Letters of Interest can be completed at any time, they should be submitted during the annual Letter of Interest process, which typically occurs in the spring of each year. This program provides loans with interest rates around 3.5 percent, but as low as 1 percent for communities meeting hardship criteria. Projects are ranked by the following criteria: projects addressing serious human health risks, projects to assure compliance with the Safe Drinking Water Act, and water systems in need based on affordability criteria.

Revisions to the SDWRLF have been implemented for the purpose of making loan funds more affordable to lower income communities. OECDD has developed a "Disadvantaged Community" status in the SDWRLF program where communities that qualify can be eligible for a "hardship criteria" loan interest rate of 1 percent for a 30-year term and for "Principal Forgiveness" (essentially a grant) up to $250,000 or 25 percent of the total loan amount, whichever is less. To evaluate eligibility for Disadvantaged Community status, the following criteria must be met:

a) Funding from any source being evaluated for the improvements project must result in a community's monthly residential water cost for 7,500 gallons of water exceeding 1.48 percent of the 2000 MHI ($41.75 as discussed above). The monthly residential water cost must include all OM&R costs, existing debt cost, and the anticipated additional monthly cost for the new debt. If the monthly costs charged to residential customers to meet all these obligations exceed 1.48 percent of the 2000 MHI, then the community meets the Disadvantaged Community status and

is eligible for hardship criteria funding, pending further evaluation, as summarized hereafter.

b) The total loan amount of the project is then re-evaluated at the hardship criteria interest rate of 1 percent for a 30-year term. The total loan amount may also be reduced by the principal forgiveness amount, which may not exceed the lesser of $250,000 or 25 percent of the total SDWRLF award for the project. If the resulting monthly water cost charged to residential customers to cover the existing OM&R, existing debt service, and new loan at the 1 percent rate is still equal to or greater than 1.48 percent of the 2000 MHI, then the community qualifies for the hardship criteria rate and principal forgiveness. If the resulting average monthly water cost required to meet all obligations is less than 1.48 percent of the MHI, then the community does not qualify for the principal forgiveness.

A preliminary analysis of the City of Umatilla's existing water rates, debt service, and OM&R costs indicates that the City would likely not qualify for the Disadvantaged Community status or the hardship criteria loan with principal forgiveness. The discussion of the City's MHI and required water rates with the OCDBG program discussed previously applies to this program as well.

Without a project connection with a serious health risk or compliance issue, this funding source is not a likely candidate for the City.

When Umatilla is ready to move forward with a project involving funding alternatives as presented above, it is important for the City to consult with funding agencies early to ascertain which programs you would be eligible to receive funding from for the proposed improvements. This consultation with funding agencies is usually done through the Project Intake process and related subsequent meetings. OECDD utilizes a "Project Intake Form" to outline a city's project, including the needs, project requirements, affected area, estimated project cost, timeframe, schedule, etc. OECDD evaluates the project based on information collected for the Intake Form to determine the best funding program suited to the project. The City may then schedule a "One-Stop Meeting" where representatives of major funding agencies meet with the City to discuss the project and funding needs and identify the funding program best suited for the project. These meetings are typically held in Salem, Oregon. Once the meeting is concluded, the City is then invited to submit a funding application to the particular funding program identified to best fit the City's needs. The Project Intake process can be completed at any time, so the City should be ready to pursue any desired funding early in the project planning phase.

The remainder of this chapter focuses on evaluating funding options for the City's water system improvements.

PRELIMINARY EQUIVALENT DWELLING UNIT ANALYSIS

When projecting future revenue for a water system, an Equivalent Dwelling Unit (EDU) analysis is usually completed. One EDU is intended to represent the average

residential water use for a given city. As an example, each 3/4-inch or smaller residential connection in Umatilla would represent one EDU. A commercial or industrial connection user with water use amounts similar to the average residential use amount would also be considered one EDU. A commercial connection such as a cafe, with three times the typical water usage as an average residential connection, would be considered three EDUs.

The City's water service accounts, as of June 2007, were analyzed to provide a preliminary EDU determination. The City provided total annual water use records for the accounting year 2006-07 for all accounts.

There are currently 1,476 residential water accounts that used approximately 218,969,000 gallons in the 2006-07 accounting year. This equates to an average use of 199,437 gallons per year per residential connection. Therefore, one EDU represents 148,353 gallons per year or 12,363 gallons per month. The water usage of all the accounts was analyzed and converted to EDUs. The following table lists the EDUs according to water meter size.

City Of Umatilla Preliminary EDU Analysis

Connection Type	Total Number of Accounts	Estimated EDUs
City:		
3/4-inch and smaller	1,476	1,476
1-inch	94	165
1-1/2-inch	30	92
2-inch	32	259
3-inch	4	155
4- and 6-inch	3	491
Port:		
3/4-inch and smaller	4	5
1-inch	2	0
1-1/2-inch	1	1
2-inch	2	6
3-inch	3	38
4- and 6-inch	1	105
Fire Flow Protection	4	0
Miscellaneous:		
3/4-inch (Outside City Limits)	44	24
2-inch (Outside City Limits)	2	10
City Usage	25	123
TOTAL ESTIMATED EDUs:	**1,729**	**2,954**

Most funding agencies will use the EDU evaluation as a basis for estimating future yearly revenues and debt capabilities for a city. The EDU determination, which is based on water consumption, is intended to equitably distribute water costs among all

users. The EDU determination helps funding agencies determine the loan (debt) amount a city can incur for their water system project.

For the City of Umatilla, the analysis presented hereafter shows that the City can likely complete the water system improvements project by obtaining only a loan, should the City wish to do so. Many funding sources that provide only loans may not require an EDU determination. Some of these agencies may only require a city's water rate structure to be equitable. The analysis presented hereafter for the City's future water rate revenue and estimated debt capacity is based on the preliminary EDU determination of 2,954.

DEBT CAPACITY

Based on the City's good financial condition, it is likely that future water projects would be accomplished with funding on hand possibly combined with loans. Depending on the timing of the improvements discussed in Chapter 6 and how the City sets the water rates, loans may not be necessary. If a loan is required, the data shown in Table 7-2 provides a general idea of the amount of debt the City could service at various average monthly water costs. These average monthly costs could represent a combination of base rates, overage fees, and water bond fees. Assuming the City needed to increase the average monthly water use rate per EDU by approximately $7 per month to $24 per month, Table 7-2 shows that the City could afford to service a $2,579,000 to $3,703,000 loan, depending on which financing option was available to the City.

It is important to note that the estimated loan capacities shown in Table 7-2 are based on the current estimate of 2,954 EDUs. The EDU figures will need to be verified as project funding proceeds. It should be recognized that this is only a very preliminary analysis, and the financial assumptions and figures presented in this study should be refined as project implementation proceeds in the future and as agreements are worked out with funding agencies. If the City incurs further debt or adjusts the water rates and/or water bond fee prior to obtaining loan or grant funds, these figures will need to be adjusted accordingly to reflect the debt payment requirements for the overall City budget.

PROJECT FUNDING OPTIONS

The City does not have a pressing project that would require additional funding at this time, and is not anticipating one in the immediate future. The selection and funding criteria of agencies change significantly over time, so current criteria will likely not apply when the City is ready to move forward with some of the larger projects anticipated and presented in Chapter 6. It is, therefore, recommended that the City make appropriate adjustments to water rates to account for increasing costs and to continue the buildup of funds for capital improvements. The costs over time are considerably lower when capital is paid for from reserves versus financed with debt.

IMPLEMENTATION OF IMPROVEMENTS

The only work recommended to be completed at this time is improvements to the distribution system. It is proposed that the City proceed with this effort with a systematic approach using local contractors or City staff.

Implementation of the remaining improvements presented in this Water System Master Plan is dependent on the rate and type of growth experience in the City and its effect on water demands. The City should continue to monitor annual water production and usage and track budget costs with revenue. Adjustments in water rates should be made as necessary to ensure expenses are covered and a reserve is built up for improvements as demands require. When the need for an additional water source is anticipated within about three years, the City should initiate the preparation of a Preliminary Engineering Report on water supply alternatives. This report should evaluate the alternative available to the City at that time including detailed cost estimates and current funding opportunities.

As the City proceeds with the operation and expansion of its water system to meet demands, it should work closely with its citizens to inform them of the system needs and the necessity for appropriate water user costs. It should be noted that average monthly water costs can be composed of base rates, overage rates, taxes, connection fees, development charges, etc. It is also a good idea to begin annually increasing rates in order to adequately fund the existing water system and keep up with inflation.

The water system improvements outlined in this Water System Master Plan will help the City maintain a reliable, quality water system. Implementing improvements as demands increase will allow the system to meet the needs of the City through the planning period and beyond. Adding additional supply capacity with a shallow well field or river pumping station utilizing the City's existing water right will allow the incremental perfecting of this right with planned expansion as the City needs it. Construction of additional storage capacity in the High Level service areas in the southwest portion of town will provide emergency reserves in the heart of future growth of the community.

As the City of Umatilla continues to grow and water demands increase, or if the existing wells develop problems, expansion of the Columbia River water diversion can occur systematically. If the City chooses a shallow well field, additional capacity can be added with the drilling of more shallow wells scaled to anticipated demands. If, instead, a pump station and package plant treatment system is selected, expansion will consist of more or larger diversion pumps and the addition of filtration units sized as appropriate. All of the improvements discussed in this Master Plan are geared toward increasing the City's water system capacity and reliability to better serve the City of Umatilla.

HISTORICAL WATER DEPARTMENT FUNDS

Fiscal Year	Total Revenue[1]	Personal Costs	Materials & Services	Capital Outlay	Transfers to Other Funds[2]	Total OM&R Expenditures	Net Income
1999-2000	$ 581,391	$ 216,246	$ 169,326	$ 4,894	$ 261,372	$ 651,838	$ (70,447)
2000-01	586,735	235,844	151,008	-	337,674	$ 724,526	$ (137,791)
2001-02	595,278	265,879	156,650	-	114,000	$ 536,529	$ 58,749
2002-03	634,682	251,982	195,563	1,997	128,580	$ 578,122	$ 56,560
2003-04	650,071	278,185	198,168	-	125,640	$ 601,993	$ 48,078
2004-05	625,721	292,034	201,110	-	119,544	$ 612,688	$ 13,033
2005-06	641,832	313,159	185,277	3,112	131,544	$ 633,092	$ 8,740
2006-07	683,111	334,450	225,653	-	128,800	$ 688,903	$ (5,792)

1 Total Revenue is from water rates, service charges, service connection fees, miscellaneous income, and interest. System development charges are not included in the total revenue shown above.

2 Transfers include $21,000 on average to the Debt Service Fund which, combined with property tax revenue, servi the water system debt of $234,611 per year.

anderson perry & associates, inc.

CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN
HISTORICAL WATER
DEPARTMENT FUNDS

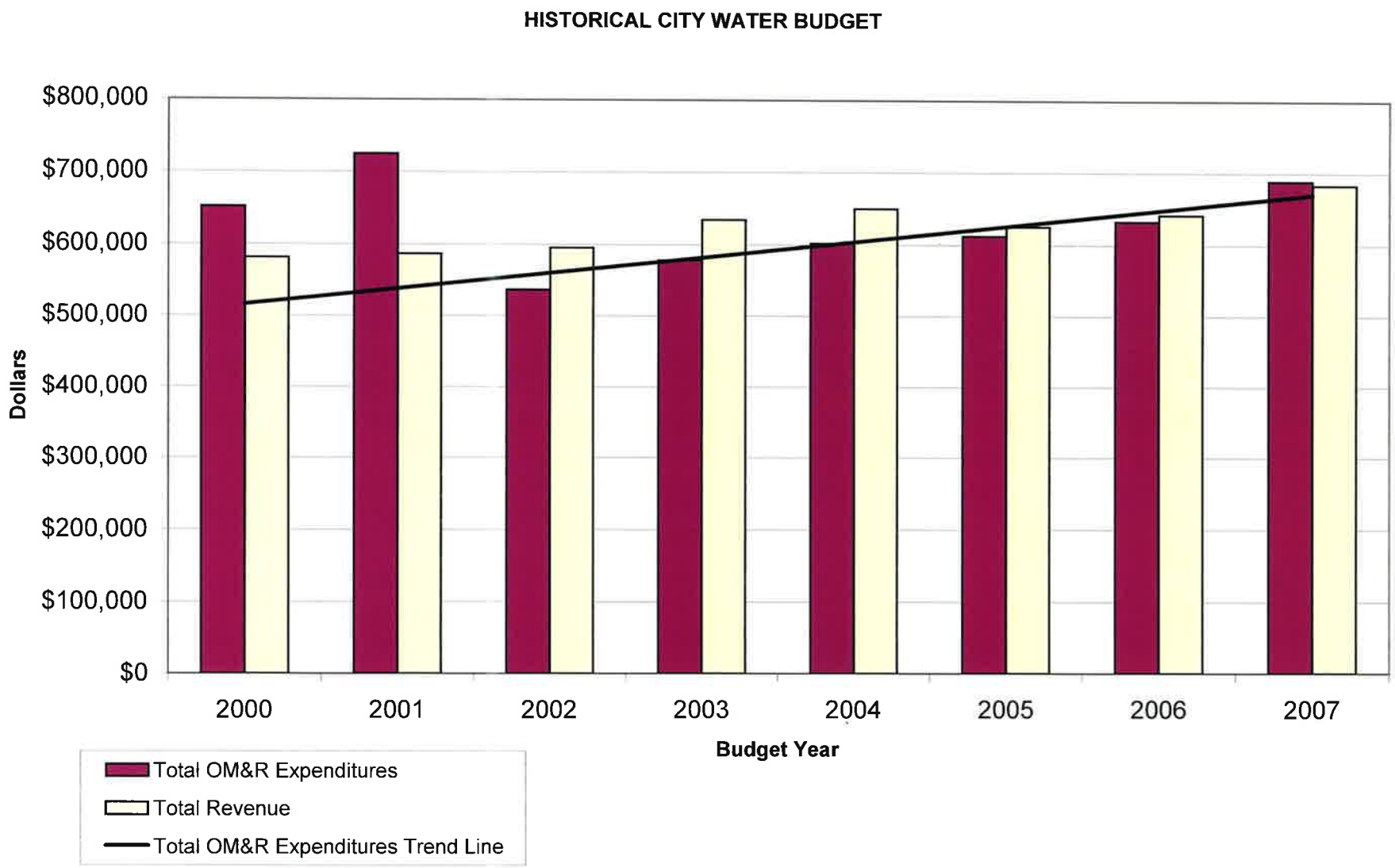
TABLE
7-1

PRELIMINARY
WATER RATE ANALYSIS FOR LOAN CAPACITY
2006-07 BUDGET YEAR

Average Monthly Cost[1]	Revenue[2]	Expenditures			Revenue Available for Debt Service	Loan Capacity	
		Estimated OM&R Costs[3]	Existing Loan Payments[4]	Total Expenditures		Typical OECDD Loan Capacity[5]	Typical RD Loan Capacity[6]
$17	$602,616	$635,000	$0	$635,000	$0	$0	$0
$18	$638,064	$635,000	$0	$635,000	$3,064	$37,000	$53,000
$19	$673,512	$635,000	$0	$635,000	$38,512	$461,000	$661,000
$20	$708,960	$635,000	$0	$635,000	$73,960	$884,000	$1,270,000
$21	$744,408	$635,000	$0	$635,000	$109,408	$1,308,000	$1,878,000
$22	$779,856	$635,000	$0	$635,000	$144,856	$1,732,000	$2,486,000
$24	$850,752	$635,000	$0	$635,000	$215,752	$2,579,000	$3,703,000
$26	$921,648	$635,000	$0	$635,000	$286,648	$3,426,000	$4,919,000
$28	$992,544	$635,000	$0	$635,000	$357,544	$4,273,000	$6,136,000
$30	$1,063,440	$635,000	$0	$635,000	$428,440	$5,121,000	$7,352,000
$32	$1,134,336	$635,000	$0	$635,000	$499,336	$5,968,000	$8,569,000
$34	$1,205,232	$635,000	$0	$635,000	$570,232	$6,815,000	$9,785,000
$36	$1,276,128	$635,000	$0	$635,000	$641,128	$7,662,000	$11,002,000
$38	$1,347,024	$635,000	$0	$635,000	$712,024	$8,509,000	$12,218,000
$40	$1,417,920	$635,000	$0	$635,000	$782,920	$9,357,000	$13,435,000
$42	$1,488,816	$635,000	$0	$635,000	$853,816	$10,204,000	$14,651,000
$44	$1,559,712	$635,000	$0	$635,000	$924,712	$11,051,000	$15,868,000

1 The current base rate of $9.75 plus $1.00 per 1,000 gallons results in an average monthly cost of approximately $17.75 per EDU.
2 Assumes 2,954 Equivalent Dwelling Units (EDUs).
3 OM&R = Operations, Maintenance, and Replacement. Average of last 4 years ending 2006-07 OM&R costs. See discussion in Chapter 7.
4 Existing loan payments included in OM&R Costs with transfer to Debt Service Fund and property taxes.
5 Assumed loan funding at 5.5 percent for 20 years. Actual loan interest rates could vary. Values rounded to nearest $1,000.
6 Assumes loan funding at 5.0 percent for 40 years. Estimated loan capacity does not include a 10 percent reserve requirement because the City's bonding authority is a general obligation bond. Actual loan interest rates could vary. Values rounded to the nearest $1,000.

SDWRLF = Safe Drinking Water Revolving Loan Fund
OECDD = Oregon Economic and Community Development Department
RD = Rural Development



anderson perry & associates, inc.

CITY OF
UMATILLA, OREGON
WATER SYSTEM MASTER PLAN
HISTORICAL CITY
WATER BUDGET

FIGURE
7-1

APPENDICES

A	Analytical Data
B	Sanitary Survey
C	Well Information
D	Port Well Lease
E	Geology and Groundwater Study
F	Hydrogeologic Survey, Phase 2 - Detailed Aquifer Test for City of Umatilla, Oregon

APPENDIX A

Analytical Data

Oregon Department of Human Services

Drinking Water Program

00914 UMATILLA, CITY OF **Classification: COMMUNITY**

Contact: ROGER FRANCES
PO BOX 130
UMATILLA, OR 97882

Phone: 541-922-3226
County: UMATILLA
Activity Status: ACTIVE

Population: 6,070
Number of Connections: 1,420

Operating Period: January 1 to December 31
Regulating Agency: REGION 3

Certified Operator(s)
Required: Y
Distribution class: 2
Treatment class: None
Filtration Endorsement Required: No

Owner Type: LOCAL GOVERNMENT
Licensed By: N/A
Approved Drinking Water Protection Plan: No
Source Water Assessment: Yes
Last Sanitary Survey Date: Apr 29, 2004

Sources

ID	Facility Name	Activity Status	Availability	Source Type	Sampling Point?
EP-A	**EP FOR GOLF COURSE AND PORT WELLS**	**A**		**GW**	**Yes**
SRC-AA	GOLF COURSE WELL (PRIMARY)	A	permanent	GW	Yes
SRC-AB	PORT WELL (UMAT3343)	A	permanent	GW	Yes
EP-B	**EP FOR INTERTIE WELL (PRIMARY)**	**A**		**GW**	**Yes**
SRC-BA	INTERTIE WELL (PRIMARY)	A	permanent	GW	Yes
EP-C	**EP FOR MCFARLAND WL (JUN-SEP) UMAT50632**	**A**		**GW**	**Yes**
SRC-CA	MCFARLAND WELL (JUN-SEP) UMAT50632	A	permanent	GW	Yes

Treatment

State ID	Facility Name	Treatment Process	Treatment Objective
WTP-A	TP FOR GOLF COURSE AND PORT WELLS	RESID. MAINT. GAS CHLORINATION	OTHER
WTP-B	TP FOR INTERTIE WELL (PRIMARY)	GASEOUS CHLORINATION, POST	OTHER
WTP-C	TP FOR MCFARLAND WL (JUN-SEP) UMAT50632	RESID. MAINT. GAS CHLORINATION	OTHER
WTP-C	TP FOR MCFARLAND WL (JUN-SEP) UMAT50632	GASEOUS CHLORINATION, PRE	TASTE / ODOR CONTROL

Consumer Confidence Reports

For Year	Date Received	Date Certified
2006	Sep 24, 2007	Sep 21, 2007

2005	Jul 21, 2006	Jul 19, 2006
2004	Jun 30, 2005	Jun 28, 2005
2003	Jun 30, 2004	Jul 19, 2004

For further information on this public water system click on the area of interest below.

System Info :: Report for Lenders :: Alerts :: Violations :: Enforcements :: Contacts :: Site Visits :: Public Notice

Coliform Summary :: Coliform Results :: Coliform Results Archives (pre 2002) :: Sampling Schedule for Coliform

Chemical Group Summary :: Latest Chemical Results :: Chemical Detections :: Sampling Schedules for Chemicals

Single Analyte Results For a System :: Lead & Copper :: Corrosion Control(LCR) :: SWTR :: Nitrates :: Arsenic

DBPs :: TOC & Alkalinity :: DBP/TOC/Bromate/Chlorine Monitoring :: Radionuclides :: FANLs

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Information by county:

Inventory :: Surface Water Systems :: Sanitary Surveys :: Alerts :: Violations :: Open Enforcements

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Inventory List for all Oregon Drinking Water Systems in Excel or printable screen format

SNC Reports for Oregon Drinking Water Systems

Oregon Department of Human Services

Drinking Water Program

PWSID: 00914
PWSName: **UMATILLA, CITY OF**
Status: A
System Type: C
Population: 6070

Fact Sheets
Definitions
Public Notice
Alerts
Enforcements

Action Levels: Lead = 0.0155 mg/l Copper = 1.35 mg/l

Lead and Copper 90th Percentile Results

Sample Date	Date Received	Round	Sample Count	Duration	Lead (mg/l)	Copper (mg/l)
Sep 26, 2006	Oct 16, 2006	0008	20	3Y	0.0010	0.0140
Oct 23, 2003	Nov 04, 2003	0007	10	3Y		0.0070
Oct 23, 2003	Nov 04, 2003	0007	10	3Y	0.0000	
Jul 20, 2000	Aug 09, 2000	0006	20	3Y	0.0010	0.0190
Jul 24, 1997	Aug 18, 1997	0005	20	YR	0.0007	0.0190
Jul 10, 1996	Jul 31, 1996	0004	20	YR	0.0039	0.0200
Jun 21, 1995	Jul 17, 1995	0003	20	YR	0.0000	0.0000
Jun 23, 1994	Jul 18, 1994	0002	40	6M	0.0000	0.0000
Aug 11, 1993	Sep 01, 1993	0001	40	6M	0.0010	0.0000

More Info

For further information on this public water system click on the area of interest below.

System Info :: Report for Lenders :: Alerts :: Violations :: Enforcements :: Contacts :: Site Visits :: Public Notice

Coliform Summary :: Coliform Results :: Coliform Results Archives (pre 2002) :: Sampling Schedule for Coliform

Chemical Group Summary :: Latest Chemical Results :: Chemical Detections :: Sampling Schedules for Chemicals

Single Analyte Results For a System :: Lead & Copper :: Corrosion Control(LCR) :: SWTR :: Nitrates :: Arsenic

DBPs :: TOC & Alkalinity :: DBP/TOC/Bromate/Chlorine Monitoring :: Radionuclides :: FANLs

Information by county:

Inventory :: Surface Water Systems :: Sanitary Surveys :: Alerts :: Violations :: Open Enforcements

Inventory List for all Oregon Drinking Water Systems in Excel or printable screen format

SNC Reports for Oregon Drinking Water Systems

Oregon Department of Human Services

Drinking Water Program

ND = Not Detected at the Minimum Reporting Level

Latest Chemical Results - PWS ID: 00914 ---- UMATILLA, CITY OF

Sample ID	Sample Date	Receive Date	Chemical	Source ID	Results	Current MCL	UOM
A70718M1	07/18/07	07/30/07	NITRATE (AS N)	EP-A	ND	10.000000	MG/L
A70718M4	07/18/07	07/30/07	NITRATE (AS N)	EP-A	ND	10.000000	MG/L
A70718M2	07/18/07	07/30/07	NITRATE (AS N)	EP-B	ND	10.000000	MG/L
A70718M3	07/18/07	07/30/07	NITRATE (AS N)	EP-C	ND	10.000000	MG/L
A60926AG3	09/26/06	10/02/06	NITRATE (AS N)	EP-A	ND	10.000000	MG/L
A60926AG4	09/26/06	10/02/06	NITRATE (AS N)	EP-A	ND	10.000000	MG/L
A60926AG2	09/26/06	10/02/06	NITRATE (AS N)	EP-B	ND	10.000000	MG/L
A60926AG1	09/26/06	10/02/06	NITRATE (AS N)	EP-C	ND	10.000000	MG/L
A50912H-1V	09/12/05	12/07/05	1,1,1-TRICHLOROETHANE	EP-A	ND	0.2000000	MG/L
A50912L-1V	09/12/05	12/07/05	1,1,1-TRICHLOROETHANE	EP-A	ND	0.2000000	MG/L
A50912L-1V	09/12/05	12/07/05	1,1,2-TRICHLOROETHANE	EP-A	ND	0.0050000	MG/L
A50912H-1V	09/12/05	12/07/05	1,1,2-TRICHLOROETHANE	EP-A	ND	0.0050000	MG/L
A50912H-1V	09/12/05	12/07/05	1,1-DICHLOROETHYLENE	EP-A	ND	0.0070000	MG/L
A50912L-1V	09/12/05	12/07/05	1,1-DICHLOROETHYLENE	EP-A	ND	0.0070000	MG/L
A50912H-1V	09/12/05	12/07/05	1,2,4-TRICHLOROBENZENE	EP-A	ND	0.0700000	MG/L
A50912L-1V	09/12/05	12/07/05	1,2,4-TRICHLOROBENZENE	EP-A	ND	0.0700000	MG/L
A50912L-1V	09/12/05	12/07/05	1,2-DICHLOROETHANE	EP-A	ND	0.0050000	MG/L
A50912H-1V	09/12/05	12/07/05	1,2-DICHLOROETHANE	EP-A	ND	0.0050000	MG/L
A50912H-1V	09/12/05	12/07/05	1,2-DICHLOROPROPANE	EP-A	ND	0.0050000	MG/L
A50912L-1V	09/12/05	12/07/05	1,2-DICHLOROPROPANE	EP-A	ND	0.0050000	MG/L
A50912L-1S	09/12/05	12/07/05	2,4,5-TP (SILVEX)	EP-A	ND	0.0500000	MG/L
A50912H-							

1S	09/12/05	12/07/05	2,4,5-TP (SILVEX)	EP-A	ND	0.0500000	MG/L
A50912H-1S	09/12/05	12/07/05	2,4-D	EP-A	ND	0.0700000	MG/L
A50912L-1S	09/12/05	12/07/05	2,4-D	EP-A	ND	0.0700000	MG/L
A50912L-1S	09/12/05	12/07/05	ALACHLOR (LASSO)	EP-A	ND	0.0020000	MG/L
A50912H-1S	09/12/05	12/07/05	ALACHLOR (LASSO)	EP-A	ND	0.0020000	MG/L
A50912H-1	09/12/05	12/07/05	ARSENIC	EP-A	ND	0.0100000	MG/L
A50912L-1	09/12/05	12/07/05	ARSENIC	EP-A	ND	0.0100000	MG/L
A50912L-1S	09/12/05	12/07/05	ATRAZINE	EP-A	ND	0.0030000	MG/L
A50912H-1S	09/12/05	12/07/05	ATRAZINE	EP-A	ND	0.0030000	MG/L
A50912H-1V	09/12/05	12/07/05	BENZENE	EP-A	ND	0.0050000	MG/L
A50912L-1V	09/12/05	12/07/05	BENZENE	EP-A	ND	0.0050000	MG/L
A50912L-1S	09/12/05	12/07/05	BENZO (A) PYRENE	EP-A	ND	0.0002000	MG/L
A50912H-1S	09/12/05	12/07/05	BENZO (A) PYRENE	EP-A	ND	0.0002000	MG/L
A50912H-1S	09/12/05	12/07/05	BHC-GAMMA (LINDANE)	EP-A	ND	0.0002000	MG/L
A50912L-1S	09/12/05	12/07/05	BHC-GAMMA (LINDANE)	EP-A	ND	0.0002000	MG/L
A50912L-1S	09/12/05	12/07/05	CARBOFURAN	EP-A	ND	0.0400000	MG/L
A50912H-1S	09/12/05	12/07/05	CARBOFURAN	EP-A	ND	0.0400000	MG/L
A50912H-1V	09/12/05	12/07/05	CARBON TETRACHLORIDE	EP-A	ND	0.0050000	MG/L
A50912L-1V	09/12/05	12/07/05	CARBON TETRACHLORIDE	EP-A	ND	0.0050000	MG/L
A50912L-1S	09/12/05	12/07/05	CHLORDANE	EP-A	ND	0.0020000	MG/L
A50912H-1S	09/12/05	12/07/05	CHLORDANE	EP-A	ND	0.0020000	MG/L
A50912H-1V	09/12/05	12/07/05	CIS-1,2-DICHLOROETHYLENE	EP-A	ND	0.0700000	MG/L
A50912L-1V	09/12/05	12/07/05	CIS-1,2-DICHLOROETHYLENE	EP-A	ND	0.0700000	MG/L
A50912L-1S	09/12/05	12/07/05	DALAPON	EP-A	ND	0.2000000	MG/L

A50912H-1S	09/12/05	12/07/05	DALAPON	EP-A	ND	0.2000000	MG/L
A50912H-1S	09/12/05	12/07/05	DI(2-ETHYLHEXYL) - ADIPATE	EP-A	ND	0.4000000	MG/L
A50912L-1S	09/12/05	12/07/05	DI(2-ETHYLHEXYL) - ADIPATE	EP-A	ND	0.4000000	MG/L
A50912L-1S	09/12/05	12/07/05	DI(2-ETHYLHEXYL) - PHTHALATE	EP-A	ND	0.0060000	MG/L
A50912H-1S	09/12/05	12/07/05	DI(2-ETHYLHEXYL) - PHTHALATE	EP-A	ND	0.0060000	MG/L
A50912H-1S	09/12/05	12/07/05	DIBROMOCHLOROPROPANE (DBCP)	EP-A	ND	0.0002000	MG/L
A50912L-1S	09/12/05	12/07/05	DIBROMOCHLOROPROPANE (DBCP)	EP-A	ND	0.0002000	MG/L
A50912L-1V	09/12/05	12/07/05	DICHLOROMETHANE	EP-A	ND	0.0050000	MG/L
A50912H-1V	09/12/05	12/07/05	DICHLOROMETHANE	EP-A	ND	0.0050000	MG/L
A50912H-1S	09/12/05	12/07/05	DINOSEB	EP-A	ND	0.0070000	MG/L
A50912L-1S	09/12/05	12/07/05	DINOSEB	EP-A	ND	0.0070000	MG/L
A50912L-1S	09/12/05	12/07/05	DIQUAT	EP-A	ND	0.0200000	MG/L
A50912H-1S	09/12/05	12/07/05	DIQUAT	EP-A	ND	0.0200000	MG/L
A50912H-1S	09/12/05	12/07/05	ENDOTHALL	EP-A	ND	0.1000000	MG/L
A50912L-1S	09/12/05	12/07/05	ENDOTHALL	EP-A	ND	0.1000000	MG/L
A50912L-1S	09/12/05	12/07/05	ENDRIN	EP-A	ND	0.0020000	MG/L
A50912H-1S	09/12/05	12/07/05	ENDRIN	EP-A	ND	0.0020000	MG/L
A50912H-1V	09/12/05	12/07/05	ETHYLBENZENE	EP-A	ND	0.7000000	MG/L
A50912L-1V	09/12/05	12/07/05	ETHYLBENZENE	EP-A	ND	0.7000000	MG/L
A50912L-1S	09/12/05	12/07/05	ETHYLENE DIBROMIDE (EDB)	EP-A	ND	0.0000500	MG/L
A50912H-1S	09/12/05	12/07/05	ETHYLENE DIBROMIDE (EDB)	EP-A	ND	0.0000500	MG/L
A50912H-1S	09/12/05	12/07/05	GLYPHOSATE	EP-A	ND	0.7000000	MG/L
A50912L-1S	09/12/05	12/07/05	GLYPHOSATE	EP-A	ND	0.7000000	MG/L

A50912L-1S	09/12/05	12/07/05	HEPTACHLOR	EP-A	ND	0.0004000	MG/L
A50912H-1S	09/12/05	12/07/05	HEPTACHLOR	EP-A	ND	0.0004000	MG/L
A50912H-1S	09/12/05	12/07/05	HEPTACHLOR EPOXIDE	EP-A	ND	0.0002000	MG/L
A50912L-1S	09/12/05	12/07/05	HEPTACHLOR EPOXIDE	EP-A	ND	0.0002000	MG/L
A50912L-1S	09/12/05	12/07/05	HEXACHLOROBENZENE	EP-A	ND	0.0010000	MG/L
A50912H-1S	09/12/05	12/07/05	HEXACHLOROBENZENE	EP-A	ND	0.0010000	MG/L
A50912H-1S	09/12/05	12/07/05	HEXACHLOROCYCLOPENTADIENE	EP-A	ND	0.0500000	MG/L
A50912L-1S	09/12/05	12/07/05	HEXACHLOROCYCLOPENTADIENE	EP-A	ND	0.0500000	MG/L
A50912L-1S	09/12/05	12/07/05	METHOXYCHLOR	EP-A	ND	0.0400000	MG/L
A50912H-1S	09/12/05	12/07/05	METHOXYCHLOR	EP-A	ND	0.0400000	MG/L
A50912H-1V	09/12/05	12/07/05	MONOCHLOROBENZENE	EP-A	ND	0.1000000	MG/L
A50912L-1V	09/12/05	12/07/05	MONOCHLOROBENZENE	EP-A	ND	0.1000000	MG/L
A50912L-1	09/12/05	12/07/05	NITRATE (AS N)	EP-A	ND	10.000000	MG/L
A50912H-1	09/12/05	12/07/05	NITRATE (AS N)	EP-A	ND	10.000000	MG/L
A50912H-1V	09/12/05	12/07/05	O-DICHLOROBENZENE	EP-A	ND	0.6000000	MG/L
A50912L-1V	09/12/05	12/07/05	O-DICHLOROBENZENE	EP-A	ND	0.6000000	MG/L
A50912L-1S	09/12/05	12/07/05	OXAMYL (VYDATE)	EP-A	ND	0.2000000	MG/L
A50912H-1S	09/12/05	12/07/05	OXAMYL (VYDATE)	EP-A	ND	0.2000000	MG/L
A50912H-1V	09/12/05	12/07/05	P-DICHLOROBENZENE	EP-A	ND	0.0750000	MG/L
A50912L-1V	09/12/05	12/07/05	P-DICHLOROBENZENE	EP-A	ND	0.0750000	MG/L
A50912L-1S	09/12/05	12/07/05	PENTACHLOROPHENOL	EP-A	ND	0.0010000	MG/L
A50912H-1S	09/12/05	12/07/05	PENTACHLOROPHENOL	EP-A	ND	0.0010000	MG/L
A50912H-1S	09/12/05	12/07/05	PICLORAM	EP-A	ND	0.5000000	MG/L
A50912L-1S	09/12/05	12/07/05	PICLORAM	EP-A	ND	0.5000000	MG/L

A50912L-1S	09/12/05	12/07/05	POLYCHLORINATED BIPHENYLS (PCB)	EP-A	ND	0.0005000	MG/L
A50912H-1S	09/12/05	12/07/05	POLYCHLORINATED BIPHENYLS (PCB)	EP-A	ND	0.0005000	MG/L
A50912H-1S	09/12/05	12/07/05	SIMAZINE	EP-A	ND	0.0040000	MG/L
A50912L-1S	09/12/05	12/07/05	SIMAZINE	EP-A	ND	0.0040000	MG/L
A50912L-1V	09/12/05	12/07/05	STYRENE	EP-A	ND	0.1000000	MG/L
A50912H-1V	09/12/05	12/07/05	STYRENE	EP-A	ND	0.1000000	MG/L
A50912H-1V	09/12/05	12/07/05	TETRACHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
A50912L-1V	09/12/05	12/07/05	TETRACHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
A50912L-1V	09/12/05	12/07/05	TOLUENE	EP-A	ND	1.0000000	MG/L
A50912H-1V	09/12/05	12/07/05	TOLUENE	EP-A	ND	1.0000000	MG/L
A50912H-1S	09/12/05	12/07/05	TOXAPHENE	EP-A	ND	0.0030000	MG/L
A50912L-1S	09/12/05	12/07/05	TOXAPHENE	EP-A	ND	0.0030000	MG/L
A50912L-1V	09/12/05	12/07/05	TRANS-1,2-DICHLOROETHYLENE	EP-A	ND	0.1000000	MG/L
A50912H-1V	09/12/05	12/07/05	TRANS-1,2-DICHLOROETHYLENE	EP-A	ND	0.1000000	MG/L
A50912H-1V	09/12/05	12/07/05	TRICHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
A50912L-1V	09/12/05	12/07/05	TRICHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
A50912L-1V	09/12/05	12/07/05	VINYL CHLORIDE	EP-A	ND	0.0020000	MG/L
A50912H-1V	09/12/05	12/07/05	VINYL CHLORIDE	EP-A	ND	0.0020000	MG/L
A50912H-1V	09/12/05	12/07/05	XYLENES	EP-A	ND	10.000000	MG/L
A50912L-1V	09/12/05	12/07/05	XYLENES	EP-A	ND	10.000000	MG/L
A50912K-1V	09/12/05	12/07/05	1,1,1-TRICHLOROETHANE	EP-B	ND	0.2000000	MG/L
A50912K-1V	09/12/05	12/07/05	1,1,2-TRICHLOROETHANE	EP-B	ND	0.0050000	MG/L
A50912K-1V	09/12/05	12/07/05	1,1-DICHLOROETHYLENE	EP-B	ND	0.0070000	MG/L

A50912K-1V	09/12/05	12/07/05	1,2,4-TRICHLOROBENZENE	EP-B	ND	0.0700000	MG/L
A50912K-1V	09/12/05	12/07/05	1,2-DICHLOROETHANE	EP-B	ND	0.0050000	MG/L
A50912K-1V	09/12/05	12/07/05	1,2-DICHLOROPROPANE	EP-B	ND	0.0050000	MG/L
A50912K-1S	09/12/05	12/07/05	2,4,5-TP (SILVEX)	EP-B	ND	0.0500000	MG/L
A50912K-1S	09/12/05	12/07/05	2,4-D	EP-B	ND	0.0700000	MG/L
A50912K-1S	09/12/05	12/07/05	ALACHLOR (LASSO)	EP-B	ND	0.0020000	MG/L
A50912K-1	09/12/05	12/07/05	ARSENIC	EP-B	ND	0.0100000	MG/L
A50912K-1S	09/12/05	12/07/05	ATRAZINE	EP-B	ND	0.0030000	MG/L
A50912K-1V	09/12/05	12/07/05	BENZENE	EP-B	ND	0.0050000	MG/L
A50912K-1S	09/12/05	12/07/05	BENZO (A) PYRENE	EP-B	ND	0.0002000	MG/L
A50912K-1S	09/12/05	12/07/05	BHC-GAMMA (LINDANE)	EP-B	ND	0.0002000	MG/L
A50912K-1S	09/12/05	12/07/05	CARBOFURAN	EP-B	ND	0.0400000	MG/L
A50912K-1V	09/12/05	12/07/05	CARBON TETRACHLORIDE	EP-B	ND	0.0050000	MG/L
A50912K-1S	09/12/05	12/07/05	CHLORDANE	EP-B	ND	0.0020000	MG/L
A50912K-1V	09/12/05	12/07/05	CIS-1,2-DICHLOROETHYLENE	EP-B	ND	0.0700000	MG/L
A50912K-1S	09/12/05	12/07/05	DALAPON	EP-B	ND	0.2000000	MG/L
A50912K-1S	09/12/05	12/07/05	DI(2-ETHYLHEXYL) - ADIPATE	EP-B	ND	0.4000000	MG/L
A50912K-1S	09/12/05	12/07/05	DI(2-ETHYLHEXYL) - PHTHALATE	EP-B	ND	0.0060000	MG/L
A50912K-1S	09/12/05	12/07/05	DIBROMOCHLOROPROPANE (DBCP)	EP-B	ND	0.0002000	MG/L
A50912K-1V	09/12/05	12/07/05	DICHLOROMETHANE	EP-B	ND	0.0050000	MG/L
A50912K-1S	09/12/05	12/07/05	DINOSEB	EP-B	ND	0.0070000	MG/L
A50912K-1S	09/12/05	12/07/05	DIQUAT	EP-B	ND	0.0200000	MG/L
A50912K-1S	09/12/05	12/07/05	ENDOTHALL	EP-B	ND	0.1000000	MG/L
A50912K-	09/12/05	12/07/05	ENDRIN	EP-B	ND	0.0020000	MG/L

1S							
A50912K-1V	09/12/05	12/07/05	ETHYLBENZENE	EP-B	ND	0.7000000	MG/L
A50912K-1S	09/12/05	12/07/05	ETHYLENE DIBROMIDE (EDB)	EP-B	ND	0.0000500	MG/L
A50912K-1S	09/12/05	12/07/05	GLYPHOSATE	EP-B	ND	0.7000000	MG/L
A50912K-1S	09/12/05	12/07/05	HEPTACHLOR	EP-B	ND	0.0004000	MG/L
A50912K-1S	09/12/05	12/07/05	HEPTACHLOR EPOXIDE	EP-B	ND	0.0002000	MG/L
A50912K-1S	09/12/05	12/07/05	HEXACHLOROBENZENE	EP-B	ND	0.0010000	MG/L
A50912K-1S	09/12/05	12/07/05	HEXACHLOROCYCLOPENTADIENE	EP-B	ND	0.0500000	MG/L
A50912K-1S	09/12/05	12/07/05	METHOXYCHLOR	EP-B	ND	0.0400000	MG/L
A50912K-1V	09/12/05	12/07/05	MONOCHLOROBENZENE	EP-B	ND	0.1000000	MG/L
A50912K-1	09/12/05	12/07/05	NITRATE (AS N)	EP-B	ND	10.000000	MG/L
A50912K-1V	09/12/05	12/07/05	O-DICHLOROBENZENE	EP-B	ND	0.6000000	MG/L
A50912K-1S	09/12/05	12/07/05	OXAMYL (VYDATE)	EP-B	ND	0.2000000	MG/L
A50912K-1V	09/12/05	12/07/05	P-DICHLOROBENZENE	EP-B	ND	0.0750000	MG/L
A50912K-1S	09/12/05	12/07/05	PENTACHLOROPHENOL	EP-B	ND	0.0010000	MG/L
A50912K-1S	09/12/05	12/07/05	PICLORAM	EP-B	ND	0.5000000	MG/L
A50912K-1S	09/12/05	12/07/05	POLYCHLORINATED BIPHENYLS (PCB)	EP-B	ND	0.0005000	MG/L
A50912K-1S	09/12/05	12/07/05	SIMAZINE	EP-B	ND	0.0040000	MG/L
A50912K-1V	09/12/05	12/07/05	STYRENE	EP-B	ND	0.1000000	MG/L
A50912K-1V	09/12/05	12/07/05	TETRACHLOROETHYLENE	EP-B	ND	0.0050000	MG/L
A50912K-1V	09/12/05	12/07/05	TOLUENE	EP-B	ND	1.0000000	MG/L
A50912K-1S	09/12/05	12/07/05	TOXAPHENE	EP-B	ND	0.0030000	MG/L
A50912K-1V	09/12/05	12/07/05	TRANS-1,2-DICHLOROETHYLENE	EP-B	ND	0.1000000	MG/L
A50912K-1V	09/12/05	12/07/05	TRICHLOROETHYLENE	EP-B	ND	0.0050000	MG/L

A50912K-1V	09/12/05	12/07/05	VINYL CHLORIDE	EP-B	ND	0.0020000	MG/L
A50912K-1V	09/12/05	12/07/05	XYLENES	EP-B	ND	10.000000	MG/L
A50912J-1V	09/12/05	12/07/05	1,1,1-TRICHLOROETHANE	EP-C	ND	0.2000000	MG/L
A50912J-1V	09/12/05	12/07/05	1,1,2-TRICHLOROETHANE	EP-C	ND	0.0050000	MG/L
A50912J-1V	09/12/05	12/07/05	1,1-DICHLOROETHYLENE	EP-C	ND	0.0070000	MG/L
A50912J-1V	09/12/05	12/07/05	1,2,4-TRICHLOROBENZENE	EP-C	ND	0.0700000	MG/L
A50912J-1V	09/12/05	12/07/05	1,2-DICHLOROETHANE	EP-C	ND	0.0050000	MG/L
A50912J-1V	09/12/05	12/07/05	1,2-DICHLOROPROPANE	EP-C	ND	0.0050000	MG/L
A50912J-1S	09/12/05	12/07/05	2,4,5-TP (SILVEX)	EP-C	ND	0.0500000	MG/L
A50912J-1S	09/12/05	12/07/05	2,4-D	EP-C	ND	0.0700000	MG/L
A50912J-1S	09/12/05	12/07/05	ALACHLOR (LASSO)	EP-C	ND	0.0020000	MG/L
A50912J-1	09/12/05	12/07/05	ARSENIC	EP-C	ND	0.0100000	MG/L
A50912J-1S	09/12/05	12/07/05	ATRAZINE	EP-C	ND	0.0030000	MG/L
A50912J-1V	09/12/05	12/07/05	BENZENE	EP-C	ND	0.0050000	MG/L
A50912J-1S	09/12/05	12/07/05	BENZO (A) PYRENE	EP-C	ND	0.0002000	MG/L
A50912J-1S	09/12/05	12/07/05	BHC-GAMMA (LINDANE)	EP-C	ND	0.0002000	MG/L
A50912J-1S	09/12/05	12/07/05	CARBOFURAN	EP-C	ND	0.0400000	MG/L
A50912J-1V	09/12/05	12/07/05	CARBON TETRACHLORIDE	EP-C	ND	0.0050000	MG/L
A50912J-1S	09/12/05	12/07/05	CHLORDANE	EP-C	ND	0.0020000	MG/L
A50912J-1V	09/12/05	12/07/05	CIS-1,2-DICHLOROETHYLENE	EP-C	ND	0.0700000	MG/L
A50912J-1S	09/12/05	12/07/05	DALAPON	EP-C	ND	0.2000000	MG/L
A50912J-1S	09/12/05	12/07/05	DI(2-ETHYLHEXYL) - ADIPATE	EP-C	ND	0.4000000	MG/L
A50912J-1S	09/12/05	12/07/05	DI(2-ETHYLHEXYL) - PHTHALATE	EP-C	ND	0.0060000	MG/L
A50912J-	09/12/05	12/07/05	DIBROMOCHLOROPROPANE	EP-C	ND	0.0002000	MG/L

1S			(DBCP)				
A50912J-1V	09/12/05	12/07/05	DICHLOROMETHANE	EP-C	ND	0.0050000	MG/L
A50912J-1S	09/12/05	12/07/05	DINOSEB	EP-C	ND	0.0070000	MG/L
A50912J-1S	09/12/05	12/07/05	DIQUAT	EP-C	ND	0.0200000	MG/L
A50912J-1S	09/12/05	12/07/05	ENDOTHALL	EP-C	ND	0.1000000	MG/L
A50912J-1S	09/12/05	12/07/05	ENDRIN	EP-C	ND	0.0020000	MG/L
A50912J-1V	09/12/05	12/07/05	ETHYLBENZENE	EP-C	ND	0.7000000	MG/L
A50912J-1S	09/12/05	12/07/05	ETHYLENE DIBROMIDE (EDB)	EP-C	ND	0.0000500	MG/L
A50912J-1S	09/12/05	12/07/05	GLYPHOSATE	EP-C	ND	0.7000000	MG/L
A50912J-1S	09/12/05	12/07/05	HEPTACHLOR	EP-C	ND	0.0004000	MG/L
A50912J-1S	09/12/05	12/07/05	HEPTACHLOR EPOXIDE	EP-C	ND	0.0002000	MG/L
A50912J-1S	09/12/05	12/07/05	HEXACHLOROBENZENE	EP-C	ND	0.0010000	MG/L
A50912J-1S	09/12/05	12/07/05	HEXACHLOROCYCLOPENTADIENE	EP-C	ND	0.0500000	MG/L
A50912J-1S	09/12/05	12/07/05	METHOXYCHLOR	EP-C	ND	0.0400000	MG/L
A50912J-1V	09/12/05	12/07/05	MONOCHLOROBENZENE	EP-C	ND	0.1000000	MG/L
A50912J-1	09/12/05	12/07/05	NITRATE (AS N)	EP-C	0.2000000	10.000000	MG/L
A50912J-1V	09/12/05	12/07/05	O-DICHLOROBENZENE	EP-C	ND	0.6000000	MG/L
A50912J-1S	09/12/05	12/07/05	OXAMYL (VYDATE)	EP-C	ND	0.2000000	MG/L
A50912J-1V	09/12/05	12/07/05	P-DICHLOROBENZENE	EP-C	ND	0.0750000	MG/L
A50912J-1S	09/12/05	12/07/05	PENTACHLOROPHENOL	EP-C	ND	0.0010000	MG/L
A50912J-1S	09/12/05	12/07/05	PICLORAM	EP-C	ND	0.5000000	MG/L
A50912J-1S	09/12/05	12/07/05	POLYCHLORINATED BIPHENYLS (PCB)	EP-C	ND	0.0005000	MG/L
A50912J-1S	09/12/05	12/07/05	SIMAZINE	EP-C	ND	0.0040000	MG/L
A50912J-1V	09/12/05	12/07/05	STYRENE	EP-C	ND	0.1000000	MG/L

A50912J-1V	09/12/05	12/07/05	TETRACHLOROETHYLENE	EP-C		ND	0.0050000	MG/L
A50912J-1V	09/12/05	12/07/05	TOLUENE	EP-C		ND	1.0000000	MG/L
A50912J-1S	09/12/05	12/07/05	TOXAPHENE	EP-C		ND	0.0030000	MG/L
A50912J-1V	09/12/05	12/07/05	TRANS-1,2-DICHLOROETHYLENE	EP-C		ND	0.1000000	MG/L
A50912J-1V	09/12/05	12/07/05	TRICHLOROETHYLENE	EP-C		ND	0.0050000	MG/L
A50912J-1V	09/12/05	12/07/05	VINYL CHLORIDE	EP-C		ND	0.0020000	MG/L
A50912J-1V	09/12/05	12/07/05	XYLENES	EP-C		ND	10.000000	MG/L
A40825Q-1	08/25/04	11/16/04	ASBESTOS	DIST-A		ND	7.0000000	MG/L
A40825N-02	08/25/04	09/17/04	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0015000		0.0600000	MG/L
A40825N-01	08/25/04	09/17/04	TOTAL HALOACETIC ACIDS (HAA5)	DIST-A	0.0010000		0.0600000	MG/L
A40825N-02	08/25/04	09/17/04	TOTAL TRIHALOMETHANES (TTHM)	DIST-A	0.0091000		0.0800000	MG/L
A40825N-01	08/25/04	09/17/04	TOTAL TRIHALOMETHANES (TTHM)	DIST-A	0.0069000		0.0800000	MG/L
A40825T-2	08/25/04	09/09/04	NITRATE (AS N)	EP-A		ND	10.000000	MG/L
A40825T-3	08/25/04	09/09/04	NITRATE (AS N)	EP-A		ND	10.000000	MG/L
A40825T-1	08/25/04	09/09/04	NITRATE (AS N)	EP-B		ND	10.000000	MG/L
A40825T-4	08/25/04	09/09/04	NITRATE (AS N)	EP-C		ND	10.000000	MG/L
A31023Y-3R	10/23/03	01/12/04	GROSS ALPHA, EXCLDNG RN & U	EP-A		ND	15.000000	pCi
A31023AC-3	10/23/03	11/04/03	NITRATE (AS N)	EP-A		ND	10.000000	MG/L
A31023Y-3R	10/23/03	01/12/04	RADIUM, COMBINED (226, 228)	EP-A		ND	5.0000000	pCi
A31023Y-3R	10/23/03	01/12/04	URANIUM, COMBINED	EP-A		ND	0.0300000	MG/L
A31023Y-1R	10/23/03	01/12/04	GROSS ALPHA, EXCLDNG RN & U	EP-B		ND	15.000000	pCi
A31023AC-1	10/23/03	11/04/03	NITRATE (AS N)	EP-B		ND	10.000000	MG/L
A31023Y-1R	10/23/03	01/12/04	RADIUM, COMBINED (226, 228)	EP-B		ND	5.0000000	pCi
A31023Y-1R	10/23/03	01/12/04	URANIUM, COMBINED	EP-B		ND	0.0300000	MG/L
A31023Y-4R	10/23/03	01/12/04	GROSS ALPHA, EXCLDNG RN & U	EP-C		ND	15.000000	pCi

A31023AC-4	10/23/03	11/04/03	NITRATE (AS N)	EP-C	0.9000000	10.000000	MG/L
A31023AC-2	10/23/03	11/04/03	NITRATE (AS N)	EP-C	ND	10.000000	MG/L
A31023Y-4R	10/23/03	01/12/04	RADIUM, COMBINED (226, 228)	EP-C	ND	5.0000000	pCi
A31023Y-4R	10/23/03	01/12/04	URANIUM, COMBINED	EP-C	ND	0.0300000	MG/L
A20829S-1V	08/29/02	07/16/03	1,1,1-TRICHLOROETHANE	EP-A	ND	0.2000000	MG/L
A20829S-1V	08/29/02	07/16/03	1,1,2-TRICHLOROETHANE	EP-A	ND	0.0050000	MG/L
A20829S-1V	08/29/02	07/16/03	1,1-DICHLOROETHYLENE	EP-A	ND	0.0070000	MG/L
A20829S-1V	08/29/02	07/16/03	1,2,4-TRICHLOROBENZENE	EP-A	ND	0.0700000	MG/L
A20829S-1V	08/29/02	07/16/03	1,2-DICHLOROETHANE	EP-A	ND	0.0050000	MG/L
A20829S-1V	08/29/02	07/16/03	1,2-DICHLOROPROPANE	EP-A	ND	0.0050000	MG/L
A20829S-1S	08/29/02	07/16/03	2,4,5-TP (SILVEX)	EP-A	ND	0.0500000	MG/L
A20829S-1S	08/29/02	07/16/03	2,4-D	EP-A	ND	0.0700000	MG/L
A20829S-1S	08/29/02	07/16/03	ALACHLOR (LASSO)	EP-A	ND	0.0020000	MG/L
A20829S-1I	08/29/02	07/16/03	ANTIMONY	EP-A	ND	0.0060000	MG/L
A20829S-1I	08/29/02	07/16/03	ARSENIC	EP-A	ND	0.0100000	MG/L
A20829S-1S	08/29/02	07/16/03	ATRAZINE	EP-A	ND	0.0030000	MG/L
A20829S-1I	08/29/02	07/16/03	BARIUM	EP-A	0.0069000	2.0000000	MG/L
A20829S-1V	08/29/02	07/16/03	BENZENE	EP-A	ND	0.0050000	MG/L
A20829S-1S	08/29/02	07/16/03	BENZO (A) PYRENE	EP-A	ND	0.0002000	MG/L
A20829S-1I	08/29/02	07/16/03	BERYLLIUM	EP-A	ND	0.0040000	MG/L
A20829S-1S	08/29/02	07/16/03	BHC-GAMMA (LINDANE)	EP-A	ND	0.0002000	MG/L
A20829S-1I	08/29/02	07/16/03	CADMIUM	EP-A	ND	0.0050000	MG/L
A20829S-1S	08/29/02	07/16/03	CARBOFURAN	EP-A	ND	0.0400000	MG/L
A20829S-1V	08/29/02	07/16/03	CARBON TETRACHLORIDE	EP-A	ND	0.0050000	MG/L
A20829S-1S	08/29/02	07/16/03	CHLORDANE	EP-A	ND	0.0020000	MG/L

A20829S-1I	08/29/02	07/16/03	CHROMIUM	EP-A	ND	0.1000000	MG/L
A20829S-1V	08/29/02	07/16/03	CIS-1,2-DICHLOROETHYLENE	EP-A	ND	0.0700000	MG/L
A20829S-1I	08/29/02	07/16/03	CYANIDE	EP-A	ND	0.2000000	MG/L
A20829S-1S	08/29/02	07/16/03	DALAPON	EP-A	ND	0.2000000	MG/L
A20829S-1S	08/29/02	07/16/03	DI(2-ETHYLHEXYL) - ADIPATE	EP-A	ND	0.4000000	MG/L
A20829S-1S	08/29/02	07/16/03	DI(2-ETHYLHEXYL) - PHTHALATE	EP-A	ND	0.0060000	MG/L
A20829S-1S	08/29/02	07/16/03	DIBROMOCHLOROPROPANE (DBCP)	EP-A	ND	0.0002000	MG/L
A20829S-1V	08/29/02	07/16/03	DICHLOROMETHANE	EP-A	ND	0.0050000	MG/L
A20829S-1S	08/29/02	07/16/03	DINOSEB	EP-A	ND	0.0070000	MG/L
A20829S-1S	08/29/02	07/16/03	DIQUAT	EP-A	ND	0.0200000	MG/L
A20829S-1S	08/29/02	07/16/03	ENDOTHALL	EP-A	ND	0.1000000	MG/L
A20829S-1S	08/29/02	07/16/03	ENDRIN	EP-A	ND	0.0020000	MG/L
A20829S-1V	08/29/02	07/16/03	ETHYLBENZENE	EP-A	ND	0.7000000	MG/L
A20829S-1S	08/29/02	07/16/03	ETHYLENE DIBROMIDE (EDB)	EP-A	ND	0.0000500	MG/L
A20829S-1I	08/29/02	07/16/03	FLUORIDE	EP-A	2.0000000	4.0000000	MG/L
A20829S-1S	08/29/02	07/16/03	GLYPHOSATE	EP-A	ND	0.7000000	MG/L
A20829S-1S	08/29/02	07/16/03	HEPTACHLOR	EP-A	ND	0.0004000	MG/L
A20829S-1S	08/29/02	07/16/03	HEPTACHLOR EPOXIDE	EP-A	ND	0.0002000	MG/L
A20829S-1S	08/29/02	07/16/03	HEXACHLOROBENZENE	EP-A	ND	0.0010000	MG/L
A20829S-1S	08/29/02	07/16/03	HEXACHLOROCYCLOPENTADIENE	EP-A	ND	0.0500000	MG/L
A20829S-1I	08/29/02	07/16/03	MERCURY	EP-A	ND	0.0020000	MG/L
A20829S-1S	08/29/02	07/16/03	METHOXYCHLOR	EP-A	ND	0.0400000	MG/L
A20829S-1V	08/29/02	07/16/03	MONOCHLOROBENZENE	EP-A	ND	0.1000000	MG/L
A20829S-1I	08/29/02	07/16/03	NICKEL	EP-A	ND	0.1000000	MG/L
A20829S-1I	08/29/02	07/16/03	NITRATE (AS N)	EP-A	ND	10.000000	MG/L
A20829S-1I	08/29/02	01/01/53	NITRATE+NITRITE (AS N)	EP-A	ND	10.000000	MG/L

A20829S-1I	08/29/02	07/16/03	NITRITE (AS N)	EP-A	ND	1.0000000	MG/L
A20829S-1V	08/29/02	07/16/03	O-DICHLOROBENZENE	EP-A	ND	0.6000000	MG/L
A20829S-1S	08/29/02	07/16/03	OXAMYL (VYDATE)	EP-A	ND	0.2000000	MG/L
A20829S-1V	08/29/02	07/16/03	P-DICHLOROBENZENE	EP-A	ND	0.0750000	MG/L
A20829S-1S	08/29/02	07/16/03	PENTACHLOROPHENOL	EP-A	ND	0.0010000	MG/L
A20829S-1S	08/29/02	07/16/03	PICLORAM	EP-A	ND	0.5000000	MG/L
A20829S-1S	08/29/02	07/16/03	POLYCHLORINATED BIPHENYLS (PCB)	EP-A	ND	0.0005000	MG/L
A20829S-1I	08/29/02	07/16/03	SELENIUM	EP-A	ND	0.0500000	MG/L
A20829S-1S	08/29/02	07/16/03	SIMAZINE	EP-A	ND	0.0040000	MG/L
A20829S-1I	08/29/02	07/16/03	SODIUM	EP-A	110.00000		MG/L
A20829S-1V	08/29/02	07/16/03	STYRENE	EP-A	ND	0.1000000	MG/L
A20829S-1V	08/29/02	07/16/03	TETRACHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
A20829S-1I	08/29/02	07/16/03	THALLIUM	EP-A	ND	0.0020000	MG/L
A20829S-1V	08/29/02	07/16/03	TOLUENE	EP-A	ND	1.0000000	MG/L
A20829S-1S	08/29/02	07/16/03	TOXAPHENE	EP-A	ND	0.0030000	MG/L
A20829S-1V	08/29/02	07/16/03	TRANS-1,2-DICHLOROETHYLENE	EP-A	ND	0.1000000	MG/L
A20829S-1V	08/29/02	07/16/03	TRICHLOROETHYLENE	EP-A	ND	0.0050000	MG/L
A20829S-1V	08/29/02	07/16/03	VINYL CHLORIDE	EP-A	ND	0.0020000	MG/L
A20829S-1V	08/29/02	07/16/03	XYLENES	EP-A	ND	10.000000	MG/L
A20829Q-1V	08/29/02	07/16/03	1,1,1-TRICHLOROETHANE	EP-B	ND	0.2000000	MG/L
A20829Q-1V	08/29/02	07/16/03	1,1,2-TRICHLOROETHANE	EP-B	ND	0.0050000	MG/L
A20829Q-1V	08/29/02	07/16/03	1,1-DICHLOROETHYLENE	EP-B	ND	0.0070000	MG/L
A20829Q-1V	08/29/02	07/16/03	1,2,4-TRICHLOROBENZENE	EP-B	ND	0.0700000	MG/L
A20829Q-1V	08/29/02	07/16/03	1,2-DICHLOROETHANE	EP-B	ND	0.0050000	MG/L
A20829Q-	08/29/02	07/16/03	1,2-DICHLOROPROPANE	EP-B	ND	0.0050000	MG/L

1V							
A20829Q-1S	08/29/02	07/16/03	2,4,5-TP (SILVEX)	EP-B	ND	0.0500000	MG/L
A20829Q-1S	08/29/02	07/16/03	2,4-D	EP-B	ND	0.0700000	MG/L
A20829Q-1S	08/29/02	07/16/03	ALACHLOR (LASSO)	EP-B	ND	0.0020000	MG/L
A20829Q-1I	08/29/02	07/16/03	ANTIMONY	EP-B	ND	0.0060000	MG/L
A20829Q-1I	08/29/02	07/16/03	ARSENIC	EP-B	ND	0.0100000	MG/L
A20829Q-1S	08/29/02	07/16/03	ATRAZINE	EP-B	ND	0.0030000	MG/L
A20829Q-1I	08/29/02	07/16/03	BARIUM	EP-B	0.0047000	2.0000000	MG/L
A20829Q-1V	08/29/02	07/16/03	BENZENE	EP-B	ND	0.0050000	MG/L
A20829Q-1S	08/29/02	07/16/03	BENZO (A) PYRENE	EP-B	ND	0.0002000	MG/L
A20829Q-1I	08/29/02	07/16/03	BERYLLIUM	EP-B	ND	0.0040000	MG/L
A20829Q-1S	08/29/02	07/16/03	BHC-GAMMA (LINDANE)	EP-B	ND	0.0002000	MG/L
A20829Q-1I	08/29/02	07/16/03	CADMIUM	EP-B	ND	0.0050000	MG/L
A20829Q-1S	08/29/02	07/16/03	CARBOFURAN	EP-B	ND	0.0400000	MG/L
A20829Q-1V	08/29/02	07/16/03	CARBON TETRACHLORIDE	EP-B	ND	0.0050000	MG/L
A20829Q-1S	08/29/02	07/16/03	CHLORDANE	EP-B	ND	0.0020000	MG/L
A20829Q-1I	08/29/02	07/16/03	CHROMIUM	EP-B	ND	0.1000000	MG/L
A20829Q-1V	08/29/02	07/16/03	CIS-1,2-DICHLOROETHYLENE	EP-B	ND	0.0700000	MG/L
A20829Q-1I	08/29/02	07/16/03	CYANIDE	EP-B	ND	0.2000000	MG/L
A20829Q-1S	08/29/02	07/16/03	DALAPON	EP-B	ND	0.2000000	MG/L
A20829Q-1S	08/29/02	07/16/03	DI(2-ETHYLHEXYL) - ADIPATE	EP-B	ND	0.4000000	MG/L
A20829Q-1S	08/29/02	07/16/03	DI(2-ETHYLHEXYL) - PHTHALATE	EP-B	ND	0.0060000	MG/L
A20829Q-1S	08/29/02	07/16/03	DIBROMOCHLOROPROPANE (DBCP)	EP-B	ND	0.0002000	MG/L
A20829Q-1V	08/29/02	07/16/03	DICHLOROMETHANE	EP-B	ND	0.0050000	MG/L
A20829Q-1S	08/29/02	07/16/03	DINOSEB	EP-B	ND	0.0070000	MG/L
A20829Q-1S	08/29/02	07/16/03	DIQUAT	EP-B	ND	0.0200000	MG/L

A20829Q-1S	08/29/02	07/16/03	ENDOTHALL	EP-B	ND	0.1000000	MG/L
A20829Q-1S	08/29/02	07/16/03	ENDRIN	EP-B	ND	0.0020000	MG/L
A20829Q-1V	08/29/02	07/16/03	ETHYLBENZENE	EP-B	ND	0.7000000	MG/L
A20829Q-1S	08/29/02	07/16/03	ETHYLENE DIBROMIDE (EDB)	EP-B	ND	0.0000500	MG/L
A20829Q-1I	08/29/02	07/16/03	FLUORIDE	EP-B	2.9000000	4.0000000	MG/L
A20829Q-1S	08/29/02	07/16/03	GLYPHOSATE	EP-B	ND	0.7000000	MG/L
A20829Q-1S	08/29/02	07/16/03	HEPTACHLOR	EP-B	ND	0.0004000	MG/L
A20829Q-1S	08/29/02	07/16/03	HEPTACHLOR EPOXIDE	EP-B	ND	0.0002000	MG/L
A20829Q-1S	08/29/02	07/16/03	HEXACHLOROBENZENE	EP-B	ND	0.0010000	MG/L
A20829Q-1S	08/29/02	07/16/03	HEXACHLOROCYCLOPENTADIENE	EP-B	ND	0.0500000	MG/L
A20829Q-1I	08/29/02	07/16/03	MERCURY	EP-B	ND	0.0020000	MG/L
A20829Q-1S	08/29/02	07/16/03	METHOXYCHLOR	EP-B	ND	0.0400000	MG/L
A20829Q-1V	08/29/02	07/16/03	MONOCHLOROBENZENE	EP-B	ND	0.1000000	MG/L
A20829Q-1I	08/29/02	07/16/03	NICKEL	EP-B	ND	0.1000000	MG/L
A20829Q-1I	08/29/02	07/16/03	NITRATE (AS N)	EP-B	ND	10.000000	MG/L
A20829Q-1I	08/29/02	01/01/53	NITRATE+NITRITE (AS N)	EP-B	ND	10.000000	MG/L
A20829Q-1I	08/29/02	07/16/03	NITRITE (AS N)	EP-B	ND	1.0000000	MG/L
A20829Q-1V	08/29/02	07/16/03	O-DICHLOROBENZENE	EP-B	ND	0.6000000	MG/L
A20829Q-1S	08/29/02	07/16/03	OXAMYL (VYDATE)	EP-B	ND	0.2000000	MG/L
A20829Q-1V	08/29/02	07/16/03	P-DICHLOROBENZENE	EP-B	ND	0.0750000	MG/L
A20829Q-1S	08/29/02	07/16/03	PENTACHLOROPHENOL	EP-B	ND	0.0010000	MG/L
A20829Q-1S	08/29/02	07/16/03	PICLORAM	EP-B	ND	0.5000000	MG/L
A20829Q-1S	08/29/02	07/16/03	POLYCHLORINATED BIPHENYLS (PCB)	EP-B	ND	0.0005000	MG/L
A20829Q-1I	08/29/02	07/16/03	SELENIUM	EP-B	ND	0.0500000	MG/L
A20829Q-1S	08/29/02	07/16/03	SIMAZINE	EP-B	ND	0.0040000	MG/L
A20829Q-1I	08/29/02	07/16/03	SODIUM	EP-B	120.00000		MG/L

A20829Q-1V	08/29/02	07/16/03	STYRENE	EP-B	ND	0.1000000	MG/L
A20829Q-1V	08/29/02	07/16/03	TETRACHLOROETHYLENE	EP-B	ND	0.0050000	MG/L
A20829Q-1I	08/29/02	07/16/03	THALLIUM	EP-B	ND	0.0020000	MG/L
A20829Q-1V	08/29/02	07/16/03	TOLUENE	EP-B	ND	1.0000000	MG/L
A20829Q-1S	08/29/02	07/16/03	TOXAPHENE	EP-B	ND	0.0030000	MG/L
A20829Q-1V	08/29/02	07/16/03	TRANS-1,2-DICHLOROETHYLENE	EP-B	ND	0.1000000	MG/L
A20829Q-1V	08/29/02	07/16/03	TRICHLOROETHYLENE	EP-B	ND	0.0050000	MG/L
A20829Q-1V	08/29/02	07/16/03	VINYL CHLORIDE	EP-B	ND	0.0020000	MG/L
A20829Q-1V	08/29/02	07/16/03	XYLENES	EP-B	ND	10.000000	MG/L
A20829T-1V	08/29/02	07/16/03	1,1,1-TRICHLOROETHANE	EP-C	ND	0.2000000	MG/L
A20829T-1V	08/29/02	07/16/03	1,1,2-TRICHLOROETHANE	EP-C	ND	0.0050000	MG/L
A20829T-1V	08/29/02	07/16/03	1,1-DICHLOROETHYLENE	EP-C	ND	0.0070000	MG/L
A20829T-1V	08/29/02	07/16/03	1,2,4-TRICHLOROBENZENE	EP-C	ND	0.0700000	MG/L
A20829T-1V	08/29/02	07/16/03	1,2-DICHLOROETHANE	EP-C	ND	0.0050000	MG/L
A20829T-1V	08/29/02	07/16/03	1,2-DICHLOROPROPANE	EP-C	ND	0.0050000	MG/L
A20829T-1S	08/29/02	07/16/03	2,4,5-TP (SILVEX)	EP-C	ND	0.0500000	MG/L
A20829T-1S	08/29/02	07/16/03	2,4-D	EP-C	ND	0.0700000	MG/L
A20829T-1S	08/29/02	07/16/03	ALACHLOR (LASSO)	EP-C	ND	0.0020000	MG/L
A20829T-1I	08/29/02	07/16/03	ANTIMONY	EP-C	ND	0.0060000	MG/L
A20829T-1I	08/29/02	07/16/03	ARSENIC	EP-C	ND	0.0100000	MG/L
A20829T-1S	08/29/02	07/16/03	ATRAZINE	EP-C	ND	0.0030000	MG/L
A20829T-1I	08/29/02	07/16/03	BARIUM	EP-C	0.0059000	2.0000000	MG/L
A20829T-1V	08/29/02	07/16/03	BENZENE	EP-C	ND	0.0050000	MG/L
A20829T-1S	08/29/02	07/16/03	BENZO (A) PYRENE	EP-C	ND	0.0002000	MG/L
A20829T-1I	08/29/02	07/16/03	BERYLLIUM	EP-C	ND	0.0040000	MG/L

A20829T-1S	08/29/02	07/16/03	BHC-GAMMA (LINDANE)	EP-C	ND	0.0002000	MG/L
A20829T-1I	08/29/02	07/16/03	CADMIUM	EP-C	ND	0.0050000	MG/L
A20829T-1S	08/29/02	07/16/03	CARBOFURAN	EP-C	ND	0.0400000	MG/L
A20829T-1V	08/29/02	07/16/03	CARBON TETRACHLORIDE	EP-C	ND	0.0050000	MG/L
A20829T-1S	08/29/02	07/16/03	CHLORDANE	EP-C	ND	0.0020000	MG/L
A20829T-1I	08/29/02	07/16/03	CHROMIUM	EP-C	ND	0.1000000	MG/L
A20829T-1V	08/29/02	07/16/03	CIS-1,2-DICHLOROETHYLENE	EP-C	ND	0.0700000	MG/L
A20829T-1I	08/29/02	07/16/03	CYANIDE	EP-C	ND	0.2000000	MG/L
A20829T-1S	08/29/02	07/16/03	DALAPON	EP-C	ND	0.2000000	MG/L
A20829T-1S	08/29/02	07/16/03	DI(2-ETHYLHEXYL) - ADIPATE	EP-C	ND	0.4000000	MG/L
A20829T-1S	08/29/02	07/16/03	DI(2-ETHYLHEXYL) - PHTHALATE	EP-C	ND	0.0060000	MG/L
A20829T-1S	08/29/02	07/16/03	DIBROMOCHLOROPROPANE (DBCP)	EP-C	ND	0.0002000	MG/L
A20829T-1V	08/29/02	07/16/03	DICHLOROMETHANE	EP-C	ND	0.0050000	MG/L
A20829T-1S	08/29/02	07/16/03	DINOSEB	EP-C	ND	0.0070000	MG/L
A20829T-1S	08/29/02	07/16/03	DIQUAT	EP-C	ND	0.0200000	MG/L
A20829T-1S	08/29/02	07/16/03	ENDOTHALL	EP-C	ND	0.1000000	MG/L
A20829T-1S	08/29/02	07/16/03	ENDRIN	EP-C	ND	0.0020000	MG/L
A20829T-1V	08/29/02	07/16/03	ETHYLBENZENE	EP-C	ND	0.7000000	MG/L
A20829T-1S	08/29/02	07/16/03	ETHYLENE DIBROMIDE (EDB)	EP-C	ND	0.0000500	MG/L
A20829T-1I	08/29/02	07/16/03	FLUORIDE	EP-C	1.6000000	4.0000000	MG/L
A20829T-1S	08/29/02	07/16/03	GLYPHOSATE	EP-C	ND	0.7000000	MG/L
A20829T-1S	08/29/02	07/16/03	HEPTACHLOR	EP-C	ND	0.0004000	MG/L
A20829T-1S	08/29/02	07/16/03	HEPTACHLOR EPOXIDE	EP-C	ND	0.0002000	MG/L
A20829T-1S	08/29/02	07/16/03	HEXACHLOROBENZENE	EP-C	ND	0.0010000	MG/L
A20829T-	08/29/02	07/16/03	HEXACHLOROCYCLOPENTADIENE	EP-C	ND	0.0500000	MG/L

1S							
A20829T-1I	08/29/02	07/16/03	MERCURY	EP-C	ND	0.0020000	MG/L
A20829T-1S	08/29/02	07/16/03	METHOXYCHLOR	EP-C	ND	0.0400000	MG/L
A20829T-1V	08/29/02	07/16/03	MONOCHLOROBENZENE	EP-C	ND	0.1000000	MG/L
A20829T-1I	08/29/02	07/16/03	NICKEL	EP-C	ND	0.1000000	MG/L
A20829T-1I	08/29/02	07/16/03	NITRATE (AS N)	EP-C	0.0200000	10.000000	MG/L
A20829T-1I	08/29/02	01/01/53	NITRATE+NITRITE (AS N)	EP-C	0.0200000	10.000000	MG/L
A20829T-1I	08/29/02	07/16/03	NITRITE (AS N)	EP-C	ND	1.0000000	MG/L
A20829T-1V	08/29/02	07/16/03	O-DICHLOROBENZENE	EP-C	ND	0.6000000	MG/L
A20829T-1S	08/29/02	07/16/03	OXAMYL (VYDATE)	EP-C	ND	0.2000000	MG/L
A20829T-1V	08/29/02	07/16/03	P-DICHLOROBENZENE	EP-C	ND	0.0750000	MG/L
A20829T-1S	08/29/02	07/16/03	PENTACHLOROPHENOL	EP-C	ND	0.0010000	MG/L
A20829T-1S	08/29/02	07/16/03	PICLORAM	EP-C	ND	0.5000000	MG/L
A20829T-1S	08/29/02	07/16/03	POLYCHLORINATED BIPHENYLS (PCB)	EP-C	ND	0.0005000	MG/L
A20829T-1I	08/29/02	07/16/03	SELENIUM	EP-C	ND	0.0500000	MG/L
A20829T-1S	08/29/02	07/16/03	SIMAZINE	EP-C	ND	0.0040000	MG/L
A20829T-1I	08/29/02	07/16/03	SODIUM	EP-C	98.000000		MG/L
A20829T-1V	08/29/02	07/16/03	STYRENE	EP-C	ND	0.1000000	MG/L
A20829T-1V	08/29/02	07/16/03	TETRACHLOROETHYLENE	EP-C	ND	0.0050000	MG/L
A20829T-1I	08/29/02	07/16/03	THALLIUM	EP-C	ND	0.0020000	MG/L
A20829T-1V	08/29/02	07/16/03	TOLUENE	EP-C	ND	1.0000000	MG/L
A20829T-1S	08/29/02	07/16/03	TOXAPHENE	EP-C	ND	0.0030000	MG/L
A20829T-1V	08/29/02	07/16/03	TRANS-1,2-DICHLOROETHYLENE	EP-C	ND	0.1000000	MG/L
A20829T-1V	08/29/02	07/16/03	TRICHLOROETHYLENE	EP-C	ND	0.0050000	MG/L
A20829T-1V	08/29/02	07/16/03	VINYL CHLORIDE	EP-C	ND	0.0020000	MG/L
A20829T-1V	08/29/02	07/16/03	XYLENES	EP-C	ND	10.000000	MG/L

Archived Results

Sample Date	Receive Date	Chemical	Source ID	Results	MCL
06/14/01	07/02/01	Nitrate	AA	0.3000000	10.000000
06/14/01	07/02/01	Nitrate	BA	0.4000000	10.000000
06/14/01	07/02/01	Nitrate	CA	0.3000000	10.000000
07/20/00	08/07/00	Nitrate	AA	0.4000000	10.000000
07/20/00	08/07/00	Nitrate	BA	0.3000000	10.000000
07/20/00	08/07/00	Nitrate	CA	1.6000000	10.000000
06/16/99	07/26/99	1,1,1,2-Tetrachloroethane	AA	ND	
06/16/99	07/26/99	1,1,1-Trichloroethane	AA	ND	0.2000000
06/16/99	07/26/99	1,1,2,2,-Tetrachloroethane	AA	ND	
06/16/99	07/26/99	1,1,2-Trichloroethane	AA	ND	0.0050000
06/16/99	07/26/99	1,1-Dichloroethane	AA	ND	
06/16/99	07/26/99	1,1-Dichloroethylene	AA	ND	0.0070000
06/16/99	07/26/99	1,1-Dichloropropene	AA	ND	
06/16/99	07/26/99	1,2,3-Trichloropropane	AA	ND	
06/16/99	07/26/99	1,2,4-Trichlorobenzene	AA	ND	0.0700000
06/16/99	07/26/99	1,2-Dibromo-3-Chloropropane (DBCP)	AA	ND	0.0002000
06/16/99	07/26/99	1,2-Dichloroethane	AA	ND	0.0050000
06/16/99	07/26/99	1,2-Dichloropropane	AA	ND	0.0050000
06/16/99	07/26/99	1,3-Dichloropropane	AA	ND	
06/16/99	07/26/99	1,3-Dichloropropene	AA	ND	
06/16/99	07/26/99	2,2-Dichloropropane	AA	ND	
06/16/99	07/26/99	2,4,5-TP Silvex	AA	ND	0.0500000
06/16/99	07/26/99	2,4-D	AA	ND	0.0700000
06/16/99	07/26/99	3-Hydroxycarbofuran	AA	ND	
06/16/99	07/26/99	Adipates (Di(2-Ethylhexyl))	AA	ND	0.4000000
06/16/99	07/26/99	Alachlor (Lasso)	AA	ND	0.0020000
06/16/99	07/26/99	Aldicarb	AA	ND	
06/16/99	07/26/99	Aldicarb Sulfone	AA	ND	
06/16/99	07/26/99	Aldicarb Sulfoxide	AA	ND	
06/16/99	07/26/99	Aldrin	AA	ND	
06/16/99	07/26/99	Antimony Total	AA	ND	0.0060000
06/16/99	07/26/99	Arsenic	AA	ND	0.0500000
06/16/99	07/26/99	Atrazine	AA	ND	0.0030000
06/16/99	07/26/99	Barium	AA	0.0080000	2.0000000
06/16/99	07/26/99	Benzene	AA	ND	0.0050000

06/16/99	07/26/99	Benzo (A) Pyrene	AA	ND	0.0002000
06/16/99	07/26/99	Beryllium Total	AA	ND	0.0040000
06/16/99	07/26/99	BHC-gamma (Lindane)	AA	ND	0.0002000
06/16/99	07/26/99	Bromobenzene	AA	ND	
06/16/99	07/26/99	Bromodichloromethane	AA	ND	
06/16/99	07/26/99	Bromoform	AA	0.0120000	
06/16/99	07/26/99	Bromomethane	AA	ND	
06/16/99	07/26/99	Butachlor	AA	ND	
06/16/99	07/26/99	Cadmium	AA	ND	0.0050000
06/16/99	07/26/99	Carbaryl	AA	ND	
06/16/99	07/26/99	Carbofuran	AA	ND	0.0400000
06/16/99	07/26/99	Carbon Tetrachloride	AA	ND	0.0050000
06/16/99	07/26/99	Chlordane	AA	ND	0.0020000
06/16/99	07/26/99	Chloroethane	AA	ND	
06/16/99	07/26/99	Chloroform	AA	ND	
06/16/99	07/26/99	Chloromethane	AA	ND	
06/16/99	07/26/99	Chromium	AA	ND	0.1000000
06/16/99	07/26/99	Cis-1,2-Dichloroethylene	AA	ND	0.0700000
06/16/99	07/26/99	Cyanide	AA	ND	0.2000000
06/16/99	07/26/99	Dalapon	AA	ND	0.2000000
06/16/99	07/26/99	Dibromochloromethane	AA	0.0012000	
06/16/99	07/26/99	Dibromomethane	AA	ND	
06/16/99	07/26/99	Dicamba	AA	ND	
06/16/99	07/26/99	Dichloromethane (Methylene Chloride)	AA	ND	0.0050000
06/16/99	07/26/99	Dieldrin	AA	ND	
06/16/99	07/26/99	Dinoseb	AA	ND	0.0070000
06/16/99	07/26/99	Diquat	AA	ND	0.0200000
06/16/99	07/26/99	Endothall	AA	ND	0.1000000
06/16/99	07/26/99	Endrin	AA	ND	0.0020000
06/16/99	07/26/99	Ethylbenzene	AA	ND	0.7000000
06/16/99	07/26/99	Ethylene Dibromide (EDB)	AA	ND	0.0000500
06/16/99	07/26/99	Fluoride	AA	2.0000000	4.0000000
06/16/99	07/26/99	Glyphosate	AA	ND	0.7000000
06/16/99	09/02/99	Gross Alpha, Excl. Radon & U	AA	ND	15.000000
06/16/99	07/26/99	Heptachlor	AA	ND	0.0004000
06/16/99	07/26/99	Heptachlor Epoxide	AA	ND	0.0002000

06/16/99	07/26/99	Hexachlorobenzene (HCB)	AA	ND	0.0010000
06/16/99	07/26/99	Hexachlorocyclopentadiene	AA	ND	0.0500000
06/16/99	07/26/99	M-Dichlorobenzene	AA	ND	
06/16/99	07/26/99	Mercury	AA	ND	0.0020000
06/16/99	07/26/99	Methomyl	AA	ND	
06/16/99	07/26/99	Methoxychlor	AA	ND	0.0400000
06/16/99	07/26/99	Metolachlor	AA	ND	
06/16/99	07/26/99	Metribuzin	AA	ND	
06/16/99	07/26/99	Monochlorobenzene (Chlorobenzene)	AA	ND	0.1000000
06/16/99	07/26/99	Nickel	AA	ND	0.1000000
06/16/99	07/26/99	Nitrate	AA	ND	10.000000
06/16/99	07/26/99	Nitrite	AA	ND	1.0000000
06/16/99	07/26/99	O-Chlorotoluene	AA	ND	
06/16/99	07/26/99	O-Dichlorobenzene	AA	ND	0.6000000
06/16/99	07/26/99	P-Chlorotoluene	AA	ND	
06/16/99	07/26/99	P-Dichlorobenzene	AA	ND	0.0750000
06/16/99	07/26/99	Pentachlorophenol	AA	ND	0.0010000
06/16/99	07/26/99	Phthalates (Di(2-Ethylhexyl))	AA	ND	0.0060000
06/16/99	07/26/99	Picloram	AA	ND	0.5000000
06/16/99	07/26/99	Propachlor	AA	ND	
06/16/99	07/26/99	Selenium	AA	ND	0.0500000
06/16/99	07/26/99	Simazine	AA	ND	0.0040000
06/16/99	07/26/99	Sodium	AA	98.000000	
06/16/99	07/26/99	Styrene	AA	ND	0.1000000
06/16/99	07/26/99	Sulfate	AA	45.000000	
06/16/99	07/26/99	Tetrachloroethylene	AA	ND	0.0050000
06/16/99	07/26/99	Thallium Total	AA	ND	0.0020000
06/16/99	07/26/99	Toluene	AA	ND	1.0000000
06/16/99	07/26/99	Total Polychlorinated Biphenyls (PCB)	AA	ND	0.0005000
06/16/99	07/26/99	Total Xylenes	AA	ND	10.000000
06/16/99	07/26/99	Toxaphene	AA	ND	0.0030000
06/16/99	07/26/99	Trans-1,2-Dichloroethylene	AA	ND	0.1000000
06/16/99	07/26/99	Trichloroethylene	AA	ND	0.0050000
06/16/99	07/26/99	Vinyl Chloride	AA	ND	0.0020000
06/16/99	07/26/99	Vydate (Oxamyl)	AA	ND	0.2000000
06/16/99	07/13/99	1,1,1,2-Tetrachloroethane	BA	ND	

06/16/99	07/13/99	1,1,1-Trichloroethane	BA	ND	0.2000000
06/16/99	07/13/99	1,1,2,2,-Tetrachloroethane	BA	ND	
06/16/99	07/13/99	1,1,2-Trichloroethane	BA	ND	0.0050000
06/16/99	07/13/99	1,1-Dichloroethane	BA	ND	
06/16/99	07/13/99	1,1-Dichloroethylene	BA	ND	0.0070000
06/16/99	07/13/99	1,1-Dichloropropene	BA	ND	
06/16/99	07/13/99	1,2,3-Trichloropropane	BA	ND	
06/16/99	07/13/99	1,2,4-Trichlorobenzene	BA	ND	0.0700000
06/16/99	07/13/99	1,2-Dibromo-3-Chloropropane (DBCP)	BA	ND	0.0002000
06/16/99	07/13/99	1,2-Dichloroethane	BA	ND	0.0050000
06/16/99	07/13/99	1,2-Dichloropropane	BA	ND	0.0050000
06/16/99	07/13/99	1,3-Dichloropropane	BA	ND	
06/16/99	07/13/99	1,3-Dichloropropene	BA	ND	
06/16/99	07/13/99	2,2-Dichloropropane	BA	ND	
06/16/99	07/13/99	2,4,5-TP Silvex	BA	ND	0.0500000
06/16/99	07/13/99	2,4-D	BA	ND	0.0700000
06/16/99	07/13/99	3-Hydroxycarbofuran	BA	ND	
06/16/99	07/13/99	Adipates (Di(2-Ethylhexyl))	BA	ND	0.4000000
06/16/99	07/13/99	Alachlor (Lasso)	BA	ND	0.0020000
06/16/99	07/13/99	Aldicarb	BA	ND	
06/16/99	07/13/99	Aldicarb Sulfone	BA	ND	
06/16/99	07/13/99	Aldicarb Sulfoxide	BA	ND	
06/16/99	07/13/99	Aldrin	BA	ND	
06/16/99	07/13/99	Antimony Total	BA	ND	0.0060000
06/16/99	07/13/99	Arsenic	BA	ND	0.0500000
06/16/99	07/13/99	Atrazine	BA	ND	0.0030000
06/16/99	07/13/99	Barium	BA	0.0050000	2.0000000
06/16/99	07/13/99	Benzene	BA	ND	0.0050000
06/16/99	07/13/99	Benzo (A) Pyrene	BA	ND	0.0002000
06/16/99	07/13/99	Beryllium Total	BA	ND	0.0040000
06/16/99	07/13/99	BHC-gamma (Lindane)	BA	ND	0.0002000
06/16/99	07/13/99	Bromobenzene	BA	ND	
06/16/99	07/13/99	Bromodichloromethane	BA	ND	
06/16/99	07/13/99	Bromoform	BA	ND	
06/16/99	07/13/99	Bromomethane	BA	ND	
06/16/99	07/13/99	Butachlor	BA	ND	

06/16/99	07/13/99	Cadmium	BA	ND	0.0050000
06/16/99	07/13/99	Carbaryl	BA	ND	
06/16/99	07/13/99	Carbofuran	BA	ND	0.0400000
06/16/99	07/13/99	Carbon Tetrachloride	BA	ND	0.0050000
06/16/99	07/13/99	Chlordane	BA	ND	0.0020000
06/16/99	07/13/99	Chloroethane	BA	ND	
06/16/99	07/13/99	Chloroform	BA	ND	
06/16/99	07/13/99	Chloromethane	BA	ND	
06/16/99	07/13/99	Chromium	BA	ND	0.1000000
06/16/99	07/13/99	Cis-1,2-Dichloroethylene	BA	ND	0.0700000
06/16/99	07/13/99	Cyanide	BA	ND	0.2000000
06/16/99	07/13/99	Dalapon	BA	ND	0.2000000
06/16/99	07/13/99	Dibromochloromethane	BA	ND	
06/16/99	07/13/99	Dibromomethane	BA	ND	
06/16/99	07/13/99	Dicamba	BA	ND	
06/16/99	07/13/99	Dichloromethane (Methylene Chloride)	BA	ND	0.0050000
06/16/99	07/13/99	Dieldrin	BA	ND	
06/16/99	07/13/99	Dinoseb	BA	ND	0.0070000
06/16/99	07/13/99	Diquat	BA	ND	0.0200000
06/16/99	07/13/99	Endothall	BA	ND	0.1000000
06/16/99	07/13/99	Endrin	BA	ND	0.0020000
06/16/99	07/13/99	Ethylbenzene	BA	ND	0.7000000
06/16/99	07/13/99	Ethylene Dibromide (EDB)	BA	ND	0.0000500
06/16/99	07/13/99	Fluoride	BA	2.8000000	4.0000000
06/16/99	07/13/99	Glyphosate	BA	ND	0.7000000
06/16/99	09/02/99	Gross Alpha, Excl. Radon & U	BA	ND	15.000000
06/16/99	07/13/99	Heptachlor	BA	ND	0.0004000
06/16/99	07/13/99	Heptachlor Epoxide	BA	ND	0.0002000
06/16/99	07/13/99	Hexachlorobenzene (HCB)	BA	ND	0.0010000
06/16/99	07/13/99	Hexachlorocyclopentadiene	BA	ND	0.0500000
06/16/99	07/13/99	M-Dichlorobenzene	BA	ND	
06/16/99	07/13/99	Mercury	BA	ND	0.0020000
06/16/99	07/13/99	Methomyl	BA	ND	
06/16/99	07/13/99	Methoxychlor	BA	ND	0.0400000
06/16/99	07/13/99	Metolachlor	BA	ND	
06/16/99	07/13/99	Metribuzin	BA	ND	

06/16/99	07/13/99	Monochlorobenzene (Chlorobenzene)	BA	ND	0.1000000
06/16/99	07/13/99	Nickel	BA	ND	0.1000000
06/16/99	07/13/99	Nitrate	BA	ND	10.000000
06/16/99	07/13/99	Nitrite	BA	ND	1.0000000
06/16/99	07/13/99	O-Chlorotoluene	BA	ND	
06/16/99	07/13/99	O-Dichlorobenzene	BA	ND	0.6000000
06/16/99	07/13/99	P-Chlorotoluene	BA	ND	
06/16/99	07/13/99	P-Dichlorobenzene	BA	ND	0.0750000
06/16/99	07/13/99	Pentachlorophenol	BA	ND	0.0010000
06/16/99	07/13/99	Phthalates (Di(2-Ethylhexyl))	BA	ND	0.0060000
06/16/99	07/13/99	Picloram	BA	ND	0.5000000
06/16/99	07/13/99	Propachlor	BA	ND	
06/16/99	07/13/99	Selenium	BA	ND	0.0500000
06/16/99	07/13/99	Simazine	BA	ND	0.0040000
06/16/99	07/13/99	Sodium	BA	110.00000	
06/16/99	07/13/99	Styrene	BA	ND	0.1000000
06/16/99	07/13/99	Sulfate	BA	49.000000	
06/16/99	07/13/99	Tetrachloroethylene	BA	ND	0.0050000
06/16/99	07/13/99	Thallium Total	BA	ND	0.0020000
06/16/99	07/13/99	Toluene	BA	ND	1.0000000
06/16/99	07/13/99	Total Polychlorinated Biphenyls (PCB)	BA	ND	0.0005000
06/16/99	07/13/99	Total Xylenes	BA	ND	10.000000
06/16/99	07/13/99	Toxaphene	BA	ND	0.0030000
06/16/99	07/13/99	Trans-1,2-Dichloroethylene	BA	ND	0.1000000
06/16/99	07/13/99	Trichloroethylene	BA	ND	0.0050000
06/16/99	07/13/99	Vinyl Chloride	BA	ND	0.0020000
06/16/99	07/13/99	Vydate (Oxamyl)	BA	ND	0.2000000
06/16/99	07/26/99	1,1,1,2-Tetrachloroethane	CA	ND	
06/16/99	07/26/99	1,1,1-Trichloroethane	CA	ND	0.2000000
06/16/99	07/26/99	1,1,2,2,-Tetrachloroethane	CA	ND	
06/16/99	07/26/99	1,1,2-Trichloroethane	CA	ND	0.0050000
06/16/99	07/26/99	1,1-Dichloroethane	CA	ND	
06/16/99	07/26/99	1,1-Dichloroethylene	CA	ND	0.0070000
06/16/99	07/26/99	1,1-Dichloropropene	CA	ND	
06/16/99	07/26/99	1,2,3-Trichloropropane	CA	ND	
06/16/99	07/26/99	1,2,4-Trichlorobenzene	CA	ND	0.0700000

06/16/99	07/26/99	1,2-Dibromo-3-Chloropropane (DBCP)	CA	ND	0.0002000
06/16/99	07/26/99	1,2-Dichloroethane	CA	ND	0.0050000
06/16/99	07/26/99	1,2-Dichloropropane	CA	ND	0.0050000
06/16/99	07/26/99	1,3-Dichloropropane	CA	ND	
06/16/99	07/26/99	1,3-Dichloropropene	CA	ND	
06/16/99	07/26/99	2,2-Dichloropropane	CA	ND	
06/16/99	07/26/99	2,4,5-TP Silvex	CA	ND	0.0500000
06/16/99	07/26/99	2,4-D	CA	ND	0.0700000
06/16/99	07/26/99	3-Hydroxycarbofuran	CA	ND	
06/16/99	07/26/99	Adipates (Di(2-Ethylhexyl))	CA	ND	0.4000000
06/16/99	07/26/99	Alachlor (Lasso)	CA	ND	0.0020000
06/16/99	07/26/99	Aldicarb	CA	ND	
06/16/99	07/26/99	Aldicarb Sulfone	CA	ND	
06/16/99	07/26/99	Aldicarb Sulfoxide	CA	ND	
06/16/99	07/26/99	Aldrin	CA	ND	
06/16/99	07/26/99	Antimony Total	CA	ND	0.0060000
06/16/99	07/26/99	Arsenic	CA	ND	0.0500000
06/16/99	07/26/99	Atrazine	CA	ND	0.0030000
06/16/99	07/26/99	Barium	CA	0.0060000	2.0000000
06/16/99	07/26/99	Benzene	CA	ND	0.0050000
06/16/99	07/26/99	Benzo (A) Pyrene	CA	ND	0.0002000
06/16/99	07/26/99	Beryllium Total	CA	ND	0.0040000
06/16/99	07/26/99	BHC-gamma (Lindane)	CA	ND	0.0002000
06/16/99	07/26/99	Bromobenzene	CA	ND	
06/16/99	07/26/99	Bromodichloromethane	CA	ND	
06/16/99	07/26/99	Bromoform	CA	ND	
06/16/99	07/26/99	Bromomethane	CA	ND	
06/16/99	07/26/99	Butachlor	CA	ND	
06/16/99	07/26/99	Cadmium	CA	ND	0.0050000
06/16/99	07/26/99	Carbaryl	CA	ND	
06/16/99	07/26/99	Carbofuran	CA	ND	0.0400000
06/16/99	07/26/99	Carbon Tetrachloride	CA	ND	0.0050000
06/16/99	07/26/99	Chlordane	CA	ND	0.0020000
06/16/99	07/26/99	Chloroethane	CA	ND	
06/16/99	07/26/99	Chloroform	CA	ND	
06/16/99	07/26/99	Chloromethane	CA	ND	

06/16/99	07/26/99	Chromium	CA	ND	0.1000000
06/16/99	07/26/99	Cis-1,2-Dichloroethylene	CA	ND	0.0700000
06/16/99	07/26/99	Cyanide	CA	ND	0.2000000
06/16/99	07/26/99	Dalapon	CA	ND	0.2000000
06/16/99	07/26/99	Dibromochloromethane	CA	ND	
06/16/99	07/26/99	Dibromomethane	CA	ND	
06/16/99	07/26/99	Dicamba	CA	ND	
06/16/99	07/26/99	Dichloromethane (Methylene Chloride)	CA	ND	0.0050000
06/16/99	07/26/99	Dieldrin	CA	ND	
06/16/99	07/26/99	Dinoseb	CA	ND	0.0070000
06/16/99	07/26/99	Diquat	CA	ND	0.0200000
06/16/99	07/26/99	Endothall	CA	ND	0.1000000
06/16/99	07/26/99	Endrin	CA	ND	0.0020000
06/16/99	07/26/99	Ethylbenzene	CA	ND	0.7000000
06/16/99	07/26/99	Ethylene Dibromide (EDB)	CA	ND	0.0000500
06/16/99	07/26/99	Fluoride	CA	1.5000000	4.0000000
06/16/99	07/26/99	Glyphosate	CA	ND	0.7000000
06/16/99	09/02/99	Gross Alpha, Excl. Radon & U	CA	ND	15.000000
06/16/99	07/26/99	Heptachlor	CA	ND	0.0004000
06/16/99	07/26/99	Heptachlor Epoxide	CA	ND	0.0002000
06/16/99	07/26/99	Hexachlorobenzene (HCB)	CA	ND	0.0010000
06/16/99	07/26/99	Hexachlorocyclopentadiene	CA	ND	0.0500000
06/16/99	07/26/99	M-Dichlorobenzene	CA	ND	
06/16/99	07/26/99	Mercury	CA	ND	0.0020000
06/16/99	07/26/99	Methomyl	CA	ND	
06/16/99	07/26/99	Methoxychlor	CA	ND	0.0400000
06/16/99	07/26/99	Metolachlor	CA	ND	
06/16/99	07/26/99	Metribuzin	CA	ND	
06/16/99	07/26/99	Monochlorobenzene (Chlorobenzene)	CA	ND	0.1000000
06/16/99	07/26/99	Nickel	CA	ND	0.1000000
06/16/99	07/26/99	Nitrate	CA	0.0600000	10.000000
06/16/99	07/26/99	Nitrite	CA	ND	1.0000000
06/16/99	07/26/99	O-Chlorotoluene	CA	ND	
06/16/99	07/26/99	O-Dichlorobenzene	CA	ND	0.6000000
06/16/99	07/26/99	P-Chlorotoluene	CA	ND	
06/16/99	07/26/99	P-Dichlorobenzene	CA	ND	0.0750000

06/16/99	07/26/99	Pentachlorophenol	CA	ND	0.0010000
06/16/99	07/26/99	Phthalates (Di(2-Ethylhexyl))	CA	ND	0.0060000
06/16/99	07/26/99	Picloram	CA	ND	0.5000000
06/16/99	07/26/99	Propachlor	CA	ND	
06/16/99	07/26/99	Selenium	CA	ND	0.0500000
06/16/99	07/26/99	Simazine	CA	ND	0.0040000
06/16/99	07/26/99	Sodium	CA	89.000000	
06/16/99	07/26/99	Styrene	CA	ND	0.1000000
06/16/99	07/26/99	Sulfate	CA	36.000000	
06/16/99	07/26/99	Tetrachloroethylene	CA	ND	0.0050000
06/16/99	07/26/99	Thallium Total	CA	ND	0.0020000
06/16/99	07/26/99	Toluene	CA	ND	1.0000000
06/16/99	07/26/99	Total Polychlorinated Biphenyls (PCB)	CA	ND	0.0005000
06/16/99	07/26/99	Total Xylenes	CA	ND	10.000000
06/16/99	07/26/99	Toxaphene	CA	ND	0.0030000
06/16/99	07/26/99	Trans-1,2-Dichloroethylene	CA	ND	0.1000000
06/16/99	07/26/99	Trichloroethylene	CA	ND	0.0050000
06/16/99	07/26/99	Vinyl Chloride	CA	ND	0.0020000
06/16/99	07/26/99	Vydate (Oxamyl)	CA	ND	0.2000000
07/13/98	07/30/98	Nitrate	AA	ND	10.000000
07/13/98	07/30/98	Nitrate	BA	ND	10.000000
07/13/98	07/30/98	Nitrate	CA	0.1100000	10.000000
07/24/97	08/18/97	Nitrate	BA	ND	10.000000
07/24/97	08/18/97	Nitrate	CA	0.0500000	10.000000
07/10/96	08/16/96	1,1,1,2-Tetrachloroethane	AA	ND	
07/10/96	08/16/96	1,1,1-Trichloroethane	AA	ND	0.2000000
07/10/96	08/16/96	1,1,2,2,-Tetrachloroethane	AA	ND	
07/10/96	08/16/96	1,1,2-Trichloroethane	AA	ND	0.0050000
07/10/96	08/16/96	1,1-Dichloroethane	AA	ND	
07/10/96	08/16/96	1,1-Dichloroethylene	AA	ND	0.0070000
07/10/96	08/16/96	1,1-Dichloropropene	AA	ND	
07/10/96	08/16/96	1,2,3-Trichloropropane	AA	ND	
07/10/96	08/16/96	1,2,4-Trichlorobenzene	AA	ND	0.0700000
07/10/96	08/16/96	1,2-Dibromo-3-Chloropropane (DBCP)	AA	ND	0.0002000
07/10/96	08/16/96	1,2-Dichloroethane	AA	ND	0.0050000
07/10/96	08/16/96	1,2-Dichloropropane	AA	ND	0.0050000

07/10/96	08/16/96	1,3-Dichloropropane	AA	ND	
07/10/96	08/16/96	1,3-Dichloropropene	AA	ND	
07/10/96	08/16/96	2,2-Dichloropropane	AA	ND	
07/10/96	08/16/96	2,4,5-TP Silvex	AA	ND	0.0500000
07/10/96	08/16/96	2,4-D	AA	ND	0.0700000
07/10/96	08/16/96	3-Hydroxycarbofuran	AA	ND	
07/10/96	08/16/96	Adipates (Di(2-Ethylhexyl))	AA	ND	0.4000000
07/10/96	08/16/96	Alachlor (Lasso)	AA	ND	0.0020000
07/10/96	08/16/96	Aldicarb	AA	ND	
07/10/96	08/16/96	Aldicarb Sulfone	AA	ND	
07/10/96	08/16/96	Aldicarb Sulfoxide	AA	ND	
07/10/96	08/16/96	Aldrin	AA	ND	
07/10/96	08/16/96	Antimony Total	AA	ND	0.0060000
07/10/96	08/16/96	Arsenic	AA	0.0006000	0.0500000
07/10/96	08/16/96	Atrazine	AA	ND	0.0030000
07/10/96	08/16/96	Barium	AA	0.0070000	2.0000000
07/10/96	08/16/96	Benzene	AA	ND	0.0050000
07/10/96	08/16/96	Benzo (A) Pyrene	AA	ND	0.0002000
07/10/96	08/16/96	Beryllium Total	AA	ND	0.0040000
07/10/96	08/16/96	BHC-gamma (Lindane)	AA	ND	0.0002000
07/10/96	08/16/96	Bromobenzene	AA	ND	
07/10/96	08/16/96	Bromodichloromethane	AA	ND	
07/10/96	08/16/96	Bromoform	AA	ND	
07/10/96	08/16/96	Bromomethane	AA	ND	
07/10/96	08/16/96	Cadmium	AA	ND	0.0050000
07/10/96	08/16/96	Carbaryl	AA	ND	
07/10/96	08/16/96	Carbofuran	AA	ND	0.0400000
07/10/96	08/16/96	Carbon Tetrachloride	AA	ND	0.0050000
07/10/96	08/16/96	Chlordane	AA	ND	0.0020000
07/10/96	08/16/96	Chloroethane	AA	ND	
07/10/96	08/16/96	Chloroform	AA	ND	
07/10/96	08/16/96	Chloromethane	AA	ND	
07/10/96	08/16/96	Chromium	AA	0.0010000	0.1000000
07/10/96	08/16/96	Cis-1,2-Dichloroethylene	AA	ND	0.0700000
07/10/96	08/16/96	Cyanide	AA	ND	0.2000000
07/10/96	08/16/96	Dalapon	AA	ND	0.2000000
07/10/96	08/16/96	Dibromochloromethane	AA	ND	

07/10/96	08/16/96	Dibromomethane	AA	ND	
07/10/96	08/16/96	Dicamba	AA	ND	
07/10/96	08/16/96	Dichloromethane (Methylene Chloride)	AA	ND	0.0050000
07/10/96	08/16/96	Dieldrin	AA	ND	
07/10/96	08/16/96	Dinoseb	AA	ND	0.0070000
07/10/96	08/16/96	Diquat	AA	ND	0.0200000
07/10/96	08/16/96	Endothall	AA	ND	0.1000000
07/10/96	08/16/96	Endrin	AA	ND	0.0020000
07/10/96	08/16/96	Ethylbenzene	AA	ND	0.7000000
07/10/96	08/16/96	Ethylene Dibromide (EDB)	AA	ND	0.0000500
07/10/96	08/16/96	Fluoride	AA	2.0000000	4.0000000
07/10/96	08/16/96	Glyphosate	AA	ND	0.7000000
07/10/96	08/16/96	Heptachlor	AA	ND	0.0004000
07/10/96	08/16/96	Heptachlor Epoxide	AA	ND	0.0002000
07/10/96	08/16/96	Hexachlorobenzene (HCB)	AA	ND	0.0010000
07/10/96	08/16/96	Hexachlorocyclopentadiene	AA	ND	0.0500000
07/10/96	08/16/96	M-Dichlorobenzene	AA	ND	
07/10/96	08/16/96	Mercury	AA	ND	0.0020000
07/10/96	08/16/96	Methomyl	AA	ND	
07/10/96	08/16/96	Methoxychlor	AA	ND	0.0400000
07/10/96	08/16/96	Monochlorobenzene (Chlorobenzene)	AA	ND	0.1000000
07/10/96	08/16/96	Nickel	AA	ND	0.1000000
07/10/96	08/16/96	Nitrate	AA	ND	10.000000
07/10/96	08/16/96	Nitrite	AA	ND	1.0000000
07/10/96	08/16/96	O-Chlorotoluene	AA	ND	
07/10/96	08/16/96	O-Dichlorobenzene	AA	ND	0.6000000
07/10/96	08/16/96	P-Chlorotoluene	AA	ND	
07/10/96	08/16/96	P-Dichlorobenzene	AA	ND	0.0750000
07/10/96	08/16/96	Pentachlorophenol	AA	ND	0.0010000
07/10/96	08/16/96	Phthalates (Di(2-Ethylhexyl))	AA	ND	0.0060000
07/10/96	08/16/96	Picloram	AA	ND	0.5000000
07/10/96	08/16/96	Propachlor	AA	ND	
07/10/96	08/16/96	Selenium	AA	ND	0.0500000
07/10/96	08/16/96	Simazine	AA	ND	0.0040000
07/10/96	08/16/96	Sodium	AA	93.000000	

07/10/96	08/16/96	Styrene	AA	ND	0.1000000
07/10/96	08/16/96	Sulfate	AA	40.000000	
07/10/96	08/16/96	Tetrachloroethylene	AA	ND	0.0050000
07/10/96	08/16/96	Thallium Total	AA	ND	0.0020000
07/10/96	08/16/96	Toluene	AA	ND	1.0000000
07/10/96	08/16/96	Total Polychlorinated Biphenyls (PCB)	AA	ND	0.0005000
07/10/96	08/16/96	Total Xylenes	AA	ND	10.000000
07/10/96	08/16/96	Toxaphene	AA	ND	0.0030000
07/10/96	08/16/96	Trans-1,2-Dichloroethylene	AA	ND	0.1000000
07/10/96	08/16/96	Trichloroethylene	AA	ND	0.0050000
07/10/96	08/16/96	Vinyl Chloride	AA	ND	0.0020000
07/10/96	08/16/96	Vydate (Oxamyl)	AA	ND	0.2000000
07/10/96	08/16/96	1,1,1,2-Tetrachloroethane	BA	ND	
07/10/96	08/16/96	1,1,1-Trichloroethane	BA	ND	0.2000000
07/10/96	08/16/96	1,1,2,2,-Tetrachloroethane	BA	ND	
07/10/96	08/16/96	1,1,2-Trichloroethane	BA	ND	0.0050000
07/10/96	08/16/96	1,1-Dichloroethane	BA	ND	
07/10/96	08/16/96	1,1-Dichloroethylene	BA	ND	0.0070000
07/10/96	08/16/96	1,1-Dichloropropene	BA	ND	
07/10/96	08/16/96	1,2,3-Trichloropropane	BA	ND	
07/10/96	08/16/96	1,2,4-Trichlorobenzene	BA	ND	0.0700000
07/10/96	08/16/96	1,2-Dibromo-3-Chloropropane (DBCP)	BA	ND	0.0002000
07/10/96	08/16/96	1,2-Dichloroethane	BA	ND	0.0050000
07/10/96	08/16/96	1,2-Dichloropropane	BA	ND	0.0050000
07/10/96	08/16/96	1,3-Dichloropropane	BA	ND	
07/10/96	08/16/96	1,3-Dichloropropene	BA	ND	
07/10/96	08/16/96	2,2-Dichloropropane	BA	ND	
07/10/96	08/16/96	2,4,5-TP Silvex	BA	ND	0.0500000
07/10/96	08/16/96	2,4-D	BA	ND	0.0700000
07/10/96	08/16/96	3-Hydroxycarbofuran	BA	ND	
07/10/96	08/16/96	Adipates (Di(2-Ethylhexyl))	BA	ND	0.4000000
07/10/96	08/16/96	Alachlor (Lasso)	BA	ND	0.0020000
07/10/96	08/16/96	Aldicarb	BA	ND	
07/10/96	08/16/96	Aldicarb Sulfone	BA	ND	
07/10/96	08/16/96	Aldicarb Sulfoxide	BA	ND	
07/10/96	08/16/96	Aldrin	BA	ND	

07/10/96	08/16/96	Antimony Total	BA	ND	0.0060000
07/10/96	08/16/96	Arsenic	BA	0.0006000	0.0500000
07/10/96	08/16/96	Atrazine	BA	ND	0.0030000
07/10/96	08/16/96	Barium	BA	0.0050000	2.0000000
07/10/96	08/16/96	Benzene	BA	ND	0.0050000
07/10/96	08/16/96	Benzo (A) Pyrene	BA	ND	0.0002000
07/10/96	08/16/96	Beryllium Total	BA	ND	0.0040000
07/10/96	08/16/96	BHC-gamma (Lindane)	BA	ND	0.0002000
07/10/96	08/16/96	Bromobenzene	BA	ND	
07/10/96	08/16/96	Bromodichloromethane	BA	ND	
07/10/96	08/16/96	Bromoform	BA	ND	
07/10/96	08/16/96	Bromomethane	BA	ND	
07/10/96	08/16/96	Cadmium	BA	ND	0.0050000
07/10/96	08/16/96	Carbaryl	BA	ND	
07/10/96	08/16/96	Carbofuran	BA	ND	0.0400000
07/10/96	08/16/96	Carbon Tetrachloride	BA	ND	0.0050000
07/10/96	08/16/96	Chlordane	BA	ND	0.0020000
07/10/96	08/16/96	Chloroethane	BA	ND	
07/10/96	08/16/96	Chloroform	BA	ND	
07/10/96	08/16/96	Chloromethane	BA	ND	
07/10/96	08/16/96	Chromium	BA	ND	0.1000000
07/10/96	08/16/96	Cis-1,2-Dichloroethylene	BA	ND	0.0700000
07/10/96	08/16/96	Cyanide	BA	ND	0.2000000
07/10/96	08/16/96	Dalapon	BA	ND	0.2000000
07/10/96	08/16/96	Dibromochloromethane	BA	ND	
07/10/96	08/16/96	Dibromomethane	BA	ND	
07/10/96	08/16/96	Dicamba	BA	ND	
07/10/96	08/16/96	Dichloromethane (Methylene Chloride)	BA	ND	0.0050000
07/10/96	08/16/96	Dieldrin	BA	ND	
07/10/96	08/16/96	Dinoseb	BA	ND	0.0070000
07/10/96	08/16/96	Diquat	BA	ND	0.0200000
07/10/96	08/16/96	Endothall	BA	ND	0.1000000
07/10/96	08/16/96	Endrin	BA	ND	0.0020000
07/10/96	08/16/96	Ethylbenzene	BA	ND	0.7000000
07/10/96	08/16/96	Ethylene Dibromide (EDB)	BA	ND	0.0000500
07/10/96	08/16/96	Fluoride	BA	3.0000000	4.0000000

07/10/96	08/16/96	Glyphosate	BA	ND	0.7000000
07/10/96	08/16/96	Heptachlor	BA	ND	0.0004000
07/10/96	08/16/96	Heptachlor Epoxide	BA	ND	0.0002000
07/10/96	08/16/96	Hexachlorobenzene (HCB)	BA	ND	0.0010000
07/10/96	08/16/96	Hexachlorocyclopentadiene	BA	ND	0.0500000
07/10/96	08/16/96	M-Dichlorobenzene	BA	ND	
07/10/96	08/16/96	Mercury	BA	ND	0.0020000
07/10/96	08/16/96	Methomyl	BA	ND	
07/10/96	08/16/96	Methoxychlor	BA	ND	0.0400000
07/10/96	08/16/96	Monochlorobenzene (Chlorobenzene)	BA	ND	0.1000000
07/10/96	08/16/96	Nickel	BA	ND	0.1000000
07/10/96	08/16/96	Nitrate	BA	ND	10.000000
07/10/96	08/16/96	Nitrite	BA	ND	1.0000000
07/10/96	08/16/96	O-Chlorotoluene	BA	ND	
07/10/96	08/16/96	O-Dichlorobenzene	BA	ND	0.6000000
07/10/96	08/16/96	P-Chlorotoluene	BA	ND	
07/10/96	08/16/96	P-Dichlorobenzene	BA	ND	0.0750000
07/10/96	08/16/96	Pentachlorophenol	BA	ND	0.0010000
07/10/96	08/16/96	Phthalates (Di(2-Ethylhexyl))	BA	ND	0.0060000
07/10/96	08/16/96	Picloram	BA	ND	0.5000000
07/10/96	08/16/96	Propachlor	BA	ND	
07/10/96	08/16/96	Selenium	BA	0.0010000	0.0500000
07/10/96	08/16/96	Simazine	BA	ND	0.0040000
07/10/96	08/16/96	Sodium	BA	100.00000	
07/10/96	08/16/96	Styrene	BA	ND	0.1000000
07/10/96	08/16/96	Sulfate	BA	45.000000	
07/10/96	08/16/96	Tetrachloroethylene	BA	ND	0.0050000
07/10/96	08/16/96	Thallium Total	BA	ND	0.0020000
07/10/96	08/16/96	Toluene	BA	ND	1.0000000
07/10/96	08/16/96	Total Polychlorinated Biphenyls (PCB)	BA	ND	0.0005000
07/10/96	08/16/96	Total Xylenes	BA	ND	10.000000
07/10/96	08/16/96	Toxaphene	BA	ND	0.0030000
07/10/96	08/16/96	Trans-1,2-Dichloroethylene	BA	ND	0.1000000
07/10/96	08/16/96	Trichloroethylene	BA	ND	0.0050000
07/10/96	08/16/96	Vinyl Chloride	BA	ND	0.0020000
07/10/96	08/16/96	Vydate (Oxamyl)	BA	ND	0.2000000

07/10/96	08/16/96	1,1,1,2-Tetrachloroethane	CA	ND	
07/10/96	08/16/96	1,1,1-Trichloroethane	CA	ND	0.2000000
07/10/96	08/16/96	1,1,2,2,-Tetrachloroethane	CA	ND	
07/10/96	08/16/96	1,1,2-Trichloroethane	CA	ND	0.0050000
07/10/96	08/16/96	1,1-Dichloroethane	CA	ND	
07/10/96	08/16/96	1,1-Dichloroethylene	CA	ND	0.0070000
07/10/96	08/16/96	1,1-Dichloropropene	CA	ND	
07/10/96	08/16/96	1,2,3-Trichloropropane	CA	ND	
07/10/96	08/16/96	1,2,4-Trichlorobenzene	CA	ND	0.0700000
07/10/96	08/16/96	1,2-Dibromo-3-Chloropropane (DBCP)	CA	ND	0.0002000
07/10/96	08/16/96	1,2-Dichloroethane	CA	ND	0.0050000
07/10/96	08/16/96	1,2-Dichloropropane	CA	ND	0.0050000
07/10/96	08/16/96	1,3-Dichloropropane	CA	ND	
07/10/96	08/16/96	1,3-Dichloropropene	CA	ND	
07/10/96	08/16/96	2,2-Dichloropropane	CA	ND	
07/10/96	08/16/96	2,4,5-TP Silvex	CA	ND	0.0500000
07/10/96	08/16/96	2,4-D	CA	ND	0.0700000
07/10/96	08/16/96	3-Hydroxycarbofuran	CA	ND	
07/10/96	08/16/96	Adipates (Di(2-Ethylhexyl))	CA	ND	0.4000000
07/10/96	08/16/96	Alachlor (Lasso)	CA	ND	0.0020000
07/10/96	08/16/96	Aldicarb	CA	ND	
07/10/96	08/16/96	Aldicarb Sulfone	CA	ND	
07/10/96	08/16/96	Aldicarb Sulfoxide	CA	ND	
07/10/96	08/16/96	Aldrin	CA	ND	
07/10/96	08/16/96	Antimony Total	CA	ND	0.0060000
07/10/96	08/16/96	Arsenic	CA	0.0005000	0.0500000
07/10/96	08/16/96	Atrazine	CA	ND	0.0030000
07/10/96	08/16/96	Barium	CA	0.0060000	2.0000000
07/10/96	08/16/96	Benzene	CA	ND	0.0050000
07/10/96	08/16/96	Benzo (A) Pyrene	CA	ND	0.0002000
07/10/96	08/16/96	Beryllium Total	CA	ND	0.0040000
07/10/96	08/16/96	BHC-gamma (Lindane)	CA	ND	0.0002000
07/10/96	08/16/96	Bromobenzene	CA	ND	
07/10/96	08/16/96	Bromodichloromethane	CA	ND	
07/10/96	08/16/96	Bromoform	CA	ND	
07/10/96	08/16/96	Bromomethane	CA	ND	

07/10/96	08/16/96	Cadmium	CA	ND	0.0050000
07/10/96	08/16/96	Carbaryl	CA	ND	
07/10/96	08/16/96	Carbofuran	CA	ND	0.0400000
07/10/96	08/16/96	Carbon Tetrachloride	CA	ND	0.0050000
07/10/96	08/16/96	Chlordane	CA	ND	0.0020000
07/10/96	08/16/96	Chloroethane	CA	ND	
07/10/96	08/16/96	Chloroform	CA	ND	
07/10/96	08/16/96	Chloromethane	CA	ND	
07/10/96	08/16/96	Chromium	CA	ND	0.1000000
07/10/96	08/16/96	Cis-1,2-Dichloroethylene	CA	ND	0.0700000
07/10/96	08/16/96	Cyanide	CA	ND	0.2000000
07/10/96	08/16/96	Dalapon	CA	ND	0.2000000
07/10/96	08/16/96	Dibromochloromethane	CA	ND	
07/10/96	08/16/96	Dibromomethane	CA	ND	
07/10/96	08/16/96	Dicamba	CA	ND	
07/10/96	08/16/96	Dichloromethane (Methylene Chloride)	CA	ND	0.0050000
07/10/96	08/16/96	Dieldrin	CA	ND	
07/10/96	08/16/96	Dinoseb	CA	ND	0.0070000
07/10/96	08/16/96	Diquat	CA	ND	0.0200000
07/10/96	08/16/96	Endothall	CA	ND	0.1000000
07/10/96	08/16/96	Endrin	CA	ND	0.0020000
07/10/96	08/16/96	Ethylbenzene	CA	ND	0.7000000
07/10/96	08/16/96	Ethylene Dibromide (EDB)	CA	ND	0.0000500
07/10/96	08/16/96	Fluoride	CA	1.6000000	4.0000000
07/10/96	08/16/96	Glyphosate	CA	ND	0.7000000
07/10/96	08/16/96	Heptachlor	CA	ND	0.0004000
07/10/96	08/16/96	Heptachlor Epoxide	CA	ND	0.0002000
07/10/96	08/16/96	Hexachlorobenzene (HCB)	CA	ND	0.0010000
07/10/96	08/16/96	Hexachlorocyclopentadiene	CA	ND	0.0500000
07/10/96	08/16/96	M-Dichlorobenzene	CA	ND	
07/10/96	08/16/96	Mercury	CA	ND	0.0020000
07/10/96	08/16/96	Methomyl	CA	ND	
07/10/96	08/16/96	Methoxychlor	CA	ND	0.0400000
07/10/96	08/16/96	Monochlorobenzene (Chlorobenzene)	CA	ND	0.1000000
07/10/96	08/16/96	Nickel	CA	ND	0.1000000
07/10/96	08/16/96	Nitrate	CA	0.1300000	10.000000

07/10/96	08/16/96	Nitrite	CA	ND	1.0000000
07/10/96	08/16/96	O-Chlorotoluene	CA	ND	
07/10/96	08/16/96	O-Dichlorobenzene	CA	ND	0.6000000
07/10/96	08/16/96	P-Chlorotoluene	CA	ND	
07/10/96	08/16/96	P-Dichlorobenzene	CA	ND	0.0750000
07/10/96	08/16/96	Pentachlorophenol	CA	ND	0.0010000
07/10/96	08/16/96	Phthalates (Di(2-Ethylhexyl))	CA	ND	0.0060000
07/10/96	08/16/96	Picloram	CA	ND	0.5000000
07/10/96	08/16/96	Propachlor	CA	ND	
07/10/96	08/16/96	Selenium	CA	ND	0.0500000
07/10/96	08/16/96	Simazine	CA	ND	0.0040000
07/10/96	08/16/96	Sodium	CA	86.000000	
07/10/96	08/16/96	Styrene	CA	ND	0.1000000
07/10/96	08/16/96	Sulfate	CA	32.000000	
07/10/96	08/16/96	Tetrachloroethylene	CA	ND	0.0050000
07/10/96	08/16/96	Thallium Total	CA	ND	0.0020000
07/10/96	08/16/96	Toluene	CA	ND	1.0000000
07/10/96	08/16/96	Total Polychlorinated Biphenyls (PCB)	CA	ND	0.0005000
07/10/96	08/16/96	Total Xylenes	CA	ND	10.000000
07/10/96	08/16/96	Toxaphene	CA	ND	0.0030000
07/10/96	08/16/96	Trans-1,2-Dichloroethylene	CA	ND	0.1000000
07/10/96	08/16/96	Trichloroethylene	CA	ND	0.0050000
07/10/96	08/16/96	Vinyl Chloride	CA	ND	0.0020000
07/10/96	08/16/96	Vydate (Oxamyl)	CA	ND	0.2000000
08/09/95	09/25/95	Conductivity @ 25 C U-MHO	AA	429.00000	
08/09/95	01/16/96	Gross Alpha, Excl. Radon & U	AA	1.4400000	15.000000
08/09/95	09/25/95	Gross Alpha, Incl. Radon & U	AA	1.4400000	
08/09/95	09/25/95	Ph	AA	9.3000000	
08/09/95	09/25/95	Conductivity @ 25 C U-MHO	BA	475.00000	
08/09/95	01/16/96	Gross Alpha, Excl. Radon & U	BA	ND	15.000000
08/09/95	09/25/95	Gross Alpha, Incl. Radon & U	BA	ND	
08/09/95	09/25/95	Ph	BA	9.9000000	
08/09/95	01/16/96	Gross Alpha, Excl. Radon & U	C	ND	15.000000
08/09/95	09/25/95	Conductivity @ 25 C U-MHO	CA	394.00000	
08/09/95	09/25/95	Gross Alpha, Incl. Radon & U	CA	ND	
08/09/95	09/25/95	Ph	CA	10.000000	

04/04/95	04/27/95	Nitrate	AA	ND	10.000000
04/04/95	04/27/95	Nitrate	BA	ND	10.000000
04/04/95	04/27/95	Nitrate	CA	0.0100000	10.000000
03/10/94	04/27/94	2,4,5-TP Silvex	AA	ND	0.0500000
03/10/94	04/27/94	2,4-D	AA	ND	0.0700000
03/10/94	04/27/94	Dalapon	AA	ND	0.2000000
03/10/94	04/27/94	Dicamba	AA	ND	
03/10/94	04/27/94	Dinoseb	AA	ND	0.0070000
03/10/94	04/27/94	Pentachlorophenol	AA	ND	0.0010000
03/10/94	04/27/94	Picloram	AA	ND	0.5000000
12/21/93	01/18/94	Cyanide	CA	ND	0.2000000
08/11/93	01/12/94	Cyanide	CA	ND	0.2000000
06/16/93	01/03/94	Cyanide	CA	ND	0.2000000
05/19/93	12/08/93	Cyanide	CA	ND	0.2000000
05/14/93	12/08/93	1,1,1,2-Tetrachloroethane	BA	ND	
05/14/93	12/08/93	1,1,1-Trichloroethane	BA	ND	0.2000000
05/14/93	12/08/93	1,1,2,2,-Tetrachloroethane	BA	ND	
05/14/93	12/08/93	1,1,2-Trichloroethane	BA	ND	0.0050000
05/14/93	12/08/93	1,1-Dichloroethane	BA	ND	
05/14/93	12/08/93	1,1-Dichloroethylene	BA	ND	0.0070000
05/14/93	12/08/93	1,1-Dichloropropene	BA	ND	
05/14/93	12/08/93	1,2,3-Trichloropropane	BA	ND	
05/14/93	12/08/93	1,2,4-Trichlorobenzene	BA	ND	0.0700000
05/14/93	12/08/93	1,2-Dibromo-3-Chloropropane (DBCP)	BA	ND	0.0002000
05/14/93	12/08/93	1,2-Dichloroethane	BA	ND	0.0050000
05/14/93	12/08/93	1,2-Dichloropropane	BA	ND	0.0050000
05/14/93	12/08/93	1,3-Dichloropropane	BA	ND	
05/14/93	12/08/93	1,3-Dichloropropene	BA	ND	
05/14/93	12/08/93	2,2-Dichloropropane	BA	ND	
05/14/93	12/08/93	Benzene	BA	ND	0.0050000
05/14/93	12/08/93	Bromobenzene	BA	ND	
05/14/93	12/08/93	Bromodichloromethane	BA	ND	
05/14/93	12/08/93	Bromoform	BA	ND	
05/14/93	12/08/93	Bromomethane	BA	ND	
05/14/93	12/08/93	Carbon Tetrachloride	BA	ND	0.0050000
05/14/93	12/08/93	Chloroethane	BA	ND	

05/14/93	12/08/93	Chloroform	BA	ND	
05/14/93	12/08/93	Chloromethane	BA	ND	
05/14/93	12/08/93	Cis-1,2-Dichloroethylene	BA	ND	0.0700000
05/14/93	12/08/93	Dibromochloromethane	BA	ND	
05/14/93	12/08/93	Dibromomethane	BA	ND	
05/14/93	12/08/93	Dichloromethane (Methylene Chloride)	BA	ND	0.0050000
05/14/93	12/08/93	Ethylbenzene	BA	ND	0.7000000
05/14/93	12/08/93	Ethylene Dibromide (EDB)	BA	ND	0.0000500
05/14/93	12/08/93	Hexachlorocyclopentadiene	BA	ND	0.0500000
05/14/93	12/08/93	M-Dichlorobenzene	BA	ND	
05/14/93	12/08/93	Monochlorobenzene (Chlorobenzene)	BA	ND	0.1000000
05/14/93	12/08/93	O-Chlorotoluene	BA	ND	
05/14/93	12/08/93	O-Dichlorobenzene	BA	ND	0.6000000
05/14/93	12/08/93	P-Chlorotoluene	BA	ND	
05/14/93	12/08/93	P-Dichlorobenzene	BA	ND	0.0750000
05/14/93	12/08/93	Styrene	BA	ND	0.1000000
05/14/93	12/08/93	Tetrachloroethylene	BA	ND	0.0050000
05/14/93	12/08/93	Toluene	BA	ND	1.0000000
05/14/93	12/08/93	Total Xylenes	BA	ND	10.000000
05/14/93	12/08/93	Trans-1,2-Dichloroethylene	BA	ND	0.1000000
05/14/93	12/08/93	Trichloroethylene	BA	ND	0.0050000
05/14/93	12/08/93	Vinyl Chloride	BA	ND	0.0020000
05/14/93	12/08/93	1,1,1,2-Tetrachloroethane	CA	ND	
05/14/93	12/08/93	1,1,1-Trichloroethane	CA	ND	0.2000000
05/14/93	12/08/93	1,1,2,2,-Tetrachloroethane	CA	ND	
05/14/93	12/08/93	1,1,2-Trichloroethane	CA	ND	0.0050000
05/14/93	12/08/93	1,1-Dichloroethane	CA	ND	
05/14/93	12/08/93	1,1-Dichloroethylene	CA	ND	0.0070000
05/14/93	12/08/93	1,1-Dichloropropene	CA	ND	
05/14/93	12/08/93	1,2,3-Trichloropropane	CA	ND	
05/14/93	12/08/93	1,2,4-Trichlorobenzene	CA	ND	0.0700000
05/14/93	12/08/93	1,2-Dibromo-3-Chloropropane (DBCP)	CA	ND	0.0002000
05/14/93	12/08/93	1,2-Dichloroethane	CA	ND	0.0050000
05/14/93	12/08/93	1,2-Dichloropropane	CA	ND	0.0050000
05/14/93	12/08/93	1,3-Dichloropropane	CA	ND	

05/14/93	12/08/93	1,3-Dichloropropene	CA	ND	
05/14/93	12/08/93	2,2-Dichloropropane	CA	ND	
05/14/93	12/08/93	Benzene	CA	ND	0.0050000
05/14/93	12/08/93	Bromobenzene	CA	ND	
05/14/93	12/08/93	Bromodichloromethane	CA	ND	
05/14/93	12/08/93	Bromoform	CA	ND	
05/14/93	12/08/93	Bromomethane	CA	ND	
05/14/93	12/08/93	Carbon Tetrachloride	CA	ND	0.0050000
05/14/93	12/08/93	Chloroethane	CA	ND	
05/14/93	12/08/93	Chloroform	CA	ND	
05/14/93	12/08/93	Chloromethane	CA	ND	
05/14/93	12/08/93	Cis-1,2-Dichloroethylene	CA	ND	0.0700000
05/14/93	12/08/93	Dibromochloromethane	CA	ND	
05/14/93	12/08/93	Dibromomethane	CA	ND	
05/14/93	12/08/93	Dichloromethane (Methylene Chloride)	CA	ND	0.0050000
05/14/93	12/08/93	Ethylbenzene	CA	ND	0.7000000
05/14/93	12/08/93	Ethylene Dibromide (EDB)	CA	ND	0.0000500
05/14/93	12/08/93	Hexachlorocyclopentadiene	CA	ND	0.0500000
05/14/93	12/08/93	M-Dichlorobenzene	CA	ND	
05/14/93	12/08/93	Monochlorobenzene (Chlorobenzene)	CA	ND	0.1000000
05/14/93	12/08/93	O-Chlorotoluene	CA	ND	
05/14/93	12/08/93	O-Dichlorobenzene	CA	ND	0.6000000
05/14/93	12/08/93	P-Chlorotoluene	CA	ND	
05/14/93	12/08/93	P-Dichlorobenzene	CA	ND	0.0750000
05/14/93	12/08/93	Styrene	CA	ND	0.1000000
05/14/93	12/08/93	Tetrachloroethylene	CA	ND	0.0050000
05/14/93	12/08/93	Toluene	CA	ND	1.0000000
05/14/93	12/08/93	Total Xylenes	CA	ND	10.000000
05/14/93	12/08/93	Trans-1,2-Dichloroethylene	CA	ND	0.1000000
05/14/93	12/08/93	Trichloroethylene	CA	ND	0.0050000
05/14/93	12/08/93	Vinyl Chloride	CA	ND	0.0020000
04/13/93	12/08/93	Alachlor (Lasso)	AA	ND	0.0020000
04/13/93	12/08/93	Aldrin	AA	ND	
04/13/93	12/08/93	Atrazine	AA	ND	0.0030000
04/13/93	12/08/93	BHC-gamma (Lindane)	AA	ND	0.0002000
04/13/93	12/08/93	Butachlor	AA	ND	

04/13/93	12/08/93	Chlordane	AA	ND	0.0020000
04/13/93	12/08/93	Dieldrin	AA	ND	
04/13/93	12/08/93	Endothall	AA	ND	0.1000000
04/13/93	12/08/93	Endrin	AA	ND	0.0020000
04/13/93	12/08/93	Glyphosate	AA	ND	0.7000000
04/13/93	12/08/93	Heptachlor	AA	ND	0.0004000
04/13/93	12/08/93	Heptachlor Epoxide	AA	ND	0.0002000
04/13/93	12/08/93	Hexachlorobenzene (HCB)	AA	ND	0.0010000
04/13/93	12/08/93	Hexachlorocyclopentadiene	AA	ND	0.0500000
04/13/93	12/08/93	Methoxychlor	AA	ND	0.0400000
04/13/93	12/08/93	Metolachlor	AA	ND	
04/13/93	12/08/93	Metribuzin	AA	ND	
04/13/93	12/08/93	Propachlor	AA	ND	
04/13/93	12/08/93	Simazine	AA	ND	0.0040000
04/13/93	12/08/93	Toxaphene	AA	ND	0.0030000
04/13/93	12/08/93	Alachlor (Lasso)	BA	ND	0.0020000
04/13/93	12/08/93	Aldrin	BA	ND	
04/13/93	12/08/93	Atrazine	BA	ND	0.0030000
04/13/93	12/08/93	BHC-gamma (Lindane)	BA	ND	0.0002000
04/13/93	12/08/93	Butachlor	BA	ND	
04/13/93	12/08/93	Chlordane	BA	ND	0.0020000
04/13/93	12/08/93	Dieldrin	BA	ND	
04/13/93	12/08/93	Endothall	BA	ND	0.1000000
04/13/93	12/08/93	Endrin	BA	ND	0.0020000
04/13/93	12/08/93	Glyphosate	BA	ND	0.7000000
04/13/93	12/08/93	Heptachlor	BA	ND	0.0004000
04/13/93	12/08/93	Heptachlor Epoxide	BA	ND	0.0002000
04/13/93	12/08/93	Hexachlorobenzene (HCB)	BA	ND	0.0010000
04/13/93	12/08/93	Hexachlorocyclopentadiene	BA	ND	0.0500000
04/13/93	12/08/93	Methoxychlor	BA	ND	0.0400000
04/13/93	12/08/93	Metolachlor	BA	ND	
04/13/93	12/08/93	Metribuzin	BA	ND	
04/13/93	12/08/93	Propachlor	BA	ND	
04/13/93	12/08/93	Simazine	BA	ND	0.0040000
04/13/93	12/08/93	Toxaphene	BA	ND	0.0030000
04/13/93	12/08/93	Alachlor (Lasso)	CA	ND	0.0020000
04/13/93	12/08/93	Aldrin	CA	ND	

04/13/93	12/08/93	Atrazine	CA	ND	0.0030000
04/13/93	12/08/93	BHC-gamma (Lindane)	CA	ND	0.0002000
04/13/93	12/08/93	Butachlor	CA	ND	
04/13/93	12/08/93	Chlordane	CA	ND	0.0020000
04/13/93	12/08/93	Dieldrin	CA	ND	
04/13/93	12/08/93	Endothall	CA	ND	0.1000000
04/13/93	12/08/93	Endrin	CA	ND	0.0020000
04/13/93	12/08/93	Glyphosate	CA	ND	0.7000000
04/13/93	12/08/93	Heptachlor	CA	ND	0.0004000
04/13/93	12/08/93	Heptachlor Epoxide	CA	ND	0.0002000
04/13/93	12/08/93	Hexachlorobenzene (HCB)	CA	ND	0.0010000
04/13/93	12/08/93	Hexachlorocyclopentadiene	CA	ND	0.0500000
04/13/93	12/08/93	Methoxychlor	CA	ND	0.0400000
04/13/93	12/08/93	Metolachlor	CA	ND	
04/13/93	12/08/93	Metribuzin	CA	ND	
04/13/93	12/08/93	Propachlor	CA	ND	
04/13/93	12/08/93	Simazine	CA	ND	0.0040000
04/13/93	12/08/93	Toxaphene	CA	ND	0.0030000
03/24/93	12/08/93	1,1,1,2-Tetrachloroethane	AA	ND	
03/24/93	12/08/93	1,1,1-Trichloroethane	AA	ND	0.2000000
03/24/93	12/08/93	1,1,2,2,-Tetrachloroethane	AA	ND	
03/24/93	12/08/93	1,1,2-Trichloroethane	AA	ND	0.0050000
03/24/93	12/08/93	1,1-Dichloroethane	AA	ND	
03/24/93	12/08/93	1,1-Dichloroethylene	AA	ND	0.0070000
03/24/93	12/08/93	1,1-Dichloropropene	AA	ND	
03/24/93	12/08/93	1,2,3-Trichloropropane	AA	ND	
03/24/93	12/08/93	1,2,4-Trichlorobenzene	AA	ND	0.0700000
03/24/93	12/08/93	1,2-Dibromo-3-Chloropropane (DBCP)	AA	ND	0.0002000
03/24/93	12/08/93	1,2-Dichloroethane	AA	ND	0.0050000
03/24/93	12/08/93	1,2-Dichloropropane	AA	ND	0.0050000
03/24/93	12/08/93	1,3-Dichloropropane	AA	ND	
03/24/93	12/08/93	1,3-Dichloropropene	AA	ND	
03/24/93	12/08/93	2,2-Dichloropropane	AA	ND	
03/24/93	12/08/93	2,4,5-TP Silvex	AA	0.0003000	0.0500000
03/24/93	12/08/93	2,4-D	AA	ND	0.0700000
03/24/93	12/08/93	3-Hydroxycarbofuran	AA	ND	

03/24/93	12/08/93	Adipates (Di(2-Ethylhexyl))	AA	ND	0.4000000
03/24/93	12/08/93	Aldicarb	AA	ND	
03/24/93	12/08/93	Aldicarb Sulfone	AA	ND	
03/24/93	12/08/93	Aldicarb Sulfoxide	AA	ND	
03/24/93	12/08/93	Antimony Total	AA	ND	0.0060000
03/24/93	12/08/93	Arsenic	AA	ND	0.0500000
03/24/93	12/08/93	Barium	AA	0.0070000	2.0000000
03/24/93	12/08/93	Benzene	AA	ND	0.0050000
03/24/93	12/08/93	Benzo (A) Pyrene	AA	ND	0.0002000
03/24/93	12/08/93	Beryllium Total	AA	ND	0.0040000
03/24/93	12/08/93	Bromobenzene	AA	ND	
03/24/93	12/08/93	Bromodichloromethane	AA	ND	
03/24/93	12/08/93	Bromoform	AA	ND	
03/24/93	12/08/93	Bromomethane	AA	ND	
03/24/93	12/08/93	Cadmium	AA	ND	0.0050000
03/24/93	12/08/93	Carbaryl	AA	ND	
03/24/93	12/08/93	Carbofuran	AA	ND	0.0400000
03/24/93	12/08/93	Carbon Tetrachloride	AA	ND	0.0050000
03/24/93	12/08/93	Chloroethane	AA	ND	
03/24/93	12/08/93	Chloroform	AA	ND	
03/24/93	12/08/93	Chloromethane	AA	ND	
03/24/93	12/08/93	Chromium	AA	ND	0.1000000
03/24/93	12/08/93	Cis-1,2-Dichloroethylene	AA	ND	0.0700000
03/24/93	12/08/93	Cyanide	AA	ND	0.2000000
03/24/93	12/08/93	Dalapon	AA	ND	0.2000000
03/24/93	12/08/93	Dibromochloromethane	AA	ND	
03/24/93	12/08/93	Dibromomethane	AA	ND	
03/24/93	12/08/93	Dicamba	AA	ND	
03/24/93	12/08/93	Dichloromethane (Methylene Chloride)	AA	ND	0.0050000
03/24/93	12/08/93	Dinoseb	AA	ND	0.0070000
03/24/93	12/08/93	Ethylbenzene	AA	ND	0.7000000
03/24/93	12/08/93	Ethylene Dibromide (EDB)	AA	ND	0.0000500
03/24/93	12/08/93	Fluoride	AA	2.3000000	4.0000000
03/24/93	12/08/93	Glyphosate	AA	ND	0.7000000
03/24/93	12/08/93	M-Dichlorobenzene	AA	ND	
03/24/93	12/08/93	Mercury	AA	ND	0.0020000

03/24/93	12/08/93	Methomyl	AA	ND	
03/24/93	12/08/93	Monochlorobenzene (Chlorobenzene)	AA	ND	0.1000000
03/24/93	12/08/93	Nickel	AA	ND	0.1000000
03/24/93	12/08/93	Nitrate	AA	ND	10.000000
03/24/93	12/08/93	Nitrate-Nitrite	AA	ND	10.000000
03/24/93	12/08/93	Nitrite	AA	ND	1.0000000
03/24/93	12/08/93	O-Chlorotoluene	AA	ND	
03/24/93	12/08/93	O-Dichlorobenzene	AA	ND	0.6000000
03/24/93	12/08/93	P-Chlorotoluene	AA	ND	
03/24/93	12/08/93	P-Dichlorobenzene	AA	ND	0.0750000
03/24/93	12/08/93	Pentachlorophenol	AA	ND	0.0010000
03/24/93	12/08/93	Phthalates (Di(2-Ethylhexyl))	AA	ND	0.0060000
03/24/93	12/08/93	Picloram	AA	ND	0.5000000
03/24/93	12/08/93	Selenium	AA	ND	0.0500000
03/24/93	12/08/93	Sodium	AA	89.000000	
03/24/93	12/08/93	Styrene	AA	ND	0.1000000
03/24/93	12/08/93	Sulfate	AA	47.000000	
03/24/93	12/08/93	Tetrachloroethylene	AA	ND	0.0050000
03/24/93	12/08/93	Thallium Total	AA	ND	0.0020000
03/24/93	12/08/93	Toluene	AA	ND	1.0000000
03/24/93	12/08/93	Total Polychlorinated Biphenyls (PCB)	AA	ND	0.0005000
03/24/93	12/08/93	Total Xylenes	AA	ND	10.000000
03/24/93	12/08/93	Trans-1,2-Dichloroethylene	AA	ND	0.1000000
03/24/93	12/08/93	Trichloroethylene	AA	ND	0.0050000
03/24/93	12/08/93	Vinyl Chloride	AA	ND	0.0020000
03/24/93	12/08/93	Vydate (Oxamyl)	AA	ND	0.2000000
03/24/93	12/08/93	2,4,5-TP Silvex	BA	ND	0.0500000
03/24/93	12/08/93	2,4-D	BA	ND	0.0700000
03/24/93	12/08/93	3-Hydroxycarbofuran	BA	ND	
03/24/93	12/08/93	Adipates (Di(2-Ethylhexyl))	BA	ND	0.4000000
03/24/93	12/08/93	Aldicarb	BA	ND	
03/24/93	12/08/93	Aldicarb Sulfone	BA	ND	
03/24/93	12/08/93	Aldicarb Sulfoxide	BA	ND	
03/24/93	12/08/93	Antimony Total	BA	ND	0.0060000
03/24/93	12/08/93	Arsenic	BA	ND	0.0500000
03/24/93	12/08/93	Barium	BA	ND	2.0000000

03/24/93	12/08/93	Benzo (A) Pyrene	BA	ND	0.0002000
03/24/93	12/08/93	Beryllium Total	BA	ND	0.0040000
03/24/93	12/08/93	Cadmium	BA	ND	0.0050000
03/24/93	12/08/93	Carbaryl	BA	ND	
03/24/93	12/08/93	Carbofuran	BA	ND	0.0400000
03/24/93	12/08/93	Chromium	BA	ND	0.1000000
03/24/93	12/08/93	Cyanide	BA	ND	0.2000000
03/24/93	12/08/93	Dalapon	BA	ND	0.2000000
03/24/93	12/08/93	Dicamba	BA	ND	
03/24/93	12/08/93	Dinoseb	BA	ND	0.0070000
03/24/93	12/08/93	Fluoride	BA	3.2000000	4.0000000
03/24/93	12/08/93	Glyphosate	BA	ND	0.7000000
03/24/93	12/08/93	Mercury	BA	ND	0.0020000
03/24/93	12/08/93	Methomyl	BA	ND	
03/24/93	12/08/93	Nickel	BA	ND	0.1000000
03/24/93	12/08/93	Nitrate	BA	ND	10.000000
03/24/93	12/08/93	Nitrate-Nitrite	BA	ND	10.000000
03/24/93	12/08/93	Nitrite	BA	ND	1.0000000
03/24/93	12/08/93	Pentachlorophenol	BA	ND	0.0010000
03/24/93	12/08/93	Phthalates (Di(2-Ethylhexyl))	BA	ND	0.0060000
03/24/93	12/08/93	Picloram	BA	ND	0.5000000
03/24/93	12/08/93	Selenium	BA	ND	0.0500000
03/24/93	12/08/93	Sodium	BA	100.00000	
03/24/93	12/08/93	Sulfate	BA	44.000000	
03/24/93	12/08/93	Thallium Total	BA	ND	0.0020000
03/24/93	12/08/93	Total Polychlorinated Biphenyls (PCB)	BA	ND	0.0005000
03/24/93	12/08/93	Vydate (Oxamyl)	BA	ND	0.2000000
03/24/93	12/08/93	2,4,5-TP Silvex	CA	ND	0.0500000
03/24/93	12/08/93	2,4-D	CA	ND	0.0700000
03/24/93	12/08/93	3-Hydroxycarbofuran	CA	ND	
03/24/93	12/08/93	Adipates (Di(2-Ethylhexyl))	CA	ND	0.4000000
03/24/93	12/08/93	Aldicarb	CA	ND	
03/24/93	12/08/93	Aldicarb Sulfone	CA	ND	
03/24/93	12/08/93	Aldicarb Sulfoxide	CA	ND	
03/24/93	12/08/93	Antimony Total	CA	ND	0.0060000
03/24/93	12/08/93	Arsenic	CA	ND	0.0500000

03/24/93	12/08/93	Barium	CA	0.0060000	2.0000000
03/24/93	12/08/93	Benzo (A) Pyrene	CA	ND	0.0002000
03/24/93	12/08/93	Beryllium Total	CA	ND	0.0040000
03/24/93	12/08/93	Cadmium	CA	ND	0.0050000
03/24/93	12/08/93	Carbaryl	CA	ND	
03/24/93	12/08/93	Carbofuran	CA	ND	0.0400000
03/24/93	12/08/93	Chromium	CA	ND	0.1000000
03/24/93	12/08/93	Cyanide	CA	1.7000000	0.2000000
03/24/93	12/08/93	Dalapon	CA	ND	0.2000000
03/24/93	12/08/93	Dicamba	CA	ND	
03/24/93	12/08/93	Dinoseb	CA	ND	0.0070000
03/24/93	12/08/93	Fluoride	CA	ND	4.0000000
03/24/93	12/08/93	Glyphosate	CA	ND	0.7000000
03/24/93	12/08/93	Mercury	CA	ND	0.0020000
03/24/93	12/08/93	Methomyl	CA	ND	
03/24/93	12/08/93	Nickel	CA	ND	0.1000000
03/24/93	12/08/93	Nitrate	CA	ND	10.000000
03/24/93	12/08/93	Nitrate-Nitrite	CA	ND	10.000000
03/24/93	12/08/93	Nitrite	CA	ND	1.0000000
03/24/93	12/08/93	Pentachlorophenol	CA	ND	0.0010000
03/24/93	12/08/93	Phthalates (Di(2-Ethylhexyl))	CA	ND	0.0060000
03/24/93	12/08/93	Picloram	CA	ND	0.5000000
03/24/93	12/08/93	Selenium	CA	ND	0.0500000
03/24/93	12/08/93	Sodium	CA	84.000000	
03/24/93	12/08/93	Sulfate	CA	31.000000	
03/24/93	12/08/93	Thallium Total	CA	ND	0.0020000
03/24/93	12/08/93	Total Polychlorinated Biphenyls (PCB)	CA	ND	0.0005000
03/24/93	12/08/93	Vydate (Oxamyl)	CA	ND	0.2000000
08/28/91	11/07/91	Gross Alpha, Excl. Radon & U	AA	ND	15.000000
08/28/91	11/07/91	Gross Alpha, Excl. Radon & U	BA	ND	15.000000
08/28/91	11/07/91	Gross Alpha, Excl. Radon & U	CA	ND	15.000000
03/04/91	08/13/91	Arsenic	AA	ND	0.0500000
03/04/91	08/13/91	Barium	AA	ND	2.0000000
03/04/91	08/13/91	Cadmium	AA	ND	0.0050000
03/04/91	08/13/91	Chromium	AA	ND	0.1000000
03/04/91	08/13/91	Fluoride	AA	2.0500000	4.0000000

03/04/91	08/13/91	Lead	AA	ND	0.0150000
03/04/91	08/13/91	Mercury	AA	ND	0.0020000
03/04/91	08/13/91	Nitrate	AA	ND	10.000000
03/04/91	08/13/91	Selenium	AA	ND	0.0500000
03/04/91	08/13/91	Silver	AA	ND	0.1000000
03/04/91	08/13/91	Arsenic	BA	ND	0.0500000
03/04/91	08/13/91	Barium	BA	ND	2.0000000
03/04/91	08/13/91	Cadmium	BA	ND	0.0050000
03/04/91	08/13/91	Chromium	BA	ND	0.1000000
03/04/91	08/13/91	Fluoride	BA	2.7000000	4.0000000
03/04/91	08/13/91	Lead	BA	ND	0.0150000
03/04/91	08/13/91	Mercury	BA	ND	0.0020000
03/04/91	08/13/91	Nitrate	BA	ND	10.000000
03/04/91	08/13/91	Selenium	BA	ND	0.0500000
03/04/91	08/13/91	Silver	BA	ND	0.1000000
03/04/91	08/13/91	Arsenic	CA	ND	0.0500000
03/04/91	08/13/91	Barium	CA	ND	2.0000000
03/04/91	08/13/91	Cadmium	CA	ND	0.0050000
03/04/91	08/13/91	Chromium	CA	ND	0.1000000
03/04/91	08/13/91	Fluoride	CA	1.6000000	4.0000000
03/04/91	08/13/91	Lead	CA	ND	0.0150000
03/04/91	08/13/91	Mercury	CA	ND	0.0020000
03/04/91	08/13/91	Nitrate	CA	ND	10.000000
03/04/91	08/13/91	Selenium	CA	ND	0.0500000
03/04/91	08/13/91	Silver	CA	ND	0.1000000
03/27/90	06/20/90	1,1,1-Trichloroethane	AA	ND	0.2000000
03/27/90	06/20/90	1,1-Dichloroethylene	AA	ND	0.0070000
03/27/90	06/20/90	1,2-Dichloroethane	AA	ND	0.0050000
03/27/90	06/20/90	Benzene	AA	ND	0.0050000
03/27/90	06/20/90	Carbon Tetrachloride	AA	ND	0.0050000
03/27/90	06/20/90	P-Dichlorobenzene	AA	ND	0.0750000
03/27/90	06/20/90	Trichloroethylene	AA	ND	0.0050000
03/27/90	06/20/90	Vinyl Chloride	AA	ND	0.0020000
03/27/90	06/20/90	1,1,1-Trichloroethane	BA	ND	0.2000000
03/27/90	06/20/90	1,1-Dichloroethylene	BA	ND	0.0070000
03/27/90	06/20/90	1,2-Dichloroethane	BA	ND	0.0050000
03/27/90	06/20/90	Benzene	BA	ND	0.0050000

03/27/90	06/20/90	Carbon Tetrachloride	BA	ND	0.0050000
03/27/90	06/20/90	P-Dichlorobenzene	BA	ND	0.0750000
03/27/90	06/20/90	Trichloroethylene	BA	ND	0.0050000
03/27/90	06/20/90	Vinyl Chloride	BA	ND	0.0020000
03/27/90	06/20/90	1,1,1-Trichloroethane	CA	ND	0.2000000
03/27/90	06/20/90	1,1-Dichloroethylene	CA	ND	0.0070000
03/27/90	06/20/90	1,2-Dichloroethane	CA	ND	0.0050000
03/27/90	06/20/90	Benzene	CA	ND	0.0050000
03/27/90	06/20/90	Carbon Tetrachloride	CA	ND	0.0050000
03/27/90	06/20/90	P-Dichlorobenzene	CA	ND	0.0750000
03/27/90	06/20/90	Trichloroethylene	CA	ND	0.0050000
03/27/90	06/20/90	Vinyl Chloride	CA	ND	0.0020000
05/04/88	08/08/88	Fluoride	BA	2.9600000	4.0000000
04/08/88	05/02/88	Arsenic	AA	ND	0.0500000
04/08/88	05/02/88	Barium	AA	0.0070000	2.0000000
04/08/88	05/02/88	Cadmium	AA	ND	0.0050000
04/08/88	05/02/88	Chromium	AA	0.0040000	0.1000000
04/08/88	05/02/88	Fluoride	AA	2.1300000	4.0000000
04/08/88	05/02/88	Lead	AA	ND	0.0150000
04/08/88	05/02/88	Mercury	AA	0.0005000	0.0020000
04/08/88	05/02/88	Nitrate	AA	0.0500000	10.000000
04/08/88	05/02/88	Selenium	AA	ND	0.0500000
04/08/88	05/02/88	Silver	AA	ND	0.1000000
04/08/88	05/02/88	Arsenic	BA	ND	0.0500000
04/08/88	05/02/88	Barium	BA	0.0050000	2.0000000
04/08/88	05/02/88	Cadmium	BA	ND	0.0050000
04/08/88	05/02/88	Chromium	BA	0.0040000	0.1000000
04/08/88	05/02/88	Fluoride	BA	3.1300000	4.0000000
04/08/88	05/02/88	Lead	BA	ND	0.0150000
04/08/88	05/02/88	Mercury	BA	0.0005000	0.0020000
04/08/88	05/02/88	Nitrate	BA	0.0500000	10.000000
04/08/88	05/02/88	Selenium	BA	ND	0.0500000
04/08/88	05/02/88	Silver	BA	ND	0.1000000
04/08/88	05/02/88	Arsenic	CA	ND	0.0500000
04/08/88	05/02/88	Barium	CA	0.0080000	2.0000000
04/08/88	05/02/88	Cadmium	CA	ND	0.0050000
04/08/88	05/02/88	Chromium	CA	0.0030000	0.1000000

04/08/88	05/02/88	Fluoride	CA	1.8000000	4.0000000
04/08/88	05/02/88	Lead	CA	0.0050000	0.0150000
04/08/88	05/02/88	Mercury	CA	0.0005000	0.0020000
04/08/88	05/02/88	Nitrate	CA	0.0500000	10.000000
04/08/88	05/02/88	Selenium	CA	ND	0.0500000
04/08/88	05/02/88	Silver	CA	ND	0.1000000

A blank or a 0 in the MCL column indicates that a MCL has not been set for that chemical
This list represents the latest test results for ***all*** *sources and entry points the system has. For systems with multiple sources the list will probably be a mix of results from all sources. But these are the latest results.*

For further information on this public water system click on the area of interest below.

System Info :: Report for Lenders :: Alerts :: Violations :: Enforcements :: Contacts :: Site Visits :: Public Notice

Coliform Summary :: Coliform Results :: Coliform Results Archives (pre 2002) :: Sampling Schedule for Coliform

Chemical Group Summary :: Latest Chemical Results :: Chemical Detections :: Sampling Schedules for Chemicals

Single Analyte Results For a System :: Lead & Copper :: Corrosion Control(LCR) :: SWTR :: Nitrates :: Arsenic

DBPs :: TOC & Alkalinity :: DBP/TOC/Bromate/Chlorine Monitoring :: Radionuclides :: FANLs

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Information by county:

Inventory :: Surface Water Systems :: Sanitary Surveys :: Alerts :: Violations :: Open Enforcements

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Inventory List for all Oregon Drinking Water Systems in Excel or printable screen format

SNC Reports for Oregon Drinking Water Systems

APPENDIX B

Sanitary Survey

Oregon
Theodore R. Kulongoski, Governor

Department of Human Services
Health Services
Drinking Water Program
700 SE Emigrant, Rm. 240
Pendleton, OR 97801
(541) 276-8006
FAX (541) 276-4778

June 4, 2004

Roger Frances
City of Umatilla
P.O. Box 130
Umatilla, Oregon 97882

Re: Sanitary Survey of the City of Umatilla, PWS ID: 4100914

Thank you for your time and assistance in performing the sanitary survey. I have enclosed a copy of the survey report for your records. The report is based on information collected during the April 29th site visit. Please review the report and let me know if you find any errors.

The following items need to be addressed to meet public water system standards:

- An asbestos sample needs to be collected. The last sample on record was collected March 24, 1993. One sample every nine years is required for systems that have asbestos-cement pipe. The sample should be collected at a location near the largest section of a/c pipe during the month when water temperature is warmest. Complete sampling requirements can be found on the "Water Quality Monitoring" page of the report.

  Sample Tested 8/25/04

- Four sets of Disinfection Byproduct samples must be collected annually starting this year. The samples are to be collected this summer from locations with maximum residence time that represent the four different sources. I have enclosed some additional information on this rule.

- To be considered complete, the City's coliform sampling plan needs to include the following elements:
  - a map of the distribution system showing routine and repeat sample sites
  - a narrative description of the plan and sampling procedure
  - a sample siting plan and maintenance program that identifies routine and repeat sampling sites and a rotation schedule. I have enclosed a fact sheet that goes into more detail.

If you have any questions, comments, or need this information in an alternate format please call me at 541-276-8006 extension 354.

Sincerely,

William Goss

William Goss, EIT
Regional Engineering Assistant

c. Drinking Water Program, Portland

enclosure

Sanitary Survey Deficiency Summary

OHD Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF PWS ID: 41 00914

Operator/Contact: ROGER FRANCES County: UMATILLA

Yes	No		Date to be Corrected	Date Corrected
	X	**Surface Source Deficiencies**		
	X	**Well Construction Deficiencies**		
	X	**Spring / Other Deficiencies**		
	X	**Disinfection Deficiencies**		
	X	**Treatment Deficiencies**		
	X	**Storage / Pressure Tank Deficiencies**		
	X	**Distribution Deficiencies**		
X		**Monitoring Deficiencies** ASBESTOS		
	X	**Management Deficiencies**		

Comments:

Surveyor: BILL GROSS Date of Survey: 4/29/04

SS1A699 rev. 6/99

Inventory & Narrative
Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF PWS ID: 41 0 0 9 1 4

Inventory

Date of Survey: 4/29/04
County: UMATILLA

Type
- ☒ Community (C)
- ☐ Non-Transient non-community (P)
- ☐ Transient non-community (N)
- ☐ State-regulated (S)

Size
Population: 6070
Connections: 1420
Service Chars: R 1
Ownership: 4

Season
☒ All year ☐ Seasonal
Begins: Ends:

Coliform Sampling
Period: ☒ Monthly ☐ Quarterly
Samples Required: 7

License
☒ Not Lic. ☐ HD ☐ Ag.

Responsible Agency
☒ State ☐ County ☐ Dept. of Ag.

Mailing Address:
Contact Name / Phone #: ROGER FRANCES 541-922-3226
Street Address: P.O. BOX 130
City, State, Zip: UMATILLA OR 97882

Legal/Owner Address:
Contact Name / Phone #: ROGER FRANCES 541-922-3226
Street Address: 300 6TH ST.
City, State, Zip: UMATILLA OR 97882

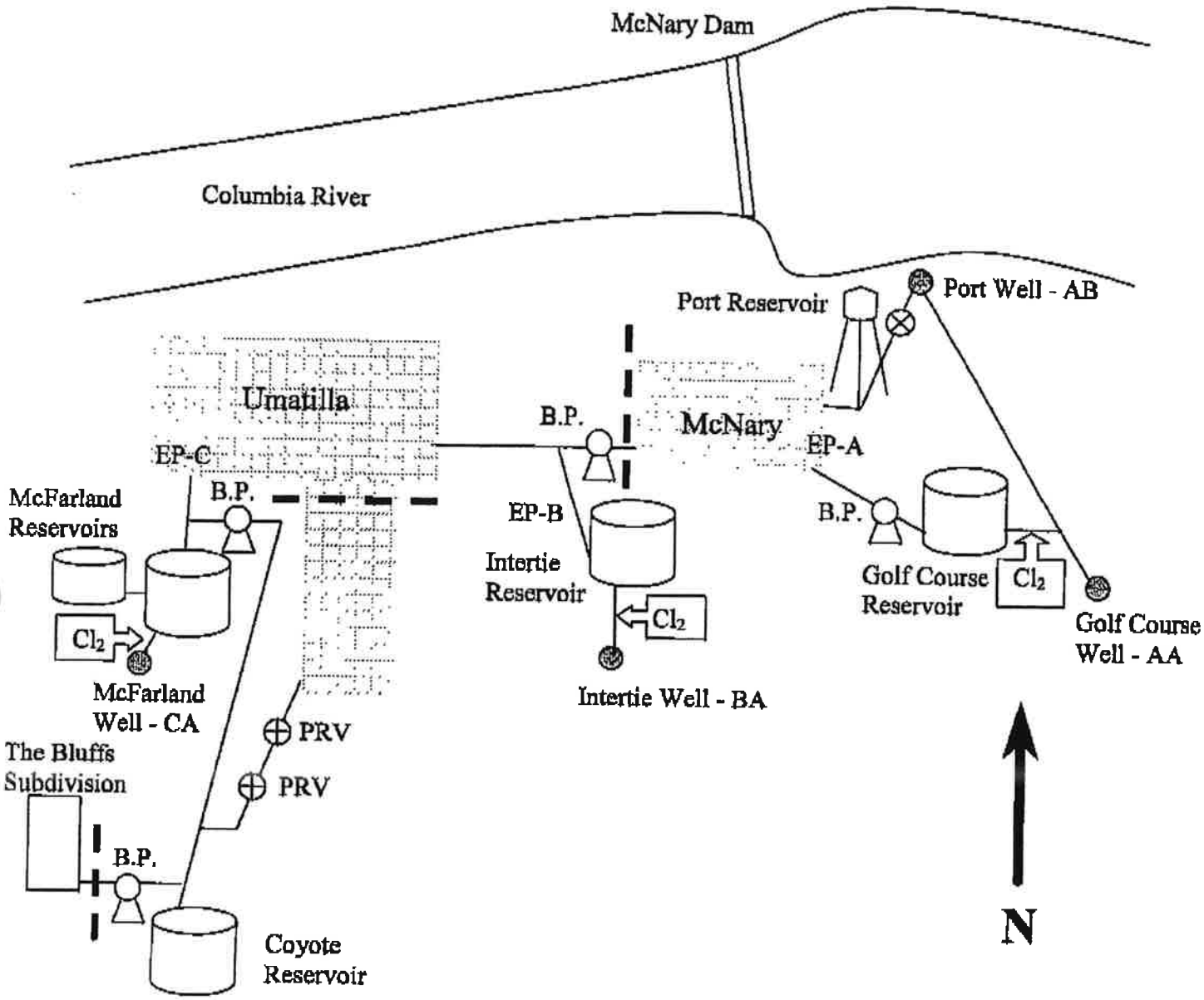
Supply Address:
Contact Name / Phone #: SAME AS ABOVE
Street Address:
City, State, Zip:

Emergency Systems available:
Name: N/A PWS ID#:
Name: PWS ID#:
Name: PWS ID#:

Narrative:

The City's water system has four deep basalt year-round sources: Golf Course Well, Port Well, Intertie Well, and McFarland Well. Gas chlorination is provided at all entry points for residual maintenance. The system is divided into four pressure zones. Six reservoirs with a total capacity of 4,775,000 gallons serve as storage. The system serves a population of approximately 6100, including 1600 prisoners at Two Rivers Correctional Institute.

Umatilla, City of Schematic PWS ID: 4100914



Key

⊗ - valve, normally closed

B.P. – booster pump station

PRV – pressure reducing valve

Four pressure zones are separated by heavy dashed lines

Not to scale

Source Information

Oregon Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF PWS ID: 41 00914

Entry Points: (Location where water enters distribution and is sampled)

ID	Name	Source Type: Ground	Surface	GWUDI	Pur. Ground	Pur. Surface	Availability: Permanent	Seasonal	Begins	Ends	Emergency	None	Treatment Codes
A	EP FOR GOLF COURSE &	X					X		/	/			X401
	PORT WELLS								/	/			
B	EP FOR INTERTIE WELL	X					X		/	/			X401
C	EP FOR McFARLAND WELL	X					X		/	/			X401, T403
									/	/			
									/	/			

Individual Sources contributing at Entry Point:

ID		Name	Land Use*	Capacity (GPM)	Source Type: Ground	Surface	GWUDI	Pur. Ground	Pur. Surface	Availability: Permanent	Seasonal	Emergency	None	Treatment Codes
A	A	GOLF COURSE WELL	E, M	2000	X					X				X401
A	B	PORT WELL	F	2000	X					X				X401
B	A	INTERTIE WELL	G, J	760	X					X				X401
C	A	McFARLAND WELL	G, J	525	X					X				X401, T403

*Land Use Codes: (A) Pristine Forest (B) Irrigated Crops (C) Non-Irrigated Crops (D) Pasture (E) Light Industry (F) Heavy Industry (G) Urban-Sewered Area (H) Rural On-Site Sewage Disposal (I) Urban On-Site Sewage Disposal (J) Rangeland (K) Managed Forest (L) Commercial (M) Recreational Use

Comments: (How and when sources are used, etc.) ALL WELLS ARE USED YEAR-ROUND

Yes	No	
X		Does the water system have water rights for all sources? (☐ Not required)
X		USGS Location Map (name and number) attached? USGS UMATILLA OR
X		Has a Source Water Assessment been completed by OHD or DEQ?
X		Delineation attached/on file?
X		Hydrogeologic/sensitivity analysis on file?
X		• Highly sensitive characteristics? Explain: NO INFO ON CASING SEAL FOR McFARLAND WELL.
X		Have there been any changes since the original Source Water Assessment? Explain: PORT WELL ADDED TO SYSTEM IN JAN. 2004

Comments on Source Water Assessment:

Source: Well Information

OHD Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF

PWS ID: 41 00914

	Source ID:	AA	AB	BA	CA		
	Well Log on File	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Wellhead Construction	Depth of Well (ft.)	989	845	1134	785		
	Depth of Grout Seal (ft.)	60	109	60	UNK		
	Year of Installation (yr.)	1978	1967	1979	1947		
	Casing Diameter (in.)	20	24	20	16		
	• Sanitary Seal & Casing Watertight	X	X	X	X		
	• Screened Vent	X	X	X	X		
	• Wellhead Protected from Flooding	X	X	X	X		
	• Well Meets Setbacks from Hazards	X		X	X		
	Water Level Device	X	X	X	X		
	• Wellhead Terminates Above Grade	X	X	X		X	
	• Concrete Slab Around Casing	X	X	X	X		
	Casing Height Above Slab (in.)	24	12	24	0		
	Pitless Adapter	X	X	X	X		
	• Protective Housing	X	X	X	X		
Control Building	Flowmeter	X	X	X	X		
	Pressure Gauge	X	X	X	X		
	• Pump to Waste Piping	X	X	X	X		
	• Raw Sample Tap	X	X	X	X		
	• Treated Sample Tap	X	N/A	X	X		
	Heated/Lighted	X	X	X	X		
	Floor Drain	X	X	X	X		
	Pump Removal Provision	X	X	X	X		
	Check Valve	X	X	X	X		
	Air/Vacuum Relief	X	X	X	X		
Pumping Equipment	Pump Type*	VT	SU	VT	SU		
	Pump Setting (ft.)	UNK	UNK	650	275		
	Discharge Pressure (psi)	UNK	UNK	UNK	UNK		
	Horsepower (hp)	300	300	200	50		
	Bearing Lubrication (FG oil/water)	W	W	W	W		
	Pumping Capacity (gpm)	2000	2000	760	525		
	Static Water Level (ft..)	200	140	145	159		

*Pump Types: (VT) Vertical Turbine (SU) Submersible (CE) Centrifugal (SJ) Shallow Jet (DJ) Deep Jet (OT) Other

Comments: PORT WELL - AB WENT ONLINE JAN. 2004
GOLFCOURSE WELL - AA HAS BACKUP GENERATOR
McFARLAND WELL - CA HAD NEW PUMP INSTALLED ~ '93-'95

Disinfection

OHD Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF PWS ID: 41 0 0 9 1 4

#	Disinfection Method*	Location	Disinfection Source Water	Residual Maintenance	Proportional to flow	Dosage Recorded
1	CHLORINE GAS	GOLF COURSE WELL	☐	☒	☐	☐
2	" "	INTERTIE WELL	☐	☒	☐	☐
3	" "	McFARLAND WELL	☐	☒	☐	☐

*Chlorine Gas, Sodium Hypochlorite, On-Site Generated Sodium Hypochlorite, Calcium Hypochlorite, Chloramines, Ozone, UV, Mixed-Oxidants, Other

Yes No

☒ ☐ • Is a DPD type test kit used?

☒ ☐ • Are residuals recorded as required?

Distribution: ☐ Daily # samples _____ ☒ Other MONTHLY

Entry Point (sw only): ☐ Daily # samples _____ ☐ Continuous if > 3300 pop

☐ ☒ If chlorinating for residual maintenance only, are raw water coliform samples taken? How often? _____

☐ **Chlorine gas:**

☒ ☐ Separate room for gas storage & feeder?

☒ ☐ Fan with on/off switch outside?

☒ ☐ Vent located next to the floor?

☒ ☐ Door with a window?

☒ ☐ Gas cylinders properly secured?

☒ ☐ Door that opens out?

☒ ☐ Self-contained breathing apparatus?

☐ ☒ Air scrubber system?

☐ **UV Light**

☐ ☐ • Plan Review approval?

☐ ☐ • Does all water contact UV(no bypass)?

☐ ☐ • Is lamp sleeve cleaned?

☐ ☐ • Is lamp replaced annually?

☐ ☐ • Intensity sensor with alarm or shut-off?

CT Evaluation

Disinfection requirement (check one): (sw)1.0 log removal giardia (sw)0.5 log removal giardia

(gw) 30 minutes contact time (gw) 4.0 log removal viruses

Maximum demand flow _____

Effective volume calculation (at lowest water level) _____

Minimum contact time _____ (estimated)

☐ ☐ • Does contact chamber have effluent flow meter or adequate alternative?

If no, how is peak flow determined for CT calculations? _____

☐ ☐ • Has tracer study been conducted or adequate alternative?

Tracer Study Date _____ Demand flow _____

Volume used _____ Results _____ minutes

Describe alternate method to determine contact time: _____

Range of chlorine residual at first user _____

☐ ☐ • (SW only) are pH, Temperature, and chlorine residual measured daily at first user?

☐ ☐ • (SW only) Are CT values being calculated correctly? _____

☐ ☐ • Are CT values met at all times?

Comments: RESIDUAL IN SYSTEM KEPT CONSISTENT AT 0.5 ppm CONCENTRATION KEPT HIGHER AT McFARLAND WELL FOR SULFUR ODOR CONTROL.

Storage & Pressure Tanks

OHD Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF PWS ID: 41 00914

Number	Name	Tank Type*	Tank Material	Year Built	Volume (gal.)
1	GOLF COURSE RESERVOIR	G	STEEL	1995	1,800,000
2	INTERTIE RESERVOIR	G	STEEL	1979	1,500,000
3	McFARLAND RESERVOIR - OLD	G	CONCRETE	1947	150,000
4	McFARLAND RESERVOIR - NEW	G	STEEL	~1979	500,000
5	COYOTE RESERVOIR	G	STEEL	1979	700,000

Reservoir Features

*(G) Ground (E) Elevated (P) Pressure SUB-Total Volume= 4,650,000

Reservoir Number	1 Yes	1 No	2 Yes	2 No	3 Yes	3 No	4 Yes	4 No	5 Yes	5 No
Hatch: • Locked	X		X		X		X		X	
• Watertight	X		X		X		X		X	
Shoebox type lid (curbing)	X		X			X	X		X	
Features:										
• Drain to Daylight	X		X		X		X			X
Overflow	X		X		X		X		X	
• Flap Valve (on drain and/or overflow)	X		N/A		X		X		N/A	
• Screened Vent	X		X		X		X		X	
Water Level Gauge	X		X		X		X		X	
Bypass Piping	X			X	X			X		X
Fence/Gate	X		X		X		X		X	
• Cathodic Plates Watertight	X		N/A		N/A		N/A		N/A	
Alarm for high/low levels	X		X		X		X		X	
Maintenance:										
Exterior in Good Condition	X		X		X		X		X	
• Approved Interior Coating	X		X		X		X		X	
• Annual Inspection	X		X		X		X		X	
• Cleaning Schedule	X		X		X		X		X	
• Continuously disinfected	N/A		N/A		N/A		N/A		N/A	
Plumbing Configuration:										
Separate Inlet/Outlet	X		X		X		X			X
Baffling		X		X		X		X		X
Used for Contact Time		X		X		X		X		X

Hydropneumatic Tank Number				
Used for Contact Time				
• Accessible for Maintenance				
Separate Inlet/Outlet				
Bypass Piping				
Access Port				
• Drain				
Pressure Relief Device w/Gauge				
Air Blow Off Valve				
Air Bladder/Diaphram				
Valve for Adding Air				
Water Level Sight Glass				

Comments:

#5 DRAINS TO DRYWELL

#1 HAS ELECTRICAL CORROSION CONTROL

#2 OVERFLOW BURIED W/ ROCKS

CONTINUED ON NEXT PAGE

Storage & Pressure Tanks

OHD Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF PWS ID: 41 00914

Number	Name	Tank Type*	Tank Material	Year Built	Volume (gal.)
6	PORT RESERVOIR	E	STEEL	1967	125,000
				SUB-TOTAL	4,650,000

Reservoir Features

*(G) Ground (E) Elevated (P) Pressure

Total Volume= 4,775,000

	Reservoir Number: 6									
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Hatch: • Locked	X									
• Watertight	X									
Shoebox type lid (curbing)	X									
Features:										
• Drain to Daylight	X									
Overflow	X									
• Flap Valve (on drain and/or overflow)	N/A									
• Screened Vent	X									
Water Level Gauge	X									
Bypass Piping	X									
Fence/Gate	X									
• Cathodic Plates Watertight	N/A									
Alarm for high/low levels	X									
Maintenance:										
Exterior in Good Condition	X									
• Approved Interior Coating	X									
• Annual Inspection	X									
• Cleaning Schedule	X									
• Continuously disinfected	N/A									
Plumbing Configuration:										
Separate Inlet/Outlet		X								
Baffling		X								
Used for Contact Time		X								

Hydropneumatic Tank Number				
Used for Contact Time				
• Accessible for Maintenance				
Separate Inlet/Outlet				
Bypass Piping				
Access Port				
• Drain				
Pressure Relief Device w/Gauge				
Air Blow Off Valve				
Air Bladder/Diaphram				
Valve for Adding Air				
Water Level Sight Glass				

Comments:

PORT RESERVOIR CLEANED, RELINED, PAINTED IN 1985. DRAIN/OVERFLOW IS PIPED A LONG DISTANCE DOWNHILL TOWARD RIVER.

Distribution System Information
OHD Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF PWS ID: 41 00914

Service Area and Facility Map

Yes No
[X] [ ] • Does the system have a Service Area and Facility Map with the following features:

- [X] Booster Pumps
- [X] Pressure Reducing Valves
- [X] Pressure Zones
- [ ] Sampling Points
- [X] Sources-wells & withdrawal points
- [X] Storage Facilities (reservoirs)
- [X] Treatment Facilities
- [X] Water Lines (including size and material)

Distribution Data

Yes	No		Comments
X		• System pressure >20 psi?	4 PRESSURE ZONES
X		System metered? (what %?)	100%
X		Water system leakage <10%?	ANNUAL WATER AUDIT, LEAK DETECT DONE EVERY 5 YEARS
X		Waterline depth >30"?	36"-48" AVG. 48"
X		Piping looped?	
X		• Hydrants or adequate blowoffs on all dead ends?	
X		• Routine flushing? (how often?)	ANNUALLY BY FIRE DEP'T.
X		Adequate valving?	
X		Routine valve turning? (how often?)	ANNUALLY

Comments: ~40% DUCTILE IRON, ~55% PVC, SOME A/C PIPE

Cross Connection Program (Community systems only)

Yes	No		Comments
X		• Ordinance or enabling authority?	
X		• Testing records current?	
X		Approved devices installed?	~ 90
X		• Annual summary report sent?	
		If more than 300 Connections:	
X		• Certified inspector?	ROGER FRANCES
X		• Complete written program plan?	

Comments:

Booster Pumps

Name/Location	HP	GPM	Aux. Power?	comments
Coyote	10	-	no	variable speed drive
	30	1000	no	
	30	1000	no	
	100	2000	yes	for fire flows
McFarland	100	1250	no	
	100	1250	no	
Golf Course	60	1000	no	
	60	1000	no	
	60	1000	no	
	240	2500	diesel powered	for fire flows
McNary	60	500	no	

Water Quality Monitoring

OHD Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF PWS ID: 41 00914

Contaminant	N/A	Frequency	Next Tests Due
Coliform Bacteria		MONTHLY	
Nitrate		ANNUALLY	OCT. 2004
Inorganic Chemicals (SW)	☒		
Inorganic Chemicals (GW)	☐	ONCE EVERY NINE YEARS	AUG. 2011
Arsenic	☐	ONCE EVERY THREE YEARS	AUG. 2005
SOC's-Regulated	☐	ONCE EVERY THREE YEARS	AUG. 2005
SOC's-Unregulated (>10,000 pop.)	☒		
VOC's-Regulated	☐	ONCE EVERY THREE YEARS	AUG. 2005
VOC's-Unregulated (>10,000 pop.)	☒		
Radiological	☐	ONCE EVERY NINE YEARS	OCT. 2012
Asbestos	☐	ONCE EVERY NINE YEARS	PAST DUE
TTHM	☐	ANNUALLY	SUMMER 2004
HAA5	☐	ANNUALLY	SUMMER 2004
Lead & Copper	☐	ONCE EVERY THREE YEARS	OCT. 2006
Turbidity	☒		
Source Water Microbiological	☒		

For CT calculations (see CPE).

Yes No
☐ ☒ • Is all required monitoring current?

Comments: ASBESTOS - LAST SAMPLE ON RECORD 3/24/93

☒ ☐ Has the system experienced chemical (last 5 years) or bacteriological (last 2 years) detections? If yes, what contaminant and when? FLUORIDE AT INTERTIE WELL 1999, 2002 TOTAL COLIFORM NOV. 2003

N/A • Have all MCL violations been addressed? NO MCL VIOLATIONS

☒ ☐ Does the system have any monitoring reductions granted? Explain: LEAD & COPPER, IOC'S

☒ ☐ • Does the system have a written coliform sampling plan?

Does the plan include:

Yes	No	
☐	☒	Brief narrative?
☐	☒	Distribution map?
☒	☐	Sample site locations?
☒	☐	Rotation schedule?
☐	☒	Repeat locations?

Where in the system are the monitoring sites for TTHM and HAA5: (☐Not required)

☒ ☐ At the location of maximum residence time?
☒ ☐ At area(s) of low concentration of users?
☒ ☐ At areas representing different supply sources?

Comments: COLIFORM SAMPLES COLLECTED AT HOMES FROM EACH P. ZONE. TTHM & HAA5 SAMPLES DUE FOR FIRST TIME IN SUMMER 2004

Management & Operations

OHD Drinking Water Program Sanitary Survey

System: UMATILLA, CITY OF PWS ID: 41 0 0 9 1 4

Management Operations

Identify management structure of water system staff: CITY MANAGER / PUBLIC WORKS SUPERINTENDANT / P.W. STAFF

Yes	No	
X		Do water system revenues pay for operation, maintenance and staffing?
X		Do water system revenues go into a reserve fund for capital improvement projects?
X		• Does system have an operation and maintenance manual?
X		• Does system have an emergency response plan?

Operator/Cross Connection Certification

Requirements for system: WT___ WD 2

Name	Certification Number	Water Treatment Level	Water Distribution Level	Filtration Endorsement	Cross Connection Inspection Number	Backflow Assembly Tester #
DRC:* ROGER FRANCES	3099		2	☐	2929	
RICHARD L. CHRISTIAN	6383		2	☐		
MITCH TIPTON	1540		1	☐		
SILVERIO GASMEN, JR.	6375		1	☐		
				☐		

*DRC = direct responsible charge. Attach additional sheets if necessary to list all certified personnel.

Yes	No	
X		• Is there an operator at required certification level?
X		• Are CEUs being maintained?

Plan Review/Master Plan

X		• Have all major modifications (since 8/21/81) been approved by OHD?
	X	Does system have a current plan review exemption for water main extensions?
X		• Does the system have a current (<20 yr. old) master plan? (☐ Not required if <300 connections)
		1988 What year was the plan completed?
Yes	No	
	X	Does the master plan include a water conservation plan?

Compliance Status

X		• Is water system in compliance (all Administrative Orders and Notices of Violation resolved)?
		1 How many violations has the system had in the past two years?
X		Does the system issue Public Notice for Violations as required?

Other

	X	Has a capacity assessment been completed by OHD? If yes, list deficiencies noted:
X		Are consumer confidence reports sent to users each year?

Comments: ERP IS BEING UPDATED USING VULNERABILITY ASSESSMENT RESULTS. ANDERSON-PERRY IS DRAFTING A NEW MASTER PLAN THAT WILL INCLUDE A WATER CONSERVATION PLAN.

Figure 1

City of Umatilla
Drinking Water Protection Area

4000 0 4000 8000 12000 Feet

1:48,000

Drinking Water Protection Area (DWPA)
1,2, 5, and 10 Year Time of Travel (TOT)
Analytical Method

N

Model Parameters
Delineation Area (mi*mi): 3.61
Transmissivity (ft*ft/day): 1432
Production Interval (ft): 45
Effective Porosity: 0.25
Usage (gal/day): 2,101,750

Well Location: Township 5N Range 28E Section 14
Umatilla County
Golf Course Well 45°55'14.951"N 119°16'35.055"W
Intertie Well 45°54'56.677"N 119°18'29.207"W
McFarland Well 45°54'27.517"N 119°20'58.231"W

Prepared by: JF
Project Manager: JF RG #1867
File # 4100914

USGS Umatilla, OR Quadrangle
(part section) 7.5' Series (Topographic)

APPENDIX C

Well Information

McFarland Well

Water Right Information Query Results

Contact Information

Current contact information

CITY OF UMATILLA
CITY HALL
UMATILLA, OR 97882

Water Right Information

Status: Non-Cancelled
County: Umatilla
File Folder Location: Salem
Watermaster District: 5

Documents View all scanned documents

Application: G 2755 digital map
- Received: 12/24/1963

Permit: G 2560 document, digital map
- Signature: 10/26/1999

Certificate: 76316 document, digital map, paper map
- Signature: 10/26/1999
- Type: Remaining

Order(s)

Volume-Page	Signature	Description
53-1368	10/26/1999	APPROVES T-8264
53-1368	10/26/1999	APPROVES T-8264

Transfer(s)

Transfer	Transfer type	Status
T8264 (Remaining)	Regular	Approved

Point(s) of Diversion

POD 1 - WELL 2 > UMATILLA RIVER

Place(s) of Use Add TRS grouping

Use - MUNICIPAL USES (Primary); Priority Date: 12/24/1963

Water Right Genealogy

- Cert:34523 OR CN
  - Inchoate: T 8264 CF (REG) *
  - Cert:76316 RR *

View Water Rights in same Family

Help understanding and working with the Water Rights Information System

Report Errors with Water Right Data

Return to WRIS Query

Permit No. G- 2560

APPLICATION FOR A PERMIT

To Appropriate the Ground Waters of the State of Oregon

I, THE CITY OF UMATILLA,
(Name of applicant)

of City Hall, county of Umatilla,
(Postoffice Address)

state of Oregon, do hereby make application for a permit to appropriate the following described ground waters of the state of Oregon, SUBJECT TO EXISTING RIGHTS:

If the applicant is a corporation, give date and place of incorporation

1915, County of Umatilla, State of Oregon

1. *Give name of nearest stream to which the well, tunnel or other source of water development is situated* Umatilla River
(Name of stream)

a *tributary of* the Columbia River

2. *The amount of water which the applicant intends to apply to beneficial use is* 2.28 *cubic feet per second or* 1,000 *gallons per minute.*

3. *The use to which the water is to be applied is* municipal use ~~domestic water supply~~ for the City of Umatilla

4. *The well or other source is located* 30 ± *ft.* S. (N. or S.) *and* 30 ± *ft.* W. (E. or W.) *from the* NE. ~~NW~~ *corner of* Section 19
(Section or subdivision)

(If preferable, give distance and bearing to section corner)

(If there is more than one well, each must be described. Use separate sheet if necessary)

being within the NE ¼ of NE ¼ *of Sec.* 19, *Twp.* 5 N., *R.* 28 E., *W. M., in the county of* Umatilla, Oregon

5. *The* pipe line (Canal or pipe line) *to be* 1½ to 2 *miles in length, terminating in the* SE ¼ of SE ¼ (Smallest legal subdivision) *of Sec.* 8, *Twp.* 5 N *R.* 28 E, *W. M., the proposed location being shown throughout on the accompanying map.*

6. *The name of the well or other works is* City of Umatilla Well No. 2

DESCRIPTION OF WORKS

7. *If the flow to be utilized is artesian, the works to be used for the control and conservation of the supply when not in use must be described.*

8. *The development will consist of* a well (Give number of wells, tunnels, etc.) *having a diameter of* 16 to 8 *inches and an estimated depth of* 785 *feet. It is estimated that* 400 *feet of the well will require* 16 to 8 inch (Kind) *casing. Depth to water table is estimated* 117 (1947) (Feet) 255 ft. (estimated 1963).

CANAL SYSTEM OR PIPE LINE—

9. *(a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: width on top (at water line)* ..... *feet; width on bottom* ..... *feet; depth of water* ..... *feet; grade* ..... *feet fall per one thousand feet.*

(b) At ..... *miles from headgate: width on top (at water line)* ..... *feet; width on bottom* ..... *feet; depth of water* ..... *feet; grade* ..... *feet fall per one thousand feet.*

(c) Length of pipe, ... *ft.; size at intake,* ..... *in.; in size at* ..... *ft. from intake* ..... *in.; size at place of use* ..... *in.; difference in elevation between intake and place of use,* ..... *ft. Is grade uniform?* ..... *Estimated capacity,* ..... *sec. ft.*

10. *If pumps are to be used, give size and type* Peerless No. 46273 - 10" estimated.

Give horsepower and type of motor or engine to be used 100 HP General Electric

11. *If the location of the well, tunnel, or other development work is less than one-fourth mile from a natural stream or stream channel, give the distance to the nearest point on each of such channels and the difference in elevation between the stream bed and the ground surface at the source of development*

See attached map.

12. *Location of area to be irrigated, or place of use* See attached map

Township N. or S.	Range E. or W. of Willamette Meridian	Section	Forty-acre Tract	Number Acres To Be Irrigated
5N	2BE	8	SE¼, SE¼	municipal use
"	"	8	SW¼, SE¼	"
"	"	8	SE¼, SW¼	"
"	"	17	The NE¼ & NW¼ Sec 17	3 acres
"	"	17	NE¼, SW¼	municipal use
	"	17	NW¼, SW¼	"
5N	"	17	SW¼, SW¼	
"	"	18	NE¼, NE¼	"
	"	18	SE¼, NE¼	"
	"	18	NE¼, SE¼	

(If more space required, attach separate sheet)

Character of soil .....

Kind of crops raised .....

MUNICIPAL SUPPLY— 2560

12. To supply the city of Umatilla

in Umatilla county, having a present population of 605

and an estimated population of 1,000 in 19 70

ANSWER QUESTIONS 14, 15, 16, 17 AND 18 IN ALL CASES

14. Estimated cost of proposed works, $ 12,500.00

15. Construction work will begin on or before completed - 1947

16. Construction work will be completed on or before completed - 1947

17. The water will be completely applied to the proposed use on or before New in use.

18. If the ground water supply is supplemental to an existing water supply, identify any application for permit, permit, certificate or adjudicated right to appropriate water, made or held by the applicant. Another well located near the Umatilla River in the NE ¼ of the SW ¼ of Section 17, Township 5 North, Range 28 East.

Warren W. Aney
WARREN W. ANEY, (Signature of applicant) Mayor

Remarks: This application is to place the well on records that should have been completed many years ago.

STATE OF OREGON,
County of Marion, } ss.

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for .....

In order to retain its priority, this application must be returned to the State Engineer, with corrections on or before ....., 19.....

WITNESS my hand this ..... day of ....., 19.....

STATE ENGINEER

By .....

ASSISTANT

STATE OF OREGON, }
County of Marion, } ss.

PERMIT

This is to certify that I have examined the foregoing application and do hereby grant the same, SUBJECT TO EXISTING RIGHTS and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 2.0 cubic feet per second measured at the point of diversion from the well or source of appropriation, or its equivalent in case of rotation with other water users, from well No. 2

The use to which this water is to be applied is municipal

If for irrigation, this appropriation shall be limited to - - of one cubic foot per second or its equivalent for each acre irrigated and shall be further limited to a diversion of not to exceed acre feet per acre for each acre irrigated during the irrigation season of each year;

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The well shall be cased as necessary in accordance with good practice and if the flow is artesian the works shall include proper capping and control valve to prevent the waste of ground water.

The works constructed shall include an air line and pressure gauge or an access port for measuring line, adequate to determine water level elevation in the well at all times.

The permittee shall install and maintain a weir, meter, or other suitable measuring device, and shall keep a complete record of the amount of ground water withdrawn.

The priority date of this permit is December 24, 1963

Actual construction work shall begin on or before March 10, 1965 and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19 65

Complete application of the water to the proposed use shall be made on or before October 1, 19 66

WITNESS my hand this 10th day of March, 19 64.

Chris L. Wheeler
STATE ENGINEER

Application No. G-2755
Permit No. G-2560

PERMIT
TO APPROPRIATE THE GROUND WATERS OF THE STATE OF OREGON

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 24th day of December, 19 63 at 8:00 o'clock A. M.

Returned to applicant:

Approved: March 10, 1964

Recorded in book No. 10 of Ground Water Permits on page 2560

CHRIS L. WHEELER
STATE ENGINEER

Drainage Basin No. 7 page 23

State Printing

STATE OF OREGON

COUNTY OF UMATILLA

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* THE CITY OF UMATILLA

of City Hall, Umatilla *, State of* Oregon *, has made proof to the satisfaction of the STATE ENGINEER of Oregon, of a right to the use of the waters of* Well No. 2

a tributary of Umatilla River (Columbia River) *for the purpose of* municipal

under Permit No. G-2560 *of the State Engineer, and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from* December 24, 1963

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 2.0 cubic feet per second

or its equivalent in case of rotation, measured at the point of diversion from the stream. The point of diversion is located in the NE¼ NE¼, Section 19, T. 5 N., R. 28 E., W. M. Well located 30 feet South and 30 feet West from the NE Corner, Section 19.

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to - - - - - - *of one cubic foot per second per acre,*

and shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

S½ SE¼
Section 8
W½ NW¼
Section 16
NE¼ NW¼
S½ NW¼
SW¼
Section 17
SE¼ NE¼
NE¼ SE¼
Section 18
T. 5 N., R. 28 E., W. M.

Canceled By Change of Use T-8264

The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described.

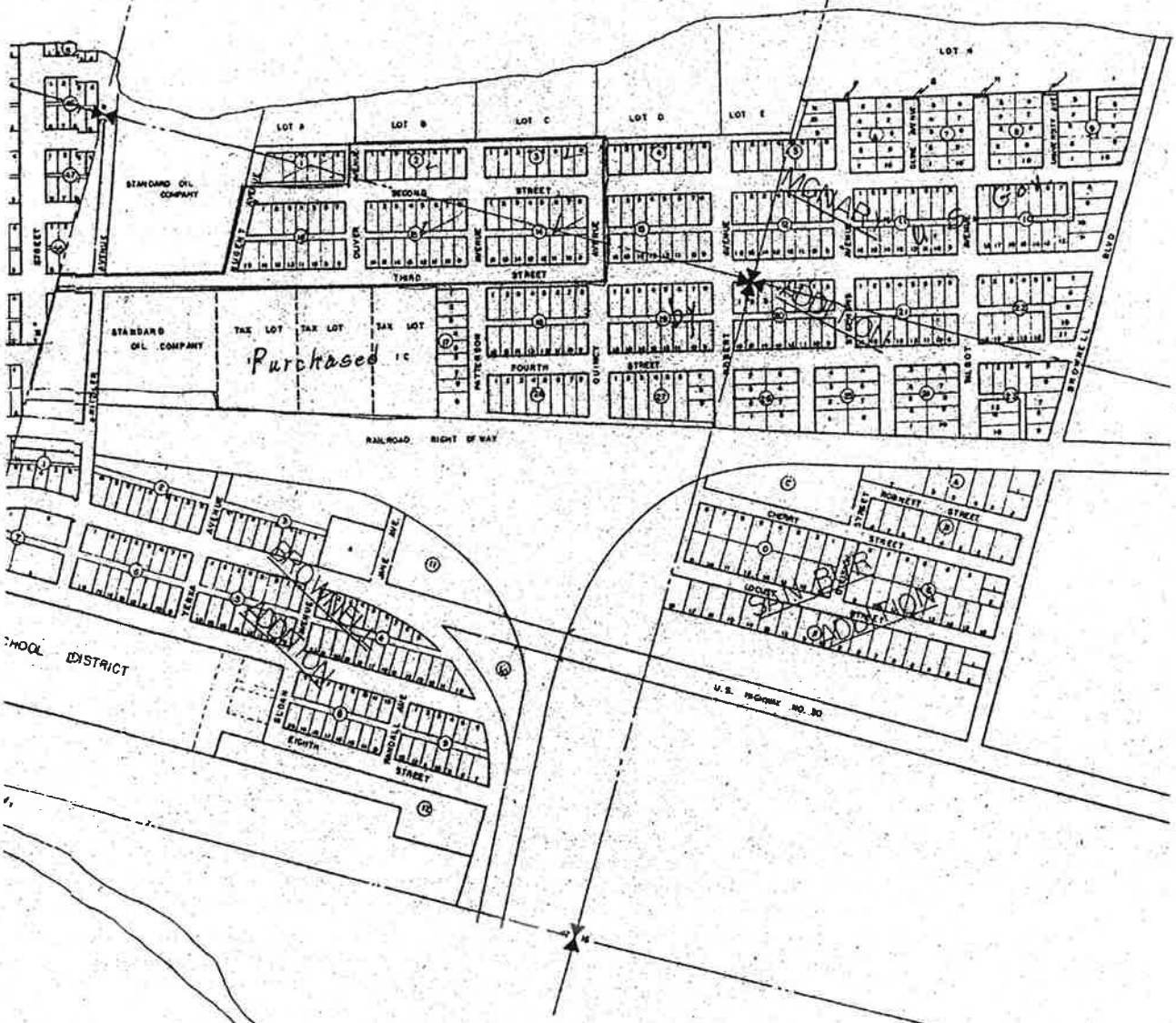
WITNESS the signature of the State Engineer, affixed this date. December 29, 1967

CHRIS L. WHEELER
State Engineer

Recorded in State Record of Water Right Certificates, Volume 26 *, page* 34523

6-2560
page 1
34523
76316

6-2560
page 2



OFFICIAL MAP

CITY OF UMATILLA, OREGON & VICINITY

A. EASTON, MAYOR
MIRIAM McKENZIE, RECORDER

FRANK R. OFNER
CITY ENGINEER

JANUARY 1, 1952

OFT
E, W.M.

obtained for
Permit G-2560
Cert 34523

STATE OF OREGON

COUNTY OF UMATILLA

ORDER APPROVING A CHANGE IN USE, PLACE OF USE, AND POINTS OF APPROPRIATION

Pursuant to ORS 537.705, after notice was given and no objections were filed, and finding that no injury to existing water rights would result, this order approves, as conditioned or limited herein, TRANSFER 8264 submitted by

UMATILLA COUNTY SCHOOL DISTRICT 6R
P.O. BOX 430
UMATILLA, OREGON 97882.

The right to be modified, as evidenced by a PORTION of Certificate 34523, was perfected under Permit G-2560 with a date of priority of DECEMBER 24, 1963. The right allows the use of WELL 2, in the UMATILLA RIVER BASIN, for MUNICIPAL USE. The amount of water to which this right is entitled is limited to an amount actually beneficially used and shall not exceed 0.75 cubic foot per second, if available at the original well; NE¼ NE¼, SECTION 19, T 5 N, R 28 E, WM; 30 FEET SOUTH AND 30 FEET WEST FROM THE NE CORNER, SECTION 19, or its equivalent in case of rotation, measured at the well.

The use shall conform to any reasonable rotation system ordered by the proper state officer.

The authorized place of use is as follows:

S½ SE¼
SECTION 8

W½ NW¼
SECTION 16

NE¼ NW¼
S½ NW¼
SW¼
SECTION 17

SE¼ NE¼
NE¼ SE¼
SECTION 18
TOWNSHIP 5 NORTH, RANGE 28 EAST, W.M.

The right to use water for the above purpose is restricted to beneficial use on the lands or place of use described.

The applicant proposes to change the use to COMMERCIAL USE in a school.

The applicant proposes to change the place of use to:

SW¼ NE¼
SE¼ NW¼
SECTION 17
TOWNSHIP 5 NORTH, RANGE 28 EAST, W.M.

The applicant proposes to change the point of appropriation to:

SW¼ NE¼, SECTION 17, T 5 N, R 28 E, WM; A - 340 FEET NORTH AND 90 FEET EAST; B - 290 FEET NORTH AND 180 FEET EAST; BOTH FROM THE CENTER, SECTION 17.

THESE CHANGES TO AN EXISTING WATER RIGHT MAY BE MADE PROVIDED THE FOLLOWING CONDITIONS ARE MET BY THE WATER USER:

1. The proposed change shall be completed on or before October 1, 2001.

2. The quantity of water diverted at the new point of appropriation (well), together with the quantity diverted at the old point of appropriation, shall not exceed the quantity of water lawfully available from the original point of appropriation.

3. The water user shall install an in-line flow meter or other suitable device for measuring and recording the quantity of water used. The type and plans of the measuring device must be approved by the Department prior to beginning construction and shall be installed under the general supervision of the Department.

4. Water shall be acquired from the same aquifer as the original point of appropriation.

5. The former place of use shall no longer be served as part of this water right.

6. This water right shall no longer be entitled to the privileges enjoyed by municipal rights, and shall be subject to forfeiture in accordance with the provisions of ORS 540.610.

Certificate 34523 is canceled. A new certificate will be issued to confirm that portion of the right NOT involved in this transfer. When satisfactory proof of the completed change is received, a new certificate confirming this water right will be issued.

WITNESS the signature of the Water Resources Director,

affixed OCT 26 1999.

For Martha O. Pagel, Director

T-8264

Contact Information

Current contact information

APPLICANT:
UMATILLA COUNTY SCHOOL DISTRICT 6R
PO BOX 430
UMATILLA, OR 97882

Transfer Information

View all scanned documents

Status

- Type: Regular
- Status: Approved
- Begin Date: n/a
- End Date: n/a

Proposed Action

- Point of Appropriation
- Place of Use
- Character of Use

Orders associated with rights in the transfer

Volume-Page	Signature	Description
53-1368	10/26/1999	APPROVES T-8264

Processing History

Staff Person Responsible: no caseworker currently assigned

Process Step	Date Initiated	Estimated Completion Date	Date Completed	Remarks
Claim of Beneficial Use Due				
Received	5/5/1999		5/5/1999	
Watermaster Review	5/17/1999		5/17/1999	
Final Order Issued	10/26/1999		10/26/1999	

Rights this impacts

n/a

Results of the transfer

	Application	Permit	Certificate	Decree	Claim
Inchoate: T 8264 CF (REG) *	G2755	G2560			
Cert:76316 RR *	G2755	G2560	76316		

Help understanding and working with the Water Rights Information System

Report Errors with Water Right Data

Return to WRIS Query

STATE OF OREGON

COUNTY OF UMATILLA

CERTIFICATE OF WATER RIGHT

THIS CERTIFICATE ISSUED TO

THE CITY OF UMATILLA
CITY HALL
UMATILLA, OREGON 97882

confirms the right to use the waters of WELL 2 in the UMATILLA RIVER BASIN for MUNICIPAL USE.

This right was perfected under Permit G-2560. The date of priority is DECEMBER 24, 1963. The amount of water to which this right is entitled is limited to an amount actually beneficially used and shall not exceed 1.25 CUBIC FOOT PER SECOND or its equivalent in case of rotation, measured at the well.

The well is located as follows:

NE¼ NE¼, SECTION 19, T 5 N, R 28 E, WM; 30 FEET SOUTH AND 30 FEET WEST FROM THE NE CORNER, SECTION 19.

The use shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use to which this right is appurtenant is as follows:

S½ SE¼
SECTION 8

W½
SECTION 16

NE¼ NW¼
S½ NW¼
SW¼
SECTION 17

SE¼ NE¼
NE¼ SE¼
SECTION 18

TOWNSHIP 5 NORTH, RANGE 28 EAST, W.M.

This certificate describes that portion of the water right confirmed by Certificate 34523, State Record of Water Right Certificates, NOT modified by the provisions of an order of the Water Resources Director entered OCT 26 1999, approving Transfer Application 8264

The issuance of this superseding certificate does not confirm the status of the water right in regard to the provisions of ORS 540.610 pertaining to forfeiture or abandonment.

The right to the use of the water for the above purpose is restricted to beneficial use on the lands or place of use described.

WITNESS the signature of the Water Resources Director, affixed OCT 26 1999.

For Martha O. Pagel, Director

Recorded in State Record of Water Right Certificates numbered 76316.

T-8264.LHN

Golf Course/Intertie Well

Water Right Information Query Results

Contact Information

Current contact information

CITY OF UMATILLA
PO BOX 130
UMATILLA, OR 97882

Water Right Information

Status: Non-Cancelled
County: Umatilla
File Folder Location: Salem
Watermaster District: 5

Documents View all scanned documents

Application: G 8592 digital map

Received: 12/28/1977

Permit: G 8042 document, digital map, paper map

Signature: 5/11/1978

Permit Workflow

Action	Date	Result	Completed By
Completion Date [C Date]	10/1/1999		
CBU Received	3/19/2003		MICHAEL BLANCHARDPOSADA

Order(s)

Volume-Page	Signature	Description
35-142	8/27/1981	EXTENDS TIME LIMITS FOR MULTIPLE PERMITS
39-40	2/20/1985	EXTENSION OF TIME ORDER
44-53	2/16/1990	EXTENSION ORDER
49-66	2/22/1995	EXTENDS TIME LIMITS ON CERTAIN PERMITS

Point(s) of Diversion

POD 1 - INTERTIE WELL >

Description

T-R-S-QQ: 5.00N-28.00E-16-SE NE

Location Description: 2515 FEET SOUTH & 140 FEET WEST FROM NE CORNER, SECTION 16

POD Rate

Max Rate (cfs)	Rate (cfs)	Max Volume (af)	Volume (af)
8.9	8.9		

MUNICIPAL USES (Primary)

Priority Date	Max Rate (cfs)	Rate (cfs)	Max Volume (af)	Volume (af)	Rate/Acre	Duty	Start Date	End Date	Remarks
12/28/1977	8.9	8.9					1/1	12/31	

POD 2 - GOLF COURSE WELL >

Description

T-R-S-QQ: 5.00N-28.00E-14-NE NW

Location Description: 825 FEET SOUTH & 2550 FEET EAST FROM NW CORNER, SECTION 14

POD Rate

Max Rate (cfs)	Rate (cfs)	Max Volume (af)	Volume (af)
8.9	8.9		

MUNICIPAL USES (Primary)

Priority Date	Max Rate (cfs)	Rate (cfs)	Max Volume (af)	Volume (af)	Rate/Acre	Duty	Start Date	End Date	Remarks
12/28/1977	8.9	8.9					1/1	12/31	

Place(s) of Use Add TRS grouping

Use - MUNICIPAL USES (Primary); Priority Date: 12/28/1977

Water Right Genealogy

--No genealogy records available for this water right, try the family link below instead.

View Water Rights in same Family

Help understanding and working with the Water Rights Information System

Report Errors with Water Right Data

Return to WRIS Query

Application No. G-8592 Permit No. G 8042

RECEIVED
DEC 20 1977
WATER RESOURCES DEPT
SALEM, OREGON

STATE OF OREGON WATER RESOURCES DEPARTMENT

Application for a Permit to Appropriate Ground Water

I, City of Umatilla
(Name of Applicant)

of P. O. Box 130, Umatilla
(Mailing Address) (City)

State of Oregon, 97882 Phone No. ..... do hereby
(Zip Code)

make application for a permit to appropriate the following described ground waters of the State of Oregon:

1. The development will consist of two wells
(Give number of wells, tile lines, infiltration galleries, etc.)

having a diameter of 20-inches and an estimated depth of 1000 feet.
(see attached)

2. The well or other source is to be located ..... ft. (N. or S.) and ..... ft. (E. or W.)

from the ..... corner of .....
(Public Land Survey Corner)

.....
(If there is more than one well, each must be described)

..... being within the ..... ¼ of the ..... ¼ of

Sec. ..... Tp. ..... R. ....., W. M., in the county of .....

3. Location of area to be irrigated, or place of use if use other than irrigation. (see attached)

Township	Range	Section	List ¼ ¼ of Section	List use and/or number of acres to be irrigated

4. It is estimated that 500 feet of the well will require steel casing.
(Kind)

5. Depth to water table is estimated 250 (Feet) Well drilled by .....

Form 690-3-0-1-77

6. *The amount of water which the applicant intends to apply to beneficial use is* ..... *cubic feet per second or* .....8,000.. *gallons per minute.* (4,000 gallons per minute per well.)

7. *The use to which the water is to be applied is* ...municipal consumption

8. *If the flow to be utilized is artesian, the works to be used for the control and conservation of the supply when not in use must be described.*

N/A

9. *If the location of the well, or other development work is less than one-fourth mile from a natural stream channel, give the distance to the channel and the difference in elevation between the stream bed and the ground surface at the source of development.*

N/A

10. *DESCRIPTION OF WORKS*

Include length and dimensions of supply ditch or pipeline, size and type of pump and motor, type of irrigation system to adequately describe the proposed distribution system.

Both wells will utilize deep well vertical turbine type pumps capable of pumping approximately 4000 GPM. The actual sizing of the pump equipment is to be determined from well pumping test information. The water will be conducted to the City's distribution system via 16-inch diameter water pipe.

11. *Construction work will begin on or before* February 1978

12. *Construction work will be completed on or before* June 1979

13. *The water will be completely applied to the proposed use on or before* June 1979

14. *If the ground water supply is supplemental to an existing supply, identify the supply and existing water right.* City of Umatilla G-2560

Application No. G-8592 *Permit No.* G 8042

Application for a Permit
To Appropriate Ground Water-attachment

FOR: City of Umatilla

2. The Golf Course Well is to be located 825 feet south and 2,550 feet east from the northwest corner of Section 14, being within the northeast 1/4 of the northwest 1/4 of Section 14, TP 5N R 28E, W.M., in the county of Umatilla.

The Intertie Well is to be located 2,515 feet south and 140 feet west from the northeast corner of Section 16 being within the southeast 1/4 of the northeast 1/4 of Section 16 TP 5N, R 28E, W.M., in the county of Umatilla.

3. LOCATION OF AREA TO BE IRRIGATED, OR PLACE OF USE.....

Township North or South	Range, E. or W. of Willamette Meridian	Section	Government Subdivision	Number of Acres to be Irrigated
5 N.	27 E., W.M.	13	NE1/4 SE1/4, SE1/4 SE1/4, SE1/4 NE1/4	80
5 N.	28 E., W.M.	8	SE1/4 SE1/4, SW1/4 SE1/4, NE1/4 SE1/4	46
		9	SE1/4, SW1/4, SE1/4 NE1/4, SW1/4 NE1/4	364
		10	SW1/4, SE1/4, SW1/4 NW1/4, SE1/4 NW1/4	320
		11	SE1/4, SW1/4, SE1/4 NE1/4, SW1/4 NE1/4	273
		12	SE1/4, SW1/4	339
		13	All	640
		14	All	640
		15	All	640
		16	All	640
		17	All	633
		18	SW1/4, SE1/4, SE1/4 NW1/4, SW1/4 NW1/4, SE1/4 NE1/4, SW1/4 NW1/4, NE1/4 NE1/4	461
		19	All	640
		20	All	640
		21	All	640
		22	All	640
		23	All	640
		24	All	640
		27	NE1/4 NW1/4	160
		28	NE1/4 NW1/4	160
		29	NE1/4 NW1/4	160
		30	NE1/4	160
5 N.	29 E., W.M.	7	SW1/4, SE1/4 SE1/4, SW1/4 SE1/4, NW1/4 SE1/4	212
		8	SW1/4 SW1/4, SE1/4 SW1/4	26
		17	All	614
		18	All	640
		19	All	640
		20	NE1/4 NE1/4, NW1/4 NE1/4, NE1/4 NW1/4, NW1/4 NW1/4	80

RECEIVED
MAR 14 1978
WATER RESOURCES DEPT.
SALEM, OREGON

Application No. G 8592
Permit No. G 8042

Remarks:

Randy Hoffman - CH2M Hill
Signature of Applicant
for City of Umatilla

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for completion

In order to retain its priority, this application must be returned to the Water Resources Director with corrections on or before April 24, *19* 78

WITNESS my hand this 22nd *day of* February, *19* 78

James E. Sexson *Water Resources Director*

By Larry Tell
Larry Tell

RECEIVED
MAR 14 1978
WATER RESOURCES DEPT.
SALEM, OREGON

This instrument was first received in the office of the Water Resources Director at Salem, Oregon, on the 28th *day of* December, *19* 77, *at* 11:00 *o'clock* a.m.

Application No. G-8592 *Permit No.* G 8042

Application No. G-8592 Permit No. G 8042

Permit to Appropriate the Public Waters of the State of Oregon

G 8042

This is to certify that I have examined the foregoing application and do hereby grant the same, SUBJECT TO EXISTING RIGHTS INCLUDING THE EXISTING MINIMUM FLOW POLICIES ESTABLISHED BY THE WATER POLICY REVIEW BOARD and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 17.8 *cubic feet per second measured at the point of diversion from the well or source of appropriation, or its equivalent in case of rotation with other water users, from* Intertie well and Golf Course well; being 8.9 c.f.s. from each well.

The use to which this water is to be applied is municipal.

If for irrigation, this appropriation shall be limited to ..... *of one cubic foot per second or its equivalent for each acre irrigated and shall be further limited to a diversion of not to exceed* ..... *acre feet per acre for each acre irrigated during the irrigation season of each year;*

If the wells are determined to be hydraulically connected to the basalt aquifers within the Butter Creek Critical Groundwater Area, appropriation of water from the wells may be restricted or completely controled by order of the Water Resources Director.

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The well shall be constructed in accordance with the General Standards for the Construction and Maintenance of Water Wells in Oregon.

The works constructed shall include an air line and pressure gauge or an access port for measuring line, adequate to determine water level elevation in the well at all times.

The permittee shall install and maintain a weir, meter, or other suitable measuring device, and shall keep a complete record of the amount of ground water withdrawn.

The priority date of this permit is December 28, 1977

Actual construction work shall begin on or before May 11, 1979 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19*79

Extended to Oct. 1, 1984 Extended to October 1, 1989 Extended to 10-1-94, 10-1-99

*Complete application of the water to the proposed use shall be made on or before October 1, 19*80

Extended to Oct. 1, 1984 Extended to October 1, 1989 Extended to 10-1-94, 10-1-99

WITNESS my hand this 11th *day of* May, *19*78

James E. Sexton

Water Resources Director

RH

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.

Intertie well

WATER WELL REPORT

STATE OF OREGON

(Please type or print)

(Do not write above this line)

State Well No. 5N/28E-16ad

State Permit No.

(1) OWNER:

Name CITY OF UMATILLA

Address PO Box 130 UMATILLA ORE. 97882

(2) TYPE OF WORK (check): INTERTIE WELL

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary ☒ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

CASING INSTALLED: Threaded ☐ Welded ☒

20" Diam. from +2 ft. to 500 ft. Gage .375

" Diam. from ft. to ft. Gage

" Diam. from ft. to ft. Gage

PERFORATIONS: Perforated? ☐ Yes ☒ No.

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.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No

Manufacturer's Name

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 ☐ No If yes, by whom? VALLEY PUMP Co

Yield: 1245 gal./min. with 324 ft. drawdown after 24 hrs.

" " "

" " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m.

Temperature of water 68° Depth artesian flow encountered ft.

(9) CONSTRUCTION:

Well seal—Material used CEMENT GROUT

Well sealed from land surface to 60FT AND 490-500 ft.

Diameter of well bore to bottom of seal 27 in.

Diameter of well bore below seal 23 in.

Number of sacks of cement used in well seal 142 sacks

Number of sacks of bentonite used in well seal sacks

Brand name of bentonite

Number of pounds of bentonite per 100 gallons of water lbs./100 gals.

Was drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? depth of strata

Method of sealing strata off

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

(10) LOCATION OF WELL:

County UMATILLA Driller's well number 5552

SE ¼ NE ¼ Section 16 T. 5N R. 28E W.M.

Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.

Depth at which water was first found 528 ft.

Static level 156 ft. below land surface. Date 3/1/79

Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 12

Depth drilled 1134 ft. Depth of completed well 1134 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
SEE ATTACHED SHEET			

RECEIVED
JUN 6 1979
WATER RESOURCES DEPT.
SALEM, OREGON

Work started APR 24 1978 Completed MAY 21 1979

Date well drilling machine moved off of well MAY 2 1979

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] Paul O. Rodman (Drilling Machine Operator) Date JUNE 6, 1979

Drilling Machine Operator's License No. 53

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 R.L. STRASSER DRILLING Co (Person, firm or corporation) (Type or print)

Address 8110 SE SUNSET LANE PORTLAND, ORE.

[Signed] Robert L. Strasser (Water Well Contractor)

Contractor's License No. 10 Date JUNE 6, 1979

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

Phone: 771-2355

R. J. Strasser Drilling Co.

8110 S. E. Sunset Lane
Portland, Oregon 97206

RECEIVED
JUN 8 1979
WATER RESOURCES DEPT.
SALEM, OREGON

June 4, 1979

Intertie well

top soil	0 - 2
broken black basalt	2 - 51
broken brown basalt	51 - 58
hard black basalt	58 - 145
green shale	145 - 188
broken black basalt	188 - 198
hard grey basalt	198 - 345
broken black basalt and green shale	345 - 388
hard grey basalt	388 - 460
medium hard black basalt	460 - 492
hard grey basalt	492 - 502
med. hard black basalt	502 - 512
hard black basalt	512 - 528
porous black basalt	528 - 535
hard grey basalt	535 - 553
porous black basalt	553 - 573
hard grey basalt	573 - 584
hard black basalt	584 - 589
porous brown and black basalt	589 - 595
med. hard black basalt	595 - 618
broken black basalt	618 - 629
hard grey basalt	629 - 663
porous black basalt	663 - 665
reddish brown porous basalt	665 - 678
black basalt	678 - 692
hard black basalt	692 - 703
broken black basalt	703 - 724
hard black basalt	724 - 730
black basalt	730 - 738
hard black basalt	738 - 750
porous black basalt	750 - 764
black basalt	764 - 872
broken grey basalt	872 - 877
hard black basalt	877 - 892
hard grey basalt	892 - 915
soft black basalt	915 - 922
hard black basalt	922 - 927
soft black basalt	927 - 935
med. hard grey basalt	935 - 942
soft grey basalt	942 - 948

med. hard grey basalt	948 - 955
broken grey basalt	955 - 966
med. hard grey basalt	966 - 998
hard grey basalt	998 - 1034
broken grey and red basalt with sediments	1034 - 1048
hard grey basalt	1048 - 1053
broken grey and red basalt	1053 - 1061
grey basalt, some broken	1061 - 1096
med. hard black basalt	1096 - 1127
soft black basalt	1127 - 1132
hard black basalt	1132 - 1134

RECEIVED
JUN 8 1979
WATER RESOURCES DEPT.
SALEM, OREGON

of this report are to be filed with the STATE ENGINEER, SALEM, OREGON within 30 days from the date of well completion.

RECEIVED JAN 30 1979 WATER RESOURCES DEPT. SALEM, OREGON

STATE OF OREGON
(Please type or print)
(DO NOT write above this line)

State Well No. [illegible]

State Permit No.

(1) OWNER:

Name CITY OF UMATILLA

Address P.O. BOX 130 UMATILLA, ORE. 97882

(2) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:

Rotary ☒ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☒
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED: Threaded ☐ Welded ☒

20" Diam. from +2 ft. to 500 ft. Gage .375

" Diam. from ft. to ft. Gage

" Diam. from ft. to ft. Gage

(6) PERFORATIONS: Perforated? ☐ Yes ☒ No.

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.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No

Manufacturer's Name

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 ☐ No If yes, by whom? VALLEY PUMP CO

Yield: 2000 gal./min. with 158 ft. drawdown after 12 hrs.

" 2500 " 235 " 24 "

" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m.

Temperature of water 68 Depth artesian flow encountered ft.

(9) CONSTRUCTION:

Well seal—Material used CEMENT GROUT

Well sealed from land surface to 60 FT. AND 490 FT. ft.

Diameter of well bore to bottom of seal 27 in.

Diameter of well bore below seal 23 in.

Number of sacks of cement used in well seal 189 sacks

Number of sacks of bentonite used in well seal sacks

Brand name of bentonite

Number of pounds of bentonite per 100 gallons of water lbs./100 gals.

Was a drive shoe used? ☒ Yes ☐ No Plugs Size: location ft.

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? depth of strata

Method of sealing strata off

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

(10) LOCATION OF WELL:

County UMATILLA Driller's well number 5544

NE ¼ NW ¼ Section 14 T. 5N R. 28E W.M.

Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.

Depth at which water was first found ft.

Static level 200 ft. below land surface. Date 10/11/78

Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 12

Depth drilled 989 ft. Depth of completed well 989 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
SEE ATTACHED SHEET			

Work started MAR 30 1978 Completed DEC 8 1978

Date well drilling machine moved off of well OCT 23 1978

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] Paul O Rydman (Drilling Machine Operator) Date 1/26, 1979

Drilling Machine Operator's License No. 53

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 R.J. STRASSER DRILLING CO. (Person, firm or corporation) (Type or print)

Address 8110 SE SUNSET LANE PORTLAND, ORE.

[Signed] Robert L Strasser (Water Well Contractor)

Contractor's License No. 10 Date JAN 26, 1979

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

Phone: 771-2355

R. J. Strasser Drilling Co.
8110 S. E. Sunset Lane
Portland, Oregon 97206

January 28, 1979

Log of Golf Course well

brown sand	0 - 6
broken brown rock	6 - 9
med. hard grey basalt	9 - 38
broken black basalt	38 - 55
black basalt	55 - 146
broken rock and brown clay	146 - 174
broken rock and green shale	174 - 200
hard black basalt	200 - 350
broken black basalt and green shale	350 - 363
hard black basalt	363 - 418
broken black basalt and green shale	418 - 431
med. hard black basalt	431 - 541
broken and porous basalt	541 - 550
hard black basalt	550 - 561
hard grey basalt	561 - 573
porous black basalt	573 - 576
med. hard black basalt	576 - 584
broken black basalt	584 - 590
hard grey basalt	590 - 640
med. hard black basalt	640 - 653
hard grey basalt	653 - 658
porous black basalt	658 - 662
med. hard black basalt	662 - 673
hard grey basalt	673 - 685
med. hard grey basalt	685 - 700
hard grey basalt	700 - 717
porous black and blue basalt	717 - 734
hard grey basalt	734 - 758
porous black basalt	758 - 767
hard grey basalt	767 - 792
med. hard black basalt	792 - 823
hard grey basalt	823 - 859
broken black basalt	859 - 862
hard grey basalt	862 - 873
very hard grey basalt	873 - 888
med. hard black basalt	888 - 899
broken black basalt	899 - 948
med. hard black basalt	948 - 969
grey basalt	969 - 989

JIM PURSWELL'S PUMP COMPANY, INC
P.O. Box 264
HERMISTON, OREGON 97838

(503) 567-2640
FAX (503) 567-6348

INTERTIE WELL

5595

PHONE	DATE OF ORDER 1-25-95
ORDER TAKEN BY Dennis M.	CUSTOMER'S ORDER NUMBER Verbal - Roger F.
☐ DAY WORK ☐ CONTRACT ☐ EXTRA	
JOB NAME NUMBER	
JOB LOCATION	
JOB PHONE	STARTING DATE

TO City of Umatilla
P.O. Box 130
Umatilla, OR 97882

TERMS:
Net 30 Days From 3-6-95

OR CCB #49914

QTY.	MATERIAL	PRICE	AMOUNT
1	11" Fairbanks Morse Turbine Pump - Model 11 M-13 Serial # F4D2938333X 13 stage		7594.00
30'	8" x 10' Water Lube Column		6999.00
200'	1 1/16" Water Lube Shafting w/ Sleeves		2805.00
30	8" x 1 1/16" Water Lube Spiders w/ Bearings		1723.00
1,002'	1/4" Galv. Pipe (Air Line)		722.40
10'	3/8" Poly Tube (Air Line)		488.00
	Thank You!		
	THIS PUMP INSTALLED IN INTERTIE WELL IN 3/1995		

DATE COMPLETED

TOTAL MATERIALS 20,333.40

Work ordered by

Signature
I hereby acknowledge the satisfactory completion of the above described work

DESCRIPTION OF WORK

Provide & Install new 13 stage 11" Fairbanks Morse Turbine Pump

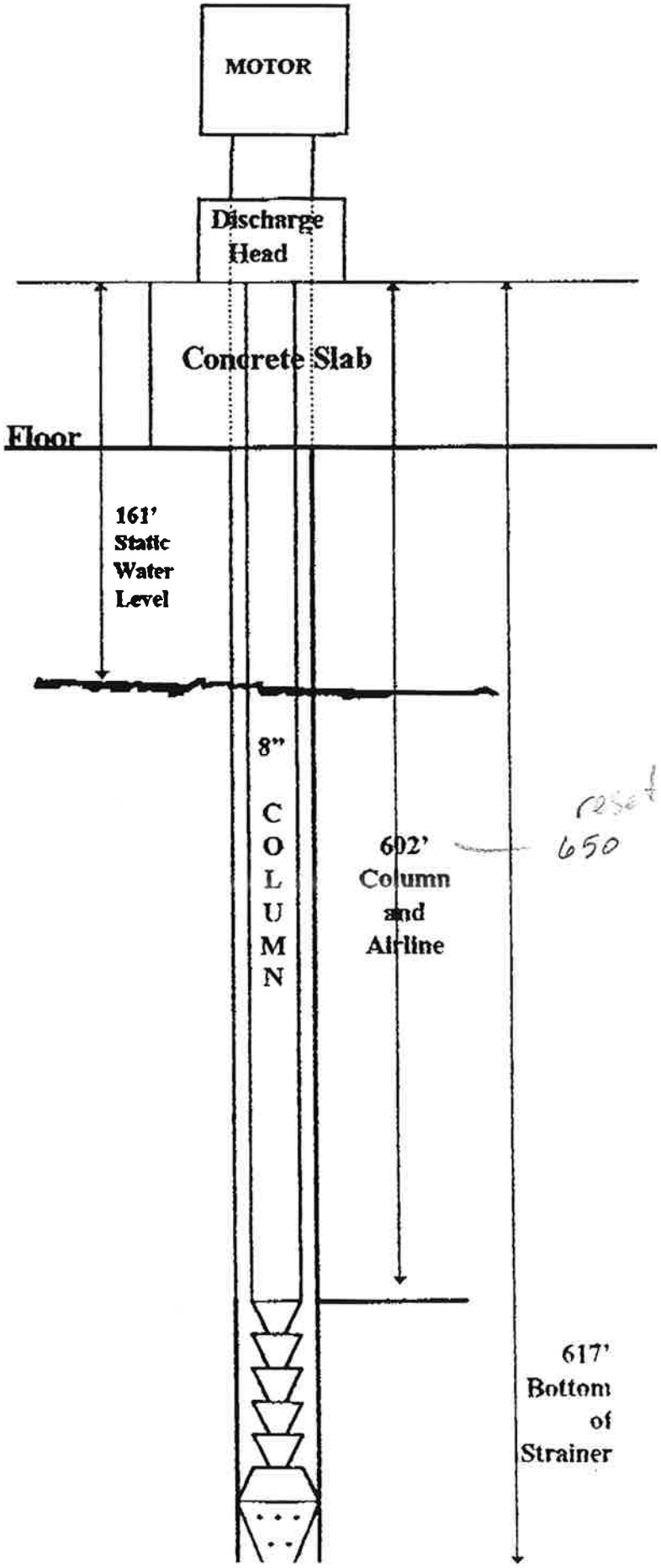
Installed the pump on 602' of 8" Column
Static water level is 162'

OTHER CHARGES

Crane	2978.50
TOTAL OTHER	2978.50

LABOR	HRS.	RATE	AMOUNT
Labor to Install			2790.00
Labor to Check Shafting			240.00
TOTAL LABOR			3030.00
TOTAL MATERIALS			20,333.40
TOTAL OTHER			2978.50
TAX			
TOTAL			26,341.90

Thank You



reset to 650 in 1995

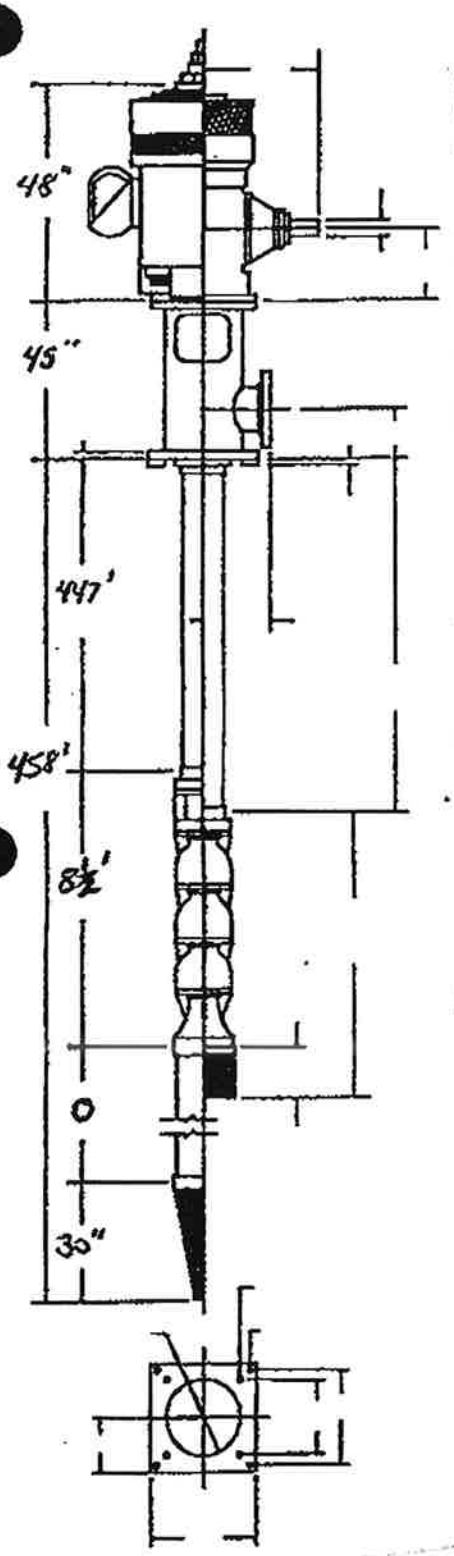
old pump

March 3, 1995
City of Umatilla
Innertie Well

Pump Information
Fairbanks-Morse Bowl
11-M, 13 Stage
850 gpm at 680' TDH
602' of 8" x 1-11/16" Column

AMERICAN TURBINE

Golf Course Well
new pump



DATE 1-17-96
CUSTOMER City of Umatilla
JOB NAME Golf Course Well

GEAR DRIVE

H.P. X MFGR. X
RATIO X B.D. X

MOTOR

H.P. 300 MFGR. U.S.
R.P.M. 1250 SIZE 5006 P
PHASE/CYCLE/VOLTS 3 Phase 460V 60 cycle

DISCHARGE HEAD

TYPE Worthington SIZE 12 X 12

MECHANICAL SEAL

TYPE Packing STYLE Graphite

BASE PLATE

SIZE 42 X 42 X 1⅛"
MATERIAL Steel

COLUMN ASSEMBLY

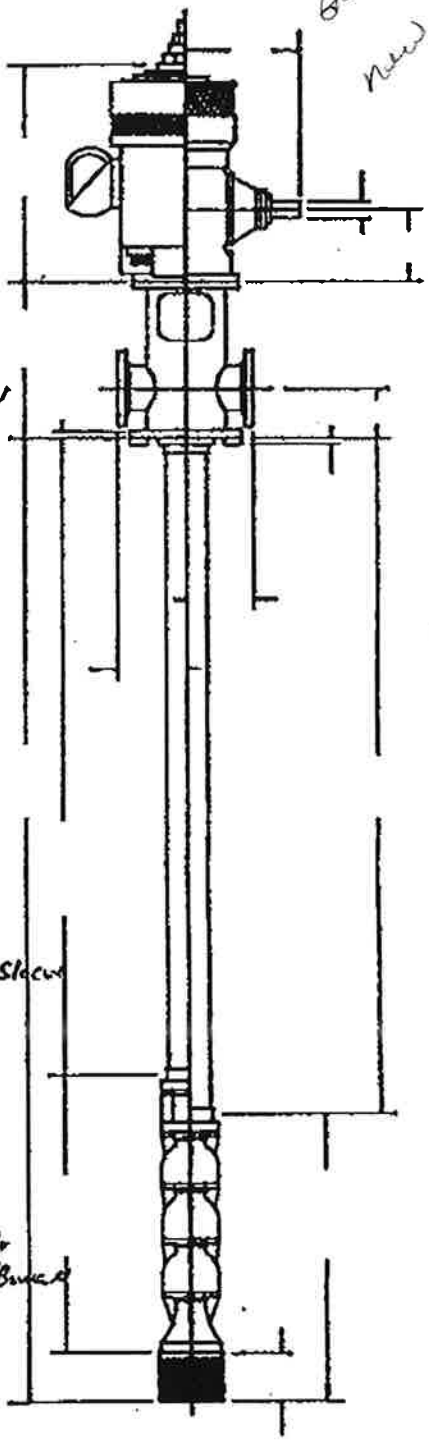
PIPE SIZE/LENGTH 12"
PIPE WALL .330"
SHAFT SIZE/LENGTH 1 15/16"
SHAFT MATERIAL C1045 shaft - 304 SS Sleeve
TUBE SIZE/LENGTH —

BOWL ASSEMBLY

MODEL 15 M 200-5 O/L P/L
NO. OF STAGES 5
G.P.M. 2000 T.D.H. 440
MATERIAL:
BOWL A 48-30 CI IMPELLER C83800 Br
SHAFT 416 SS BEARING C84400 br/Bronze
COLLET C 1215 steel BOLTS grade 5
BOWL W.R. MATERIAL —
IMPELLER W.R. MATERIAL —

STRAINER

TYPE Cone MATERIAL Galv steel
SUCTION PIPE SIZE 12"



COMMENTS: GOLF COURSE WELL
AIRLINE 447' B.G.S. - GAUGE AT
± 4' ABOVE FLOOR

CLAIM OF BENEFICIAL USE AND SITE REPORT

PERMIT NUMBER: **G-8042**

IN THE NAME OF: CITY OF UMATILLA
P.O. BOX 130
UMATILLA, OREGON 97882
(541) 922-3226

INFORMATION: The City of Umatilla submitted an application to develop a water source. Application file number G-8592 was accepted and Permit Number **G-8042** was issued on May 5, 1978. Permit **G-8042** authorizes the use of a total of 17.8 cfs of water from two wells for municipal purposes. The authorized use from each well is 8.9 cfs. The wells drilled under this permit are known locally as the Golf Course Well and the Intertie Well.

The City of Umatilla has replaced the pumps in both wells. The initial site visit for well improvements took place in March 1995 for the Intertie Well and September 1996 for the Golf Course Well. The well projects, including type of use, extent of use, capacity of system, and permit conditions, was reviewed with the City of Umatilla.

SOURCE: Two wells: The Golf Course Well is 989 feet deep with a 20-inch (I.D.) welded steel casing set to 500 feet below ground surface. From 500 to 989 feet below ground surface, the well is a 12-inch diameter open rock hole. The well has a cement grout seal from the surface down to 109 feet and from 490 to 500 feet below ground surface. It has a new American Turbine brand pump. The well was drilled by R. J. Strasser Drilling Co., 8110 S.E. Sunset Lane, Portland, Oregon 97206, beginning May 30, 1978, and completed December 8, 1978. The static water level on October 11, 1978, was reported as 200 feet below land surface in the water well report. The static water level recorded in the new pump installation record on October 1, 1996, was 187 feet below land surface. The static water level as published in the City of Umatilla draft Water System Master Plan - 2001 varies from a high of 192 feet in the winter to a low of 212 feet during the summer.

The static water level in March 2003 was 192 feet below land surface. To date, the City of Umatilla public works personnel have not seen any significant variation in the static water level. A pump test of the new pump by Purswell Pump, P.O. Box 264, Hermiston, Oregon 97838, shows an average drawdown of 140 to 160 feet at a rate of approximately 1,900 gpm. There is a 2-inch screened well vent for access to the well. There is also an access tube for an air line and a down hole pressure transducer is installed with readout telemetered to the master panel at the City shop. Enclosed are copies of the water well report and pump test.

The Intertie Well is 1,134 feet deep with a 20-inch (I.D.) welded steel casing set to 500 feet below ground surface. From 500 to 1,134 feet below ground surface the well is a 12-inch diameter open rock hole. The well has a cement grout seal from the surface down to 60 feet and from 490 to 500 feet below ground surface. It has a new Fairbanks-Morse brand pump. The well was drilled by R. J. Strasser Drilling Co., 8110 S.E. Sunset Lane, Portland, Oregon 97206, beginning April 24, 1978, and completed May 21, 1978. The static water level was reported as 156 feet below land surface in the water well report. The static water level as published in the City of Umatilla draft Water System Master Plan - 2001 is 165 feet below land surface. The static water level in March 2003 was 165 feet below land surface. To date, the City of Umatilla public works personnel have not seen any significant variation in the static water level. The average drawdown shown in the Master Plan is 420 feet at a rate of $\pm$760 gpm. There is a 2-inch screened well vent for access to the well. There is also an access tube for an air line. Enclosed are copies of the water well report and a well pump settings diagram.

WELL PUMPS AND MOTORS:

The Golf Course Well has a 300 Hp U.S. electric motor, 3-phase, 460 volt, 60 Hz, with an operating speed of 1,760 rpm. The pump is an American Turbine brand, model 15M200-5, 5 stage, line shaft vertical turbine pump. A design pump performance curve is enclosed.

The Intertie Well has a 200 Hp U.S. electric motor, 3-phase, 460 volt, 60 Hz, with an operating speed of 1,770 rpm. The pump is a Fairbanks-Morse brand, model 11M7000, 13 stage, line shaft vertical turbine pump. A design pump performance curve is enclosed.

CONVEYANCES: The Golf Course Well is located inside a pump station building. The pump station is adjacent to the McNary Reservoir. The reservoir is a 1,800,000-gallon steel tank. The McNary Booster Pump Station is also located at this site. The Golf Course Well pump station contains a flowmeter indicator-totalizer-transmitter linked via telemetry to the City shops, a pressure gauge, and a well water level drawdown gauge. An electrical panel adjacent to the well is equipped with a pump motor starter, telemetry, and controls. The Golf Course Well has a 12-inch ductile iron discharge pipe, a 3/8-inch HDPE airline for the drawdown gauge, and a pressure transducer cable for the transmitter. The 12-inch ductile iron pipe exits the pump station and is connected with a series of valves to the McNary Reservoir or bypasses to the McNary Booster Pump Station. The reservoir and the booster pump station are connected to the water distribution system serving the City of Umatilla's water service area.

The Intertie Well is located inside a pump station building adjacent to the Intertie Reservoir. The reservoir is a 1,500,000-gallon steel tank. The pump station contains a flowmeter indicator-totalizer-transmitter linked via telemetry to the City shops, a pressure gauge, and a well water level drawdown gauge. An electrical panel adjacent to the well is equipped with a pump motor starter, telemetry, and controls. The Intertie Well has an 12-inch ductile iron discharge pipe, a 3/8-inch HDPE airline for the drawdown gauge, and a pressure transducer cable for the transmitter. The 12-inch ductile iron pipe exits the pump station and is connected with a series of valves to the Intertie Reservoir. The reservoir is connected to the water distribution system serving the City of Umatilla's water service area.

CAPACITY: The City of Umatilla operates the Golf Course Well based on the water level of the McNary Reservoir and the Intertie Well based on the water level of the Intertie Well. Both of these on-demand systems are activated through telemetry and controls as needed to keep the respective reservoirs at a proper operating level.

The Golf Course Well was pumped at an average of 1,900 gpm during the initial pump test of the pump by Purswell Pump with an average drawdown of 140 to 160 feet. Enclosed is a copy of that pump/motor installation record. The design pumping rate of the pump is 2,000 gpm at 440 feet total dynamic head (TDH). The average pumping rate, as observed at the flowmeter, is 1,950 gpm, with a near full reservoir.

The permitted rate of 8.9 cfs or 3,994 gpm cannot be achieved with the present pump. The capacity of the pump is verified by the attached pump performance curve.

The Intertie Well has been pumped at an average of 760 gpm with an average drawdown of 420 feet as published in City of Umatilla draft Water System Master Plan - 2001. The design pumping rate of the pump is 850 gpm at 680 feet total dynamic head (TDH) for the normal operating condition of a near full reservoir. The average pumping rate, as observed at the flowmeter, is 750 gpm, with a near full reservoir. The permitted rate of 8.9 cfs or 3,994 gpm cannot be achieved with the present pump. The capacity of the pump is verified by the attached pump performance curve.

USE: Use is municipal within the City of Umatilla's water service area. The water service area has changed since Permit **G-8042** was issued. The current water service area is shown on this Claim of Beneficial Use Map.

LIFT: For the Golf Course Well, the pump operating level lift, measured as the mean elevation difference between the pumping water level of ±142 feet above sea level (±490 feet ground surface elevation - ±348 feet) and the maximum operating level of the McNary water storage reservoir (±524 feet above sea level), is:

Lift = 524 feet - 142 feet = ±382 feet
Primary design capacity (TDH) was calculated as 2,000 gpm at 440 feet TDH.

For the Intertie Well, the pump operating level lift, measured as the mean elevation difference between the pumping water level of ±(-130) feet above sea level (±455 feet ground surface elevation -(±585 feet)) and the maximum operating level of the Intertie water storage reservoir (±521 feet above sea level), is:

Lift = 524 feet - (-130) feet = ±654 feet
Primary design capacity (TDH) was calculated as 850 gpm at 680 feet TDH.

SURVEY TIE: Location of the Golf Course Well was determined from conventional survey methods using a Topcon Total Station. Location of the Intertie Well was derived from digital base mapping of Umatilla. The ties to the

Northwest corner of Section 14 and the Northeast corner of Section 16, T. 5 N., R. 28 E. W. M. are protracted and based on record information.

SPECIAL CONDITIONS AND REMARKS:

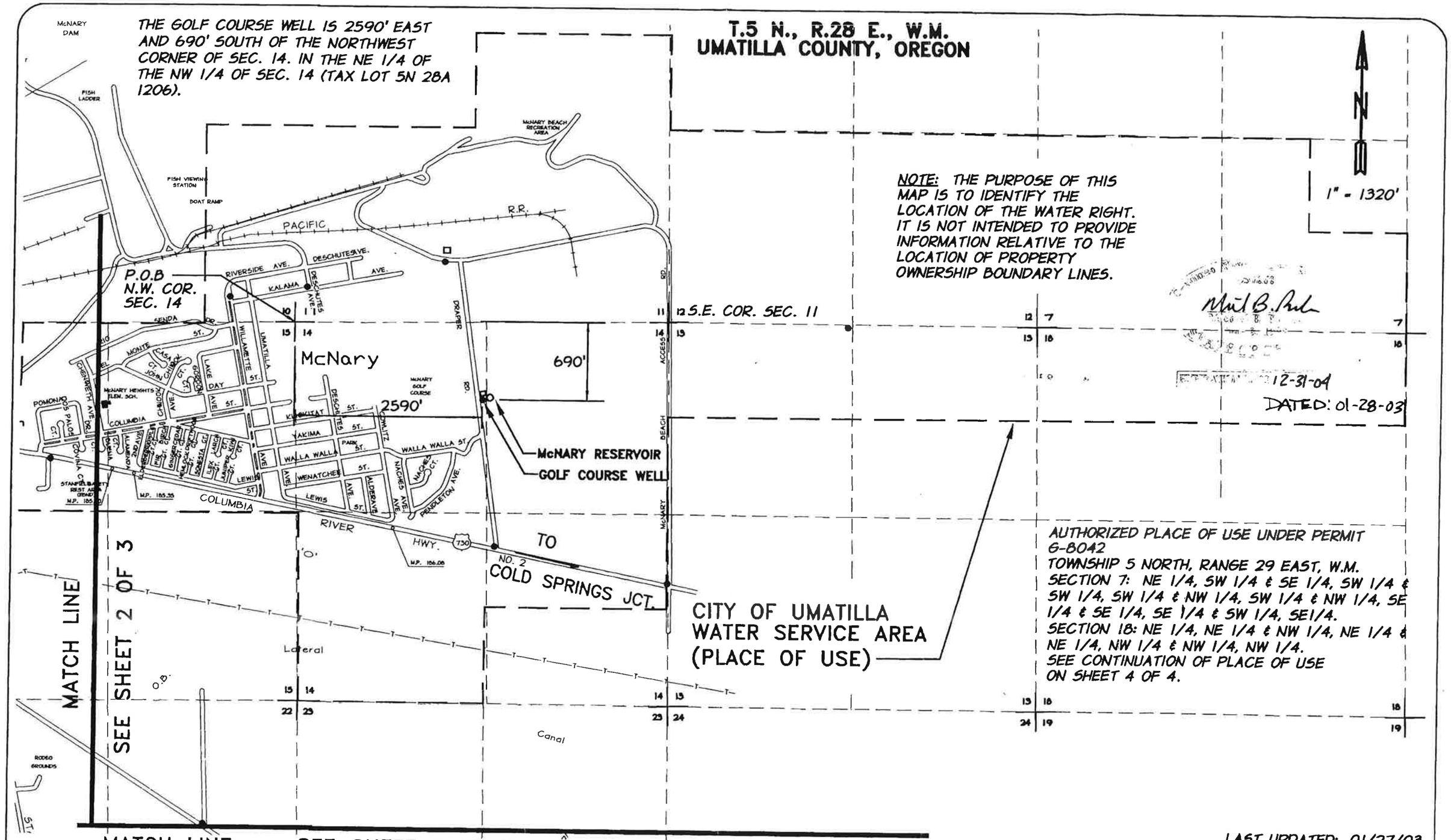
The conditions of the permit have been met as described in this report. The static water level of both wells can be continuously monitored via telemetry at the City shops. Water was put to beneficial use from the Golf Course Well in 1979 and from the Intertie Well in 1978. The full rate of 8.9 cfs for each well, as authorized by the permit, has not been perfected. The limiting factor for the Golf Course Well is the size of the pump. The limiting factor for the Intertie Well is also the size of the pump. As provided for in ORS 537.260, Subsection 4, the incremental rate of 4.45 cfs (2,000 gpm) should be certified and considered perfected for the Golf Course Well under the terms of this Water Right. The incremental rate of 1.69 cfs (760 gpm) should be certified and considered perfected for the Intertie Well under the terms of this Water Right. The City will submit an application for extension of time to perfect the remainder of the permitted municipal water right.

This final proof survey and inspection of the use, as found to be completed under the terms and conditions of Permit No. **G-8042** was completed by me and Jess Holt, P.E., working under my direct supervision. Jess was the design engineer for the Golf Course and Intertie Well system improvements. Field verification of flows, pump system, and area of beneficial use were completed in March 1995 and September 1996, and verified in March 2003. Attached are three years of water records for the Intertie and Golf Course Wells. The facts contained in this report and accompanying claim of beneficial use map are correct to the best of my knowledge.

I, Larry Clucas, City Manager of the City of Umatilla, Oregon, agree to the findings of the Certified Water Right Examiner and do submit this Site Report and Map as my Claim of Beneficial Use of Water as provided under the terms and conditions of Permit No. **G-8042.**

_____

Larry Clucas, City Manager



LAST UPDATED: 01/27/03

APPLICATION: G-8592
PERMIT: G-8042
DATE OF SURVEY: INTERTIE WELL, MARCH 1995
GOLF COURSE WELL, SEPTEMBER 1996

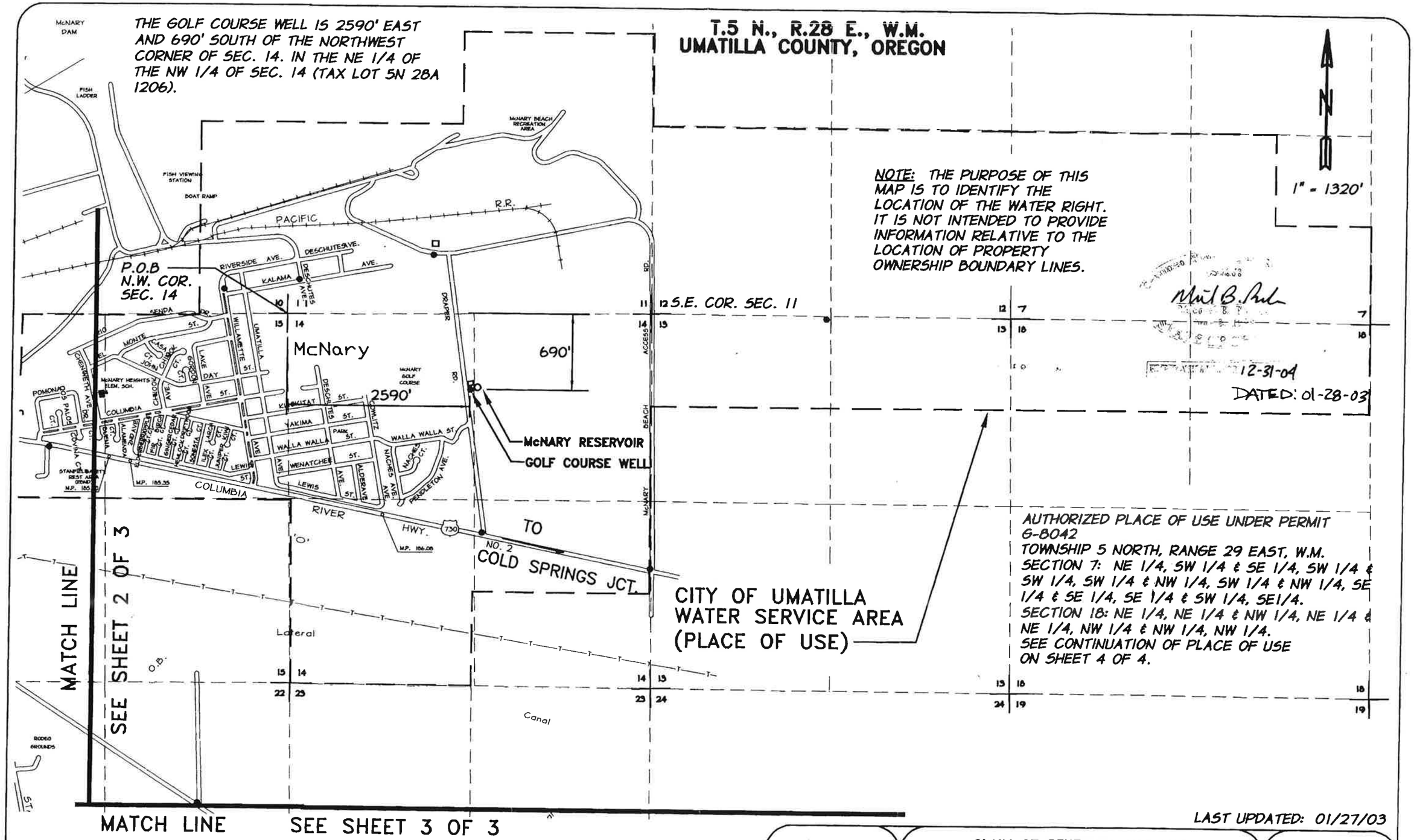
anderson perry & associates, inc.

CLAIM OF BENEFICAL USE MAP
CITY OF UMATILLA
GOLF COURSE WELL & INTERTIE WELL
UMATILLA, OREGON

FIGURE
1 of 4

J# 1413-50-207

PATH: S:/UMATCITY/WATERRIGHTS03/GOLFWELLCBU



LAST UPDATED: 01/27/03

APPLICATION: G-8592
PERMIT: G-8042
DATE OF SURVEY: INTERTIE WELL, MARCH 1995
GOLF COURSE WELL, SEPTEMBER 1996

anderson perry & associates, inc.

CLAIM OF BENEFICAL USE MAP
CITY OF UMATILLA
GOLF COURSE WELL & INTERTIE WELL
UMATILLA, OREGON

FIGURE
1 of 4

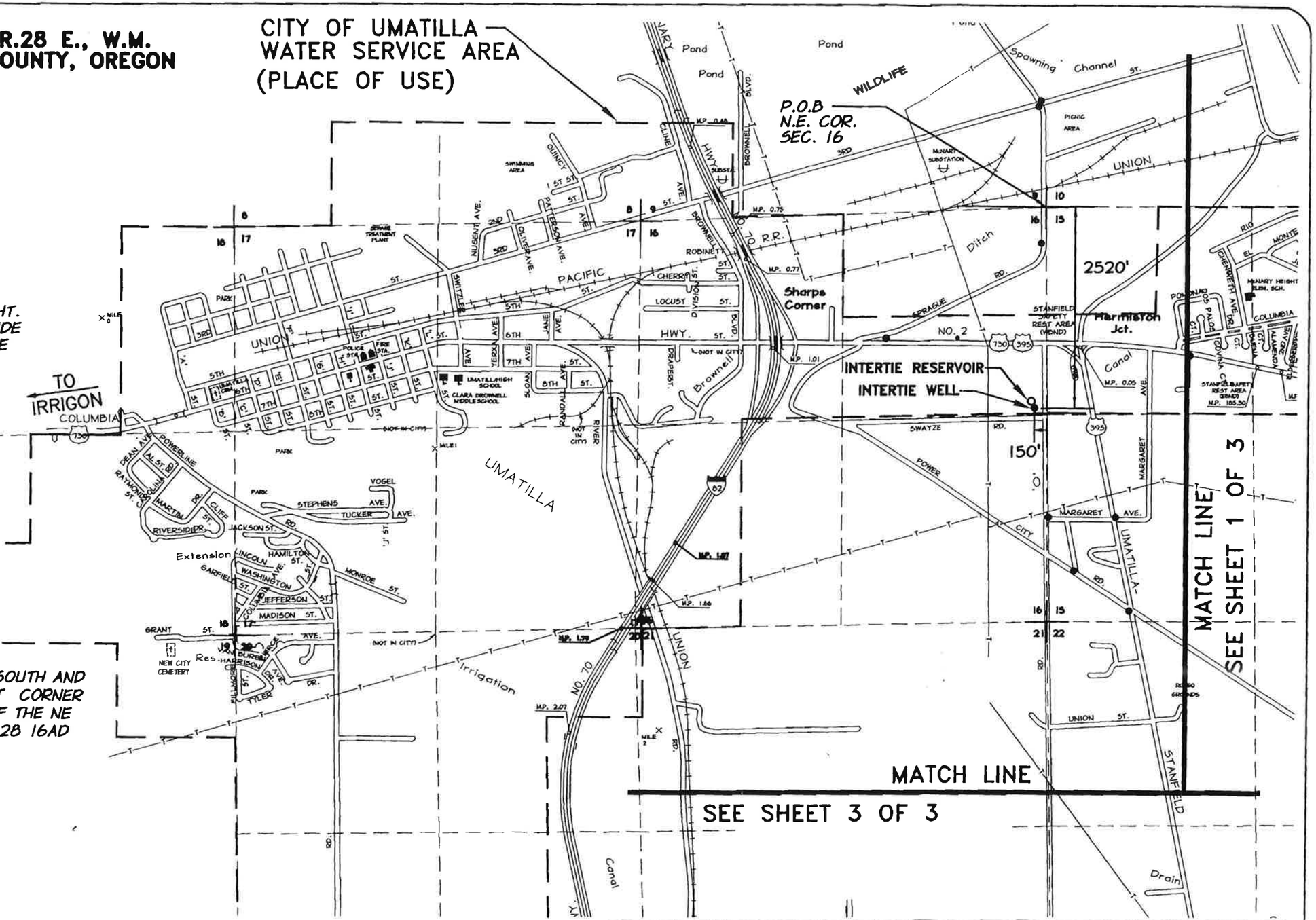
J# 1413-50-207

PATH: S:/UMATCITY/WATERRIGHTS03/GOLFWELLCBU

T.5 N., R.28 E., W.M.
UMATILLA COUNTY, OREGON

1" = 1320'

NOTE: THE PURPOSE OF THIS MAP IS TO IDENTIFY THE LOCATION OF THE WATER RIGHT. IT IS NOT INTENDED TO PROVIDE INFORMATION RELATIVE TO THE LOCATION OF PROPERTY OWNERSHIP BOUNDARY LINES.



THE INTERTIE WELL IS 2520' SOUTH AND 150' WEST OF THE NORTHEAST CORNER OF SEC. 16. IN THE SE 1/4 OF THE NE 1/4 OF SEC. 16 (TAX LOT 5N 28 16AD 800).

12-31-04

DATED 01-28-03

LAST UPDATED: 01/27/03

APPLICATION: G-8592
PERMIT: G-8042
DATE OF SURVEY: INTERTIE WELL, MARCH 1995
GOLF COURSE WELL, SEPTEMBER 1996

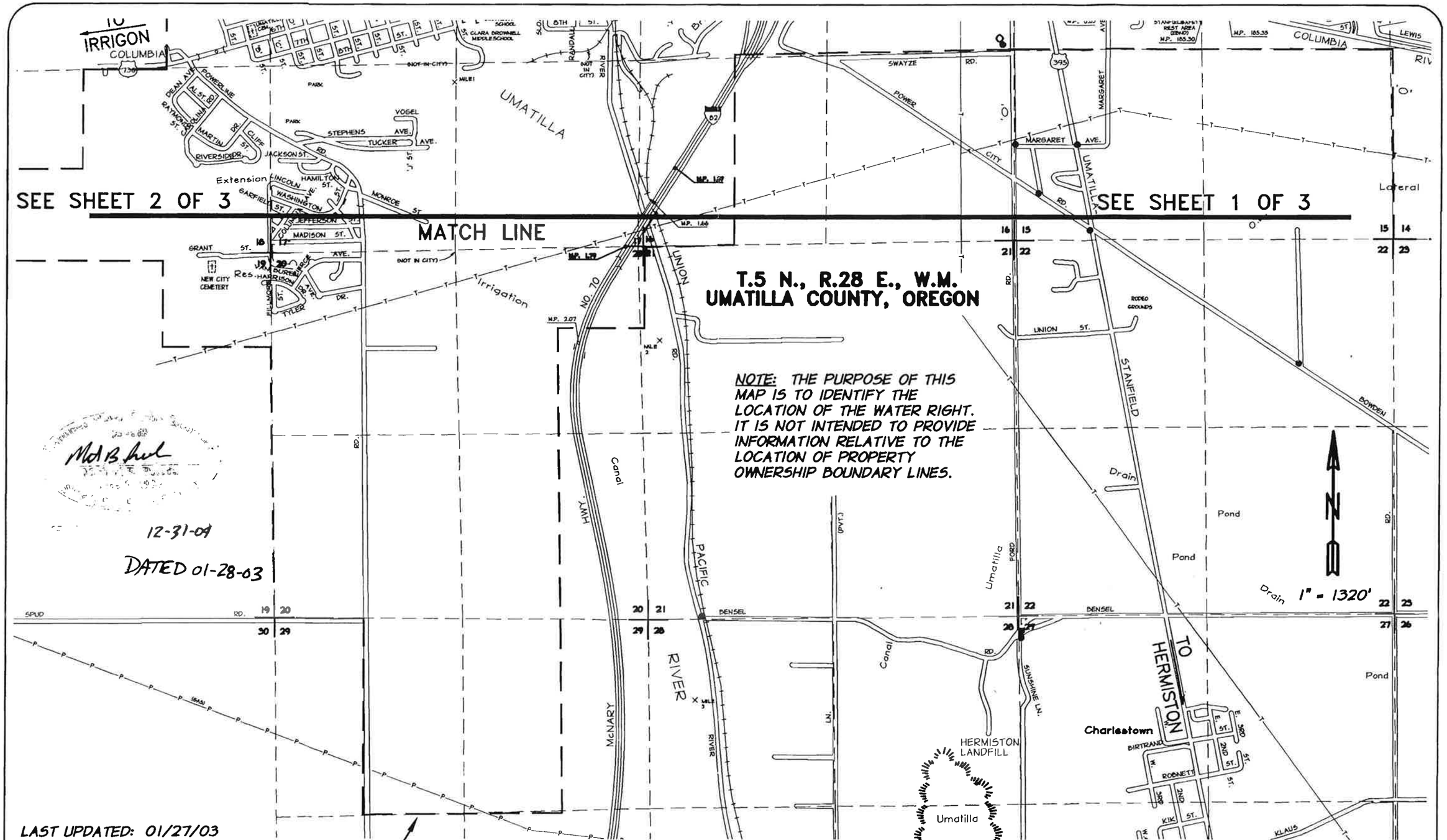
anderson perry & associates, inc.

CLAIM OF BENEFICAL USE MAP
CITY OF UMATILLA
GOLF COURSE WELL & INTERTIE WELL
UMATILLA, OREGON

FIGURE
2 of 4

J# 1413-50-207

PATH: S:/UMATCITY/WATERRIGHTS03/GOLFWELLCBU



CITY OF UMATILLA
WATER SERVICE AREA
(PLACE OF USE)

APPLICATION: G-8592
PERMIT: G-8042
DATE OF SURVEY: INTERTIE WELL, MARCH 1995
GOLF COURSE WELL, SEPTEMBER 1996

anderson perry & associates, inc.

CLAIM OF BENEFICAL USE MAP
CITY OF UMATILLA
GOLF COURSE WELL & INTERTIE WELL
UMATILLA, OREGON

FIGURE
3 of 4

J# 1413-50-207

PATH: S:/UMATCITY/WATERRIGHTS03/GOLFWELLCBU

T.5 N., R.28 E., W.M.
UMATILLA COUNTY, OREGON

(CONTINUED)

AUTHORIZED PLACE OF USE UNDER PERMIT G-3112 AND TRANSFER T-8701
TOWNSHIP 5 NORTH, RANGE 28 EAST, W.M.
SECTION 8: SE 1/4, SW 1/4 & SE 1/4, SE 1/4 & SW 1/4, SE 1/4.
SECTION 9: SW 1/4, SW 1/4.
SECTION 10: NE 1/4, SE 1/4 & SE 1/4, SE 1/4.
SECTION 11: SW 1/4, NE 1/4 & SE 1/4, NE 1/4 & NE 1/4, SE 1/4 & NW 1/4, SE 1/4 & SE 1/4, SE 1/4 & SW 1/4, SE 1/4 & NE 1/4, SW 1/4 & NW 1/4, SW 1/4 & SE 1/4, SW 1/4 & SW 1/4.
SECTION 12: NE 1/4, SE 1/4 & NW 1/4, SE 1/4 & SE 1/4, SE 1/4 & SW 1/4, SE 1/4 & NE 1/4, SW 1/4 & NW 1/4, SW 1/4 & SE 1/4, SW 1/4 & SW 1/4, SW 1/4.

SECTION 13: NE 1/4, NE 1/4 & NW 1/4, NE 1/4 & NE 1/4, NW 1/4 & NW 1/4, NW 1/4
SECTION 14: NE 1/4, NE 1/4 & NW 1/4, NE 1/4 & SE 1/4, NE 1/4 & SW 1/4, NE 1/4 & NE 1/4, NW 1/4, SE 1/4, NW 1/4 & NW 1/4, NW 1/4 & SW 1/4, NW 1/4 & NE 1/4, SW 1/4 & SE 1/4, SW 1/4 & SW 1/4, SW 1/4 & NW 1/4, SW 1/4 & NE 1/4, SE 1/4 & NW 1/4, SE 1/4.
SECTION 15: NE 1/4, NE 1/4 & SE 1/4, NE 1/4 & NW 1/4, NE 1/4 & SW 1/4, NE 1/4 & NE 1/4, NW 1/4 & SE 1/4, NW 1/4 & SW 1/4, NW 1/4.
SECTION 16: SE 1/4, NE 1/4 & SW 1/4, NE 1/4 & NE 1/4, NW 1/4 & SE 1/4, NW 1/4 & NW 1/4, NW 1/4 & SW 1/4, NW 1/4 & NW 1/4, SW 1/4 & SW 1/4, SW 1/4.
SECTION 17: NE 1/4, NE 1/4 & NW 1/4, NE 1/4 & NE 1/4, NW 1/4 & NW 1/4, NW 1/4 & SW 1/4, NW 1/4 & SE 1/4, NW 1/4 & SW 1/4, NE 1/4 & SE 1/4, NE 1/4 & NE 1/4, SE 1/4 & NW 1/4, SE 1/4, NE 1/4, SW 1/4 & NW 1/4, SW 1/4 & SE 1/4, SW 1/4 & SW 1/4, SW 1/4.
SECTION 18: NE 1/4, NE 1/4 & SE 1/4, NE 1/4 & NE 1/4, SE 1/4 & NW 1/4, SE 1/4 & SE 1/4, SE 1/4 & SW /14, SE 1/4 & SE 1/4, SW 1/4 & SW 1/4, SW 1/4.
SECTION 19: NE 1/4, NE 1/4
SECTION 20: NE 1/4, NE 1/4 & NW 1/4, NE 1/4 & SW 1/4, NE 1/4 & NE 1/4, NW 1/4 & NW 1/4, NW 1/4 & SE 1/4, NW 1/4 & SW 1/4, NW 1/4 & NW 1/4, SE 1/4 & SW 1/4, SE 1/4 & NE 1/4, SW 1/4 & NW 1/4, SW 1/4 & SE 1/4, SW 1/4 & SW 1/4, SW 1/4.
SECTION 29: NW 1/4, NE 1/4 & SW /14, NE 1/4 & NE 1/4, NW 1/4 & SE 1/4, NW 1/4.

12-31-09

DATED 01-28-03

LAST UPDATED: 01/27/03

APPLICATION: G-8592
PERMIT: G-8042
DATE OF SURVEY: INTERTIE WELL, MARCH 1995
GOLF COURSE WELL, SEPTEMBER 1996

anderson perry & associates, inc.

CLAIM OF BENEFICAL USE MAP
CITY OF UMATILLA
GOLF COURSE WELL & INTERTIE WELL
UMATILLA, OREGON

FIGURE
4 of 4

J# 1413-50-207

PATH: S:/UMATCITY/WATERRIGHTS03/GOLFWELLCBU

Port Well

Water Right Information Query Results

Contact Information

Current contact information

PORT OF UMATILLA
PO BOX 879
UMATILLA, OR 97882

CITY OF UMATILLA
PO BOX 130
UMATILLA, OR 97882

Water Right Information

Status: Non-Cancelled
County: Umatilla
File Folder Location: Salem
Watermaster District: 5

Documents

View all scanned documents

Application: G 3612 digital map

Received: 8/10/1966

Permit: G 3112 document, digital map, paper map

Signature: 11/3/1966

Permit Workflow

Action	Date	Result	Completed By
Extension Received	9/20/1999		
Extension PFO 315 Issued	1/22/2002		
Extension FO Issued	6/11/2002		
Extended Completion Date	10/1/2029		ANNREECE

Order(s)

Volume-Page	Signature	Description
19-204	4/1/1970	ORDER APPROVING THE CHANGE IN PLACE OF USE FROM DESCHUTES RIVER IN THE NAMES OF FAY A., OMA C. AND DONALD YOUNG (COID) Y-8
22-310	11/20/1972	EXTENSIONS OF TIME
25-100	9/16/1974	ORDER EXTENDING TIME IN WHICH TO COMPLETE CONSTRUCTION AND MAKE COMPLETE APPLICATION OF WATER UNDER CERTAIN PERMITS
28-299	2/14/1977	EXTENDS TIME, CERTAIN PERMITS
30-668	5/24/1978	EXTENDS TIME FOR CERTAIN PERMITS
33-702	9/22/1980	EXTENDS TIME FOR B & C ON 212 PERMITS
39-40	2/20/1985	EXTENSION OF TIME ORDER
45-78	1/29/1991	ORDER EXTENDING TIME LIMIT ON PERMITS
49-205	6/12/1995	EXTENDS TIME LIMITS ON CERTAIN PERMITS
56-718	7/29/2002	APPROVING T-8701 - AMEN

Point(s) of Diversion

POD 1 - A WELL > COLUMBIA RIVER

Description

T-R-S-QQ: 5.00N-28.00E-11-NE SW

Location Description: 2045 FEET NORTH & 1790 FEET EAST FROM SW CORNER, SECTION 11

POD Rate

Max Rate (cfs)	Rate (cfs)	Max Volume (af)	Volume (af)
4.46	4.46		

MUNICIPAL USES (Primary)

Priority Date	Max Rate (cfs)	Rate (cfs)	Max Volume (af)	Volume (af)	Rate/Acre	Duty	Start Date	End Date	Remarks
8/10/1966	4.46	4.46					1/1	12/31	

Place(s) of Use

Add TRS grouping

Use - MUNICIPAL USES (Primary); Priority Date: 8/10/1966

Water Right Genealogy

Permit:G 3112
- Inchoate: T 8701 CF (AMN)
  - Permit:G 3112 *

View Water Rights in same Family

Help understanding and working with the Water Rights Information System

Report Errors with Water Right Data

Return to WRIS Query

RECEIVED
AUG 1 1 1966
STATE ENGINEER
...ON

Permit No. G- G 3112

APPLICATION FOR A PERMIT

To Appropriate the Ground Waters of the State of Oregon

I, Port of Umatilla
(Name of applicant)

of P. O. Box 408, McNary, Oregon, county of Umatilla,
(Postoffice Address)

state of Oregon, do hereby make application for a permit to appropriate the following described ground waters of the state of Oregon, SUBJECT TO EXISTING RIGHTS:

If the applicant is a corporation, give date and place of incorporation

1. *Give name of nearest stream to which the well, tunnel or other source of water development is situated* Columbia River
(Name of stream)
tributary of --

2. *The amount of water which the applicant intends to apply to beneficial use is* 4.46 *cubic feet per second or* 2,000 *gallons per minute.*

3. *The use to which the water is to be applied is* Municipal Water Supply

4. *The well or other source is located* 2,045 *ft.* N. (N. or S.) *and* 1,790 *ft.* E (E. or W.) *from the* SW *corner of* Section 11, Township 5 North, Range 28 East, W.M.
(Section or subdivision)
(If preferable, give distance and bearing to section corner)
(If there is more than one well, each must be described. Use separate sheet if necessary)
being within the NE 1/4 of SW 1/4 *of Sec.* 11, *Twp.* 5 N., *R.* 28 E., *W. M., in the county of* Umatilla

5. *The* connecting pipeline (Canal or pipe line) *to be* 0.4 *miles in length, terminating in the* SE 1/4 of SW 1/4 (Smallest legal subdivision) *of Sec.* 11, *Twp.* 5 N., *R.* 28 E., *W. M., the proposed location being shown throughout on the accompanying map.*

6. *The name of the well or other works is* Port of Umatilla Well No. 1

DESCRIPTION OF WORKS

7. *If the flow to be utilized is artesian, the works to be used for the control and conservation of the supply when not in use must be described.*

Do not expect to encounter free flowing artesian water.

8. *The development will consist of* one well (Give number of wells, tunnels, etc.) *having a diameter of* 18 *inches and an estimated depth of* 800 *feet. It is estimated that* 350 *feet of the well will require* steel (Kind) *casing. Depth to water table is estimated* 170 (Feet)

G1— —2.5M

T-8701 Δ POU V.56p.718

CANAL SYSTEM OR PIPE LINE—

9. (a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: width on top (at water line) -- feet; width on bottom -- feet; depth of water -- feet; grade -- feet fall per one thousand feet.

(b) At -- miles from headgate: width on top (at water line) -- feet; width on bottom -- feet; depth of water -- feet; grade -- feet fall per one thousand feet.

(c) Length of pipe, 2,100+ ft.; size at ~~intake~~ well 12 in.; in size at 2,100+ ft. from intake 12 in.; size at place of use 12 in.; difference in elevation between ~~intake~~ well and place of use, Variable ft. Is grade uniform? Pressure system Estimated capacity, 5.0 sec. ft.

10. If pumps are to be used, give size and type 2,000 gpm Vertical Turbine Well Pump

Give horsepower and type of motor or engine to be used 450 horsepower Electric Motor

11. If the location of the well, tunnel, or other development work is less than one-fourth mile from a natural stream or stream channel, give the distance to the nearest point on each of such channels and the difference in elevation between the stream bed and the ground surface at the source of development

Distance to Columbia River - 400 feet +

Difference in elevation between stream bed and ground surface at well - 40+ ft.

12. Location of ~~area to be irrigated or~~ place of use

Township N. or S.	Range E. or W. of Willamette Meridian	Section	Forty-acre Tract	Number Acres To Be Irrigated
5 N.	28 E.	10	NE 1/4 of SE 1/4	--
5 N.	28 E.	10	SE 1/4 of SE 1/4	--
5 N.	28 E.	11	SW 1/4 of NE 1/4	--
5 N.	28 E.	11	SE 1/4 of NW 1/4	--
5 N.	28 E.	11	NE 1/4 of SE 1/4	--
5 N.	28 E.	11	NW 1/4 of SE 1/4	--
5 N.	28 E.	11	SE 1/4 of SE 1/4	--
5 N.	28 E.	11	SW 1/4 of SE 1/4	--
5 N.	28 E.	11	NE 1/4 of SW 1/4	--
5 N.	28 E.	11	NW 1/4 of SW 1/4	--
5 N.	28 E.	11	SE 1/4 of SW 1/4	--
5 N.	28 E.	11	SW 1/4 of SW 1/4	--

(If more space required, attach separate sheet)

(Continued on attached sheet)

Character of soil --

Kind of crops raised --

G 3112

RECEIVED
AUG 25 1966
STATE ENGINEER
SALEM, OREGON

Continuation of Item 12 of Application for a Permit

To Appropriate the Ground Waters of the State of Oregon

T. N. or S.	Range E. or W. of Willamette Mer.	Section	Forty-acre Tract	Number Acres To Be Irrigated
5 N.	28 E.	12	NE 1/4 of SE 1/4	--
5 N.	28 E.	12	NW 1/4 of SE 1/4	--
5 N.	28 E.	12	SE 1/4 of SE 1/4	--
5 N.	28 E.	12	SW 1/4 of SE 1/4	--
5 N.	28 E.	12	NE 1/4 of SW 1/4	--
5 N.	28 E.	12	NW 1/4 of SW 1/4	--
5 N.	28 E.	12	SE 1/4 of SW 1/4	--
5 N.	28 E.	12	SW 1/4 of SW 1/4	--
5 N.	28 E.	14	NE 1/4 of NE 1/4	--
5 N.	28 E.	14	NW 1/4 of NE 1/4	--
5 N.	28 E.	14	SE 1/4 of NE 1/4	--
5 N.	28 E.	14	SW 1/4 of NE 1/4	--
5 N.	28 E.	14	NE 1/4 of NW 1/4	--
5 N.	28 E.	14	SE 1/4 of NW 1/4	--
5 N.	28 E.	14	NE 1/4 of SE 1/4	--
5 N.	28 E.	14	NW 1/4 of SE 1/4	--
5 N.	28 E.	14	NE 1/4 of SW 1/4	--

MUNICIPAL SUPPLY—

13. To supply the ~~City of~~ Port of Umatilla

in Umatilla county, having a present population of NA

and an estimated population of NA in 19

ANSWER QUESTIONS 14, 15, 16, 17 AND 18 IN ALL CASES

14. Estimated cost of proposed works, $ 190,000

15. Construction work will begin on or before 15 September 1966

16. Construction work will be completed on or before 1 October 1967, 10-1-94

17. The water will be completely applied to the proposed use on or before 1 October 1970, 10-1-94

18. If the ground water supply is supplemental to an existing water supply, identify any application for permit, permit, certificate or adjudicated right to appropriate water, made or held by the applicant. --

H. D. Whitacre
Secretary
(Signature of applicant)

Remarks:

STATE OF OREGON,
County of Marion, } ss.

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for completion

In order to retain its priority, this application must be returned to the State Engineer, with corrections on or before October 12, 19 66.

WITNESS my hand this 12th day of August, 1966

RECEIVED
AUG 25 1966
STATE ENGINEER
OREGON

CHRIS L. WHEELER
STATE ENGINEER

By Larry W. Schroeck
ASSISTANT

STATE OF OREGON, } ss.
County of Marion, }

PERMIT

This is to certify that I have examined the foregoing application and do hereby grant the same, SUBJECT TO EXISTING RIGHTS and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 4.46 *cubic feet per second measured at the point of diversion from the well or source of appropriation, or its equivalent in case of rotation with other water users, from* a well

The use to which this water is to be applied is municipal

If for irrigation, this appropriation shall be limited to ——— *of one cubic foot per second or its equivalent for each acre irrigated and shall be further limited to a diversion of not to exceed* ..... *acre feet per acre for each acre irrigated during the irrigation season of each year;* .....

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The well shall be cased as necessary in accordance with good practice and if the flow is artesian the works shall include proper capping and control valve to prevent the waste of ground water.

The works constructed shall include an air line and pressure gauge or an access port for measuring line, adequate to determine water level elevation in the well at all times.

The permittee shall install and maintain a weir, meter, or other suitable measuring device, and shall keep a complete record of the amount of ground water withdrawn.

The priority date of this permit is August 10, 1966

Actual construction work shall begin on or before November 3, 1967 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19*68

Extended to Oct. 1 1971 Extended to Oct 1979 Extended to Oct. 1, 1984 Extended to Oct. 1 1973 Extended to Oct. 1977

*Complete application of the water to the proposed use shall be made on or before October 1, 19*69

Extended to Oct. 1 1971 Extended to Oct. 1979 Extended to Oct. 1, 1984 Extended to Oct. 1 1978 Extended to Oct. 1 1975 Extended to Oct. 1977

WITNESS my hand this 3rd *day of* November, 1966

"B" Ext. to: 10-1-2029

"C" Ext. to: 10-1-2029

[signature]
STATE ENGINEER

BC- Extended to October 1, 1969, 10-1-99

PC

Application No. G- 3612

Permit No. G- G 3112

PERMIT

TO APPROPRIATE THE GROUND WATERS OF THE STATE OF OREGON

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 10th day of August, 1966, at 1:00 o'clock P M.

Returned to applicant:

Approved: November 3, 1966

Recorded in book No. ..... of Ground Water Permits on page G 3112

CHRIS L. WHEELER
STATE ENGINEER

Drainage Basin No. 7 page 57

State Printing
$28.00

STATE OF OREGON

COUNTY OF UMATILLA

ORDER APPROVING A CHANGE IN PLACE OF USE

Pursuant to ORS 537.211, after notice was given and finding that no injury to existing water rights would result, this order approves, as conditioned or limited herein, **PERMIT AMENDMENT** T-8701 submitted by

PORT OF UMATILLA
P.O. BOX 879
UMATILLA, OREGON 97882

CITY OF UMATILLA
P.O. BOX 130
UMATILLA, OREGON 97882.

The permit to be modified is Permit G-3112 with a date of priority of AUGUST 10, 1966. The permit allows the use of A WELL, in the COLUMBIA RIVER BASIN, for MUNICIPAL USE. The amount of water to which this permit is entitled is limited to an amount actually beneficially used and shall not exceed 4.46 cubic feet per second, if available at the original well; NE¼ SW¼, SECTION 11, T 5 N, R 28 E, W.M.; 2045 FEET NORTH AND 1790 FEET EAST FROM THE SW CORNER OF SECTION 11, or its equivalent in case of rotation, measured at the well.

This is an order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2).

Pursuant to ORS 536.075 and OAR 137-004-080 and OAR 690-01-005 you may either petition for judicial review or petition the Director for reconsideration of this order.

The authorized place of use is as follows:

NE¼ SE¼
SE¼ SE¼
SECTION 10

SW¼ NE¼
SE¼ NW¼
NE¼ SW¼
NW¼ SW¼
SW¼ SW¼
SE¼ SW¼
NE¼ SE¼
NW¼ SE¼
SW¼ SE¼
SE¼ SE¼
SECTION 11

NE¼ SW¼
NW¼ SW¼
SW¼ SW¼
SE¼ SW¼
NE¼ SE¼
NW¼ SE¼
SW¼ SE¼
SE¼ SE¼
SECTION 12

NE¼ NE¼
NW¼ NE¼
SW¼ NE¼
SE¼ NE¼
NE¼ NW¼
SE¼ NW¼
NE¼ SW¼
NE¼ SE¼
NW¼ SE¼
SECTION 14

TOWNSHIP 5 NORTH, RANGE 28 EAST, W.M.

The right to use water for the above purpose is restricted to beneficial use on the lands or place of use described.

The applicants propose to change the place of use to:

SE¼ SW¼
S½ SE¼
SECTION 8

SW¼ SW¼
SECTION 9

E½ SE¼
SECTION 10

S½ NE¼
SW¼
SE¼
SECTION 11

SW¼
SE¼
SECTION 12

N½ NE¼
N½ NW¼
SECTION 13

NE¼
NW¼
SW¼
N½ SE¼
SECTION 14

NE¼
NE¼ NW¼
S½ NW¼
SECTION 15

S½ NE¼
NW¼
W½ SW¼
SECTION 16

NE¼
NW¼
SW¼
N½ SE¼
SECTION 17

E½ NE¼
S½ SW¼
SE¼
SECTION 18

NE¼ NE¼
SECTION 19

NE¼ NE¼
W½ NE¼
NW¼
SW¼
W½ SE¼
SECTION 20

W½ NE¼
E½ NW¼
SECTION 29

TOWNSHIP 5 NORTH, RANGE 28 EAST, W.M.

SW¼
NW¼ SE¼
S½ SE¼
SECTION 7

N½ NE¼
N½ NW¼
SECTION 18

TOWNSHIP 5 NORTH, RANGE 29 EAST, W.M.

THIS CHANGE TO AN EXISTING WATER PERMIT MAY BE MADE PROVIDED THE FOLLOWING CONDITIONS ARE MET BY THE WATER USER:

1. All other terms and conditions of the permit remain the same.

Permit G-3112, in the name of PORT OF UMATILLA is amended as described herein.

WITNESS the signature of the Water Resources Director, affixed JUL 29 2002.

For Paul R. Cleary, Director

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.

UMAT 3343

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

State Well No. 5N/28-11 ca
State Permit No. UMAT 5561 WS9

(1) OWNER:
Name PORT OF UMATILLA
Address McNARY, OREGON

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☒ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☒ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

CASING INSTALLED: Threaded ☐ Welded ☒
24" Diam. from 0 ft. to 109 ft. Gage 375
20" Diam. from 99 ft. to 345 ft. Gage 375
" Diam. from ft. to ft. Gage

PERFORATIONS: Perforated? ☐ Yes ☒ No.
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.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot size Set from ft. to ft.
Diam. Slot size Set from ft. to ft.

(8) WATER LEVEL: Completed well.
Static level 94 ft. below land surface Date 5/24/67
Artesian pressure lbs. per square inch Date

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? STRASSER
Yield: 2000 gal./min. with 48 ft. drawdown after 23 hrs.
2500 " 74 " 3 "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 75° Was a chemical analysis made? ☐ Yes ☒ No

(10) CONSTRUCTION:
Well seal—Material used CEMENT GROUT
Depth of seal 97 FT. TO 109 FT. ft.
Diameter of well bore to bottom of seal 30 in.
Were any loose strata cemented off? ☐ Yes ☒ No Depth
Was a drive shoe used? ☐ Yes ☒ No
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(11) LOCATION OF WELL:
County UMATILLA Driller's well number 4250
~~SE~~ NE ¼ ~~NE~~ SW ¼ Section 11 T. 5N R. 28E W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG: Diameter of well below casing 12
Depth drilled 850 ft. Depth of completed well 850 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 as drilling proceeds. Note drilling rates.

MATERIAL	From	To	SWL
SEE ATTACHED SHEET			

Work started OCT 25 1966 Completed JUNE 6 1967
Date well drilling machine moved off of well JUNE 8 1967

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Paul O Rydman (Drilling Machine Operator) Date JULY 18, 1967
Drilling Machine Operator's License No. 53

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 R.J. STRASSER DRILLING Co (Person, firm or corporation) (Type or print)
Address 8110 SE SUNSET LANE PORTLAND ORE
[Signed] Robert L. Strasser (Water Well Contractor)
Contractor's License No. 10 Date JULY 18, 1967

(USE ADDITIONAL SHEETS IF NECESSARY)

PRospect 1-2355

5N/28-11 Umatilla ca

R. J. Strasser Drilling Co.

8110 S. E. Sunset Lane
Portland, Oregon 97206

Log of Well for Port of Umatilla

fine sand	0'- 21'
coarse sand	21'- 26'
coarse sand and large gravel	26'- 30'
gravel, some binder	30'- 41'
gravel and boulders	41' - 56'
sand silt and large gravel	56'- 98'
black basalt	98'-109'
broken basalt	109'-119'
red lava	119'-134'
broken brown lava	134'-150'
red lava	150'-161'
broken lava	161'-164'
medium hard grey basalt	164'-172'
hard grey basalt	172'-253'
broken black basalt	253'-262'
blue clay and baslt	262'-286'
medium hard grey basalt	286'-291'
hard grey basalt	291'-317'
broken grey basalt	317'-320'
broken black basalt and some clay	320'-341'
medium hard grey basalt	341'-355'
hard grey basalt	355'-386'
broken grey basalt	386'-401'
medium hard grey basalt	401'-405'
hard grey basalt	405'-434'
broken brown basalt	440'-444'
medium hard grey basalt	444'-450'
broken grey basalt	450'-464'
broken brown basalt	464'-487'
medium hard black basalt	487'-512'
hard grey basalt	512'-524'
medium hard black basalt	524'-565'
medium hard brown basalt	565'-573'
medium hard black basalt	573'-590'
hard grey basalt	590'-604'
medium hard black basalt	604'-652'
hard grey basalt	652'-688'
black lava and clay	688'-696'
hard grey basalt	696'-706'
porous broken black lava	706'-719'
medium hard black basalt	719'-740'
hard black basalt	740'-762'
porous black basalt	762'-773'
hard black basalt	773'-793'
hard grey basalt	793'-804'
medium black vesicular basalt	804'-811'
broken black porous basalt	811'-827'
broken black and brown basalt	827'-832'
medium hard black basalt	832'-850'

CLAIM OF BENEFICIAL USE AND SITE REPORT

PERMIT NUMBER: **G-3112**

IN THE NAME OF: PORT OF UMATILLA with the CITY OF UMATILLA
P.O. BOX 130 (CITY'S ADDRESS)
UMATILLA, OREGON 97882
(541) 922-3226

INFORMATION: The Port of Umatilla submitted an application to develop a water source. Application file number G-3612 was accepted and Permit number **G-3112** was issued on November 3, 1966. Permit **G-3112** authorizes the use of 4.46 cfs of water from a well for municipal purposes. The Port of Umatilla's development of Permit **G-3112** has been done in cooperation with the City of Umatilla. The well drilled under this permit is locally known as the Port Well. On September 20, 1999, the Port of Umatilla, in cooperation with the City of Umatilla, submitted an extension of time application for Permit **G-3112**. This extension of time request was granted. A Final Order, dated June 11, 2002, was published, creating the deadline for applying water to full beneficial use of October 1, 2029. A permit amendment, Transfer **T-8701** was submitted and approved July 29, 2002. This order approved a change in place of use from the Port of Umatilla's water service area to the City of Umatilla's water service area. The City of Umatilla's water service area includes the Port of Umatilla's water service area.

The City of Umatilla developed a draft Water System Master Plan in 2001. This Master Plan was prepared by Anderson Perry & Associates, Inc. The focus of the study was the overall water system, including water supply, storage, and distribution systems. Proposed improvements were developed in cooperation with the Umatilla City Council and City staff. One of the proposed improvements identified was obtaining additional water supply capacity. One proposed option to accomplish this goal was the purchase or lease of the existing Port Well. The Port of Umatilla and the City of Umatilla entered into a 20-year lease agreement for the City to rehabilitate and further develop the Port Well.

In 2002 the City of Umatilla undertook the Port Well Pump Station and Transmission Line project. The Project Manager for this project was Jess Holt, P.E., of Anderson Perry & Associates, Inc. Jess, in cooperation with the City of Umatilla, supervised the removal of all existing pumping equipment. The well was then disinfected and prepared for new

pumping equipment. The initial site visit for well design and construction took place in August 2001. The well project, including type of use, extent of use, capacity of system, and Extension of Time conditions, was reviewed with the City of Umatilla.

SOURCE: Well: The well is 850 feet deep with a 24-inch (I.D.) welded steel casing set to 109 feet and a 20-inch (I.D.) welded steel casing set from 99 feet to 345 feet. From 345 feet to 850 feet is a 12-inch diameter open rock hole. The well has a cement grout surface seal down to 109 feet. It has a new Robbco brand submersible pump. The well was drilled by R. J. Strasser Drilling Co., 8110 S.E. Sunset Lane, Portland, Oregon 97206, beginning October 25, 1966, and completed June 6, 1967. The static water level on May 24, 1967, was reported as 94 feet below land surface in the water supply well report. The static water level at the time of the new pump installation on May 20, 2002, was 100 feet below land surface. The static water level on December 19, 2002, was 100 feet below land surface. To date, the City of Umatilla public works personnel have not seen any significant variation in the static water level. A pump test of the well by Purswell Pump, P.O. Box 264, Hermiston, Oregon 97838, shows an average drawdown of 52 feet at a rate of 1,860 gpm. There is a 2-inch well casing access port on the well. There are two 1-1/4 inch PVC access tubes: one for a pressure transducer conduit and one for an air line. Enclosed are copies of the water well report and pump test.

WELL PUMPS AND MOTORS: The well has a 250 Hp Hitachi electric 14-inch submersible motor, 3-phase, 460 volt, 60 Hz, with a maximum speed of 1,800 rpm. The pump is a Robbco brand, model 14JME, 5 stage, submersible turbine pump. A Robbco pump performance test is enclosed.

CONVEYANCES: The well is located inside a pump station building. It has a 12-inch ductile iron discharge pipe, a PVC jacketed copper power cable for submersible electrical service, a 3/8-inch HDPE airline for the drawdown gauge, and a 1-1/4 inch diameter Schedule 40 PVC pipe housing the pressure transducer cable for the transmitter. The pump discharge piping has a flowmeter and indicates flow in gpm and totalization in gallons. The pump station building is 19 feet 4 inches long, and 12 feet 7 inches wide. It houses a flowmeter indicator-totalizer-transmitter linked via telemetry to the City shops, a pressure gauge, and a well water level drawdown gauge. An electrical panel adjacent to the well is equipped with a pump motor starter, telemetry, and controls. The 12-inch ductile iron pipe exits the pump station and is connected with a

series of valves and a 12-inch ductile iron pipe water transmission line to the City of Umatilla's 1,800,000-gallon steel water storage reservoir, known locally as the McNary Reservoir. The McNary Reservoir is connected to the water distribution system serving the City of Umatilla's water service area.

CAPACITY: The City of Umatilla operates the well based on the water level of the reservoir. This on-demand system is activated through telemetry and controls as needed to keep the reservoir at a proper operating level.

The well was pumped at 2,000 gpm during the initial pump test of the pump by Purswell Pump with an average drawdown of 60 feet. Enclosed is a copy of that pump/motor installation record. The design pumping rate of the pump for maximum efficiency is 2,000 gpm for the normal operating condition of a near full reservoir. When the water level in the reservoir is down, the pump discharges approximately 2,100 gpm. The average pumping rate, as observed at the flowmeter, is 2,002 gpm with a full reservoir and after the pump has been in operation for a while. The pumping rate of 4.46 cfs or 2,002 gpm, the permitted rate, can be achieved. The reported capacity of the pump is verified by the attached pump performance test.

The total capacity of the pump is 2,000 gpm or 4.46 cfs at 365 feet total dynamic head (TDH). The rate of use allowed under Permit **G-3112** is 4.46 cfs. The City of Umatilla, with the cooperation of the Port of Umatilla, has perfected the water right to the full permitted rate of use of 4.46 cfs.

USE: Use is Municipal within the City of Umatilla's water service area. This is a change in place of use from the Port of Umatilla's water service area. This change in place of use was approved under Permit Amendment **T-8701**, Special Order Volume 56, Page 718, signed July 29, 2002. The Port's water service area is still included within the City's water service area.

LIFT: For the well, the pump operating level lift, measured as the mean elevation difference between the pumping water level of ± 223 feet above sea level (± 383 feet ground surface elevation - ± 160 feet) and the maximum operating level of the McNary water storage reservoir (± 524 feet above sea level), is:

Lift = 524 feet - 223 feet = ± 301 feet

Primary design capacity (TDH) was calculated as 2,000 gpm at

355 feet TDH.

SURVEY TIE: Location for the well was surveyed using a Topcon Robotic total station with control ties using the same instrument. Horizontal datum is based on Oregon North (NAD 83) state plane coordinates, converted to a local datum plane. Vertical datum is NAVD 88. The tie to the Southwest corner of Section 11, T. 5 N., R. 28 E. is protracted and based on record information.

SPECIAL CONDITIONS AND REMARKS: The conditions of the permit and extension of time and transfer have been met as described in this report. The City of Umatilla is currently developing a plan to report the monthly water usage and static water level of the permitted well to the Water Resources Department. The reference water level or average static water level can be continuously monitored via telemetry at the City shops. Water was put to beneficial use from this well in June 2002. The full rate of 4.46 cfs, as authorized by the permit and extension of time, should be certified and considered perfected under the terms of this Water Right.

This final proof survey and inspection of the use, as found to be completed under the terms and conditions of Permit No. **G-3112** and the extension of time for that permit, and Transfer **T-8701** was completed by me and Jess Holt, P.E., working under my direct supervision. Anderson Perry & Associates, Inc., was the design engineering team for the City of Umatilla Port Well Pump Station and Transmission Line Project - 2002. Anderson Perry & Associates, Inc., in cooperation with the City of Umatilla, also administered the construction management and construction inspection of the project. The facts contained in this report and accompanying claim of beneficial use map are correct to the best of my knowledge.

I, Larry Clucas, City Manager of the City of Umatilla, Oregon, agree to the findings of the Certified Water Right Examiner and do submit this Site Report and Map as my Claim of Beneficial Use of Water as provided under the terms and conditions of Permit No. **G-3112**

and the extension of time for that permit and Transfer **T-8701.**

_____

Larry Clucas, City Manager

APPENDIX D

Port Well Lease

LEASE

1.0 DATE

The date of this Lease is February 13, 2001.

2.0 PARTIES

The parties to this Lease are the Port of Umatilla ("Port") and the City of Umatilla ("City").

3.0 BACKGROUND

3.1 The Port owns the land described in Exhibit A, attached hereto, and by this reference incorporated herein. The leased property shall hereafter be referred to as the "Property".

3.2 On the Property there is a Well with a water right permit No. G-3112 ("Well"). The Well is identified in filings with the Water Resources Department as Port of Umatilla Well No. 1.

3.3 The Port has applied for an extension of time within which to prove up on the water right permit associated with the Well. The application for extension is pending at the Water Resources Department.

3.4 In 1974 an intertie between the City and the Port occurred which resulted in the City leasing the area water supply system from the Port and operating it.

3.4.1 In 1994 the Port conveyed the water supply system, excepting the Property and Well, to the City. A copy of the Intergovernmental Cooperation Agreement by which was accomplished, is attached hereto, as Exhibit B, and by this reference incorporated herein.

3.5 The Port and the City now desire to enter into a lease for the Property and Well.

4.0 DESCRIPTION OF LEASED PROPERTY

The Port leases to the City and the City leases from the Port the Property and Well described herein.

5.0. TERM OF LEASE

5.1 The term of this Lease will be from February 13, 2001 to February 12, 2040.

5.2 The City may terminate this Lease on 90 days written notice to the other party.

5.3 If the City terminates this Lease prior to 2040, pursuant to Paragraph 5.2 above, the City shall have no claim against the Port for any sums expended on the Property or for any other reason whatsoever.

6.0 RENT

6.1 The City shall pay as rent for said Property and Well $100.00 per year and such other costs associated with the Property and Well as set forth herein. The first year's rent shall be due on the date this Lease is executed and similar payments shall be due on or before July 1 each year thereafter.

6.2 The City agrees to pay to the Port all money owing according to the terms of this Lease as soon as it is due. If not paid when due, interest at the rate of 14% per annum will be charged to the City, but the charging of such interest shall not be a waiver of timely payments.

7.0 POSSESSION

The City is entitled to possession of the Property and Well upon payment of the initial payment described above.

8.0 WELL

8.1 The Well was drilled, cased, and tested in 1967 and consists of the following:

a) A pump and motor purchased and installed in 1968.

b) A pipeline purchased and installed in 1968.

8.2 The City shall be responsible for the cost of all work necessary to bring the Well, pump, motor, pipeline, and associated other components and replacements, up to a proper standard for use in a municipal water supply system.

8.3 The City shall be responsible for the cost of all repairs and maintenance of the Well, pump, motor, pipeline, and other accessories and replacements associated therewith.

8.4 The City acknowledges and agrees that the Port is not promising, agreeing, or covenanting in any way to the City for any water quantity or quality from the Well. The City has inspected the Property and Well, is familiar with it, and accepts the Property and Well "AS IS", without any warranties, expressed or implied.

8.4.1 The City further agrees that if the quantity or quality of the water is diminished in any way, the Port has no liability to the City for such diminishment.

8.5 The parties shall each pay for one-half of the cost for obtaining the extension of the water right permit referred to above and use their best efforts to obtain the extension, but the Port does not guarantee that any extension will be obtained.

8.6 The City shall use the permitted water right in accordance with its terms and in accordance with all applicable statutes, rules, regulations and ordinances.

8.7 The City shall cooperate with the Port at any time the Port elects to certificate the water right permit and each party to this agreement shall pay one-half of the cost of final proof survey, and other costs associated with said certification.

9.0 USE OF WATER

9.1 As set forth more particularly in Paragraph 6(a) of Exhibit B attached hereto, the City agrees to use the water from the Well primarily for the industrial water users in the Port's McNary Industrial Park. Attached hereto, marked Exhibit C, and by this reference incorporated herein, is a map depicting the McNary Industrial Park.

9.2 The City may divert Well water for emergency uses, but the emergency uses shall be subordinate and inferior to the primary use of the water and Well for the McNary Industrial Park users.

9.3 If the Port's McNary Industrial Park users are fully served and there is excess water available, then the City may divert Well water to other users within the City limits as long as such deliveries are in accordance with Oregon Water Law.

10.0 UTILITIES

The City shall pay for all utility costs associated with the use of the Well and Property.

11.0 LIENS

The City shall pay as due all claims for work done on and for services rendered or materials furnished to the Property incurred and owing by the City and shall keep the Property free of any liens resulting from the acts of the City. If the City fails to pay any such claims or to discharge any such liens, the Port, at its option, may do so and may consider the amounts as additional rent. Any amount so added shall bear interest at the rate of 14% per annum from the date expended by the Port and shall be payable upon demand. Such action by the Port shall not constitute a waiver of any right or remedy which the Port may have on account of the City's default.

12.0 COVENANTS OF TITLE

The Port covenants that the Port is the owner of the Property free of any encumbrance that would impair or interfere with the City's rights under this Lease, and that the Port has full right and authority to lease the Property described herein.

13.0 ACCESS

The Port will make available to the City sufficient access to and from the Property to allow the City to operate and maintain the Well and Property. The City shall only use the access identified by the Port and shall not use or cross any other property of the Port.

14.0 WASTE

The City shall not commit or permit to be committed any waste, strip, damage to or misuse of the Property and Well. The City shall conduct all Well operations in a reasonable and husbandlike manner and consistent with good municipal water use practices. All fences, gates, and other improvements to the Property, including the Well, pump, motor, and pipeline, shall be maintained in good condition and shall be returned to the Port upon termination of this Lease in as good a condition as they were upon execution of this Lease, reasonable wear and tear excepted.

15.0 INDEMNIFICATION

The City shall defend, indemnify and hold the Port harmless from all claims, losses, liabilities, causes of action or suit, arising out of or related to any activity of the City, including, but not limited to, the delivery of water or failure to deliver water from the Well, or those on the Property at the request of or for the benefit of the City or any condition of the Property in the possession of or under the control of the City.

16.0 COMPLIANCE WITH LAW

The City shall comply with all governmental rules and regulations with respect to the City's activities on the Property and the use of the Property and Well.

17.0 EMINENT DOMAIN

17.1 In the event of a taking of any of the Property by eminent domain or condemnation, or settlement under threat of condemnation, the City shall not be entitled to any compensation on account of the value of the leasehold interest of the City.

17.2 Provided, however, that the City shall have a right to recover from the condemnation compensation fund, those monies expended by the City on the Property that increased the Property's value. In other words, the City's right to recover monies herein is not conditioned on the amount of money expended by the City, but rather on how much those expenditures increased the Property's value.

17.2.1 By way of example, if the condemned Property has a fair market value of $100,000 and the City's improvements increase the fair market value to $150,000, then the City would be entitled to only $50,000 of the condemnation compensation fund of $150,000, irrespective of the fact that the City may have expended $200,000 on the City Property.

18.0 ASSIGNMENT

No part of the Property may be assigned, mortgaged or subleased nor may a right of use of any portion of the Property be conferred on any third person by any other means without the prior written consent of the Port. This provision shall apply to all transfers by operation of law and transfers to and by trustees in bankruptcy, receivers, administrators, executors and legatees. No consent in one instance shall prevent the provision from applying to a subsequent instance. Any such assignment, mortgage or sublease without prior written consent is void.

19.0 DEFAULT

The following shall be events of default: failure to pay rent when due; failure of the City to comply with any other term or condition or fulfill any other obligation of the Lease within ten days after written notice by the Port specifying the nature of the default with reasonable particularity; abandonment by the City of the Property. If the default is of such a nature that it cannot be completely remedied within the ten day period, this provision shall be complied with if the City begins correction of the default within the ten day period and thereafter proceeds with reasonable diligence and in good faith to effect the remedy as soon as practicable.

In the event of default, the Port shall have the right to re-enter, take possession of the Property and remove any persons or property by legal action or by self-help with the use of reasonable force and without liability for damages. Such right shall be cumulative and in addition to all other remedies available to the Port under applicable law.

20.0 ATTORNEY'S FEES

In case litigation is instituted arising directly or indirectly out of this Lease the losing party shall pay to the prevailing party its reasonable attorney's fees and court costs as determined by the court including those on appeal.

21.0 NOTICES

Any notice or payment required or permitted under this Lease shall be given when actually delivered or when deposited in the United States mail as certified mail addressed as follows:

Port of Umatilla
PO Box 879
Umatilla, Oregon 97882

City of Umatilla
300 Sixth Street
Umatilla, Oregon 97882

or to such other address as may be specified from time to time by either of the parties in writing.

22.0 INSPECTION OF PROPERTY

The Port reserves the right to go upon the Property at reasonable and proper times to inspect the same for the purpose of determining that the Lease is being properly observed and that all of the terms are being kept and performed by the City.

23.0 IMPROVEMENTS

Any improvements to the Property and Well by the City shall remain the property of the Port upon termination of this Lease unless the City obtains the written consent of the Port to remove said improvements prior to the time the improvements are placed on the Property.

24.0 CONDITION ON TERMINATION

The City agrees to deliver the Property to the Port upon the termination of this Lease in as good a condition as it was on this date, normal wear and tear excepted.

25.0 TIME IS OF THE ESSENCE

The parties acknowledge and agree that time is of the essence with respect to all of the terms, conditions and provisions of this Lease.

26.0 CAPTIONS AND INTERPRETATION

The paragraph headings used herein are for the convenience of reading only and are not intended to either limit or broaden the terms hereof. This Lease shall be interpreted as if it was prepared jointly by both parties.

PORT OF UMATILLA

By _____

CITY OF UMATILLA

By George Hash

EXHIBIT A

Port of Umatilla Well No. 1 located on a 25' x 25' parcel described as follows:

A Well located in the Northeast Quarter of the Southwest Quarter of Section 11, Township 5 North, Range 28 E.W.M., Umatilla County, described as follows:

Beginning 2,045' North and 1,795' East from the Southwest corner of Section 11, Township 5 North, Range 28 E.W.M.; thence South 12.5' to the true point of beginning; thence East 12.5'; thence North 25'; thence West 25'; thence South 25'; thence East 12.5' to the true point of beginning.

Said parcel being within the Northeast Quarter of the Southwest Quarter of Section 11, Township 5 North, Range 28, E.W.M., Umatilla County, Oregon.

INTERGOVERNMENTAL COOPERATION AGREEMENT

THIS AGREEMENT is entered into this 28 day of June, 1994, by and between the Port of Umatilla, an Oregon municipal corporation (the "Port"), and the City of Umatilla, an Oregon municipal corporation (the "City"); and

WHEREAS, ORS Chapter 190 authorizes intergovernmental cooperation agreements between and among public corporations in the interests of furthering economy and efficiency in local government; and

WHEREAS, the Port has a mission to support, promote, and build economic development within the Port district including the McNary Industrial Park, which efforts the City supports; and

WHEREAS, the Port has a further mission to develop employment opportunities within the Port district including the McNary Industrial Park, which efforts, the City encourages and supports; and

WHEREAS, the Port currently owns, and the City currently manages and operates under a lease with the Port, infrastructure devoted to the present and future usage of industry within and around the McNary Industrial Park; and

WHEREAS, the Port currently owns property and may in the future acquire additional property, that is, or will be, available for sale to the City and/or to industrial clients in furtherance of the Port's lawful functions and of the Port's goals of economic development and job creation; and

WHEREAS, the City has available to it funding for the development and improvement of its water supply system, a condition of which funding is the City's acquisition of the Port's water system; and

WHEREAS, in consideration of the City's promise to improve, "loop," and expand upon the water supply system now serving the McNary Industrial Park, the Port will agree to transfer its water system to the City and to continue to pay the debt now existing thereon; and

WHEREAS, the current water system is satisfactory for the Port's present purposes, but the Port is willing to assist the City in its efforts to improve its own system providing the Port retains an appropriate level of control over the circumstances and events that affect its ability to attract economic and industrial development into the McNary Industrial Park; and

WHEREAS, the Port, through a regional water supply system, does assist in meeting regional long term industrial and municipal needs for water, and will continue to do so; and

WHEREAS, the Port currently leases to the City the Port's water system, and the lease will expire on July 12, 1996; and

WHEREAS, it is deemed appropriate, just, and equitable by the parties hereto for the Port to transfer its water distribution system in the McNary Industrial Park (except for Port Well No. 1) to the City in exchange for the City's construction of the improvements to the water system in the McNary Industrial Park on the terms and conditions set forth below,

NOW, THEREFORE, IT IS AGREED BY THE CITY AND THE PORT AS FOLLOWS:

1. Transfer of property.

The Port dedicates and conveys unto the City all of its right, title, and interest in its existing water distribution system in the McNary Industrial Park. Attached hereto and by this reference incorporated herein is Exhibit A, which describes in particular the assets transferred to the City.

2. Acceptance of dedication and conveyance.

The City, after a full and complete opportunity to inspect and examine the transferred property, accepts the water system described in Exhibit A. The City accepts all the assets listed AS IS, and with all faults, expressly acknowledging that no warranties of any kind or nature have been offered by the Port nor relied upon by the City.

3. Reservation.

The Port reserves unto itself, and does not transfer, nor agree to transfer, the well known as Port Well No. 1, together with its appurtenances, the reserved assets being described in Exhibit B which is attached hereto and by this reference incorporated herein.

4. Conveyance of real property.

This agreement does not constitute a conveyance of any real property, nor a promise to convey real property, except as expressly set forth in this section. In conjunction with this agreement, the Port shall convey to the City the following:

(a) By way of sale, all that certain property surrounding what is known as the Golf Course Well, surrounding the proposed booster pump station, and surrounding the proposed 1.8 million gallon ground storage tank, said property consisting of approximately .67 acres; and

(b) By way of dedication, easements for construction 40 feet in width, and easements for maintenance and repair 20 feet in width, along all existing water lines conveyed to the City

hereunder, and along all water lines which are a part of the proposed improvements by the City.

5. Proposed improvements.

The City agrees to design, construct, and install at its cost, improvements to the Port's water distribution lines, said improvements being described in the attached Exhibit C, which by this reference is incorporated herein.

6. Obligation to provide service.

(a) Water service and supply. The City agrees to provide to the Port and all present and future business and industrial clients located within the McNary Industrial Park, as it now exists or is hereafter expanded, water service and supply to the extent allowable by the capacity of the water supply system, taking into account all existing and future users of the City water supply system. If the water in Port Well No. 1 becomes available to the water supply system (pursuant to Section 7 hereof), the City will guarantee that the amount of water that can be produced from Port Well No. 1 on a gallon per minute basis will be made available to the McNary Industrial Park, as it then exists or is thereafter expanded, for the Port and its clients.

(b) Fees. The City agrees to charge the Port and its industrial and business clients no more than 110 percent of the in-City rates for all water service and supply and for all hook up fees through and including July 12, 1996. Thereafter, the rates and fees shall be no more than that which is reasonable, and equitable to the general citizenry of the City, to the Port, to the businesses and industries within the Port's industrial park, and to the businesses and industries within the city limits of the City.

7. Well No. 1; transport of water.

It is understood that Port Well No. 1, being retained by the Port, offers to the Port and to its industrial clients an existing and substantial amount of additional water. It is further understood that the transmission lines that would otherwise be used to convey this water to Port clients are being transferred to the City. As part of the consideration for this transfer, the parties agree that should the capacity of the City's system ever be inadequate to service the needs of the Port or its clients, or if for any other reason the parties agree that the water from Port Well No. 1 should be made available to the City water system, they will in good faith negotiate the terms by which the water from Port Well No. 1 is brought on line for distribution to the McNary Industrial Park through the City's water system.

8. Extensions to water distribution system.

It is agreed and understood that from time to time the Port may be able to attract additional and new industrial clients into

the McNary Industrial Park and/or onto additional property that may be owned or acquired by the Port neighboring the industrial park. It is agreed that such clients will be allowed to have access to city water through the existing and improved system. The costs of hook up and of any necessary extension lines shall be borne by the Port or its client.

9. Maintenance of system.

At all times after the execution hereof, the City shall be responsible, at its own cost, to maintain and repair the water system serving the McNary Industrial Park and the Port's clients. However, the Port, or its clients, shall be responsible to bear the costs of repair and maintenance to individual service lines from the point that the service line crosses the property line of the water user.

10. Force majeure.

In the event that the delivery of water to the McNary Industrial Park is prevented or inhibited by causes beyond the reasonable control of the City, such as earthquake, lightning, drought, fire, labor strike, sudden damage from the elements, or other unavoidable casualty, then the City's obligation to supply water shall be reduced to the extent of said interference. This section does not relieve the City from designing and maintaining the water system so as to include and have operable customary or usual safeguards against interference caused by such events.

11. Transfer of employees.

There are no employees of the Port or the City transferring from one to the other as a result of this agreement.

12. Duration of agreement/right of termination.

The duration of this agreement shall be perpetual. The agreement may not be terminated except by mutual agreement of the parties.

13. Restriction on transfer.

The City may not convey, mortgage, transfer, encumber, or lease all, or any portion of, the assets described in Exhibit A or Exhibit C hereto. If the City attempts any such transfer transactions, all right, title, and interest in the property described in Exhibit A and Exhibit C shall immediately become the sole property of the Port of Umatilla, without further consideration. This restriction against encumbrance set forth in this section does not include the encumbrance resulting from the initial bonding transaction contemplated by the City for the funding of the improvements described in Exhibit C.

14. Hold harmless.

Upon the execution hereof, the City agrees to indemnify, defend, and hold harmless the Port, its officers, agents, and assigns, of and from any and all liabilities of any nature associated with the assets transferred hereunder. This includes, but is not limited to, all claims or causes of action arising out of damages to property or person, whether such damages arise by reason of tort, statutory, or contract law. This also includes all claims arising out of any condition of the transferred property, even if the condition existed or arose prior to the execution hereof.

15. Third party beneficiary.

(a) The parties hereto do not intend there to be third party beneficiaries entitled to claim contractual rights hereunder. However, both the Port and the City retain the right to enforce the obligations hereof notwithstanding the fact that the enforcement of certain obligations of the parties may benefit others.

(b) Even though the Port retains the ability to enforce obligations of this contract that may benefit its industrial and business clients, nothing stated herein shall be construed as a guarantee by the Port of the City's performance, nor the taking on of any obligation by the Port to bring action against the City on behalf of the Port's business and industrial clients.

(c) Nothing stated within this section, or within any other part of this agreement shall be construed as any agreement by the parties that the Port's business and industrial clients have limited any right of action that they might otherwise have independent of this agreement, whether such right of action or remedies exists by way of contract, implied contract, tort law, or otherwise.

16. Authority; local regulations.

By their signatures below, the parties represent to each other that this agreement is not in violation of their respective charters, resolutions, ordinances, comprehensive plans, or other internal policies or regulations.

17. Attorney's fees.

The rights and obligations hereof may be enforced in a court of competent jurisdiction. This agreement shall at all times be governed by the laws of the State of Oregon, and venue shall be in Umatilla County, Oregon. In the event of litigation arising out of the rights and obligations of this agreement, the prevailing party shall be entitled to its costs, disbursements, expert witness fees, and all expenses associated with any trials and appeals therefrom.

DATED this 28 day of June, 1994.

CITY OF UMATILLA

By George Hash
George Hash, Mayor

ATTEST:

Linda Gettmann
City Recorder

PORT OF UMATILLA

By Marjorie L Soff
~~President~~ Treasurer

By Joe C McLaughlin
Secretary

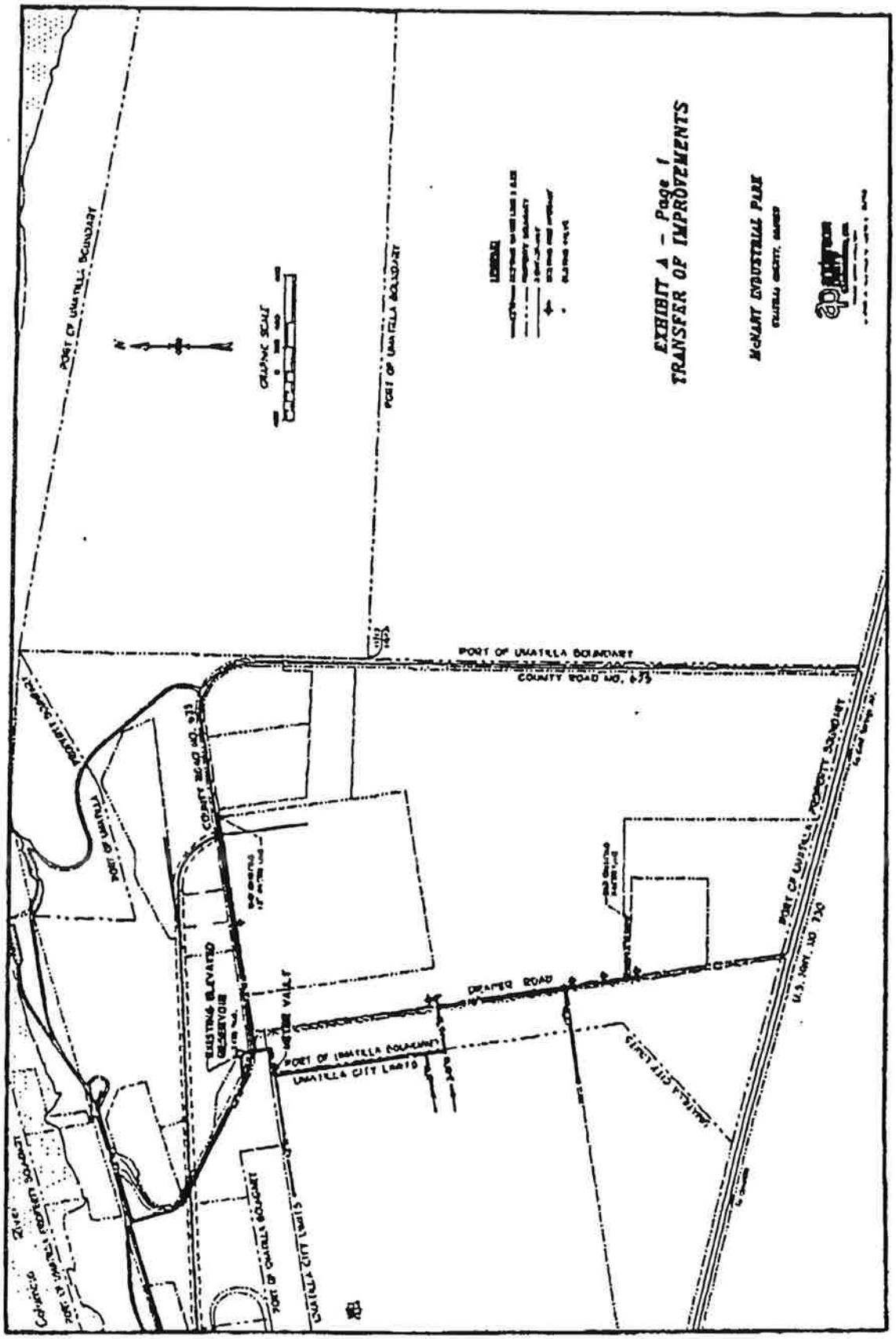


EXHIBIT B
PAGE 7 OF 10

DISTRIBUTION SYSTEM INVENTORY

Line to Corps of Engineers McNary Swimming Beach

1. 1 - Double 12" saddle strap with 2" tap.
2. 10' - 2" galvanized pipe with installation fittings.
3. 1 - 12" X 90 degree C.I. elbow.
4. 73' - 12" cast iron pipe.
5. 2,982' - 12" asbestos cement pressure pipe.
6. 2,982' - buried electrical & telemetering cable assembly
7. 100' - 10" concrete pipe.
8. 3 - 12" X 12" X 12" Flg TEE, Bld Flg End.
9. 1 - 12" gate valve flange with valve box.
10. 2 - 12" gate valve with valve box.
11. 5 - Fire hydrant assemblies.

    Typical fire hydrant assemblies:

    12" X 12" X 6" Flange TEE
    6" Flange X MJ valve and valve box
    10' X 6" cast iron pipe (average)

12. 1 - 125,000 gallon ellipsoidal elevated steel tank, 156.5' to high waterline.
13. 1 - 12" gate valve.
14. 1 - 12" X 12" X 6" TEE.
15. 1 - 12" Mechanical coupling, miscellaneous fittings and installed equipment in valve pit.
16. 1 - BIF Telemeter transmitter #72528-1.
17. 1 - Waer level control system installation, tank mounted.
18. 1 - 190' #98 chain link fence, including gate, posts, extension arms aand 3 strands of barb wire. 6' fence.
19. 136' - 8" aluminum irrigation pipe with couplers.
20. 1 - adapter - 8" aluminum to 8" galvanized.
21. 2 - 8" galvanized 45 degree Elb.

22. 1 - 8" X 10" nipple.

23. 20' - 8" galvanized pipe.

24. 1 - 8" galvanized to 12" CMP adaptor.

25. 200 lf - 12" CMP galvanized steel pipe with bands.

26. 1 - 12" X 15" reducer for CMP pipe.

27. 220' - 15" galvanized 16 ga St pipe with bands.

McNary Townsite Addition Meter Installation

28. 8 lf - 12" asbestos cement pressure pipe.

29. 320 lf - 8" cast iron pipe.

30. 26 lf - 8" steel pipe.

31. 2 - 8" 45 degree Elb. MJ, CI.

32. 1 - 8" 90 degree Elb. PE, STL.

33. 1 - 12" X 12" X 8" TEE, CL rubber ring and flg.

34. 1 - 8" flanged coupling adaptor CL

35. 2 - 8" mechanical couplings for STL.

36. 1 - 8" Flg valve - class 150.

37. 1 - 6" pressure reducing valve.

38. 1 - Manhole ring and cover.

Johns-Manville Installation

39. 1 - 12" gate valve.

40. 2 - 45 degree Elb.

41. 2,002' - 12" transit pipe

42. 50' CMP 14 ga casing pipe with seals and clamps.

43. 1 - 12" AC pipe plug fitting.

Meter Installations

44. 1 - Neptune Tri-seal 3" dual flow #18963057, including meter vaults and meter installation details. (Tidewater Barge Lines, Inc.)

45. 1 - Neptune Tri-seal 1-1/2" single flow #18809169, including meter vault and meter installation details. (Pendleton Grain Growers, Inc.)

46. 1 - Hersey-Sparling Compound #4863713, including meter vault and meter installation details and valve pit heater. (McNary Townsite Addition to City of Umatilla).

47. 1 - Hays 2" Acu-meter #647100211, including meter vault and meter installation details. (Corps of Engineers).

48. 1 - Rockwell 6" #2259882, including meter vault and meter installation details. (Johns-Manville).

49. Service and meter for Coastal Fiber.

50. Services and meters for Boise Cascade.

51. Service and meter for Forest Recovery.

DESCRIPTION OF WATER SYSTEM IMPROVEMENTS FOR ONION DEHYDRATION PLANT CONSTRUCTED IN 1989

1. 1000 LF of 12-inch, class 150 PVC, AWWA C-900 pipe.
2. 70 LF of 6-inch, class 150 PVC, AWWA C-900 pipe
3. 2 12-inch valves
4. 2 fire hydrants and 6-inch auxiliary valves
5. Flowmeter and vault
6. Connection to previously existing water line

APPENDIX E

Geology and Groundwater Study

CITY OF UMATILLA, OREGON
GROUNDWATER STUDY
JULY 1999

I. INTRODUCTION

GENERAL

This Geology and Groundwater Study was requested by Mr. Jess Holt of Anderson·Perry & Associates, Inc. The work was to be accomplished by June 1, 1999, which has been extended by mutual agreement for approximately one month.

PRIOR REPORTS

The prior report is entitled *"City of Umatilla, Oregon - Water System Study, Including System Energy Evaluation, Operation and Maintenance Information"*, published by Anderson·Perry & Associates, Inc. in 1988. The principal author and researcher was Mr. Jess Holt.

LOCATION

The City of Umatilla is located in Township 5 North, Range 28 East, Willamette Meridian. The City abuts the Columbia River and is divided by the Umatilla River as it flows north to enter the Columbia River. In the area downstream from McNary Dam, the Columbia River is called Lake Umatilla and is the reservoir of the John Day Dam, with a normal pool elevation of 265 feet. In the area upstream of McNary Dam, the Columbia River is called Lake Wallula and is the reservoir of McNary Dam, with a normal pool elevation of 340 feet.

Within Township 5 North, Range 28 East, W.M., the City of Umatilla occupies portions of Sections 8, 9, and 10 downstream of McNary Dam, and portions of Sections 10, 11, and 12 upstream of the Dam. Section 12 (site of the Two Rivers Correctional Institute which is in the S.W. 1/4 of Section 12) could be called the Urban Growth Area. South of this section, the City occupies portions of Sections 14, 15, 16, 17, 18, 19, and 20.

The City in the north boundary area is extremely irregular fitting its boundaries to that of the government-owned land and the shore line; while on the south the boundaries are governed more by topography for development and major highways. The highest elevation is 613 feet in the southeast corner of Section 19. The lowest elevations are the shore line of the two reservoirs, at 265 feet, and 340 feet.

In all reality, the City is divided into residential, industrial, and business areas connected by one mile of Highway 730, which runs parallel to the reservoirs. The City area is shown on Figure 1, identified as the *Vicinity Map* in the 1988 Report. The area is also entered from the south by Highway 395, identified as Umatilla-Hermiston-Stanfield

Highway. Also shown on the Vicinity Map, Figure 1, are the three differing systems: Coyote, Low (Old Town), and McNary High level. Repeated for clarity is an Introduction paragraph from the 1988 Report.

> "The City of Umatilla's water system supplies water to three service areas, each with different pressure and demand requirements. The largest service area is the lower Umatilla area that is comprised of the downtown and central residential area. This service area is known as the Low Level System. The Low Level System is served by the Intertie Reservoir, McFarland Reservoirs, Intertie Well, and McFarland Well. Emergency supply is also available from the McNary High Level System and Coyote Reservoir. The area with the next largest demand is the upper McNary area, including the Port Industrial area, which is referred to as the McNary High Level System. The McNary High Level System is served by the elevated Port Reservoir, the Golf Course Well, and Port Well. Emergency supply to the McNary High Level System is available from the Low Level System via the McNary Booster Pump Station. The third service area is referred to as the South Hill area, or Coyote High Level System. It is served by the Coyote Reservoir and McFarland Booster Pump Station."

POPULATION

Present. Upon completion of McNary Dam (dedication, 1953), the City of Umatilla had a population of 617 in 1960, and 679 in 1970. During 1976-1977, Umatilla annexed the McNary residential and industrial areas and population in 1980 was listed as 3,199. Throughout the 1980s and 1990s, the population remained static at about 3,100 people.

Future. The future population, upon completion of the Two River Correctional Institute (TRCI), will be increased on the order of 100 percent. This is based on a TRCI population of 1,200 inmates and 500 staff. The staff will bring families and business estimated to be on the order of 1,500 people.

PURPOSE

The purpose of this geologic study is to identify the source of the groundwater and its continued supply and use. The purpose of this follow-up report is three-fold:

1. Evaluate the existing City water wells and analyze the data for continued use.

2. Evaluate the potential for a deep basalt well.

3. Evaluate the impact of the TRCI and the overall effect on the City of Umatilla water system.

II. GEOLOGY OF THE UMATILLA BASIN

REFERENCES

This groundwater study is primarily a review of published literature and sufficient field observations to ascertain that the geologic structures are as presented or detailed. These are: published reports, water level records, open-file reports, and recorded water well logs in reports on file with the Oregon State Water Resources Department (WRD). No field mapping was done. The following listed references were heavily utilized in this study and references are made to these publications:

1. *Geology and Ground Water of the Umatilla River Basin*, by G.M. Hogenson, dated 1964. Identified as USGS Water Supply Paper 1920.

   This publication establishes the lithology of the Umatilla Basin and presents a geologic map and geologic section of the Umatilla Basin. This geologic map locates the following geologic features:

   - The Blue Mountain Anticline
   - The Horse Heaven Anticline
   - The Agency Syncline
   - The Rieth Anticline
   - The Service Anticline

   The geologic section extends from Cabbage Hill (approximate Elevation 3700, Section 25, T1N, R33E) to Umatilla, Oregon (approximate Elevation 260, Section 18, T5N, R28E), a distance of 44.5 miles. The stratigraphy of the Columbia River Basalt group is not shown and was unknown at the time. The geologic section does show the continuity of the basalt strata. The bearing of the geologic section is North 55 degrees west and is approximately normal to the Blue Mountain Anticline.

2. *A Brief Description of the Ground Water Conditions in the Ordnance Area, Morrow and Umatilla Counties, Oregon,* by Jack Sieva, WRD, Salem, Oregon - 1966. Water Report #11.

3. *Ground Water Conditions and Declining Water Levels in the Ordnance Area, Morrow and Umatilla Counties, Oregon,* by William B. McCall, WRD, Salem, Oregon - 1975. Water Report #23.

4. *Update of Ground Water Conditions and Declining Water Levels in the Butter Creek Area, Morrow and Umatilla Counties,* by Marc Morton and William Bartholomew, WRD, Salem, Oregon - 1984. Water Report #30.

References 2, 3, and 4 listed above are generally concerned with the development of groundwater in the Butter Creek area. This area is within T1N, 2N, 3N, 4N, and 5N, and

Ranges 26E, 27E, and 28E, approximately 15 miles wide from Irrigon to Umatilla, and 25 miles deep from the Columbia River to the Willamette Base Line.

Each of these reports reaches the conclusion that the water table is declining too rapidly and recommends the strict control of future water well development. Reports 3 and 4 describe the basalt structure to a limited extent, and do record the amount of decline in the water table.

5. *Umatilla Basin Report* - August 1988, Water Resources Department, Salem, Oregon.

   This is a basic data publication and on Pages 40, 41, 42, and 43 lists all the references for the Umatilla Basin, which include the reports cited above. This report lists the streams, and hydrology for these streams. On Page 49, this report lists the Municipal Water Systems and annual consumption for each. On Page 113 are the groundwater control areas of the Umatilla Basin, shown as Figure 8.

   The physical description of the Umatilla Basin as to location and size, geography, geology, and climate is given on Page 3 through 6, and the reader is urged to use this report for that basic information. This data will not be reported in this study.

6. *The Pebble Springs Nuclear Site Safety Study*, Amendment 11, dated 1978.

   This is a comprehensive study, accomplished by Shannon and Wilson, Incl, Geotechnical Consultants, Seattle, Washington, for Portland General Electric, Inc. Authorization for use of information from this report was obtained from PGE librarian, Mr. Bob Webber. This report is a public document. The Pebble Spring site was located in Section 36, T3N, R21E, Willamette Meridian.

   This report establishes the geologic structure and stratigraphy to this downstream area (western side) of the Umatilla Basin. The underlying thought is to project or extrapolate these known geologic conditions into the area of concern.

7. *Geologic Studies of the Columbia Plateau*, a Status Report dated October 1979, prepared for the U.S. Department of Energy by Rockwell International - Rockwell Hanford Operations, Richland, Washington.

   This report covers geologic mapping of the Pasco Basin and extends geologic mapping to the Oregon-Washington boundary and the Washington side of the Umatilla Basin.

REGIONAL GEOLOGY

Physiography. The Umatilla Basin forms a part of the Columbia Plateau Province. The Columbia Plateau is located between the Rocky Mountains to the east and the Cascade Mountains to the west and north. The southern extension is marked by the Basin and Range Province. This Columbia Plateau is a very large area approximately 250 miles north-south and 260 miles east-west.

The Province contains mountainous uplands and high plateaus along with numerous valleys and basins. The one common feature is the underlying rocks which are basalts extruded over a long period of time. Most investigations and authors assign this time to the Miocene Epoch (16 - 6 million years ago).

Structural Changes. Initially, the basalt flows (strata) were considered to be relatively horizontal until disturbed by very large tectonic forces. These large forces disrupted the basalt flows into the present land forms as we see them within the province. They are Yakima Basin, Pasco Basin, Walla Walla Basin, Umatilla Basin, John Day Basin, Grande Ronde Basin, and Lewiston-Clarkston Basin. The uplands are the Blue Mountains, Palouse Plateau, Horse Heaven Hills, Columbia Hills, and in-between areas. These physiographic features have been modified somewhat by erosion and deposition, but are mostly as they were at the end of structural movement.

Sequence of Change. Most investigators assign the time of disturbance to late Miocene, early Pliocene (6 million years ago), extending into middle to late Pliocene time. An early event in this tectonic process was the mountain building of the Blue Mountains. The Blue Mountains are located in both Oregon and Washington and extend in a northeast-southwest direction from Arbuckle Mountain south of Heppner, Oregon to the Lewiston-Clarkston Basin. This is a distance of approximately 140 miles. This arching of the basalt strata reached elevations between 5000 and 6000 feet above mean sea level. The crest of the Blue Mountain Anticline is moderately broad, measured in miles and the flanks have slopes of one to five degrees, with occasional steep areas above 10 degrees. See Geologic Map of Reference No. 1, *Geology and Ground Water of the Umatilla Basin*, by G.M. Hogenson (USGS Water Supply Paper 1620). The direction of dip of the strata is at right angles (normal) to the axis of the Blue Mountain Anticline. Since the anticlinal axis is sinuous (undulating), the dip of the strata change in direction. However, a general statement can be made - that the general direction of the dip of the west flank is to the northwest.

Subsequent to the uplifting of the Blue Mountains, a second application of compressional forces were applied across the west central area of the Columbia Plateau. These subsequent forces produced the Horse Heaven Anticline, Rieth Anticline, Service Anticline, and Shutler Butte Anticline. These geologic features are transverse across the lowlands and basins, and trend into or abut against the Blue Mountains. These subsequent features have been dated as late Pliocene to Pleistocene (6 - 1 million years ago). These geologic time dates are derives from the dating of the sediments trapped by these features.

The importance of these subsequent geologic features to this groundwater study is the modifying effect that these features had upon the dip slopes that resulted from the Blue Mountain Anticline. The Schutler Butte Anticline closed the western end of the Umatilla Basin by raising the basalt strata to elevations of 900 to 1000 feet. The dip slopes from this structure are east or northeast and can be easily viewed in the Columbia River south canyon wall. The Horse Heaven Anticline divided the Umatilla Basin from the Walla Walla and Pasco Basins and extends 60 or more miles in a northwest-southeast direction. This structure rises the strata to elevations of 1900 feet or more. In-between structures, Rieth Anticline and Service Butte Anticline, further divide the Umatilla Basin but to a much smaller degree. The effect is to segment or compartmentize the basin and locally disrupt the basalt strata. See Figure 2 for location of these features.

SITE GEOLOGY

The City of Umatilla occupies a small portion of the Umatilla Basin on the northeast corner. A map showing the subbasin, as Figure 3, is provided to identify the various areas. The City of Umatilla is in Area 5 on the map at T5N, R28E. Area 5 is the largest portion of the Umatilla Basin and contains most of the low lands. Area 5 extends along the Columbia River from Wallula Gap (Oregon-Washington border) west to Willow Creek. The basalt rocks exposed as outcrops in the canyon walls are identified as the Saddle Mountain Formation and the Wanapum Formation.

Figure 4 shows the stratigraphy of the Columbia River Basalt Group. Basalt strata identified in or near the City of Umatilla are the Pamona (Umatilla Butte, Elevation 669, and along the McNary Beach area, Elevation 490), and the Umatilla strata in the Hat Rock Park and Cold Springs Junction area. These basalt flows establish the stratigraphic section in the Umatilla City area. Below these Saddle Mountain strata are the Wanapum Formation, as the strata of Priest Rapids, Rosa, and Frenchman Springs flows. These Wanapum Formation strata are exposed in the canyon walls farther east, rising as the south limb, or flank, of the Horse Heaven Anticline. The south limb of the Horse Heaven Anticline and the west limb of the Rieth Anticline merge into a common slope, coming somewhat southwest.

Stratigraph. All of the wells listed on Table 1 are collared in the Pamona-Umatilla stratus of the Saddle Mountain Formation. This statement is based on rock outcrops in the general area from Cold Springs Junction to City of Umatilla. Log records of two City wells (Intertie and Golf Course are included with this report as is the Port Well). The log record of the McFarland Well is taken from the USGS Water Supply Paper 1620. Each of the well logs show penetrating an interbed-type material which is interpreted as the "Mabton Interbed", a marker bed between the Umatilla strata and the Priest Rapids strata. This is the division between Saddle Mountain Formation and the Wanapum Formation. Having a known depth (elevation) allows an estimate to be made for the thickness of the Wanapum Formation. In the western portion of the Umatilla Basin, the Wanapum Formation has been judged to be 300 to 400 feet thick. This is three strata: the Priest Rapids, Rosa, and Frenchman Springs. Flows of these strata are estimated to be 100 feet in thickness, each. It is also recognized that this estimated thickness can be much larger. However, the purpose of the study is to attempt to establish or identify the formation containing the aquifers which supply the water to these City wells. Using a depth of 300

to 400 feet for thickness of the Wanapum Formation indicates the contact to the Grande Ronde Formation at a depth of 500 to 600 feet. This is a reasonable assumption, and indicates that the aquifers are probably the flow contacts in the first, second, or third flow of the Grande Ronde Formation.

Using that assumption, and knowing the bearing of the dip slope of the basalt rock is to the northwest, allows a map search to be made of the Blue Mountain Anticline.

Blue Mountain Anticline. The Umatilla River course is east to west from Gibbon to Thorn Hollow to Mission to Pendleton. The elevation at Pendleton is 1000± feet rising to 1250 feet at Mission; to 1550 feet at Thorn Hollow; and to 1750 feet at Gibbon. South of the Umatilla River in the above described area, the land mass rises as to the west limb of the Blue Mountain Anticline. In this area, the Blue Mountain Anticline reaches elevations of 3700 feet and is capped by basalts of the Wanapum Formation. However, the Wanapum strata are not continued on the mountain slopes and these are not capable of transmitting water in the confined aquifer.

Therefore, it is reasonable to state that the aquifers in the deep water wells in Umatilla originate in the Blue Mountains in the strata of the Grande Ronde Formation. These aquifer receive the water directly from the snow pack or the stream runoff high on the Blue Mountain slopes. This is in the slope elevations of 3000 to 4000 feet where the Grande Ronde Formation strata are exposed either by structural deformation or by erosion. Once the water enters the strata, it is confined and is controlled by the rock structure. As the Grande Ronde Formation declines in elevation, it reaches the toe section of the mountain and crosses the valley created by the folding of the Ruth Anticline. This valley is part structural and part erosional. Where the strata are cut through (eroded), no water transmission is possible. Where the strata are folded down but still continuous, water is transmitted in the confined aquifers. This synclinal downfolding is as deep as 1,000 feet (reference Indian Agency Wells at Mission). After passing through the syncline, the confined water rises on the east flank of the Ruth Anticline and passes through the anticline at a depth estimated to be greater than the depth of the combined thickness of the Saddle Mountain Formation and Wanapum Formation. This depth is somewhere in the order of 700 tp 1,000 feet. This would place the crest of the Grande Ronde Formation in the range of Elevation 600 to 900 feet. The Oregon State Geologic map has the Grande Ronde Formation mapped at Rieth at an elevation of 960 feet.

The Rieth Anticline reaches elevations of 1800 to 1900 feet at or near Helix. This is on a line North 45° West from Thorn Hollow, Elevation 1650; to Adams, Elevation 1580; to Helix, Elevation 1800. There is not a deep well at Thorn Hollow. At Adams, the City well is 1,725 feet deep. The logs show water at 1,286 feet which rose to a static level of 133 feet. This is a rise in the hole of 1,155 feet. The well is cased to 1,147 feet. A pump test with the bowls at 560 feet yielded 700 gpm with 358 feet of drawdown. Since Adams is several miles east of the Rieth Crest, the Grande Ronde Formation is probably down at Elevation 300± feet. At Helix, the elevation is 1800, and the City well is 1,296 feet deep. The well is cased to the bottom; however, the casing is perforated below 500 feet. The static water level is 325 feet. Using an air test, the well yielded 400 gpm. A big change in the south occurred at the depth of 1,264 to 1,296 and changed the SWL from depth 275 to 325 feet. This probably represents water from the Grande Ronde Formation aquifer,

and places the Grande Ronde Formation at an estimated 600 to 700 feet elevation. The confined water in the Grande Ronde aquifer descends from Elevation 600 to 700 to a 300 to 400-foot elevation in the Umatilla area.

Precipitation. The enclosed Figure 5 identified as a Geologic Map and Precipitation Belt Map, indicates how the precipitation is spread across the area. Note the increase from Pendleton east to Gibbon. The contours shown are in inches of precipitation annually.

III. WATER WELLS

MCFARLAND WELL

The McFarland Well was drilled by A.M. Jannsen in 1947. A log of the well is shown on Page 139 of the USGS Water Supply Paper 1620. The well is not cased as shown on the log's second sheet.

The McFarland Well was video surveyed on March 20, 1997 as follows:

16-inch casing	-	0.0 to 165 feet
15-inch open hole	-	165 to 232 feet
12-inch open hole	-	232 to 316 feet
10-inch casing	-	316 to 373 feet
8-inch casing	-	352 to 533 feet
8-inch open hole	-	533 feet to 780 feet

The initial depth of drilling was to be 785 feet, but apparently the hole has filled in 5 feet. Table I, Page 92 of the Water Supply Paper 1620 indicates a collar elevation of 540 feet; initial SWL of 115 feet; initial yield at 1,000 gpm; and a temperature of 71°F.

Purswell Pump Company of Hermiston, Oregon performed a pump test in March of 1997 on the McFarland Well. Their summary of that test is below:

> "17 March 97 Test. Started at 8:32 a.m. with a static W.L.S. at 151 feet, an initial yield of 400 gpm with a drawdown of 28 feet (depth 179) at 1030 hours. Increased yield to 700 gpm and the drawdown slowly declined to 235 feet (total drawdown 84 feet) at 500 hours on 18 March. It stabilized at 235 feet until 0740 hours, when the test was ended. Specific capacity is 700 gpm/84 feet = 8.53 gal/ft. Drawdown. Recovery: The water surface rose to a depth of 182 feet in 1 hour, 5 minutes. Total recovery was not recorded."

The new pump installed in the well is a submersible. The design capacity of the pump is as follows:

Primary:	500 gpm at 284 feet TDH
Secondary:	620 gpm at 234 feet TDH
Bottom pump motor:	280 feet below ground level
Pumping level estimate:	210 feet
Electric motor:	50 Hp
Air line depth to:	270± top of bowl

The McFarland Well delivers water to the South Hill area and the Coyote High Level Area system. This is accomplished by pumping into the McFarland Reservoir (0.65 MG capacity) from which a booster pump lifts the water to Coyote Reservoir (0.70 MG capacity). It should be noted that interconnecting piping exists to deliver water to the low level system during an emergency.

NOTE: Subsequent to the preparation of this study, the McFarland Well was operated at 300,000 to 450,000 gallons per day during July 2000. This high usage rate caused the pumping level to drop to 270 feet below ground surface and approach the pump intake. Therefore, either the pump should be lowered or the production should be limited to 300,000 to 350,000 gallons per day.

Water Usage. Records of all water wells are recorded by the month. The water year extends from October to the following September. Therefore, it is a split year, designated 1997-1998.

WATER YEAR RECORDS
MCFARLAND WELL

Year	Quantity	Note
1990-1991	37,807,000	Off 6 months - October to March
1991-1992	29,965,000	Off 5 months - December to April
1992-1993	No Records	----
1993-1994	44,759,000	
1994-1995	88,919,000	Intertie Down (7 months)
1995-1996	45,337,000	
1996-1997	21,177,000	Off 5 months - February to June (New pump and testing)

It would appear that the average yearly use for the McFarland Well is in the order of 45 million gallons, or, about 125,000 gallons per day. With the pump yielding 600 gpm, this gives a pumping time of 3-1/2 to 4 hours.

The McFarland Well is in the Buttercreek Controlled Area and is governed by the Water Resources Department. The procedure requires that the user (City of Umatilla) request the amount of water to be utilized the following year. Each year the Public Works Director asks for 1,448 A.F. This represents 2 cfs for a total year:

896 gpm x 1,440 minutes x 365 days = 470,937,600 gallons.

$$\frac{470{,}937{,}600 \text{ gals.}}{325{,}828 \text{ gal/A.F.}} = 1{,}448 \text{ A.F.}$$

For the last several years, the Water Resources Department has allotted 250 A.F. This is 250 A.F. x 325,828 gals. = 81,457,000 gallons. To be realistic, the calculation should be that which is practical or what is possible. For instance, pump the well for 18 hours each day for 5 days a week:

600 gpm x 18 hours x 260 days = 168,580,000 gallons.

$$\frac{168{,}480{,}000 \text{ gals.}}{325{,}828} = 517 \text{ A.F.}$$

However, a request to the Water Resources Department would have to be made for an increase in quantity.

45,000,000	Coyote Area
123,000,000	Low Area
168,000,000	Could provide for both areas in an emergency. It appears to be what happened in 1994-1995.

INTERTIE WELL

The Intertie Well was drilled by R.J. Strasser in April and May of 1979. A log of the well is on file with the Water Resources Division (WRD). The well was drilled 1,134 feet deep. The well is cased from the ground line to 500 feet depth with 20-inch O.D. casing. The well is open-rock hole from 500 feet to 1,134 feet. Hole size is 12 inches. It is unknown if the 12-inch hole will take a 12-inch casing. The original SWL was 156 feet. The well yielded 1,245 gpm with a drawdown of 324 feet. Duration of the test was 24 hours. No comment on stabilization of the pumping level. From this data, the specific capacity is 1,245 gpm ÷ 324 feet = 3.8 gpm/feet of drawdown. The 324 feet of drawdown is a pumping level of 480 feet in depth.

There is no data on the original installed pump capacity or setting. Data reported for August 1995 condition shows a yield of 822 gpm, with a static water level of 152 feet and a pumping level of 552 feet. There is no data on where the pump bowls are set or how

quickly stabilization is reached. With a static water level of 152 feet and pumping level of 552 feet is a drawdown of 400 feet. The specific capacity is 2.06 gpm/feet of drawdown. This is a 47 percent loss over 16 years which would average about 3 percent per year.

Data reported for October 1997 condition yield is 760 gpm, with a SWL of 153 feet and a pumping level of 590 feet. This is a drawdown of 437 feet. The specific capacity is 760 gpm ÷437 feet = 1.74 gpm/feet drawdown; 1.74 SC 1997 test ÷ 2.05 SC 1995 test = 15 percent loss in two years. This comparison indicates that the percent loss is accelerating and possibly not much useable time left in the well.

NOTE: Subsequent to the preparation of this study, the pump was lowered to 650 feet in August 1998. Since this was done, the pumping level appears to have stabilized at approximately 560 feet below ground surface.

WATER USAGE - INTERTIE WELL

YEAR	QUANTITY GALLONS	NOTE
90/91	145,160,000	
91/92	153,778,000	
92/93	No Record	
93/94	203,645,000	
94/95	112,159,000	Rehabilitation
95/96	221,232,000	
96/97	192,420,000	

96/97 Overall Usage

Golf Course Well	222,800,000 gallons	51 percent
Intertie Well	192,420,000 gallons	44 percent
McFarland	21,177,000 gallons	4.8 percent
Total	436,397,000 gallons	

Reasonable or Normal Conditions

Golf Course Well	200,000,000 gallons	45 percent
Intertie Well	200,000,000 gallons	45 percent
McFarland Well	45,000,000 gallons	
Total	445,000,000	

Could Be Possible

Golf Course Well	360,000,000 gallons	81 percent
Intertie	0.0 gallons	0 percent
McFarland	81,000,000 gallons	19 percent
Total	441,000,000	

Golf Course Well	2,000 gpm x 720 min.	=	1,440,000 GPD
Mc Farland Well	600 gpm x 600 min.	=	360,000 GPD
Total			1,800,000 GPD

1,800,000 GPD x 250 days = 450,000,000

GOLF COURSE WELL

The Golf Course Well was drilled by R. J. Strasser in March to December of 1978. A log of the well is on file with the Water Resources Department. The well was drilled 989 feet deep and is cased from the ground line to 500 feet deep with a 20-inch O.D. casing. The well is an open rock hole from 500 feet to 989 feet. The hole size is 12 inches and it is unknown if the 12-inch hole will take 12-inch casing. The original SWL was 200 feet in depth. The well yielded 2,000 gpm with a 158 feet drawdown for 12 hours and 2,500 gpm with a drawdown 235 feet after 24 hours. From this data the specific capacity is 2,000 gpm ÷ 200 feet = 10 gpm per feet of drawdown. Likewise, 2,500 gpm ÷ 235 feet is 10.6 gpm per foot of drawdown. The 2,000 gpm yield then has a pumping level of 358 feet.

In January 1996 Purswell Pump Company installed a new American Turbine Pump with the pump bowls set to 466 feet plus 2-1/2 foot strainer with the top of the bowls on 458 feet from the top of the motor. The design capacity is 2,000 gpm with a total design head of 440 feet. This is a specific capacity of 2,000 gpm with 167 feet of drawdown as 11.9 gallons/minute/feet drawdown. In September 1996, a field test was conducted and indicated these conditions. The Golf Course Well has essentially the same characteristics as it tested with in 1978. It has had no change in 20 years.

WATER USAGE - GOLF COURSE WELL

YEAR	QUANTITY GALLONS	NOTE
90/91	146,403,000	
91/92	159,778,000	
92/93	No Record	
93/94	176,620,000	
94/95	185,768,000	
95/96	151,695,000	Jan. 1996-2,000 gpm Pump
96/97	222,809,000	

2,000 gpm x 300 min. X 365 = 219,000,000 gallons

This represents 5 years pumping each day.

PORT WELL

The Port Well was drilled by R.J. Strasser during October 1966 to June 1967. A log of the well is on file with the Water Resources Department. The well was drilled to a depth of 850 feet. The well was cased with 24-inch O.D. casing from 0.0 to 109 feet and 20-inch O.D. casing from 99 feet to 345 feet. The well is an open rock hole from 345 feet to 850 feet, with a hole size of 12 inches. The original SWL was at 94 feet depth. The well yielded 2,000 gpm for 23 hours with a drawdown of 48 feet and yielded 2,500 gpm with 74 feet of drawdown fro three hours. Water temperature recorded at 75°F. The specific capacity is 2,000 gpm with 48 feet drawdown as 41.6 gpm/feet drawdown.

There is no water usage data from the well. The history of the well seems to have been as the water sources for McNary townsite and the industrial area from 1967 until the construction of the Golf Course Well and the Intertie Well in 1978 and 1979. It is reported that the Port Well is interconnected with the Port reservoir and the Golf Course Well, however, it is separated by a shut-off valve. The City Public Works Director states that the Port Well has not been used for 10 years.

It would be logical for the City of Umatilla to acquire this well for use in the City system. It would need to be rehabilitated for sanitation and testing to meet the Health Code. The pump should be removed and examined and rehabilitated as required or necessary. A drill should be used to clean the well by surging, swabbing, and high pressure air water jetting. A video camera run should be made of the cleaned well. Since it is already plumbed to the system, it could be utilized in a short period of time.

YEARLY TOTAL USAGE - ALL WELLS

YEAR	QUANTITY GALLONS	NOTE
90/91	329,370,000	
91/92	342,868,000	
92/93	No Record	
93/94	425,024,000	
94/95	386,846,000	
95/96	418,264,000	
96/97	436,406,000	

In seven years the usage of water increased by 100,000,000 gallons. In rounded numbers, this is an increase of 15,000,000 gallons per year while the population remains nearly the same. This would seem to indicate either loss of water in piping in the system or increased use by industry.

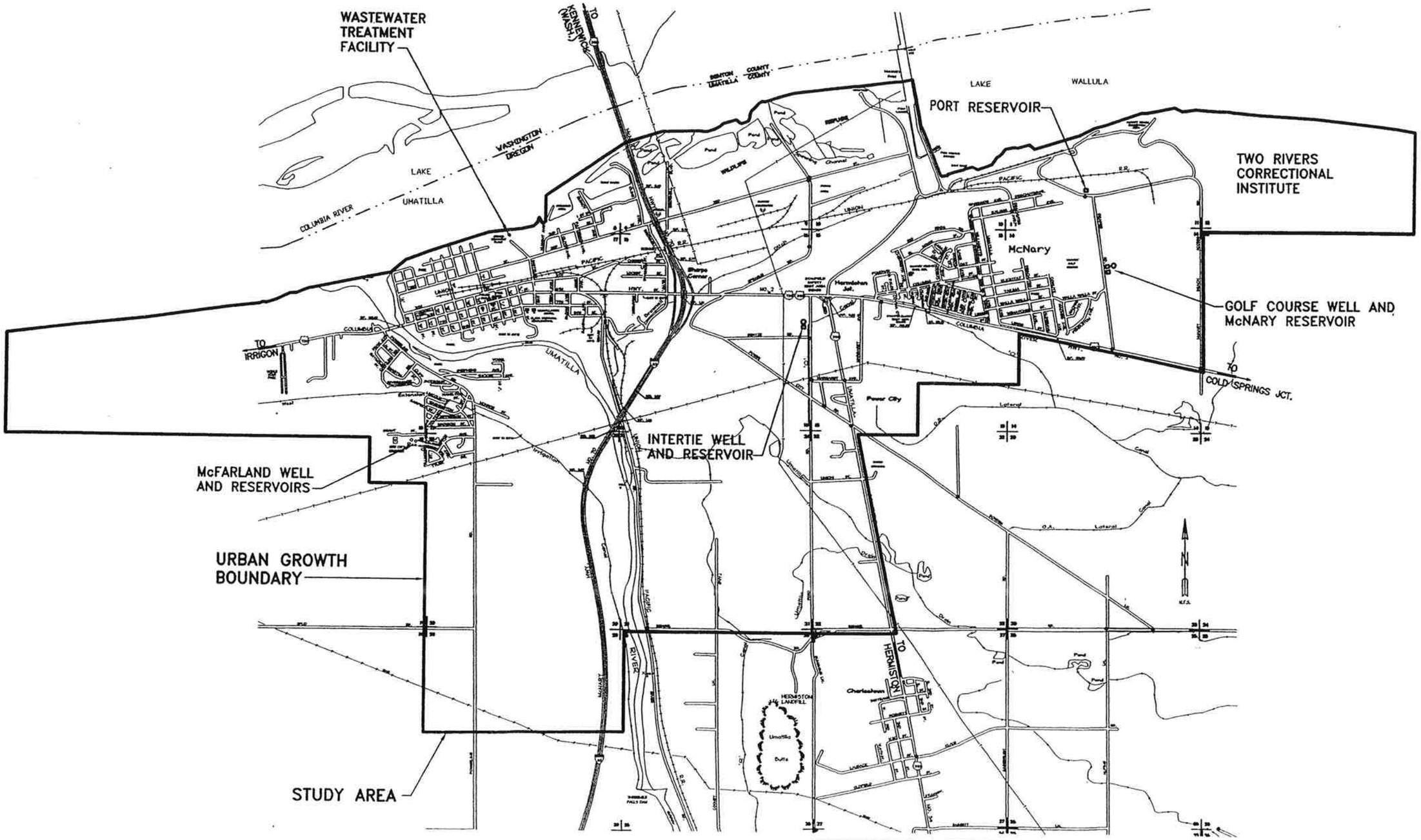
SUMMARY

1. The review of the geology of the Umatilla Basin indicates that the confined aquifers are contained in the Grand Ronde Formation and this formation transmits water from the Blue Mountains to the City of Umatilla area.

2. The City of Umatilla operates three water wells with a fourth well as "standby".

3. That the standby well (Port Well) is not in a "standby" condition; it should be acquired by the City and made operable, or otherwise replaced by an additional well.

4. The advent of a 100 percent increase in population (TRCI and support systems) well require an increase of 2 cfs of potable water in the City system. Location of the additional well is indicated by space arrangement to be Section 12 at the south quarter corner. The new well design should allow placement of 16-inch surface casing, grouted in place, to a depth of 500 feet. It should be continued in depth at a hole size of inside diameter of the 16-inch casing that could receive 12-inch casing to the bottom at 1,000 feet. Casing would be used as required by rock conditions, and hole size reductions only as necessary.



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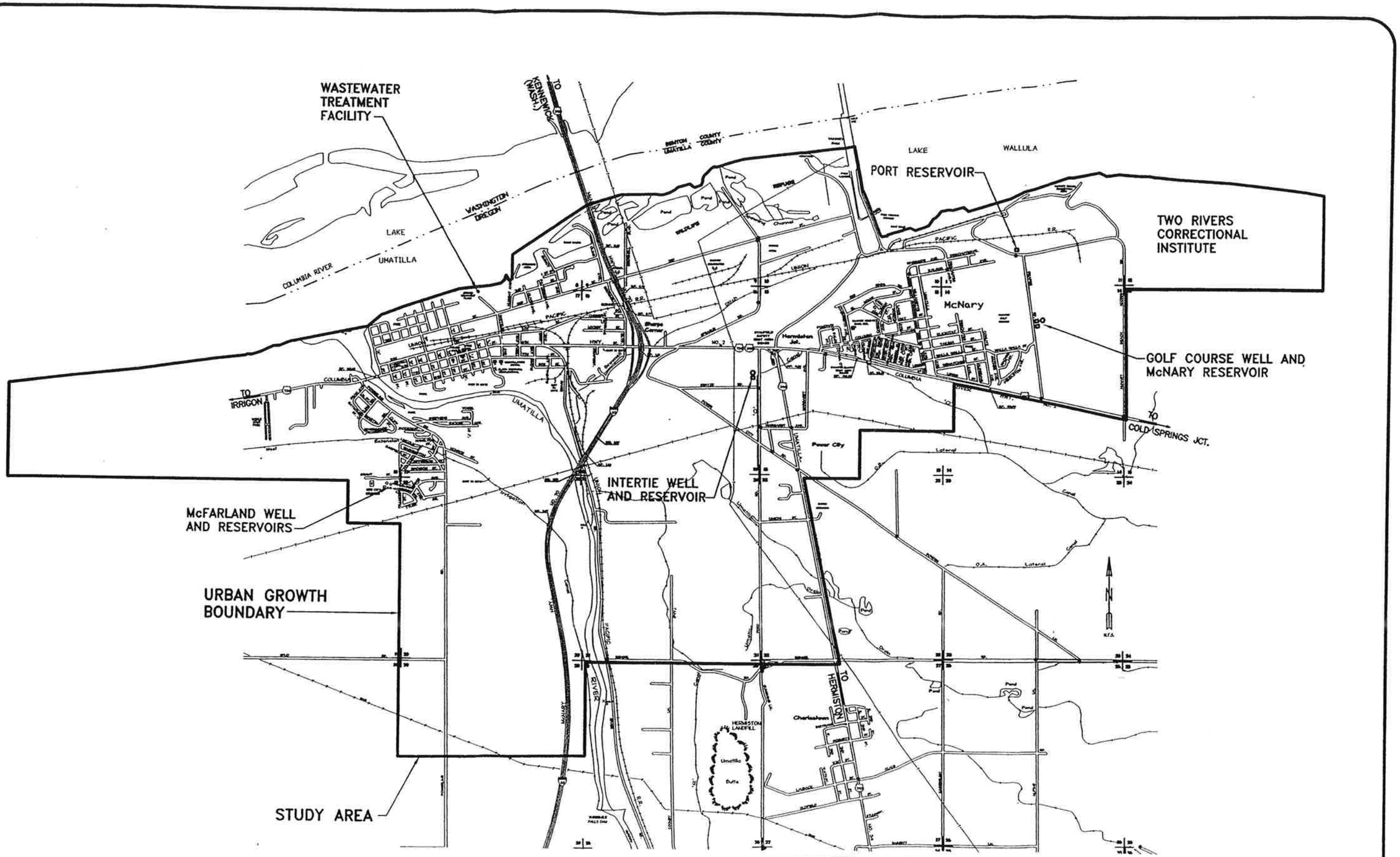
CITY OF
UMATILLA, OREGON
VICINITY MAP

FIGURE
1

PATH:/W:/UMACITY/WATER/FIG2-1.DWG



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CITY OF
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VICINITY MAP

FIGURE
1

PATH:/W:/UMACITY/WATER/FIG2-1.DWG

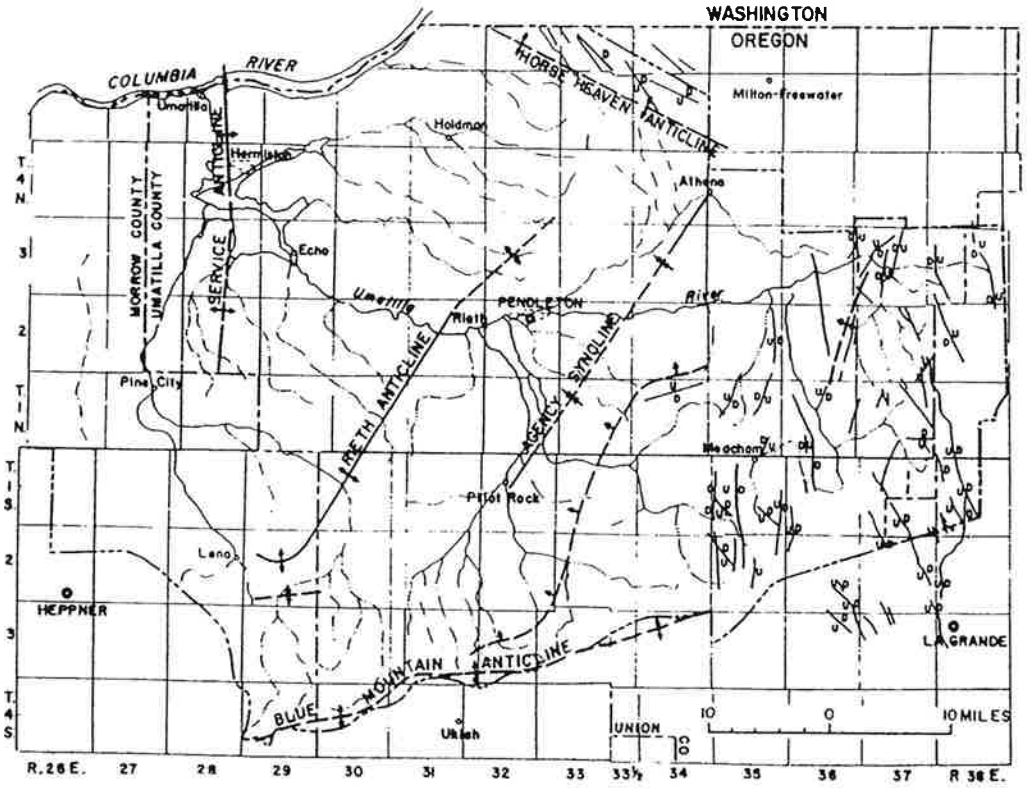

FIGURE 13.—Map of the Umatilla River basin, Oregon, showing the locations of major structural features of the Columbia River basalt.

EXPLANATION

U
D
Fault
U, *upthrown side;* D, *downthrown side*

Boundary of the area covered by this investigation

Anticline

Syncline

Upper fold of monocline

fold axes
Dashed where approximately located

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FIGURE
2

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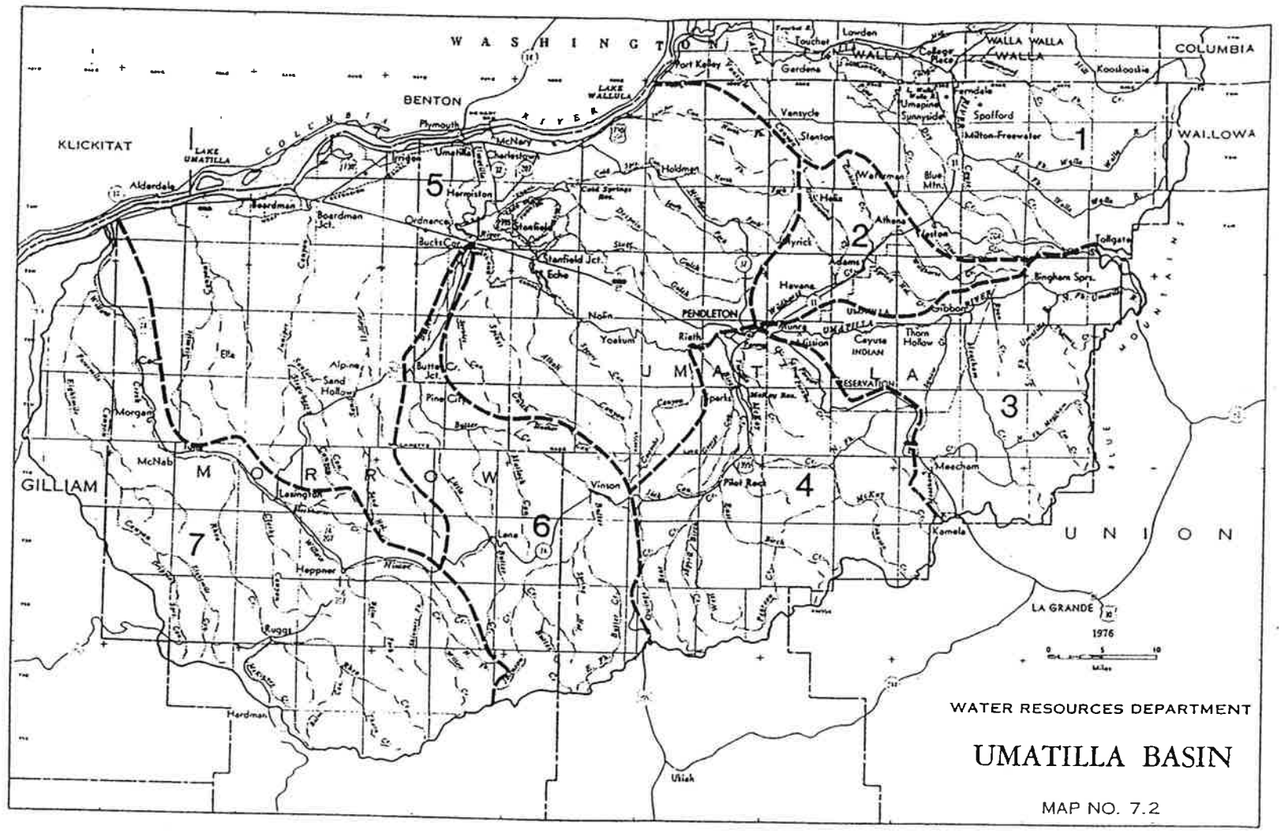

SUBBASINS

1 Walla Walla
2 Wildhorse Creek
3 Upper Umatilla
4 Birch and McKay Creeks
5 Columbia Umatilla Plateau
6 Butter Creek
7 Willow Creek

Figure 1

UMATILLA BASIN/SUBBASIN MAP

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FIGURE
3

165151

COLUMBIA RIVER BASALT GROUP

SERIES		GROUP	SUB-GROUP	FORMATION	MEMBER	K-Ar age (m.y.)	MAGNETIC POLARITY
MIOCENE	UPPER	COLUMBIA RIVER BASALT GROUP	YAKIMA BASALT SUBGROUP	SADDLE MOUNTAINS BASALT	LOWER MONUMENTAL MEMBER	6	N
					Erosional unconformity		
					ICE HARBOR MEMBER		
					Basalt of Goose Island	8.5	N
					Basalt of Martindale	8.5	R
					Basalt of Basin City	8.5	N
					Erosional unconformity		
					BUFORD MEMBER		R
					ELEPHANT MOUNTAIN MEMBER	10.5	N,T
					Erosional unconformity		
					POMONA MEMBER	12	R
					Erosional unconformity		
					ESQUATZEL MEMBER		N
					Erosional unconformity		
					WEISSENFELS RIDGE MEMBER		
					Basalt of Slippery Creek		N
					Basalt of Lewiston Orchards		N
	MIDDLE				ASOTIN MEMBER		N
					Local erosional unconformity		
					WILBER CREEK MEMBER		N
					UMATILLA MEMBER		N
					Local erosional unconformity		
				WANAPUM BASALT	PRIEST RAPIDS MEMBER		R_3
					ROZA MEMBER		T,R_3
					FRENCHMAN SPRINGS MEMBER		N
					ECKLER MOUNTAIN MEMBER		
					Basalt of Shumaker Creek		N_2
					Basalt of Dodge		N_2
					Basalt of Robinette Mountain		N_2
	LOWER			GRANDE RONDE BASALT		14-16.5	N_2
							R_2
				PICTURE GORGE BASALT	Basalt of Dayville Basalt of Monument Mountain Basalt of Twickenham	(14.6-15.8)	N_1
							R_1
				IMNAHA BASALT		R_1 T	N_0
							R_0

Figure 7. Stratigraphic nomenclature, age, and magnetic polarity for the Columbia River Basalt Group as revised by Swanson, Wright, Hooper and Bentley (1979). Black bar on the right denotes units known to be present in western Oregon and Washington.

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FIGURE
4

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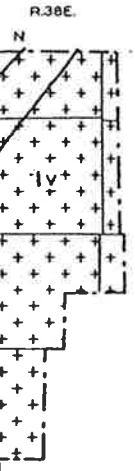

LEGEND

A	ALLUVIUM. RECENT GRAVELS, SANDS AND SILTS.
Ag	PLEISTOCENE TERRACE SANDS AND GRAVELS. GENERALLY UNCONSOLIDATED.
Ss	POORLY CONSOLIDATED SEDIMENTS UNDIFFERENTIATED LOESSIAL AND GLACIAL. 50± THICK.
Scg	MODERATELY WELL CEMENTED GRAVELS OVERLYING LAVA.
Iv	UNDIFFERENTIATED COLUMBIA RIVER LAVAS AND CONSOLIDATED TUFFS. INCLUDES SMALL EXPOSURES OF GRANITIC AND SEDIMENTARY ROCKS.

8 — AVERAGE ANNUAL PRECIPITATION IN INCHES.

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CITY OF
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FIGURE
5

ADDENDA

UMATILLA GROUND WATER STUDY

McNARY DAM - WATER WELLS R-2 AND R-3

OUTLINE

		PAGE
1.	PURPOSE	1
2.	LOCATION	1
3.	WELL DESIGN OR CONSTRUCTION	1
4.	WELL LOG RECORDS	Enclosures #1
5.	WELL PUMP RECORDS	" #2
6.	WELL CERTIFICATES	Enclosures #3
7.	WELL USE RECORDS	" #4
8.	McNARY RESERVOIR	3
9.	CONCLUSION	4

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ADDENDA

UMATILLA GROUND WATER STUDY
McNARY DAM - WATER WELLS R-2 AND R-3

1. PURPOSE: From the study of the Port Well, it was determined that the McNary water wells influenced the static water level of the Port Well. Hence, it is important to determine the degree of influence if both the Port Well and McNary Well are operated simultaneously. The McNary Wells, R-2 and R-3, could have limited amounts of water over the bowls.

2. LOCATION: Both wells are located in Township 5 North, Range 28, East Willamette Meridian. Both wells are located in Section 10 in the southeast quarter. Well R-2 is located at a distance of 1636.6 feet from the southeast corner of Section 10 on a bearing of N48 42'W. The elevation of the pump house is not given. It is reported in USGS Water Supply Paper 1620 as 360 feet. R-3 is also located in the southeast quarter of Section 10 approximately 1000 feet east of R-2 and at an elevation of 370 feet. Reference USGS Water Supply Paper 1620.

3. WELL DESIGN OR CONSTRUCTION: R-2 was drilled by A. A. Durand and Sons in 1948. The casing listed is 15-inches in diameter and a bottom depth of casing as 320 feet. This data with a material log is contained in the publication "Geology and Ground Water of the Umatilla River Basin" by G. H. Hogensen. This is USGS Water Supply Paper 1620. The log records are on page 138 and other data such as collar elevation and casing is on page 92.

R-3 was drilled by R. J. Strasser in 1952. The construction history is complete as shown on a Corps of Engineers Field Drawing No. 641, dated October 1952. The well was hand dug and cribbed to a depth of 71 feet and 36-inch casing installed to that depth. The hole was extended in depth to top of rock at 117 feet by drilling with a cable tool and 28-inch casing seated on rock. The hole was extended by drilling into rock to a depth of 299.5 feet and cased with 24-inch casing. The hole size was reduced and the hole extended in depth to 410 feet and cased with 20-inch casing. The hole was then extended in depth at the inside diameter of 20-inch casing to a depth of 494 feet as open hole, no casing. The hole size again reduced and

drilled to 611 feet and cased with 16-inch casing. The hole size was again reduced and drilled to 670 feet and cased with 12-inch casing. The hole size was reduced to the inside diameter of the 12-inch casing and drilled to the bottom of 779 feet. This section from 610 to 779 feet was left as open rock hole. The bottom 20-feet of the 12-inch casing was perforated with 3/8-inch wide by 4-inch long slots.

From reading the drawing, it is apparent that casing was used to stabilize the side walls of the hole as various different basalt flows were encountered. The drilling log helps in the identification of the formations and basalt flows. It is approximately as follows:

0.0 to 117 feet - overburden material
117 to 249 feet - Saddle Mountain formation
Umatilla Basalt Flow
249 to 299.5 feet - Mabton Interbed
Tuffaceous clays and siltstone
299.5 to 410 feet - Wanapum formation
Priest Rapids Basalt Flow
410 to 494 feet - Rosa Basalt Flow
494 to 611 feet - Frenchman Springs Basalt Flow
611 to 779 feet - Grand Ronde Formation, probably three Basalt Flows. Drill log says main Aquifer at 712 feet.

4. WELL LOG RECORDS: See Enclosures.

5. WELL PUMP RECORDS: In the Mechanical Section record files at McNary Dam, the following data was taken: Dated 1957

Well R-2: Pump - Pamona F.M.
Capacity 2400-2800 G.P.M.
Pump Setting Depth - 177 feet
Static Water Level - 103 to 108 feet
Drawdown to - 123 to 130 feet
Riser Pipe Size - 12 inches

Well R-3: Pump - Pamona
Capacity - 1200 G.P.M.
Pump Setting - 170+ feet
Static Water Level - 90-100 feet
Drawdown to - 125 to 145 feet
Riser Pipe Size - 10 inches

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Presently this pump has never been removed from this well.

Well R-2 - the original pump listed above was removed by Purswell Pump Company dated 9-16-93 using a cutting torch to disassemble. Purswell installed the following pump: American Turbine Pump, Model 15M-200. The well casing was given as 20-inch in diameter.

Capacity - 2000 G.P.M.
Total Dynamic Head - 280 feet
Speed - 1775 RPM
Maximum Bowl efficient - 85%
Strainer - Cone
Riser Column Depth - 150 feet
Pipe Size - 12-inches
Pump has three stages, each stage rated 93 feet.

No static water level or pumping level given in data.

6. WELL CERTIFICATES: See enclosures.

7. WELL USE RECORDS: Water Resources Department, Salem, Oregon, furnished the water use records that had been submitted by McNary Dam:

Year	Gallons	
	R-2	R-3
87 to 88	193,423,076	844,500
88 to 89	186,420,300	571
92 to 93	177,656,496	
93 to 94	163,948,136	35,874,520
94 to 95	193,521,064	1,850,500
95 to 96	179,108,600	10,215,700

It appears that the dam project uses about 500,000 gallons per day. There is not a breakdown for specific use such as irrigation, domestic and industrial.

8. McNARY RESERVOIR: The storage reservoir for McNary Dam is located in the McNary townsite directly south of the dam. Its location is shown on the Umatilla Quad Map, as well as the Umatilla City limits map. The reservoir is 60 feet in diameter and approximately 20 feet in height. It is about 10 feet above ground and 10 feet below ground. The bottom elevation is 485 feet and the top at the 400,000

gallon level is 504 elevation. The top is rounded and discharges by overflow at 402,000 gallons.

9. CONCLUSION: Both Water Wells R-2 and R-3 at McNary Dam are in use and functioning. The only access for measurement of static water levels and pumping levels is by airline. The airline in both wells was tested by applying air pressure (Air Bottle) and neither airline held pressure. They are both non-functioning. It is not known if or when the Corps of Engineers will correct this condition.

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WELL NO 3 - McNARY, OREGON

LOG OF HOLE - Drilled 23 Feb to 24 Sep 52.

Measurement from top of ground at Elev. 395

	6 - 10	Loose sand.
	10 - 20	Loose sand.
	20- 24	Cemented gravel & boulders.
	24 - 32	Cemented gravel & boulders.
	32 - 35	Very tight cemented gravel & boulders.
	35 - 40	Gravel & boulders.
	40 - 51	Cemented sand & gravel.
	51 - 62	Loose sand & gravel.
	62 - 64	Larger gravel, some boulders, clay binder.
	64 - 72	Cemented gravel & boulders, clay binder.
	72 - 86	Hard cemented gravel & broken basalt.
	86 - 97	Broken basalt & few gravel.
	97 - 100	Cemented gravel.
	100 - 107	Boulders, loose gravel, materials falling into hole - lost most of water.
S. O. F.	107 - 117	Cemented gravel (not bedrock).
Umatilla	117 - 124	Broken basalt, black & red.
	124 - 133	Flow breccia.
	133 - 134	Hard streak.
	133 - 249	Gray hard basalt - Crevices at 182' & 194'.
	249 - 273	Green shale.
Martin Intrusion	273 - 288	Gray clay.
	288 - 300	Salvage. - clay
Wanapum	300 - 306	Porous black basalt.
	306 - 357	Gray basalt.
P. R.	357 - 398	Black basalt, softer porous to some extent.
	398 - 405	Med. hard basalt.
	405 - 407	Green shale.
	407 - 422	Med. hard basalt.
Rosa	422 - 458	Hard gray basalt.
	458 - 466	Black rock, somewhat porous.
	466 - 471	Hard black rock.
	471 - 476	Brown & black basalt, crevices.
	476 - 496	Gray basalt.
Frenchman Springs	496 - 512	Porous rock, caving
	512 - 518	Broken black basalt.
	518 - 529	Hard Gray basalt.
	529 - 544	Broken rock with clay binder.
	544 - 582	Med. hard gray basalt.
	582 - 587	Hard gray basalt.
	587 - 596	Porous brown, red & black basalt.

Endocrine #1

	596 - 622	Gray basalt (caving badly, 608' to 612')
	622 - 633	Porous broken black basalt.
GRF.	633 - 650	Med. gray basalt.
1st Flow	650 - 670	Porous, loose black basalt. (definite change in formation at 670')
	670 - 683	Black basalt (1' crevice at 683')
2nd Flow	683 - 695	Med. hard gray basalt.
	695 - 698	Hard gray basalt.
	698 - 705	Med. hard gray basalt.
	705 - 707	Hard gray basalt.
	707 - 709	Broken rock & blue clay.
Contact zone	709 - 712	Very porous, loose basalt with green coating in vesicules.
	712 - 713½	Interbed with green slate broken rock, phyrrites of iron.
	713½ - 723	Black basalt.
3rd Flow	723 - 728	Porous black basalt with green slate.
	728 - 744	Black basalt.
	744 - 756	Porous basalt, some green slate.
	756 - 771	Black basalt.
	771 - 779	Broken black basalt.

TABLE 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
4N/35-19L1. City of Athena (well 1). Drilled by A. A. Durand and Son, 1935		
Palouse formation:		
Soil	25	25
Columbia River basalt:		
"Rock," broken	57	82
Basalt, gray, brown 141 to 195 ft	168	250
Conglomerate	100	350
Basalt, black, gray upper 45 ft	80	430
Basalt	69	499
Basalt, black	81	580
"Rock," broken	70	650
Basalt, gray	30	680
4N/35-29P1. Henry Koepke. Drilled by A. A. Durand and Son, 1940		
Palouse formation:		
Soil	16	16
Columbia River basalt:		
"Boulders"	4	20
Basalt, hard	29	49
Basalt, medium hard	7	56
Basalt, soft	74	130
Basalt, medium hard	15	145
Basalt, soft	51	196
Basalt, hard, gray	96	292
Basalt, gray	31	323
Basalt, hard	9	332
Basalt, gray and black	89	421
Basalt, gray, hard	57	478
Basalt, black	8	486
5N/28-10R1. U.S. Army Corps of Engineers. Drilled by A. A. Durand and Son, 1917		
Glaciofluviatile deposits:		
Sand	6	6
Gravel and small boulders	6	12
Boulders	18	30
Gravel	5	35
Gravel and sand	33	68
Gravel and silt	12	80
Gravel and sand	8	88
Gravel; static water level at 95 ft	13	101
Gravel and boulders	9	110
Gravel	5	115
Gravel and sand	1	116
Sand	1	117
Gravel and coarse sand	6	123
Boulders and fine sand	2	125
Boulders	3	128
Sand, fine	2	130
Boulders	8	138
Boulders and sand	8	146
Columbia River basalt:		
Basalt and shale (clay?)	8	154
Basalt, firm	6	160
Basalt, creviced	3	163
Basalt, hard	4	167
5N/28-10R2. U.S. Army Corps of Engineers. Drilled by A. A. Durand and Son, 1918		
Glaciofluviatile deposits:		
Overburden (see strata recorded in log of well-10R1)	100	100
Columbia River basalt:		
Basalt	130	230
Lower part of the Ellensburg formation:		
"Interbed" (clay?)	40	270
Columbia River basalt:		
Basalt	300	570
Basalt, scoriaceous	10	580
Basalt	80	660
"Interbed basalt"	10	670
Basalt	31	701

TABLE 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
4N/35-19L1. City of Athena (well 1). Drilled by A. A. Durand and Son, 1935		
Palouse formation:		
Soil	25	25
Columbia River basalt:		
"Rock," broken	57	82
Basalt, gray, brown 141 to 195 ft	168	250
Conglomerate	100	350
Basalt, black, gray upper 45 ft	80	430
Basalt	69	499
Basalt, black	81	580
"Rock," broken	70	650
Basalt, gray	30	680
4N/35-29P1. Henry Koepke. Drilled by A. A. Durand and Son, 1940		
Palouse formation:		
Soil	16	16
Columbia River basalt:		
"Boulders"	4	20
Basalt, hard	29	49
Basalt, medium hard	7	56
Basalt, soft	74	130
Basalt, medium hard	15	145
Basalt, soft	51	196
Basalt, hard, gray	96	292
Basalt, gray	31	323
Basalt, hard	9	332
Basalt, gray and black	89	421
Basalt, gray, hard	57	478
Basalt, black	8	486
5N/28-10R1. U.S. Army Corps of Engineers. Drilled by A. A. Durand and Son, 1947		
Glaciofluviatile deposits:		
Sand	6	6
Gravel and small boulders	6	12
Boulders	18	30
Gravel	5	35
Gravel and sand	33	68
Gravel and silt	12	80
Gravel and sand	8	88
Gravel; static water level at 95 ft	13	101
Gravel and boulders	9	110
Gravel	5	115
Gravel and sand	1	116
Sand	1	117
Gravel and coarse sand	6	123
Boulders and fine sand	2	125
Boulders	3	128
Sand, fine	2	130
Boulders	8	138
Boulders and sand	8	146
Columbia River basalt:		
Basalt and shale (clay?)	8	154
Basalt, firm	6	160
Basalt, creviced	3	163
Basalt, hard	4	167
5N/28-10R2. U.S. Army Corps of Engineers. Drilled by A. A. Durand and Son, 1948		
Glaciofluviatile deposits:		
Overburden (see strata recorded in log of well-10R1)	100	100
Columbia River basalt:		
Basalt	130	230
Lower part of the Ellensburg formation:		
"Interbed" (clay?)	10	270
Columbia River basalt:		
Basalt	300	570
Basalt, scoriaceous	10	580
Basalt	80	660
"Interbed basalt"	10	670
Basalt	34	704

TABLE 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
5N/28-10R3. U.S. Army Corps of Engineers. Drilled by R. J. Strasser, 1952		
Glaciofluviatile deposits:		
Soil and loose sand	20	20
Gravel and boulders, cemented	15	35
Gravel and boulders	5	40
Sand and gravel, cemented	14	54
Sand and gravel, loose	14	62
Gravel, some boulders and clay	10	72
Gravel, cemented, hard	14	86
Gravel	11	97
Gravel, cemented	3	100
Boulders and loose gravel	7	107
Gravel, cemented	10	117
Columbia River basalt:		
Basalt, black and red, broken	7	124
Basalt, flow breccia	9	133
Basalt, gray, hard; creviced at 182 and 194 ft	116	249
Lower part of the Ellensburg formation:		
Shale, green	24	273
Clay, gray	15	288
"Selvage"	12	300
Columbia River basalt:		
Basalt, black, porous	6	306
Basalt, gray	51	357
Basalt, black, hard and soft	48	405
Shale, green	2	407
Basalt, medium-hard	15	422
Basalt, gray and black, hard	49	471
Basalt, brown and black, creviced	5	476
Basalt, gray	20	496
Basalt, porous, caving	16	512
Basalt, gray and black, hard and broken	17	529
Basalt, broken; some clay	15	544
Basalt, gray, hard	43	587
Basalt, red, black, brown, porous	9	596
Basalt, gray	26	622
Basalt, black, porous, broken	11	633
Basalt, gray, medium-hard	17	650
Basalt, black, porous, loose	20	670
Basalt, black and gray	37	707
Basalt, broken, and blue clay	2	709
Basalt, broken, and green "slate," mineralized with iron pyrites, green coating in vesicles	4½	713½
Basalt, black, porous, and green "slate"	42½	756
Basalt, black	21	777
5N/28-19A1. City of Umatilla (well 3). Drilled by A. M. Jannsen, 1917		
Glaciofluviatile deposits:		
Clay and topsoil	17	17
Gravel and boulders	10	27
Sand	11	38
Gravel	132	170
Columbia River basalt:		
Basalt	175	345
Lower part of the Ellensburg formation and interbedded basalt:		
Clay, blue	28	373
Basalt, broken	42	415
Basalt	90	505
Clay	30	535
Columbia River basalt:		
Basalt	215	750
Sandy formation (decomposed basalt?)	5	755
Basalt	30	785

NOTE.—Casing, 16-inch, set to 170 feet; 10-inch set from 310 to 373 ft; 8-inch set from 361 to 525 ft. Open 8-inch hole from 535 to 785 ft.

[illegible]

ample Specifications for a Product Lubricated Line Shaft Turbine

(Deep Well or Short Coupled)

Section I: Operating Requirements

Bowl Assembly Specifications:

American Turbine Model 15M200 # stages 3

Fluid Type WATER Specific Gravity 1

Fluid Temp. 50 °F Well or Casing I.D. 20 ?"

Capacity 2000 gpm Total Dynamic Head 280 feet(col'm losses included)

Speed 1775 rpm Minimum Bowl Efficiency 85 %

Suction Pipe N/A" x N/A' long or (none)

Strainer: (cone type) (basket type) (none)

Column/Head Specifications:

Column Length: 150 setting(head base to top bowl) or

_____ total pump length(head base to bottom of strainer)

Nominal Pipe Size 12"

Maximum Intermediate Column Section Lengths: 10

Maximum Top and Bottom Column Section Lengths: 5

Nominal Discharge Flange Size _____" ANSI Flange Rating _____#

Companion Flange Required: (yes) (no)

Shaft Seal: (packing box) (mechanical seal)

Seal Type: (unbalanced) (balanced)

Coupling: (standard - for VHS), (rigid, spacer - for VSS)

Other _____

Enclosure #2

Post-it® Fax Note 7671	Date 6/24	# of pages ▸ 3
To Dick Gullickson	From	
Co./Dept.	Co. Pursuit Pump	
Phone 938-3874	Phone 541 [illegible]	
Fax # 541-938-9310	Fax # 541-[illegible]	

AMERICAN TURBINE Pump Company of California

3711 S. Bagley - Unit A, Fresno, CA 93725 Billing: P.O. Box 577, Lubbock, TX 79408

QUOTATION

NAME Purswell Pump QUOTE# 1323

ADDRESS 395 Old Field Rd DATE 9-16-93

CITY Hermiston CUST.P.O.#

STATE Ore ZIP JOB

ATTENTION Jim QUOTED BY R.S.K.

THANK YOU FOR THIS OPPORTUNITY TO SERVE YOU AND YOUR ORGANIZATION!
This quote is valid for days from the above date.

CONDITIONS:

G.P.M.	T.D.H.	SETTING / T.P.L.	B.H.P.

QUANTITY	WEIGHT	ITEM DESCRIPTION	@	PRICE
1		15-M-200 3 stage water Lube Turbine 12" Discharge 12" Suction		2751
14 pcs		12" x .330 x 9' 11 1/4 Column Pipe T&C Butt Thd.	259	3626
2 pcs		12" x .330 x 4' 11 1/4 Column P.P. T&C Butt Thd	229	778
14 pcs		1 1/2" x 10' C1045 w/ 304 SS Sleeve	66.71	933.94
2 pcs		1 1/2 x 5' C1045 w/ 304 SS Sleeve	54.26	108.52
15		12" Bronze Drop in Spider with Insert	82.00	1230.00
		Total Price with FGT		$
		on Shafts		902

OFF: 209-486-7867 WATS: 800-435-7887 FAX: 209-486-2341

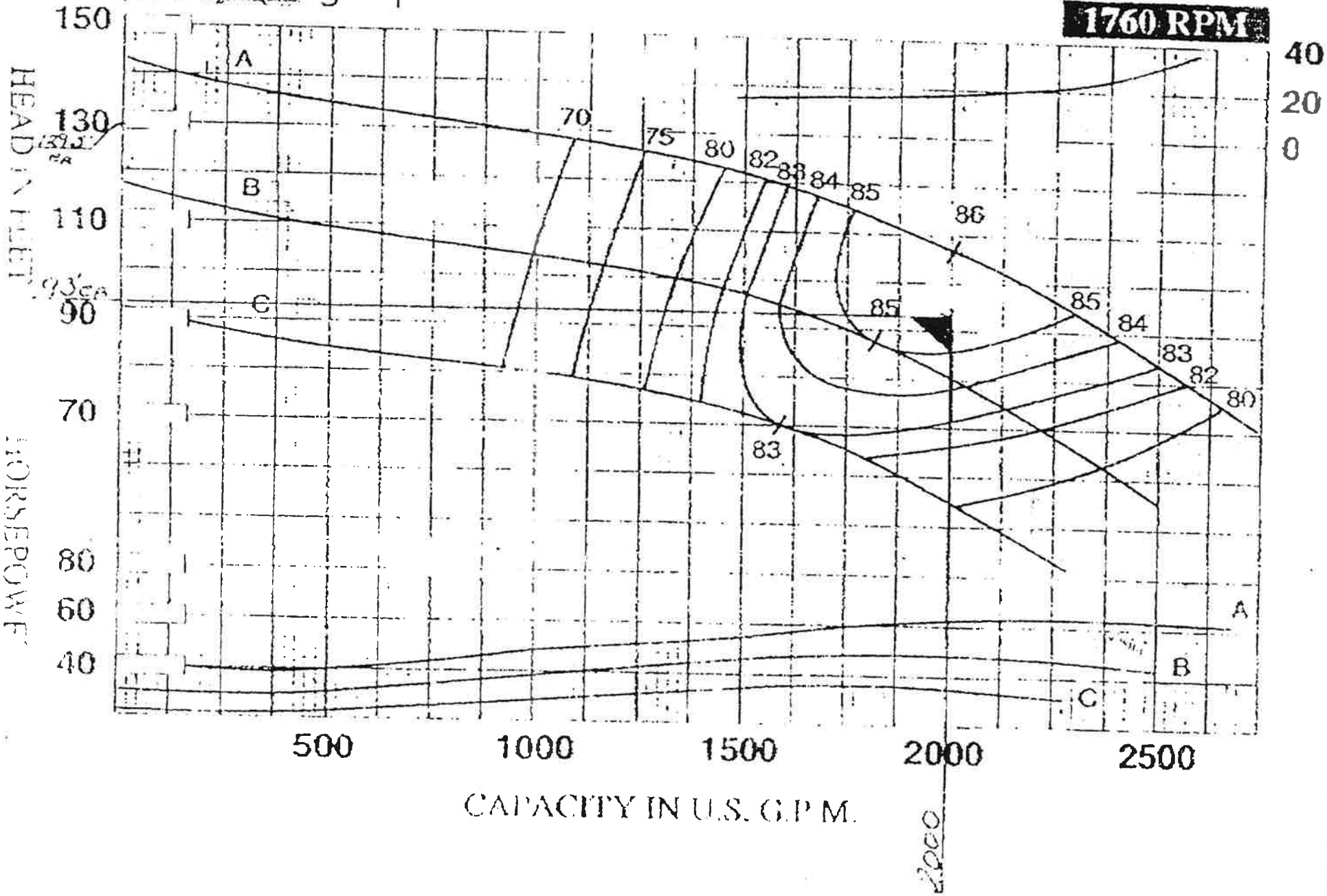
AMERICAN TURBINE

3 stage Bowl
2000 GPM @ 280' TDH

Performance Curves

15-M-200
1760 RPM

Number of Stages Required: 3



STATE OF OREGON

COUNTY OF UMATILLA

CERTIFICATE OF WATER RIGHT

This Is to Certify, That U. S. ARMY CORPS OF ENGINEERS
Walla Walla District
of Walla Walla, State of Washington, has made proo
to the satisfaction of the STATE ENGINEER of Oregon, of a right to the use of the waters o
Well No. 2
a tributary of Columbia River for the purpose o
industrial
under Permit No. G-642 of the State Engineer, and that said right to the use of said water
has been perfected in accordance with the laws of Oregon; that the priority of the right hereb
confirmed dates from June 27, 1957,

that the amount of water to which such right is entitled and hereby confirmed, for the purpose
aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not excee
5.35 cubic feet per second,

or its equivalent in case of rotation, measured at the point of diversion from the strean
The point of diversion is located in the SE¼ SE¼, Section 10, Township 5 North, Range 2
East, W.M. N. 48° 42' 07.3" W. 1636.62 ft. from the SE corner of Sec. 10,

The amount of water used for irrigation, together with the amount secured under any othe
right existing for the same lands, shall be limited to - - - - - - - - - of one cubic foot per secon
per acre,

and sha
conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right
appurtenant, is as follows:

S½
Section 10
SW¼ SW¼
Section 11
W½
Section 14
N½
Section 15
Township 5 North, Range 28 East, W.M.

Land on which water is to be used is part of that described as follows:
McNary Dam and Townsite

The right to the use of the water for the purposes aforesaid is restricted to the lands or place
use herein described.

WITNESS the signature of the State Engineer, affix
this 15th day of April, 19 5

Laura A. Stanley
State Engine

Recorded in State Record of Water Right Certificates, Volume 17, page 24701

State Printing

STATE OF OREGON

COUNTY OF UMATILLA

CERTIFICATE OF WATER RIGHT

This Is to Certify, *That* U. S. ARMY CORPS OF ENGINEERS Walla Walla District *of* City-County Airport, Walla Walla, *State of* Washington, *has made proof to the satisfaction of the STATE ENGINEER of Oregon, of a right to the use of the waters of* a well (McNary Well No. 3) *a tributary of* Columbia River *for the purpose of* industrial and domestic *under* Permit No. U-509 *of the State Engineer, and that said right to the use of said waters has been perfected in accordance with the laws of Oregon; that the priority of the right hereby confirmed dates from* February 5, 1953,

that the amount of water to which such right is entitled and hereby confirmed, for the purposes aforesaid, is limited to an amount actually beneficially used for said purposes, and shall not exceed 2.78 cubic feet per second,

or its equivalent in case of rotation, measured at the point of diversion from the stream. The point of diversion is located in the NE¼ SE¼, Section 10, Township 5 North, Range 28 East, W.M.

The amount of water used for irrigation, together with the amount secured under any other right existing for the same lands, shall be limited to - - - - - - - - - *of one cubic foot per second per acre,*

and shall conform to such reasonable rotation system as may be ordered by the proper state officer.

A description of the place of use under the right hereby confirmed, and to which such right is appurtenant, is as follows:

SE¼ SE¼
Section 10
SW¼ SW¼
Section 11
W½
Section 14
NE¼ NE¼
Section 15
Township 5 North, Range 28 East. W.M.

Land on which water is to be used is part of that described as follows:
McNary Dam and Townsite.

The right to the use of the water for the purposes aforesaid is restricted to the lands or place of use herein described.

WITNESS the signature of the State Engineer, affixed

this 24th *day of* June, 19 58.

Lewis A. Stanley
State Engineer

Recorded in State Record of Water Right Certificates, Volume 17, *page* 24162

Enclosure #3

FOR 19___ TO 19___

MONTH	ACRES IRRIGATED	IRRIGATION WATER	OTHER INDUSTRIAL	STORED WATER
			TOTAL DIVERSIONS ACRE-FEET, GALLONS, OR CUBIC FEET	
OCTOBER			400	GALLONS
NOVEMBER			1200	
DECEMBER			700	
JANUARY			1400	
FEBRUARY			300	
MARCH			6500	
APRIL			831,200	
MAY			0	
JUNE			1300	
JULY			100	
AUGUST			1100	
SEPTEMBER			300	

PLEASE DESCRIBE YOUR ESTIMATING METHODS:

WELL PUMP IS EQUIPPED WITH A WATER METER WITH COUNTER CALIBRATED IN GALLONS. THIS METER IS READ AND RECORDED DAILY.

USE CODES

IR-IRRIGATION	MU-MUNICIPAL
DO-DOMESTIC	PW-POWER
CS-CAMPSITE	RC-RECREATION
FI-FISH	RW-ROAD CONSTRUCTION
IN-INDUSTRIAL	SC-SCHOOL
LV-LIVESTOCK	TC-TEMP CONTROL
LW-LIVESTOCK/WILDLIFE	

I CERTIFY THAT THE ABOVE IS A TRUE AND ACCURATE ACCOUNTING OF WATER DIVERTED AND/OR USED.

SIGNATURE: [signature]

PERMIT U-509
WELL NUMBER 3

NOTE: WELL # 2 (PERMIT 6-642) IS USE AS OUR PRIMARY SOURCE OF WATER WITH THIS WELL (#3) USED AS A BACK-UP SOURCE

total 844,500 gals

[illegible] #2

FOR 19 87 TO 19 88

MONTH	ACRES IRRIGATED	TOTAL DIVERSIONS ACRE-FEET, GALLONS, OR CUBIC FEET IRRIGATION WATER	OTHER INDUSTRIAL	STORED WATER
OCTOBER			1,824,000	CUBIC FEET
NOVEMBER			1,668,500	
DECEMBER			1,740,000	
JANUARY			1,740,200	
FEBRUARY			1,638,900	
MARCH			1,762,900	
APRIL			2,037,500	
MAY			2,448,200	
JUNE			2,669,600	
JULY			2,762,100	
AUGUST			3,019,900	
SEPTEMBER			2,547,100	

PLEASE DESCRIBE YOUR ESTIMATING METHODS:

PUMP IS EQUIPPED WITH WATERMETER ~~THAT~~ WITH COUNTER CALIBRATED IN CUBIC FEET. THIS METER IS READ AND RECORDED DAILY.

USE CODES

IR-IRRIGATION	MU-MUNICIPAL
DO-DOMESTIC	PW-POWER
CS-CAMPSITE	RC-RECREATION
FI-FISH	RW-ROAD CONSTRUCTION
IN-INDUSTRIAL	SC-SCHOOL
LV-LIVESTOCK	TC-TEMP CONTROL
LW-LIVESTOCK/WILDLIFE	

I CERTIFY THAT THE ABOVE IS A TRUE AND ACCURATE ACCOUNTING OF WATER DIVERTED AND/OR USED.

SIGNATURE: [signature]

PERMIT G-642
WELL # 2

total 25,858,700 C.F

X 7.48 =

193,423,076 Gallons

WATER USE REPORT

NOV 08 1989

WATER RESOURCES DEPT
SALEM, OREGON

FOR 19___ TO 19___

Cert 24162

MONTH POD-ID: 504

	ACRES IRRIGATED	TOTAL DIVERSIONS ACRE-FEET, GALLONS, OR CUBIC FEET IRRIGATION WATER	OTHER ____	STORED WATER
OCTOBER 1988			3 GALLONS	
NOVEMBER			0	
DECEMBER			6	
JANUARY			0	
FEBRUARY			0	
MARCH			6	
APRIL			0	
MAY			12	
JUNE			531	
JULY			0	
AUGUST			13	
SEPTEMBER 1989			0	

PLEASE DESCRIBE YOUR ESTIMATING METHODS:

PUMP IS EQUIPPED WITH A WATER METER CALIBRATED IN GALLONS. THIS METER IS READ AND RECORDED DAILY. MD

USE CODES

IR-IRRIGATION	MU-MUNICIPAL
DO-DOMESTIC	PW-POWER
CS-CAMPSITE	RC-RECREATION
FI-FISH	RW-ROAD CONSTRUCTION
IM-INDUSTRIAL	SC-SCHOOL
LV-LIVESTOCK	TC-TEMP CONTROL
LW-LIVESTOCK/WILDLIFE	

I CERTIFY THAT THE ABOVE IS A TRUE AND ACCURATE ACCOUNTING OF WATER DIVERTED AND/OR USED.

SIGNATURE: [signature]

PERMIT # U-509
DOMESTIC WELL #3

NOTE: WELL #2 (PERMIT #G-642) IS USED AS THE PRIMARY WATER SOURCE, WELL #3 (PERMIT #U-509) IS AN EMERGENCY BACK-UP SOURCE.

571

WATER USE REPORT

FOR 1995 TO 1996

****

MONTH	ACRES IRRIGATED	TOTAL DIVERSIONS ACRE-FEET, GALLONS, OR CUBIC FEET IRRIGATION WATER	OTHER	STORED WATER
		PUMP#2 CF	PUMP#3 GAL	
OCTOBER		1,774,700	420,400	
NOVEMBER		1,848,900	0	
DECEMBER		1,851,000	1,500	
JANUARY		1,833,600	58,700	
FEBRUARY		1,725,900	9,000	
MARCH		1,806,000	800	
APRIL		2,036,300	500	
MAY		2,334,300	1,200	
JUNE		2,344,900	31,300	
JULY		2,388,600	42,000	
AUGUST		1,712,200	9,598,000	
SEPTEMBER		2,288,600	51,500	10,215,700 gallons

PLEASE DESCRIBE YOUR ESTIMATING METHODS:

USE CODES

IR-IRRIGATION	MU-MUNICIPAL
DO-DOMESTIC	PW-POWER
CS-CAMPSITE	RC-RECREATION
FI-FISH	RW-ROAD CONSTRUCTION
IN-INDUSTRIAL	SC-SCHOOL
LV-LIVESTOCK	TC-TEMP CONTROL
LW-LIVESTOCK/WILDLIFE	

I CERTIFY THAT THE ABOVE IS A TRUE AND ACCURATE ACCOUNTING OF WATER DIVERTED AND/OR USED.

SIGNATURE: Randall B. Ryan

Total 23,945,000 C.F

x 7.48 = 179,108,600

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WATER RESOURCES DEPT.
SALEM, OREGON

WATER USE REPORT

FOR 19 94 TO 19 95

****

TOTAL DIVERSIONS
ACRE-FEET, GALLONS, OR CUBIC FEET

MONTH	ACRES IRRIGATED	IRRIGATION WATER	OTHER	STORED WATER
OCTOBER			1,958,200 CF	
NOVEMBER			1,889,200 CF	200 gal.
DECEMBER			1,982,900 CF	500 gal.
JANUARY			1,929,100 CF	1,300 gal.
FEBRUARY			1,669,100 CF	200 gal.
MARCH			1,814,000 CF	63,000 gal.
APRIL			2,148,500 CF	
MAY			2,139,000 CF	
JUNE			2,120,100 CF	
JULY			2,867,400 CF	100 gal.
AUGUST			2,757,000 CF	1,774,800 gal.
SEPTEMBER			2,543,300 CF	10,400 gal.
			25,817,800	1,850,500 gals

PLEASE DESCRIBE YOUR ESTIMATING METHODS:

Water metering on both pumps.

25,817,800
X 7.48 = 193,521,064 gals

USE CODES

IR - IRRIGATION	MU - MUNICIPAL
DO - DOMESTIC	PW - POWER
CS - CAMPSITE	RC - RECREATION
FI - FISH	RW - ROAD CONSTRUCTION
IN - INDUSTRIAL	SC - SCHOOL
LV - LIVESTOCK	TC - TEMP CONTROL
LW - LIVESTOCK/WILDLIFE	

I CERTIFY THAT THE ABOVE IS A TRUE AND ACCURATE ACCOUNTING OF WATER DIVERTED AND/OR USED.

SIGNATURE

RECEIVED
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WATER RESOURCES D
SALEM, OREGON

WATER USE REPORT

FOR 1992 TO 1993

MONTH	ACRES IRRIGATED	TOTAL DIVERSIONS ACRE-FEET, GALLONS, OR CUBIC FEET IRRIGATION WATER	OTHER ____	STORED WATER
OCTOBER			1,817,000 CF	
NOVEMBER			1,615,000 CF	
DECEMBER			1,734,500 CF	
JANUARY			1,628,000 CF	
FEBRUARY			1,495,000 CF	
MARCH			1,707,700 CF	
APRIL			1,932,800 CF	
MAY			2,138,500 CF	
JUNE			2,090,938 CF	17159438
JULY			17,252,900 Gal.	
AUGUST			16,597,500 Gal.	
SEPTEMBER			15,453,500 Gal.	

PLEASE DESCRIBE YOUR ESTIMATING METHODS:

Total 177,656,496 gal

17,159,438
X 7.48 =
128,352,596 gal

USE CODES

IR-IRRIGATION	MU-MUNICIPAL
DO-DOMESTIC	PW-POWER
CS-CAMPSITE	RC-RECREATION
FI-FISH	RW-ROAD CONSTRUCTION
IN-INDUSTRIAL	SC-SCHOOL
LV-LIVESTOCK	TC-TEMP CONTROL
LW-LIVESTOCK/WILDLIFE	

I CERTIFY THAT THE ABOVE IS A TRUE AND ACCURATE ACCOUNTING OF WATER DIVERTED AND/OR USED.

SIGNATURE: [signature]

WATER USE REPORT

FOR 1993 TO 1994

MONTH	ACRES IRRIGATED	TOTAL DIVERSIONS ACRE-FEET, GALLONS, OR CUBIC FEET IRRIGATION WATER	OTHER	STORED WATER
		PUMP 2	PUMP 3	
OCTOBER			13,401,400 gal.	
NOVEMBER			11,634,300 gal.	
DECEMBER		1,606,100 cf	10,812,500 gal.	
JANUARY		1,892,900 cf	35,848,200 gals	
FEBRUARY		1,689,100 cf		
MARCH		1,925,200 cf		
APRIL		2,198,000 cf		
MAY		2,401,400 cf		
JUNE		2,344,200 cf	11,124 gal.	
JULY		2,641,600 cf	9,611 gal.	
AUGUST		2,786,900 cf	5,585 gal.	
SEPTEMBER		2,432,800 cf	26,320.00 gals	
		21,918,200	35,874,520	

PLEASE DESCRIBE YOUR ESTIMATING METHODS:

× 7.48 = 163,948,136 gals

USE CODES

IR-IRRIGATION	MU-MUNICIPAL
DO-DOMESTIC	PW-POWER
CS-CAMPSITE	RC-RECREATION
FI-FISH	RO-ROAD CONSTRUCTION
IN-INDUSTRIAL	SC-SCHOOL
LV-LIVESTOCK	TC-TEMP CONTROL
LO-LIVESTOCK/WILDLIFE	

I CERTIFY THAT THE ABOVE IS A TRUE AND ACCURATE ACCOUNTING OF WATER DIVERTED AND/OR USED.

SIGNATURE: [illegible]

Cert 24701 FOR 19 88 TO 19 89

POD-ID: 505

MONTH	ACRES IRRIGATED	TOTAL DIVERSIONS ACRE-FEET, GALLONS, OR CUBIC FEET IRRIGATION WATER	OTHER INDUSTRIAL	STORED WATER
OCTOBER 1988			2,191,600 CUBIC FEET	
NOVEMBER			1,677,000	
DECEMBER			1,698,900	
JANUARY			1,659,200	
FEBRUARY			1,554,900	
MARCH			1,737,700	
APRIL			1,798,700	
MAY			2,235,200	
JUNE			2,444,500	
JULY			2,802,100	
AUGUST			2,802,600	
SEPTEMBER 1989			2,321,000	

PLEASE DESCRIBE YOUR ESTIMATING METHODS:

PUMP IS EQUIPPED WITH A WATERMETER CALIBRATED IN CUBIC FEET. THIS METER IS READ AND RECORDED DAILY.

MD

USE CODES

IR-IRRIGATION	MU-MUNICIPAL
DO-DOMESTIC	PW-POWER
CS-CAMPSITE	RC-RECREATION
FI-FISH	RW-ROAD CONSTRUCTION
IN-INDUSTRIAL	SC-SCHOOL
LV-LIVESTOCK	TC-TEMP CONTROL
LW-LIVESTOCK/WILDLIFE	

I CERTIFY THAT THE ABOVE IS A TRUE AND ACCURATE ACCOUNTING OF WATER DIVERTED AND/OR USED.

SIGNATURE: [signature]

PERMIT #G-642
DOMESTIC WELL #2

Total 24,922,500

x 7.48 =

186,420,300 gals

APPENDIX

DM - 1000 # [illegible]

Fax 518-8130 Greg Deaman DEC 1 0 1989

4N/33E/2C

STATE OF OREGON

WATER WELL REPORT

(as required by ORS 537.765)

WATER RESOURCES DEPT.
SALEM, OREGON

(START CARD) # 11452

(1) OWNER:

Well Number: _____

Name City of Helix

Address P.O. Box 325

City Helix State OR Zip 97835

(2) TYPE OF WORK:

☑ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD

☑ Rotary Air ☐ Rotary Mud ☐ Cable

☐ Other _____

(4) PROPOSED USE:

☐ Domestic ☑ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Other _____

(5) BORE HOLE CONSTRUCTION:

Special Construction approval Yes ☐ No ☑ Depth of Completed Well 1296 ft.

Explosives used Yes ☐ No ☑ Type _____ Amount _____

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
15¼"	0	800	Cement	0	496	748 sacks
10"	800	1296				

How was seal placed: Method ☑ A ☐ B ☐ C ☐ D ☐ E

☐ Other _____

Backfill placed from _____ ft. to _____ ft. Material _____

Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12"	+2	800	.375	☑	☐	☑	☐
	[redacted]					☐	[redacted]	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	8"	790	1296	.322	☑	☐	☑	☐
					☐	☐	☐	☐

Final location of shoe(s) _____

(7) PERFORATIONS/SCREENS:

☑ Perforations Method Factory

☐ Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
500	800	1/4x3"				☑	☐
Alternated			40 ft. joints -			☐	☐
perforated			& plain			☐	☐
790	1296	1/4x3"				☐	☑
Alternated			40 ft. joints -			☐	☐
perforated			& plain			☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour

☐ Pump ☐ Bailer ☑ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
400		1296	1 hr.

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 ☐ Muddy ☐ Odor ☐ Colored ☐ Other _____

Depth of strata: _____

(9) LOCATION OF WELL by legal description:

County Umatilla Latitude _____ Longitude _____

Township 4N N or S, Range 33E E or W, WM.

Section 2 NE ¼ SW ¼

Tax Lot _____ Lot _____ Block _____ Subdivision _____

Street Address of Well (or nearest address) _____

Helix, OR 97835

(10) STATIC WATER LEVEL: After cementing casing

325 ft. below land surface. Date 11-14-8

Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:

Depth at which water was first found 79

From	To	Estimated Flow Rate	SW
79	113	150	7
244	265	35	7
334	372	70	7
534	547	100	27

(12) WELL LOG:

Ground elevation _____

Material	From	To	SW
Brown silty soil	0	79	
Soft red & brown basalt	79	113	W
Hard gray basalt	113	210	
Soft red & gray basalt	210	226	
Gray basalt	226	244	
Soft brown basalt	244	265	W
Gray basalt	265	286	
Brown & gray basalt	286	297	
Med. gray basalt	297	334	
Soft brown & gray basalt with yellow soapstone	334	372	W
Gray basalt	372	390	
Soft brown & gray basalt with yellow soapstone	390	400	
Hard gray basalt	400	464	
Soft gray basalt	464	478	
Hard gray basalt	478	534	
Soft red basalt with green soapstone	534	547	W
Red & gray basalt	547	581	

Cont. pg. 2

Date started 9-19-89 Completed 11-14-89

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, abandonment of this well is in compliance with Oregon well construct standards. Materials used and information reported above are true to my b knowledge and belief.

WWC Number _____

Signed _____ Date _____

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonm work performed on this well during the construction dates reported above. work performed during this time is in compliance with Oregon v construction standards. This report is true to the best of my knowledge a belief.

WWC Number 121

Signed Patrick C Wallace Date 12-4-89

UMH
4N/33E/2C

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

WATER RESOURCES DEPT.
SALEM, OREGON

(START CARD) # 11452 Pg. 2

(1) OWNER: Well Number: _____
Name City of Helix
Address P.O. Box 325
City Helix State OR Zip 97835

(2) TYPE OF WORK:
☐ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD
☐ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other _____

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other _____

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes ☐ No ☐ Depth of Completed Well _____ ft.
Explosives used Yes ☐ No ☐ Type _____ Amount _____

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other _____
Backfill placed from _____ ft. to _____ ft. Material _____
Gravel placed from _____ ft. to _____ ft. Size of gravel _____

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s) _____

(7) PERFORATIONS/SCREENS:
☐ Perforations Method _____
☐ Screens Type _____ Material _____

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

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 ☐ Muddy ☐ Odor ☐ Colored ☐ Other _____
Depth of strata: _____

(9) LOCATION OF WELL by legal description:
County Umatilla Latitude _____ Longitude _____
Township _____ N or S, Range _____ E or W, WM.
Section _____ _____ ¼ _____ ¼
Tax Lot _____ Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address) _____

(10) STATIC WATER LEVEL:
_____ ft. below land surface. Date _____
Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found _____

From	To	Estimated Flow Rate	SWL
820	837	150	275
1199	1230	50	275
1264	1296	75	325

(12) WELL LOG: Ground elevation _____

Material	From	To	SWL
Soft gray claystone	581	592	
Gray basalt	592	612	
Soft gray basalt	612	718	
Gray basalt	718	725	
Soft gray basalt	725	740	
Gray basalt	740	786	
Gray basalt with soapstone	786	797	
Gray basalt	797	820	
Soft brown & gray basalt with soapstone	820	837	WE
Soft gray basalt	837	885	
Hard gray basalt	885	919	
Soft gray basalt	919	932	
Hard gray basalt	932	1017	
Red & gray basalt with green soapstone	1017	1044	
Gray basalt	1044	1199	
Soft gray basalt with green soapstone	1199	1230	WE
Gray basalt	1230	1264	
Soft gray basalt with green soapstone	1264	1296	W

Date started 9-19-89 Completed 11-14-89

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, abandonment of this well is in compliance with Oregon well constructi standards. Materials used and information reported above are true to my b knowledge and belief.

WWC Number _____
Signed _____ Date _____

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonm work performed on this well during the construction dates reported above. work performed during this time is in compliance with Oregon w construction standards. This report is true to the best of my knowledge a belief.

WWC Number 121
Signed Patrick C Wallace Date 12-4-89

Collar 1580

UMAT 0551
3N/34E/4d

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

PAGE 1 OF 2

WATER RESOURCES DEPARTMENT

(START CARD) # 1492

(1) OWNER:
Well Number: #3
Name: CITY OF ADAMS
Address: P.O. BOX 20
City: ADAMS State: OR Zip: 97810

(2) TYPE OF WORK:
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD
☐ Rotary Air ☐ Rotary Mud ☐ Cable
☒ Other: ROTARY REVERSE AIR

(4) PROPOSED USE:
☐ Domestic ☒ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes ☐ No ☒ Depth of Completed Well 1725 ft.
Explosives used Yes ☐ No ☒ Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
18	0	46	NEAT			
14 3/4	46	800	CEMENT	0	800	308 SKS
10	800	1725	NONE			

How was seal placed: Method ☒ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+1	800	.375	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:	10	780	800	.365	☒	☐	☒	☐
	8	800	1147	.322	☒	☐	☒	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☒ Perforations Method MILL CUT
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
800	1147	3/4	9716	8"		☐	☐
						☐	☒
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	~~Drillstem~~ PUMP at	Time
300	157	560	1 hr. + 30 min
500	239	560	1 HR + 30 min
700	358	560	17 HRS.

Temperature of water 69 Depth Artesian Flow Found
Was a water analysis done? ☒ Yes By whom CITY ENGINEER
Did any strata contain water not suitable for intended use? ☐ Too little NO
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County UMATILLA Latitude Longitude
Township 3 N or S, Range 34 E or W, WM.
Section 4 NW ¼ SE ¼
Tax Lot 1201 Lot Block Subdivision
Street Address of Well (or nearest address) ADAMS OR

(10) STATIC WATER LEVEL:
133 ft. below land surface. Date SEPT 15
Artesian pressure lb. per square inch. Date

(11) WATER BEARING ZONES:
Depth at which water was first found 1286

From	To	Estimated Flow Rate	SW
1286	1299	50 GPM	13
1299	1376	75 GPM	13
1492	1503	100 GPM	13
1699	1725	500+ GPM	13

(12) WELL LOG:
Ground elevation

Material	From	To	SW
TAN CLAY	0	23	
GRAY BASALT	23	148	
BRN CLAY + BRN BASALT	148	166	
GRAY BASALT	166	200	
BLK BASALT	200	217	
GRAY BASALT	217	244	
GRN CLAY + BLK BASALT	244	269	
BLK BASALT	269	297	
BLK BASALT + GRN CLAY	297	336	
BLK BASALT	336	361	
BLK BASALT + GRN CLAY	361	528	
BLK BASALT	528	562	
GRAY BASALT	562	576	
BLK BASALT	576	609	
BLK BASALT HARD	609	640	
GRN CLAY	640	649	
BLK BASALT + GRN CLAY	649	667	
GRAY BASALT	667	748	
BLK BASALT + GRAY CLAY	748	763	
GRAY BASALT	763	878	
BLK BASALT + RED CLAY	878	883	
GRAY BASALT HARD	883	923	
PAGE 1 OF			

Date started JULY 24 89 Completed SEPT 16 8

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration abandonment of this well is in compliance with Oregon well construc standards. Materials used and information reported above are true to my l knowledge and belief.

WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonm work performed on this well during the construction dates reported above work performed during this time is in compliance with Oregon construction standards. This report is true to the best of my knowledge belief.

WWC Number 53-
Signed Arnold E. Holcomb Date OCT 13 8

UMAT
3N/34E/4d

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

PAGE 2 OF 2

(START CARD) # 1492

(1) OWNER:
Well Number: #3

Name CITY OF ADAMS
Address P.O. BOX 20
City ADAMS State OR Zip 97810

(2) TYPE OF WORK:
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

(3) DRILL METHOD
☐ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval Yes ☐ No ☐ Depth of Completed Well _____ ft.
Explosives used Yes ☐ No ☐ Type _____ Amount _____

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from _____ ft. to _____ ft. Material
Gravel placed from _____ ft. to _____ ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Final location of shoe(s)

(7) PERFORATIONS/SCREENS:
☐ Perforations Method
☐ Screens Type _____ Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
			1 hr.

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 ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal descriptior
County _____ Latitude _____ Longitude _____
Township _____ N or S, Range _____ E or W, WM.
Section _____ ¼ _____ ¼
Tax Lot _____ Lot _____ Block _____ Subdivision _____
Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:
_____ ft. below land surface. Date _____
Artesian pressure _____ lb. per square inch. Date _____

(11) WATER BEARING ZONES:
Depth at which water was first found

From	To	Estimated Flow Rate	SW

(12) WELL LOG:
Ground elevation

Material	From	To	SW
BLK BASALT	923	990	
BLK BASALT + GRN CLAY	990	1000	
RED BASALT	1000	1005	
BLK BASALT	1005	1030	
GRAY BASALT	1030	108	
BLK BASALT + GRAY CLAY	1088	112	
GRAY BASALT HARD	1123	1145	
RED CLAY	1145	1161	
BLK BASALT	1161	1223	
BLK BASALT + RED CLAY	1223	1241	
GRAY BASALT	1241	1286	
BLK BASALT + GRAY CLAY	1286	1299	13
BLK BASALT	1299	1376	
BLK BASALT	1376	1492	
GRAY BASALT HARD	1472	1492	
BLK BASALT SOFT	1492	1503	13
BLK BASALT MED	1503	1672	
GRAY BASALT HARD	1672	1679	
BLK BASALT SOFT	1679	1725	13

Date started JULY 24 89 Completed SEPT 16 89

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, abandonment of this well is in compliance with Oregon well construct standards. Materials used and information reported above are true to my b knowledge and belief.

WWC Number _____
Signed _____ Date _____

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonm work performed on this well during the construction dates reported above. work performed during this time is in compliance with Oregon v construction standards. This report is true to the best of my knowledge a belief.

WWC Number 53
Signed Arnold E. Holman Date OCT 13 8

TABLE 2.—*Drillers' logs of representative wells*—Continued

Materials	Thickness (feet)	Depth (feet)
5N/28-10R3. U.S. Army Corps of Engineers. Drilled by R. J. Strasser, 1952		
Glaciofluviatile deposits:		
Soil and loose sand	20	20
Gravel and boulders, cemented	15	35
Gravel and boulders	5	40
Sand and gravel, cemented	11	51
Sand and gravel, loose	11	62
Gravel, some boulders and clay	10	72
Gravel, cemented, hard	14	86
Gravel	11	97
Gravel, cemented	3	100
Boulders and loose gravel	7	107
Gravel, cemented	10	117
Columbia River basalt:		
Basalt, black and red, broken	7	124
Basalt, flow breccia	9	133
Basalt, gray, hard; creviced at 182 and 194 ft	116	249
Lower part of the Ellensburg formation:		
Shale, green	24	273
Clay, gray	15	288
"Selvage"	12	300
Columbia River basalt:		
Basalt, black, porous	6	306
Basalt, gray	51	357
Basalt, black, hard and soft	48	405
Shale, green	2	407
Basalt, medium-hard	15	422
Basalt, gray and black, hard	49	471
Basalt, brown and black, creviced	5	476
Basalt, gray	20	496
Basalt, porous, caving	16	512
Basalt, gray and black, hard and broken	17	529
Basalt, broken; some clay	15	544
Basalt, gray, hard	43	587
Basalt, red, black, brown, porous	9	596
Basalt, gray	26	622
Basalt, black, porous, broken	11	633
Basalt, gray, medium-hard	17	650
Basalt, black, porous, loose	20	670
Basalt, black and gray	37	707
Basalt, broken, and blue clay	2	709
Basalt, broken, and green "slate," mineralized with iron pyrites, green coating in vesicles	1½	713½
Basalt, black, porous, and green "slate"	42½	756
Basalt, black	21	777
5N/28-19A1. City of Umatilla (well 3). Drilled by A. M. Jannsen, 1947		
Glaciofluviatile deposits:		
Clay and topsoil	17	17
Gravel and boulders	10	27
Sand	11	38
Gravel	132	170
Columbia River basalt:		
Basalt	175	345
Lower part of the Ellensburg formation and interbedded basalt:		
Clay, blue	28	373
Basalt, broken	42	415
Basalt	90	505
Clay	30	535
Columbia River basalt:		
Basalt	215	750
Sandy formation (decomposed basalt?)	5	755
Basalt	30	785

NOTE.—Casing, 16-inch, set to 170 feet, 10-inch set from 310 to 373 ft, 8-inch set from 361 to 535 ft. Open 8-inch hole from 535 to 785 ft.

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Mc Nary #3
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Umatilla
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Single page

STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

UMAT 5930

NOV 12 1993
WATER RESOURCES DEPT.
SALEM, OREGON

2N/33E/11ad

(START CARD) # 46226

OWNER: CTUIR Well Number 3

Address P.O. Box 638

City Pendleton State OR Zip 97801

(2) TYPE OF WORK:
[X] New Well [ ] Deepen [ ] Recondition [ ] Abandon

(3) DRILL METHOD:
[ ] Rotary Air [ ] Rotary Mud [X] Cable
[X] Other Reverse Circulation Rotary

(4) PROPOSED USE:
[ ] Domestic [X] Community [ ] Industrial [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval [X] Yes [ ] No Depth of Completed Well 1100 ft.
Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
20	0	251	cement	8	424	475 sks
15	251	425	Pitless extension installed with			
12	425	1100	10" side outlet valve below grd			
			& 12" in line valve below side outlet.			

How was seal placed: Method [X] A [ ] B [X] C [ ] D [ ] E
[ ] Other
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+6	424	.375	[X]	[ ]	[X]	[ ]
	including pitless				[ ]	[ ]	[ ]	[ ]
	extension				[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:	10	409	1100	.250	[X]	[ ]	[X]	[ ]
	except at screens.				[ ]	[ ]	[ ]	[ ]

Final location of shoe(s) 424

(7) PERFORATIONS/SCREENS:
[X] Perforations Method see attached
[X] Screens Type V shape wire wrap Material 304SS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
see attached liner/screen					PS	[ ]	[X]
assembly list.						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump [ ] Bailer [ ] Air [X] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
500	38 psi backpressure		3 hr.
840	30 psi backpressure		2.5 hr.
[illegible]00	12 psi backpressure		72 hr.

Temperature of Water ~73°F 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 [ ] Muddy [ ] Odor [ ] Colored [ ] Other
Depth of strata:

819323

(9) LOCATION OF WELL by legal description:
County Umatilla Latitude Longitude
Township 2N N or S. Range 33E E or W. WM.
Section 11 SE ¼ of NE ¼
Tax Lot 1200 Lot Block Subdivision
Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:
---- ft. below land surface. Date ----
Artesian pressure 46 lb. per square inch. Date 10/6/93

(11) WATER BEARING ZONES:
Depth at which water was first found in basalt: 27'

From	To	Estimated Flow Rate	SWL
27	46	< 100	11
65	75	< 100	9
811	830	225*	*
892	1085	1000*	*

(12) WELL LOG:
Ground elevation ~ 1277

Material	From	To	SWL
see attached log			
*Well was flowing artesian below 811'.			
Shut in pressures were ~44psi (5/93).			
Intermediate flow rates were increasing			
with depth as follows:			
830' >225 gpm			
915' >275 gpm			
989' >285 gpm			
1042' >365 gpm			
1077' >900 gpm			
1100' see (8)			

Date started 12/2/92 Completed 10/26/93

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed WWC Number 1367
Date 10/29/93

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All 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.

Signed WWC Number 649
Date 10/29/93

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT

CTUIR
Well No. 3
Start Card No. 46226
10" Liner/Screen Assembly

FROM	TO	LENGTH	DESCRIPTIONS
409	413	4.0	Blank w/J Slots (reinforced & covered)
413	422.5	9.5	*
422.5	804.4	20.1x19 Pcs	*
804.4	814.4	10.0	Factory Perforations (3/16x3 perf., 40/ft, Typ.)
814.4	834.65	20.25	Screen (.150 Slot, Typ.)
834.65	844.65	10.0	Fact. Perf.
844.65	864.75	20.1	*
864.75	884.85	20.1	*
884.85	904.95	20.1	*
904.95	924.95	20.1	*
924.95	940.05	15.1	*
940.05	945.05	5.0	Fact. Perf.
945.05	965.15	20.1	Blank
965.15	985.25	20.1	Blank
985.25	1019.5	34.25	Blank
1019.5	1029.5	10.0	Fact. Perf.
1029.5	1049.75	20.25	Screen
1049.75	1064.75	15.0	Fact. Perf.
1064.75	1085	20.25	Screen
1085	1100	15.0	Fact. Perf.

*Each of these pieces have 18-1/2x6 torch perforations located 3' to 6' from top end.

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CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION
Start Card No. 46226
by Schneider Drilling Co.
June 2, 1993

Depth From	Depth To	Description
0	2	Top soil, brown
2	5	Peat & sand
5	16	Gravel, 6"- & sand, brown
16	19	Gravel, 4"- & clay, brown
19	22	Gravel, 2"- & clay, brown, conglomerate
22	27	Basalt, blk, broken, & clay, blk
27	46	Basalt, blk, fractured, med-hard
46	58	Basalt, gray, hard
58	60	Basalt, dark gray, med-hard
60	62	Basalt, blk, brkn, ves, some cly, gry & blue
62	65	Basalt, blk, well frac, & claystone, blue
65	67	Basalt, blk, vesicular
67	75	Basalt, blk, frac, some vesicular, med
75	78	Basalt, blk, vesicular, soft, & some clay, blue
78	81	Basalt, blk, frac, ves, med-sft, & some cly, blue
81	83	Basalt, blk, some frac, med-hard
83	89	Basalt, blk, frac, med, & some clay, gray
[illegible]	92	Basalt, blk & gray, frac, med
[illegible]	95	Basalt, gray, hard
95	105	Basalt, gray, hard, some frac
105	108	Basalt, gray, hard
108	109	Basalt, gray, well frac
109	128	Basalt, gray, hard
128	133	Basalt, blk, brkn, ves, some cs, blue
133	136	Basalt, blk, frac, some ves
136	140	Basalt, blk, frac, some ves, med-soft
140	143	Basalt, blk, ves, very soft, & some clay & cs, blue
143	146	Basalt, blk, ves & frac, med-soft
146	149	Basalt, blk, some frac & some ves, med
149	152	Basalt, blk, some frac, med-hard
152	161	Basalt, blk, frac, med
161	165	Basalt, drk gray, frac, med-hard
165	171	Basalt, blk-red & brn, ves, med-sft, some cs, blue
171	174	Basalt, blk, frac, some ves, & clay, gray
174	184	Basalt, blk, frac, med
184	188	Basalt, dark gray, some frac, med-hard
188	200	Basalt, gray, hard
200	201	Basalt, gray, well frac, med
201	205	Basalt, gray, hard
[illegible]	230	Basalt, gray, some frac, brown, hard
[illegible]	265	Basalt, gray & brown, some frac, hard
265	275	Basalt, gray, hard
275	280	Basalt, gray & brown, frac, med-hard
280	295	Basalt, dk gray & brown, ves, frac, med, cs, blue

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[illegible] DEPT.
[illegible]

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION
Start Card No. 46226, cont.

From	To	Description
	312	Basalt, black, ves, frac, med-soft, cs, blue
312	366	Basalt, blk & brn, frac, med-hard, some cs
366	369	Basalt, blk & brn, frac, med-hard
369	383	Basalt, dark gray, med-hard
383	385	Basalt, gray & brn, some frac, med-hard
385	388	Basalt, drk gray, frac, med, & cs, green-blue
388	393	Basalt, blk, cindery & red, ves, soft, & cs, blue
393	403	Basalt, blk, ves, med-soft, some clay, brn
403	407	Basalt, dk brn, ves, med, & cs, blue
407	410	Basalt, dk gry-blk, ves, med, & cs, blue
410	416	Basalt, blk, frac, med, & some cs, blue
416	423	Basalt, dk gray & brn, some frac, med-hard
423	425	Basalt, dk gray & brn, frac, med-hard
425	430	Basalt, dk gray & brn, frac, hard
430	437	Basalt, brn, ves, frac, med-soft, & cs, blue
437	442	Basalt, gray & brn, ves, frac, med, cs
442	458	Basalt, gray, ves, med, & some cs
458	477	Basalt, dk gray, frac, med-hard
477	485	Basalt, dk gray, ves, frac, med-hard, cs
485	488	Basalt, dk gray, frac, med, & clay & cs
488	490	Basalt, dk gray, some ves, frac, med, & cs
490	492	Basalt, dk gray, frac, med-hard
	497	Basalt, dk gray, frac, med, & cs
497	498	Basalt, dk gray, med, & cs, blue-green
498	500	Basalt, dk gray, frac, med
500	502	Basalt, gray, frac, med, & some cs, blue-green
502	504	Basalt, gray, some frac, med
504	507	Basalt, gray, some frac, med, & clay, brown
507	512	Basalt, gry, md-sft, & cs, blue-grn, & cly, gry-brn
512	518	Basalt, gray, med-soft, & clay, gray-brn
518	542	Basalt, gray, frac, med
542	545	Basalt, gray, med-hard, frac, & cs, blue-grn
545	553	Basalt, gry-brn, frc, vs, md-sft, & some cly, brn & cs, grn
553	557	Basalt, gray, ves, frac, med-soft, with clay & cs
557	570	Basalt, gray, frac, med-hard
570	577	Basalt, gray, frac, med-hard, & cs, blue-grn
577	578	Basalt, gry, frac, med-hard, & cly, blue-grn, & some cs
578	582	Basalt, gray, ves, med, & cs, blue-grn
582	596	Basalt, gray, med-hard, some frac
596	600	Basalt, gry, & rock, red, brkn, med-soft, & cly, red
600	602	Rock, red, brkn, med-soft, & cs, grn, & cly, red
602	604	Basalt, gry, & some rock, red, brkn, md-sft, & cs, grn
604	606	Basalt, gry, brkn, md-sft, & cs, bl-grn, cly, gry-brn
606	609	Basalt, gray, frac, med, & cs, blue-grn
	616	Basalt, gray, brkn, soft, & clay, gray
616	617	Basalt, gry, brkn, med-soft, & cs, blue-grn, & clay, gry
617	620	Basalt, gray, brkn, med, & cs, blue-grn
620	627	Basalt, gray, brkn, med, & some clay, brown

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CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION
Start Card No. 46226, cont.

From	To	Description
627	637	Basalt, gray, frac, med-hard, & some cs, blue-grn
637	673	Basalt, gray, frac, hard
673	674	Basalt, gray, frac, med, & cly lyrs, blue-grn & red
674	677	Basalt, gray, frac, med, & cs, blue-grn
677	679	Basalt, gray & brn, frac, med, & cs, blue-grn
679	680	Basalt, brn, frac, med-soft, & cs, blue-gry & blue-grn
680	682	Basalt, brown, brkn, med-soft, & cs, blue-grn
682	684	Basalt, gray & brown, frac, med, & cs, blue-grn
684	692	Basalt, gray & brown, frac, med
692	699	Basalt, gray, frac, med
699	709	Basalt, gray, brkn, med, & cs, blue-green
709	711	Basalt, gray, frac, hard
711	714	Basalt, gray, frac, med-hard, & cs, blue-grn
714	717	Basalt, gray, frac, med-hard, & clay, blue-grn
717	719	Basalt, gray, frac, med-hard, & cs, blue-grn
719	722	Basalt, gray, brkn, med-hard, & cs, blue-grn
722	729	Basalt, gray, frac, hard
729	734	Basalt, gray, frac, med-hard, & cs, green
734	741	Basalt, gray, brkn, med
741	743	Basalt, gray, frac, med, & cs, green
743	747	Basalt, gray, frac, med-hard
747	749	Basalt, gray, frac, hard, & some cs, green
749	759	Basalt, gray, frac, hard
759	762	Basalt, gray, frac, hard, & cs, blue-grn
762	764	Basalt, gry, brkn, soft, & cly, sandy, drk gry, & cs, blue-grn
764	777	Basalt, gray, brkn, med, & cs, blue-grn
777	779	Basalt, gray, frac, med-hard
779	797	Basalt, gray, frac, hard, & some cs, blue-grn
797	798	Basalt, gry, brkn, med-soft, & cly, sticky, sand, dk gry
798	807	Basalt, gry, brkn, med-soft, & cly, dk gry, sandy, & sandstone, blue-grn
807	811	Basalt, gray, brkn, med, & some cs, blue-green
811	828	Basalt, black, frac, med
828	830	Basalt, black, very frac, med
830	840	Basalt, dk gray, frac, med-soft, & some cs, green
840	855	Basalt, dk gray, some frac, ves, med-hard
855	872	Basalt, dk gray, some frac, hard
872	874	Basalt, dk gray, frac, ves, med-hard
874	882	Basalt, dk gray, frac, med
882	887	Basalt, dk gray, very frac, med
887	892	Basalt, dk gray & blue, very frac, med
892	897	Basalt, brown, frac, med

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CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION
Start Card No. 46226, cont.

From	To	Description
897	925	Basalt, black, frac, med
925	927	Basalt, black, more frac, med
927	932	Basalt, brown, frac, some ves, med
932	946	Basalt, black, frac, med
946	949	Basalt, dk gray, frac, med
949	952	Basalt, black, frac, med
952	957	Basalt, dk brown, frac, med
957	960	Basalt, brown-gray, frac, med-soft
960	972	Basalt, brown-black, frac, med
972	973	Basalt, dk gray & brown, frac, med-hard
973	982	Basalt, black, frac, med
982	985	Basalt, dk gray, frac, hard
985	1019	Basalt, black, frac, med
1019	1022	Basalt, black, more frac, med-soft
1022	1030	Basalt, brown-black, frac, med-soft
1030	1032	Basalt, black, frac, med
1032	1037	Basalt, brown-black, very frac/brkn, soft
1037	1056	Basalt, black, very frac/brkn, soft
[illegible]	1058	Basalt, black, some frac, med-soft
[illegible]	1060	Basalt, brown, frac, med-soft
1060	1067	Basalt, black, frac, med
1067	1070	Basalt, black, some frac, med
1070	1071	Basalt, black & brown, frac, med
1071	1075	Basalt, black, frac, med
1075	1077	Basalt, gray, more frac, med
1077	1081	Basalt, gray, very frac, some ves, med-soft
1081	1085	Basalt, gray, very frac, some ves, soft
1085	1089	Claystone, brown, soft
1089	1100	Basalt, gray, hard

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STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

UMAT 5929

NOV 12 1993
WATER RESOURCES DEPT.
SALEM, OREGON

2N/33E/9da

(START CARD) # 46225

(1) OWNER: Well Number 4

Name CTUIR

Address P.O. Box 638

City Pendleton State OR Zip 97801

(2) TYPE OF WORK:

[X] New Well [ ] Deepen [ ] Recondition [ ] Abandon

(3) DRILL METHOD:

[ ] Rotary Air [ ] Rotary Mud [X] Cable

[X] Other Reverse Circulation Rotary

(4) PROPOSED USE:

[ ] Domestic [X] Community [ ] Industrial [ ] Irrigation

[ ] Thermal [ ] Injection [ ] Other

(5) BORE HOLE CONSTRUCTION:

Special Construction approval [X] Yes [ ] No Depth of Completed Well 1057 ft.

Explosives used [ ] Yes [X] No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Amount sacks or pounds
20	0	35	cement	8	450	400sks
18	35	258	Pitless extension installed with 10"			
15	258	451	side outlet valve below ground & 12"			
10	451	1057	in line valve below side outlet.			

How was seal placed: Method [X] A [ ] B [X] C [ ] D [ ] E

[ ] Other

Backfill placed from ft. to ft. Material

Gravel placed from ft. to ft. Size of gravel

CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	12	+3.5	450	.375	[X]	[ ]	[X]	[ ]
	including pitless extension				[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
					[ ]	[ ]	[ ]	[ ]
Liner:	8	435	1025	.322	[X]	[ ]	[X]	[ ]
	8	1045	1057	.322	[X]	[ ]	[X]	[ ]

Final location of shoe(s) 450

(7) PERFORATIONS/SCREENS:

[X] Perforations Method Torch

[X] Screens Type V shape wire wrap Material 304SS

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
605	625	.5x6	160			[ ]	[X]
1025	1045	.150		8	PS	[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]
						[ ]	[ ]

(8) WELL TESTS: Minimum testing time is 1 hour

[ ] Pump [ ] Bailer [ ] Air [X] Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
380	59 psi backpressure		2 hr.
640	32 psi backpressure		2 hr.
75	14 psi backpressure		24 hr.
900	3 psi backpressure		12 hr.

Temperature of Water ~73°F 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 [ ] Muddy [ ] Odor [ ] Colored [ ] Other

Depth of strata:

SE 19322

(9) LOCATION OF WELL by legal description:

County Umatilla Latitude Longitude

Township 2N N or S. Range 33E E or W. WM.

Section 9 NE ¼ of SE ¼

Tax Lot 100 Lot Block Subdivision

Street Address of Well (or nearest address)

(10) STATIC WATER LEVEL:

--- ft. below land surface. Date ---

Artesian pressure 74 lb. per square inch. Date 10/7/93

(11) WATER BEARING ZONES:

Depth at which water was first found in basalt: 16'

From	To	Estimated Flow Rate	SWL
16	21	<20	13
207	230	<100	15
1025	1047	see (8)	see(10)

(12) WELL LOG:

Ground elevation ~1217

Material	From	To	SWL
see attached log			
Top 5' (435' to 440') is equipped with 10" J receptor, K packer, & bell reducer.			

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Date started 11/12/92 Completed 10/26/93

(unbonded) Water Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed WWC Number 1367

Date 10/29/93

(bonded) Water Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All 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.

Signed WWC Number 649

Date 10/29/93

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Start Card No. 46225
By Schneider Drilling Co.

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SALEM, OREGON

From	To	Description
0	1	Top soil, brown
1	11	Gravel, 6"-, & some clay, brown
11	16	Basalt, black, broken, soft
16	21	Basalt, black, well fractured, med
21	27	Basalt, blk & brn, brkn w/some clay, dk brn
27	40	Basalt, black, med-hard
40	50	Basalt, black, fractured, med-hard
50	68	Basalt, blk, med-soft, ves, & clay, blue, hard
68	72	Basalt, black, med, some fractures
72	77	Basalt, black, med, fractured
77	80	Basalt, black, med, fractured, vesicular
80	107	Basalt, black, med-hard, some fractures
107	120	Basalt, gray, hard
120	130	Basalt, gray, hard, some fractures
130	144	Basalt, gray, hard
144	149	Basalt, gray, hard, some fractures
149	155	Basalt, gray, hard
155	169	Basalt, gray, hard, some fractures
169	207	Basalt, gray & some black-brown, fractured, med-hard
207	214	Basalt, blue-grn, frac, brkn, soft, & some cs, grn
214	230	Basalt, blue-green, fractured, med-hard
230	244	Basalt, black & gray, fractured, med-hard
244	247	Basalt, black & gray, med-hard
247	250	Basalt, black & gray, med-hard, some fractures
250	258	Basalt, black, med-hard, some fractures
258	285	Basalt, black & brown, med-hard, some fractures
285	299	Basalt, gray, hard
299	310	Basalt, blk & brn, med, ves, & some cly, brn
310	317	Basalt, brn & red, med-soft, ves, & cly, blk
317	328	Basalt, blk & brn, ves, frac, & some cly, blue & brn
328	339	Basalt, black, med-hard, some fractures
339	344	Basalt, gray, hard
344	350	Basalt, gray, hard, some fractures
350	365	Basalt, blk & brn, med, frac, & some claystone, blue
365	384	Basalt, black, med, ves, & clay, gray
384	385	Basalt, black, med, vesicular, & some clay
385	421	Basalt, black, med, fractured

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION, cont.
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421	436	Basalt, gray, hard
436	438	Basalt, black, med-hard, fractured
438	444	Basalt, blk, med, ves, & some claystone and clay layers
444	450	Basalt, blk, med-hard, frac, & some claystone layers
450	451	Basalt, gray, med-hard, some fractures & some claystone
451	456	Basalt, dark gray, med-hard, fractured & claystone
456	471	Basalt, gray, some fractures, med-hard
471	481	Basalt, gray, very little fractures, hard
481	483	Basalt, dark gray & some blue, fractured, med
483	485	Basalt, red & some dark gray, vesicular, soft
485	486	Basalt, brn & some dark gray, vesicular, soft
486	488	Basalt, dark gray, some blue-green frac, med-soft
488	491	Basalt, dark gray, some vesicular, med-soft
491	495	Basalt, dark gray, some ves & blue frac, med-soft
495	497	Basalt, brown & dark gray, ves & blue frac, med-soft
497	500	Basalt, dark gray, some vesicular, med-soft
500	510	Basalt, dk gry & brn, some ves, some blue, frac, md-sft
510	522	Basalt, dark gray, some blue fractures, med
522	525	Basalt, dark gray, green-brown fractures, med
525	527	Basalt, gray, brown fractures, med-hard
527	530	Basalt, gray, some fractures, med-hard
530	536	Basalt, gray, some sandstone & fractures, med
536	538	Basalt, dark gray, fractured, med
538	553	Basalt, dk gry & red, very frac, ves, sft, & cs, blue-grn
553	558	Bslt, red & some gry, some ves & frac, med-sft, & cs, blue
558	560	Bslt, dk gry & red, some ves & frac, med-sft, & cs, blue
560	568	Basalt, dk gry & brn & some red, frac, med-soft, & some cs, blue
568	580	Basalt, dk gray, some fractured, med, claystone, blue
580	582	Basalt, dark gray & brown, some fractures, med-hard
582	585	Basalt, dark gray, some fractures, med-hard
585	608	Basalt, dk gry, some frac, med-hard, some cs, blue
608	623	Basalt, gray, some blue fractures, med-hard
623	629	Basalt, gray, some fractures, med-hard
629	633	Basalt, gray, some frac, med, & cs, blue-green
633	636	Basalt, gray & red, very ves & frac, soft, & cs, blue
636	638	Basalt, gray & brown & blue, ves & frac, soft
638	646	Basalt, dark gray, ves, frac, med-soft
646	650	Basalt, dk gry & brn, frac, ves, med-soft
650	651	Basalt, brown, blue fractures, med-soft
651	656	Basalt, brown-gray, some fractures, med-soft
656	676	Basalt, gray, med

CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION, cont.
Start Card No. 46225

676	681	Basalt, gray, some fractures, med
681	684	Bslt, dk gry & red-brn, ves, frac, soft, & clay/cs, bl-grn
684	691	Basalt, dark gray, some ves & frac, soft, & cs, blue-grn
691	694	Basalt, dark gray, some fractures, med
694	696	Basalt, dk gry & rusty, frac, med, & some cs, blue-grn
696	706	Basalt, dark gray, fractured, med
706	708	Basalt, dk gry & red-brn, ves, frac, sft, & cs, blue-grn
708	710	Basalt, dk gry, ves, soft, & clay/cs, blue-grn
710	716	Basalt, dark gray, some vesicular & fractures, med-soft
716	720	Basalt, dark gray & brown, fractured, med-soft
720	738	Basalt, gray, some fractures, med-hard
738	741	Basalt, dark gray, ves, med, & cs, blue-green
741	745	Basalt, dark gray & blue-green, some fractures, med
745	754	Basalt, brown, ves, frac, soft, & cly/cs, blue-green
754	759	Basalt, dark gray, med-soft
759	768	Basalt, dk gray & brn, med-soft, & clay/cs, blue-green
768	776	Basalt, dk gry, blue fractures, some vesicular, med
776	791	Basalt, dark gray, black fractures, med
791	801	Basalt, dark gray-black, black fractures, med
801	808	Basalt, dk gray-black, black & some green frac, med
808	816	Basalt, dark gray-black, less fractures, med
816	846	Basalt, gray, some fractures, med-hard
846	851	Basalt, gray, hard
851	921	Basalt, gray, fractured, med-hard
921	1010	Basalt, dark gray, fractured, med-hard
1010	1025	Basalt, gray, hard, fractured
1025	1031	Basalt, black, soft, vesicular, some brkn ss, (cinder?)
1031	1035	Basalt, black, vesicular, broken, soft
1035	1047	Basalt, black & brown, vesicular, broken, soft
1047	1057	Basalt, gray, hard

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APPENDIX F

Hydrogeologic Survey,
Phase 2 - Detailed Aquifer Test for
City of Umatilla, Oregon

RANNEY DIVISION

Layne Christensen Company

HYDROGEOLOGIC SURVEY
PHASE 2 – DETAILED AQUIFER TEST
FOR
CITY OF UMATILLA, OREGON

Prepared By:

RANNEY DIVISION

Layne Christensen Company
Kennewick, Washington

RANNEY® METHOD

June 1999

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HYDROGEOLOGIC SURVEY
PHASE 2 - DETAILED AQUIFER TEST
CITY OF UMATILLA, OREGON

1.0 INTRODUCTION

This report presents the results of a detailed aquifer test conducted for the City of Umatilla, Oregon to determine the feasibility of developing an infiltrated water supply by means of a Ranney collector well constructed adjacent to the Columbia River.

The work was carried out under a contract between the Ranney Division of Layne Christensen Company (Ranney) and the City of Umatilla, Oregon. IRZ Consulting of Hermiston provided general engineering supervision for the City during the study.

2.0 LOCATION AND HYDROGEOLOGY

The site of the investigation is located on the south bank of the Columbia River approximately two miles downstream from McNary Dam as shown in Figure SW-137-01. Within this general area, the Columbia River is 2500 to 3000 feet in width and is bordered by a relatively narrow strip of Recent alluvium consisting of sand, gravel, and cobbles with occasional lenses of clay. The alluvium is generally less than 50 feet thick and is underlain by Columbia River basalt. Approximately 2000 feet inland and adjacent to the Recent alluvium, Columbia River basalt is overlain by glaciofluviatile deposits of Pleistocene age. Upstream, in the vicinity of McNary Dam, the river is bordered by Columbia River basalt.

For Phase 1 of the hydrogeologic survey, one 8-inch diameter exploratory test well (TW-1) was drilled to determine the depth and character of the alluvial deposits. The test well was located at the west end of Marina Park approximately 120 feet from the river's edge. The log of the test well is given in Table 1.

Table 1. Log of TW-1

From (ft)	To (ft)	TW-1 Description of Material
0	2	top soil, sand & gravel
2	10	medium gravel, rounded, & sand, cemented sand on some gravel
10	26	medium-coarse gravel, cobbles, rounded, water @16 ft, gry-brn
26	27	sand & gravel with trace brown clay, light brown
27	31	fine-medium sand, gravel, brown silt, cobbles
31	39	gravel (angular & round), all sizes, dk gry sand, cobbles, brn silt
39	44	coarse dark sand, fine gravel, cobbles - drilled @42 ft
44	45	gravelly, gray clay - lost water
45	49	coarse dark sand & gravel with cobbles, water again-lower level
49	51	gravel & sand, angular-round, angular basalt cobbles, brn silt
51	51.5	drilled basalt (bedrock)

The results of a brief step rate pumping test conducted on December 16, 1998 indicated that the water-bearing deposits from a depth of 14.5 to 44 feet were very permeable and potentially suitable for the development of an infiltrated water supply for the City. The upper saturated zone (equivalent to the interval from 14.5 to 26 ft in TW-1) appeared highly permeable, with well rounded medium to coarse gravel and no sand or silt. The complete results of Phase 1 were presented in a letter-report by Ranney dated January 22, 1999. Based on the favorable results, the decision was made to proceed with Phase 2 - Detailed Aquifer Test.

For the aquifer test, two 6-inch diameter observation wells (MPOB-2 and MPOB-3) and one 12-inch diameter test pumping well (MPW) were drilled. The previously drilled TW-1 was also used as an observation well (MPOB-1). The wells were located on a line approximately parallel to the shore of the Columbia River as shown in Figure SW-137-02. Ground elevation at the site ranges from 279.1 ft-msl at MPW to 280.7 ft-msl at MPOB-3.

The materials encountered during the test well drilling were very similar to those described for TW-1, consisting of clean medium to coarse, well-rounded gravel, cobbles, and sand extending to depths of 48 to 56 feet where basalt bedrock was encountered. The field logs of the wells are given in Appendix A and shown graphically in Figure SW-137-03.

Similar to TW-1, a restrictive clay zone was noted at a depth of about 45 feet at well MPOB-3. This clay zone was not observed at wells MPOB-2 and MPW. However, the results of a brief step rate test conducted on MPW with the screen set from 38 to 48 feet indicated there must be a clay layer somewhere below a depth of 43 feet.

Based on the materials observed during drilling and the results of the first step rate test on well MPW, the depth of alluvium considered suitable for development is 44 feet and the aquifer base is taken as Elevation 235.7 ft-msl.

3.0 STEP RATE TESTING AND ANALYSIS

Two short duration step rate tests were conducted on well MPW. The first test was conducted February 18, 1999 with the well screened from a depth of 38 to 48 feet. The well was pumped at three successively higher rates for a period of approximately 40 minutes at each rate. Flow was measured using a 3-inch diameter orifice mounted on a 6-inch diameter discharge pipe. The results of the test are given in Table 2.

Table 2. MPW Step Rate Test 1

Step	Pumping Rate Q in gpm	Drawdown s in ft	Apparent Specific Capacity Q/s in gpm/ft
1	118	8.40	14.0
2	148	12.64	11.7
3	176	16.78	10.5

During the test, the discharge from the well was initially very cloudy. The water cleared slightly as the test progressed, but remained cloudy throughout the entire test. As can be noted from the table, the drawdowns in the well were excessive and the resulting apparent specific capacities were extremely low. These results together with the observed cloudiness of the water indicated that the well was screened in a zone containing clay and/or silt. Based on the testing and log of TW-1 located 39.4 feet east of MPW, the decision was made to pull and reset the screen at a depth of 33 to 43 feet.

While developing well MPW with the screen set at 33 to 43 feet, using a swab and bail technique, the driller reported that the formation was increasingly tighter below a depth of 40 feet. Thus, the most permeable deposits of the aquifer are believed to occur above a depth of about 41 feet.

The second step rate test on MPW was conducted February 25, 1999. The well was pumped at four successively higher rates for a period of 30 minutes at each rate. The water from the well was discharged to the Columbia River. Flow rate was measured by two methods; (1) using a Data Industrial Flow Sensor Series 200 flow meter and (2) using a 5-inch diameter orifice mounted on the 6-inch diameter discharge pipe. The results of the test are summarized in Table 3.

Table 3. MPW Step Rate Test 2

Step	Adjusted Pumping Rate Q in gpm	Drawdown s in ft	Apparent Specific Capacity Q/s in gpm/ft
1	303	2.02	150
2	393	2.82	139
3	502	4.02	125
4	600	5.59	107

As shown in the table, the observed drawdowns were relatively small and the apparent specific capacities were high indicating the screened interval from 33 to 43 feet is very permeable and suitable for development. These results are significantly better than the results of Step Rate Test 1 and provide additional confirmation that there is a restrictive clay or silt layer below a depth of 43 feet.

At the end of the four-step test, MPW was briefly pumped at two higher rates, 728 gpm and 847 gpm, in order to determine the optimum rate for the 48-hour constant rate test. The drawdowns for these two rates were 8.06 ft and 10.85 ft, respectively.

The measured drawdown in the pumping well consists of two major components; drawdown in the aquifer (formation loss) and drawdown due to head loss as the water flows through the screen into the well. The purpose of the step rate test is to separate these drawdown components.

According to Todd (1980) and Rorabaugh (1953), the drawdown in a well can be described by the following equation:

$$s = BQ + CQ^n \qquad \text{(Eq. 1)}$$

where, s = drawdown in ft
Q = pumping rate in gpm
BQ = aquifer drawdown (s_{aq}) in ft, B is the aquifer constant
CQ^n = well loss drawdown (s_{wl}) in ft, C is the well loss constant and n is a constant greater than one

The computer program FASTEP by Labadie and Helweg (1975) was used to compute the constants B, C, and n. The resulting drawdown equation is as follows.

$$s = 0.00624\,Q + 9.50E\text{-}13\,Q^{4.40}$$

This equation was used to create the graph shown in Figure SW-137-04. The equation provides a good solution to the test data, also plotted on the graph. The well loss constants, C = 9.50E-13 and n=4.40, will be used for the constant rate test analysis.

4.0 CONSTANT RATE TEST AND ANALYSIS

For the constant rate test the pumping well, MPW, was pumped continuously from 1:00 P.M. on March 1, 1999 until 1:00 P.M. March 3, 1999, a total test period of 48 hours.

The flow rate was measured using the two methods previously described for the step rate test. Additionally, the flow rate was checked with a Polysonics Tyme-Flyte meter provided and operated by IRZ Consulting. According to the manufacturer, this meter has an accuracy of one percent. The readings from the Polysonics meter and the Data Industrial meter were compared over a period of 35 minutes. During this period the Polysonics meter readings averaged 842 gpm and the Data Industrial meter readings averaged 862 gpm, 20 gpm or 2.4% higher, which is within the accuracy of the two meters.

The Data Industrial meter was used to measure the flow rate for the 48-hour test period. Readings were recorded hourly and the average pumping rate during the test was 867 gpm with a standard deviation of 8 gpm. Conservatively adjusting this rate downward by 2.4%, the adjusted average pumping rate is 847 gpm.

Water levels in the observation wells and the stage of the Columbia River were monitored continuously using Stevens Type F water level recorders. An electric measure tape was used to hand measure the water level in the pumping well and also, to periodically verify the chart readings on the observation wells.

The temperatures of the discharge water and the river were measured periodically throughout the test. The temperature of the water from the well was 61°F at the beginning of the test and decreased to 59°F at the end of the test period. The temperature of the river fluctuated diurnally between 43 and 47°F.

Just prior to the end of the test, samples from the test well were collected for complete chemical analysis and a sample from the Columbia River was collected for inorganic chemical analysis. Additionally, during the last 24 hours of the test, samples from the well and the river were collected for microscopic particulate analyses (MPA).

Two minor problems with the river gage occurred during the test. Once during the pre-pumping test period and again during the initial hours of the pumping period, the river gage went dry when the river stage dropped below the bottom of the gage. The second problem occurred at 5:35 P.M. on March 2nd when high winds combined with a high river stage toppled the river gage. For these three periods, tailwater elevations for McNary Dam obtained from the U.S. Army Corps of Engineers were correlated with river elevations at the test site and then used to fill in the missing data. Figure SW-137-05 shows the Columbia River hydrographs for the McNary Tailwater, the John Day Forebay, and the Marina Park test site.

The river hydrographs show that the McNary Tailwater elevation was 1.5 to 3.5 feet higher than the John Day Forebay elevation during the test period. The river elevation at Marina Park was approximately 0.7 to 1.3 feet lower than the McNary Tailwater. Thus, using the river elevation of the John Day Forebay to compute the minimum collector well yield is considered a conservative approach.

The hydrographs of the observation wells and the river are shown in Figure SW-137-06. As can be noted from the hydrographs, the water levels in the observation wells fluctuated with changes in river stage, indicating the aquifer is in hydraulic contact with the river. The magnitude of water level changes in the aquifer were significantly less than corresponding river stage changes, indicating the connection between the river and the aquifer is relatively weak. Additionally, water level changes in the aquifer lagged those of the river by periods varying from a few minutes to two hours, depending on the magnitude of the river level change.

A thorough study of the test data indicates that the aquifer-river efficiency was approximately 35 percent for a rising river condition and 22 percent for a falling river condition. The efficiency is determined by dividing the aquifer water level change by the corresponding river stage change. These efficiencies were used along with Columbia River stage elevations to extrapolate non-pumping (static) water elevations for the test wells that accounted for the increase in static levels resulting from the

increase in river stage during the test. Additionally, the fluctuations in static levels were used to calculate a distance to the line source of recharge of 768 feet under non-pumping conditions. The drawdowns were computed by subtracting the pumping water levels from the extrapolated static water levels. Because of the large change in river stage during the test, the computed drawdowns are very dependent on the extrapolated static water levels. This introduces a degree of uncertainty into the analysis that follows.

Data from the end of the aquifer test, following 48 hours of pumping were used for the distance-drawdown method of analysis. The estimated static water levels, actual pumping water levels, and uncorrected drawdowns at 48 hours are shown in Table 4.

Table 4. Constant Rate Test Drawdowns

	Distance from MPW r in ft	48-hour Est. Static Water Level ft-msl	48-hour Pumping Water Level ft-msl	48-hour Uncorrected Drawdown s in ft
MPW	0.5	266.66	255.65	11.0
MPOB-1	39.4	266.66	265.44	1.22
MPOB-2	90.8	266.66	265.61	1.05
MPOB-3	179.9	266.66	265.74	0.92

The uncorrected drawdowns were corrected to account for aquifer dewatering. In addition, the production well drawdown was corrected to account for well loss and partial penetration (Driscoll, 1986). Partial penetration corrections for the observation wells were found to be relatively insignificant.

The corrected data used for the distance versus drawdown (distance-drawdown) analysis are summarized in Table 5.

Table 5. Distance-Drawdown Data

Well	r in ft	48-hour s in ft
MPW	0.5	2.43
MPOB-1	39.4	1.20
MPOB-2	90.8	1.03
MPOB-3	179.9	0.91

These data are plotted on the distance-drawdown graph shown in Figure SW-137-07. The data were analyzed using distance-drawdown methods and line-source boundary image well theory. For a complete discussion of these methods see Walton (1970). The aquifer parameters determined from the analysis are summarized below.

Table 6. Aquifer Parameters, Distance-Drawdown Analysis

Parameter	@ 48 Hours
Transmissivity, T	702,034 gpd/ft
Storage Coefficient, S	0.038
Effective Distance to the Line of Infiltration, D	1677 ft

The analysis shows that the transmissivity and hydraulic conductivity of the aquifer are high, suggesting a favorable potential collector well yield. An evaluation of the geologic material in the vicinity of MPW indicate that the large transmissivity and conductivity are, in part, related to the coarse grained upper gravel zone. Based on Ranney's past experience, the effective distance to the line of infiltration is longer than is typical, but within the range considered suitable for development.

A longer effective distance to infiltration indicates the riverbed infiltration rate is limited. The apparent low riverbed infiltration rate is consistent with observations made during the installation of the river gage standpipe. Adjacent to the pumping well, the Columbia River pools in a semi-enclosed inlet that has no significant current to periodically scour and remove river bed sediments. At the time of the field investigations, the bed of the river consisted of a four to six inch mat of gravel, clay, silt, and sand which was difficult to remove. The low aquifer-river efficiency previously mentioned is also evidence that the riverbed infiltration rate is comparatively low for the Columbia River valley. While a low infiltration rate may limit the potential yield of the site, the riverbed will provide a high degree of natural filtration.

For the time-residual drawdown analysis, the data collected during the recovery period (after pumping stopped) were analyzed by plotting the time ratio, t/t', on a logarithmic scale versus the residual drawdown, s'. The plots for the three observation wells are shown in Figures SW-137-08, -09, and -10. In the time ratio, t is the time since pumping began and t' is the time since pumping stopped. The residual drawdown, s', is the difference between the extrapolated static water level and the recovery water level. For a complete discussion of this analysis method see Todd (1980) or Driscoll (1986).

The results of the analyses for the three observation wells are shown in Table 7.

Table 7. Aquifer Parameters, Time-Residual Drawdown Analysis

Parameter	MPOB-1	MPOB-2	MPOB-3
Transmissivity, T	699,000 gpd/ft	799,000 gpd/ft	678,000 gpd/ft
Saturated Thickness, H	30.7 ft	30.7 ft	30.7 ft
Hydraulic Conductivity, K	22,800 gpd/ft^2	26,000 gpd/ft^2	22,100 gpd/ft^2

The results of the analyses show transmissivities similar to those computed using the distance-drawdown method and confirm that the aquifer transmissivity is very large. The average hydraulic conductivity, K, for the five determinations is 23,600 gpd/ft^2.

Because the upper gravel zone, described previously, contributes significantly to the overall transmissivity, it was deemed appropriate to assign relative hydraulic conductivities to the upper gravel and the remainder of the aquifer. This was done to account for local dewatering of the upper, more permeable material that will occur during collector well operation. The hydraulic conductivities were estimated based upon relative differences between the two aquifer units and were used to calculate collector yield. By assigning the relative hydraulic conductivities, the resulting collector well yield computations are based upon aquifer properties that are more representative of the materials that will remain saturated during well operation.

Visual analysis of the grain size suggests the upper gravel zone is on the order of five times more permeable than the lower sand and gravel zone. Using this ratio, calculated hydraulic conductivities were 42,291 gpd/ft^2 for the upper gravel and 8,458 gpd/f^2 for the remainder of the aquifer. The hydraulic conductivity of the upper gravel is extremely large and is reflective of the coarse grained and well sorted nature of the material. The calculated hydraulic conductivity for the lower portion of the aquifer is similar to regional values for comparable materials, including those tested in Boardman, Oregon, where hydraulic conductivity is 6,760 gpd/ft^2 (Ranney Division, 1998).

5.0 RANNEY COLLECTOR DESIGN AND YIELD

The yield of a collector well dependent upon induced infiltration from a nearby surface water source can be computed using the following equation (modified from Mikels and Klaer, 1956):

$$Q = \frac{2 \pi T' s V_1}{2.30 V_2 \log(2D/r)} \qquad \text{(Eq. 2)}$$

where,

- Q = Collector well yield, in gallons per day.
- T' = Effective transmissivity of the aquifer corrected for aquifer dewatering, in gallons per day per foot.
- s = Collector well drawdown, in feet.
- D = Effective distance to the line of infiltration, in feet.
- r = Effective radius of the collector well, in feet.
- V_1 = Viscosity correction factor for the water temperature at which the hydraulic conductivity was determined.
- V_2 = Viscosity correction factor for the water temperature at which the yield is being determined.

The yield of the collector well will have a seasonal variation resulting from varying river stage and water temperature. The varying river stage will affect the collector well drawdown and the varying water temperature will affect the viscosity correction factor.

A review of river temperature data for the last three years for the McNary tailwater (source: U.S. Army Corps of Engineers) shows that the temperature of the river ranges from a low of 36.5°F in January or February to a high of 72.9°F in August. Based on this information and experience at similar collector well sites, the estimated aquifer temperature range is from a low of 48°F in February or March to a high of 64°F in August or September.

The elevations pertinent to the design and yield computations are shown in Table 8.

Table 8. Collector Well Design Elevations

	Elevation (ft-msl)
Top of Caisson	285
Ground	285 ±
Ordinary High Water	275
Test River Stage	266.7
Minimum River Stage	258
Minimum Pumping Level	245
Centerline Laterals	241
Caisson Cutting Shoe	234.8
Aquifer Base (clay)	235.7
Basalt Bedrock	228.8

In the following computations, two different yield conditions are evaluated using these design parameters.

For the river stage (266.7 ft-msl) and temperature (59°F) conditions observed during the test, the design drawdown is 21.7 feet, which reduces the saturated thickness at the collector well during pumping to 9.3 feet. The effective transmissivity was calculated to account for aquifer dewatering, in particular within the upper gravel zone, during well operation. Accordingly, the effective transmissivity was calculated to be 390,347 gpm/ft during pumping. The effective radius of the collector well is assumed to be 40 feet and the effective distance to the line of infiltration, D, is estimated to be 1700 feet, as calculated during the aquifer test. This effective distance places the line of infiltration in the approximate vicinity of the historical Columbia River channel before the John Day dam was constructed. The effects of the negative bedrock boundary south of the collector well site were accounted for by including an image well at a distance of 4000 feet. The viscosity correction factors, V_1 and V_2 are both equal to 1.01. Inserting these values into Eq. 2, the potential yield of the collector well is:

$$Q_{test} = 11.4 \text{ mgd } (7{,}915 \text{ gpm})$$

A late summer minimum yield will occur when river stage is low. This condition is of interest because it may occur when water demands are typically greater. The minimum summer yield is computed for low river stage 258 ft-msl and an estimated water temperature of 60°F, $V_2 = 1.00$. The design pumping level and effective distance to the line source of recharge are the same as above. However, because of the lower river levels, the saturated thickness and design drawdown are reduced accordingly. Thus, for a design drawdown of 13 feet and an effective transmissivity of 235,135 gpd/ft, the potential minimum summer yield of the collector is:

$$Q_{summer} = 4.1 \text{ mgd } (2{,}849 \text{ gpm})$$

Based on the foregoing yield computations, the recommended design yield of the collector well is the minimum summer yield of 2,849 gallons per minute (4.1 million gallons per day). However, the total footage of lateral screen projected can be adjusted to accommodate differing operating capacities, more or less than this minimum available yield, based on the City's immediate or projected demands. It is assumed that the lateral orientation and footage will be designed, as necessary, to not extend beyond the edge of the river during normal high stage of elevation 275 feet msl. The conceptual projection pattern shown in Figure SW-137-11 is not uncommon for collect wells units in the Columbia River valley and indicates how the length and direction of laterals can be modified to avoid the river edge restrictions will meeting design criteria for the minimum summer yields.

The conceptual design of the collector well shown in Figure SW-137-11 includes a 13 feet inside diameter (I.D.) by 16 feet outside diameter (O.D.) reinforced concrete caisson, located 50 feet landward of MPOB-1. The cutting shoe of the caisson is at elevation 234.8 ft-msl, approximately 50.2 feet below ground. Over 500 feet of horizontal screen laterals are projected at elevation 241 ft-msl to develop an effective well radius of 40 feet. It is recommended that, no matter the lateral projection pattern selected, the laterals consist of 12-inch diameter wirewrapped stainless steel screen, with six to ten feet of blank stainless steel pipe installed immediately adjacent the caisson. Slot sizes for the screen should be selected based upon field conditions encountered while projecting the blank lateral pipe.

It should be noted that the Corps of Engineers is currently evaluating the feasibility of operating the John Day dam to maintain a more constant pool elevation of approximately 257 feet msl. This change in the pool elevation would place the collector well over 600 feet from the river bank and reduce normal yields to levels similar to the minimum summer yields described above. If this change in operation does occur, the City may wish to evaluate moving the collector well northward, towards the new ordinary high water elevation.

6.0 WATER QUALITY

On March 3, 1999, just prior to the end of the 48-hour test period, samples from MPW and the Columbia River were collected for laboratory chemical analysis. The results are presented in Table 9 and copies of the laboratory reports are given in Appendix B.

Table 9. Results of Chemical Analyses[a]

Constituent	Columbia River 3/3/99 12:30 P.M. (mg/L)	Well MPW 3/3/99 12:15 P.M. (mg/L)	USEPA/OHD MCL (mg/L)
Primary:			
Antimony	ND[b]	ND	0.006
Arsenic	ND	0.005	0.05
Barium	ND	0.2	2
Beryllium	ND	ND	0.004
Cadmium	0.0004	ND	0.005
Chromium	ND	ND	0.1
Cyanide	ND	ND	0.2
Fluoride	ND	ND	4
Mercury	ND	ND	0.002
Nickel	ND	ND	0.1
Nitrate as N	1.2	3.2	10
Nitrite	0.02	ND	1.0
Selenium	ND	ND	0.05
Thallium	ND	ND	0.002
Gross Alpha Radiation	NR[c]	1.21 pCi/L	15 pCi/L
Secondary & Other:			
Copper	ND	ND	1.3
Iron	1.14	ND	0.3
Lead	ND	0.002	0.015
Manganese	0.04	ND	0.05
Sodium	13.08	35.5	--
Sulfate	29	55	250
Hardness	110	240	--
Total Dissolved Solids	130	330	500
Odor	NR	ND	3.0 TON
Color	30	ND	15 c.u.
pH - field (std units)	8.5	7.8	6.5-8.5

[a]Analysis by AmTest Oregon LLC, Tigard, Oregon
[b]ND = None Detected, [c]NR = Not Run

The sample from MPW was also analyzed for volatile organic compounds (VOCs) and synthetic organic compounds (SOCs) and the concentrations were all below detection

levels. The complete list of chemicals measured is given in the laboratory report in Appendix B.

The results of the analyses show that the water from the test well is of good quality with all of the chemical concentrations below the established MCLs (maximum contaminant levels). The water is classified as "hard" and iron and manganese were not detected. The mineral concentrations in the water from the well are higher than those of the Columbia River, which is typical of groundwater in the area. The constituent concentrations in the well water are considered representative of relatively stagnant groundwater and not representative of the quality that will be achieved after the collector well is constructed and infiltration from the river is fully established.

Based on experience with existing collector wells, once infiltration from the river is fully established the mineral concentrations will decrease as the native groundwater is diluted by recharge from the river. For example, conservatively assuming that the water produced by the collector well will be 50 percent surface water and 50 percent groundwater, the concentrations of hardness, TDS, and nitrate in the product water would be:

Hardness:	$(0.50)(110) + (0.50)(240) = 175$ mg/L
TDS:	$(0.50)(130) + (0.50)(330) = 230$ mg/L
Nitrate:	$(0.50)(1.2) + (0.50)(3.2) = 2.2$ mg/L

The quality of water will vary seasonally and will be dependent upon the quality of the river as well as river stage. The product water will be less mineralized at higher river stages and more mineralized at lower river stages.

As the City may recall from the exploration wells drilled in 1977 at Sites B and C, the water from those test wells was of poorer quality. At Site B, located approximately 2300 feet northeast (upstream) of the current test site, the concentrations of iron and manganese were 2.4 mg/L and 3.2 mg/L, respectively. Additionally, the water reportedly "smelled like diesel" and had a "sudsy" appearance, although it was not analyzed for petroleum contaminants. As the City knows, the Site B wells were located near an abandoned tank farm. At Site C, downstream from Marina Park, the concentrations of iron and manganese were 0.4 mg/L and 0.2 mg/L, respectively.

The fact that there was lower quality groundwater up- and downstream from the current test site deserves further consideration. Given the importance of this new water supply development, Ranney recommends installing two (or more) small diameter monitoring wells up- and downstream from the Marina Park site and testing for iron and manganese. Additionally, the upstream monitor well should be tested for VOCs and other hydrocarbon derived constituents. Depending on the results of the sampling, the City should consider developing a contaminant transport model to evaluate if the proposed collector well quality will be adversely affected over time by the surrounding ground water quality. Ranney believes the dilutive effects of recharge from the

Columbia River will act to mitigate any potential water quality problems, but we recommend the additional testing discussed above.

During the last 24 hours of the test, samples from the test well and the river were collected for microscopic particulate analysis (MPA). The results are summarized in Table 10 and the laboratory reports are given in Appendix B. The samples were collected in accordance with procedures described in the USEPA document, "Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis" (EPA Consensus Method).

Table 10. Results of Microscopic Particulate Analyses[a]

	Well MPW 3/2-3/3/99	Columbia River 3/2-3/3/99
Gallons filtered	1,218	1,114
Centrifugate	0.1 mL/100 gal	0.213 mL/100 L
Giardia	ND[b], <3.3/100 L	ND, <11/100 L
Cryptosporidium	ND, <3.3/100 L	ND, <11/100 L
Other Algae	600,000/100 gal	100,000/100 L
Diatoms	100,000/100 gal	2,000,000/100 L
Coccidia	ND	--
Plant Debris	ND	ND
Rotifers	ND	ND
Nematodes	ND	ND
Pollen	ND	ND
Ameba	ND	ND
Ciliates	ND	ND
Colorless Flagellates	ND	1,000/100 L
Crustaceans	ND	ND
Insects/Larvae	ND	ND
Other	ND	ND

[a]Analyses by CHDiagnostic and Consulting Service, Inc., Loveland, CO.
[b]ND = None Detected

According to the EPA Consensus Method, the presence of heavy amounts of other algae and diatoms gives the water a relative risk factor of 30 which falls in the high risk of surface water influence category ($\geq$20) and would be considered groundwater under the direct influence of surface water.

The amounts of algae and diatoms observed in the water from the well are indicative of raw surface water. However, the algae and diatom types found in well MPW are significantly different than those found in the Columbia River and the chemical quality of the water from MPW is indicative of true groundwater. These conflicting results suggest the well may have been contaminated during drilling or at some time prior to testing. The water used during drilling was obtained from a nearby RV park which is supplied by City water and is believed to be uncontaminated. The only other probable

source of contamination is the water tank on the drilling company's service truck which carried the water to the site. Other sources of contamination include exposure to airborne particulates and particulates from the drill stem, sand-pump bailer, and other drilling equipment.

Given the unexpected MPA result, the City should collect another sample for microscopic particulate analysis from the remaining test well (TW-1) and the Columbia River to confirm or deny the presence of algae and diatoms in the aquifer. Before collecting the sample, the well should be thoroughly sterilized by chlorinating in accordance with State of Oregon or USEPA procedures and the well should be pumped for a few hours before sample collection begins.

Based on water quality data from existing collector wells, the natural filtration process effectively removes organic matter, turbidity, algae and other surface water particulates, and pathogenic organisms such as *Giardia*. For example, the water produced by the City of Boardman's Ranney Collector has a turbidity consistently less than 0.1 ntu, averaging about 0.05 ntu. The Oregon Health Division has classified their supply as groundwater based on turbidity and MPA data.

Obviously, the classification of the proposed water supply cannot be determined until after the collector well is constructed. However, the experience at Boardman indicates that a source determination of groundwater is likely given the hydrogeologic similarities of the Boardman and Umatilla sites.

In summary, the chemical and microbiological quality of the water produced by the proposed collector well is expected to be suitable for all municipal, irrigational, and industrial uses without treatment, except for preventive disinfection. However, the additional testing recommended in this section should be completed to confirm this expectation.

7.0 SUMMARY

Three observation wells and one 12-inch diameter test pumping well were drilled at the west end of Marina Park, approximately two miles downstream from McNary Dam. Logs of the wells show that the alluvial aquifer adjacent to the Columbia River extends to depth of approximately 44 feet and consists of well-rounded coarse gravel, cobbles, and sand. There is a restrictive clay layer at a depth of approximately 44 feet and this depth is taken as the base of the alluvial aquifer. The basalt bedrock is 4 to 11 feet below the clay layer.

The hydrographs of the 48-hour constant rate pumping test show a hydraulic connection between the aquifer and river exists, but the connection is considered relatively weak. The aquifer-river efficiency was approximately 35 percent for a rising river condition and approximately 22 percent for a falling river condition.

The results of the 48-hour test show that the aquifer transmissivity and hydraulic conductivity are relatively large. Using distance-drawdown and time-residual drawdown methods of analyses, the transmissivity of the aquifer is calculated to be 702,034 gpm/ft for the test temperature of 59°F and the effective distance to the line of infiltration is about 1700 feet. The effective distance to infiltration is farther than expected and indicates the riverbed infiltration rate is relatively low.

A conceptual design of the proposed Ranney collector well is shown in Figure SW-137-11. The collector well consists of a 13 ft I.D. by 16 ft O.D. reinforced concrete caisson extending to depth of 49.2 ft below ground. Horizontal screen laterals are projected at elevation 241 ft-msl (44 feet below ground) to develop an effective radius of 40 feet. Final lateral length and orientation should account for necessary operational capacities as well as the immediate and projected demands of the City.

Based on the chemical quality of the water from the test well, the water produced by the collector well is expected to be of good quality, with insignificant amounts of iron and manganese. After infiltration from the river has been established, hardness, TDS, and nitrate concentrations are expected to decrease. At two previous test sites, up- and downstream from the current site, the groundwater was of poorer quality and contained undesirable amounts of iron and manganese. Ranney recommends installing monitoring wells up- and downstream from the current test site and testing for iron and manganese and other chemical constituents. The need for additional study would be dependent upon the results of the sampling.

The results of the MPA showed the presence of large amounts of algae and diatoms in the test well, which is indicative of raw surface water. However, the chemical analysis of the well water indicates groundwater quality. These conflicting results suggest that the well must have been contaminated during drilling. Another MPA sample should be collected from the remaining test well and the river to confirm or deny the presence of algae in the aquifer.

Experience at existing collector wells shows that the natural filtration process is highly effective at removing sand, silt, turbidity, organic matter, and pathogenic organisms such as *Giardia*. Given the hydrogeologic similarities between this site and the site of the City of Boardman's collector well, the quality of the water may be similar to that observed at Boardman. If so, the water would be low in turbidity and contain insignificant amounts of surface water particulates.

In summary, a collector well constructed at the Marina Park test site will provide the City of Umatilla with a naturally-filtered water supply during summer minimum yield conditions of approximately 2850 gpm. The water is anticipated to be suitable for all municipal, industrial, and irrigational uses without treatment, except for preventive disinfection.

The cooperation and assistance provided by City personnel and IRZ Consulting during this investigation is greatly appreciated, with particular thanks to Roger Frances and Fred Ziari. The well drilling services of Staco Well Service are also appreciated.

The test procedures, data analyses, and recommendations presented in this report were conducted and developed in accordance with generally accepted ground water engineering practices. No other warranty, express or implied, is made.

8.0 REFERENCES

Driscoll, Fletcher G. Groundwater and wells. Second Edition. Johnson Division. St. Paul, MN. 1986.

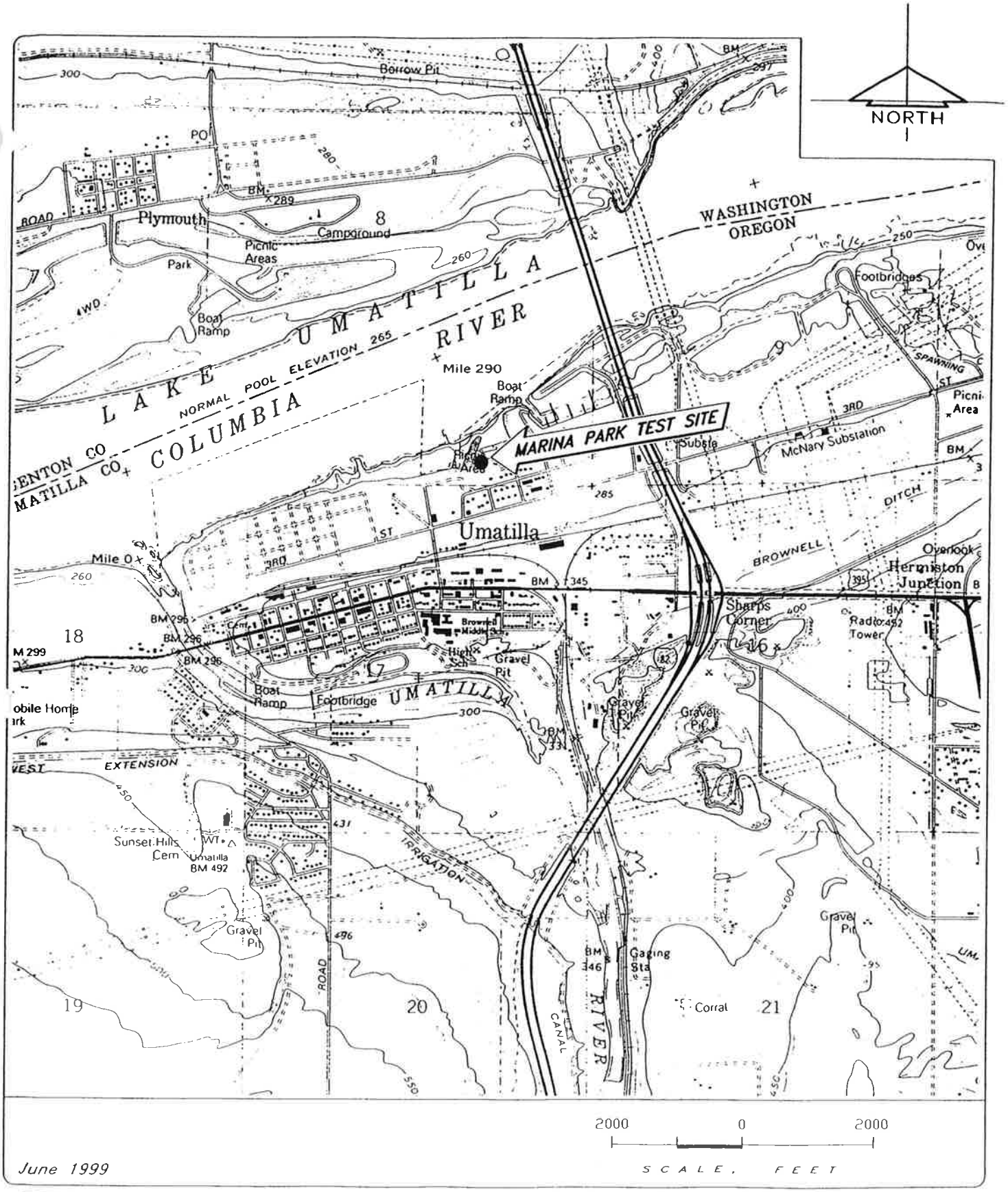
Mikels, F.C. and Klaer, F.H. Application of ground water hydraulics to the development of water supplies by induced infiltration. Publication No. 41, Association Internationale d'Hydrologie, Symposia Darcy, Dijon. 1956.

Ranney Division. Aquifer Testing, Ranney Collector Sites 2 & 3 for the City of Boardman, Oregon. Technical Report prepared for the City of Boardman, June, 1998.

Rorabaugh, M.I., Graphical and theoretical analysis of step-drawdown test of artesian well, *Proc. American Society of Civil Engineers*, v. 79, sep. 362, 1953.

Todd. D.K., Groundwater hydrology. Second Edition, John Wiley & Sons, New York. 1980.

Walton, W.C. Groundwater resource evaluation. McGraw-Hill, New York, 1970.



June 1999

Layne Christensen Company

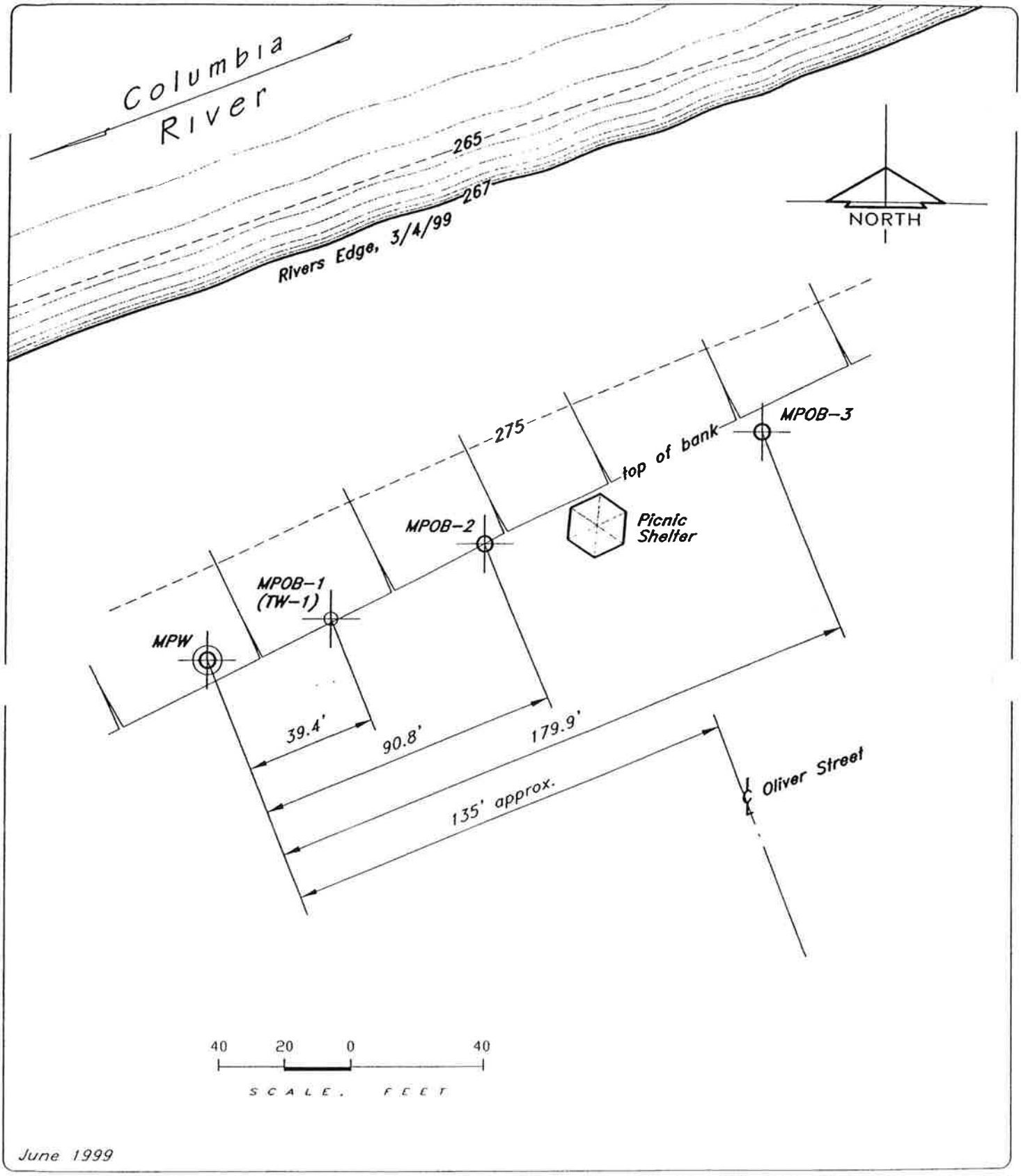
RANNEY METHOD

RANNEY DIVISION
Kennewick, Washington

TITLE
LOCATION MAP

PROJECT:
MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

SHT. No.
SW-137-01



June 1999

Layne Christensen Company

RANNEY METHOD

RANNEY DIVISION
Kennewick, Washington

TITLE: LOCATIONS of WELLS

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

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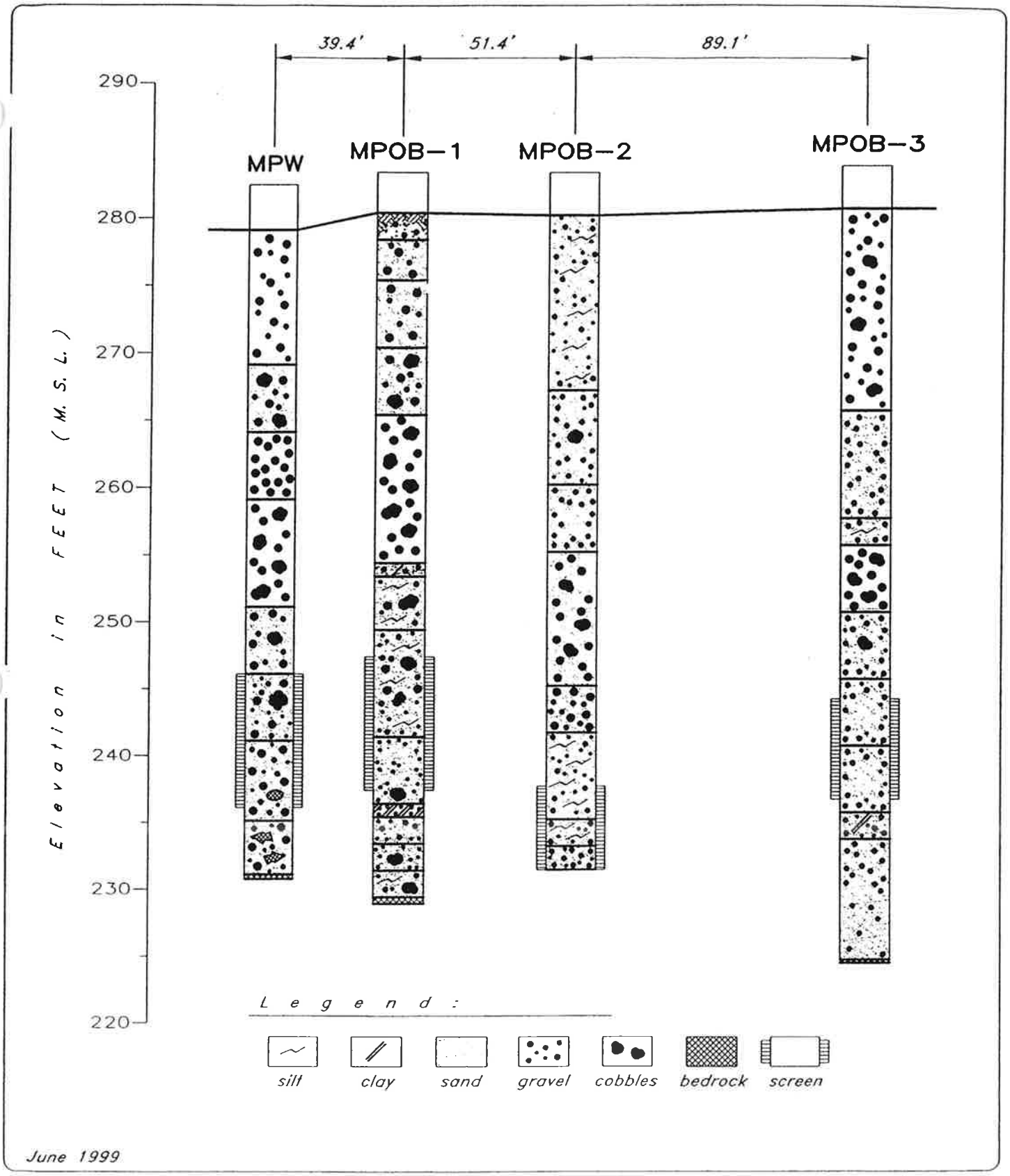

Layne Christensen Company

RANNEY METHOD

RANNEY DIVISION
Kennewick, Washington

TITLE: LOGS of WELLS

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

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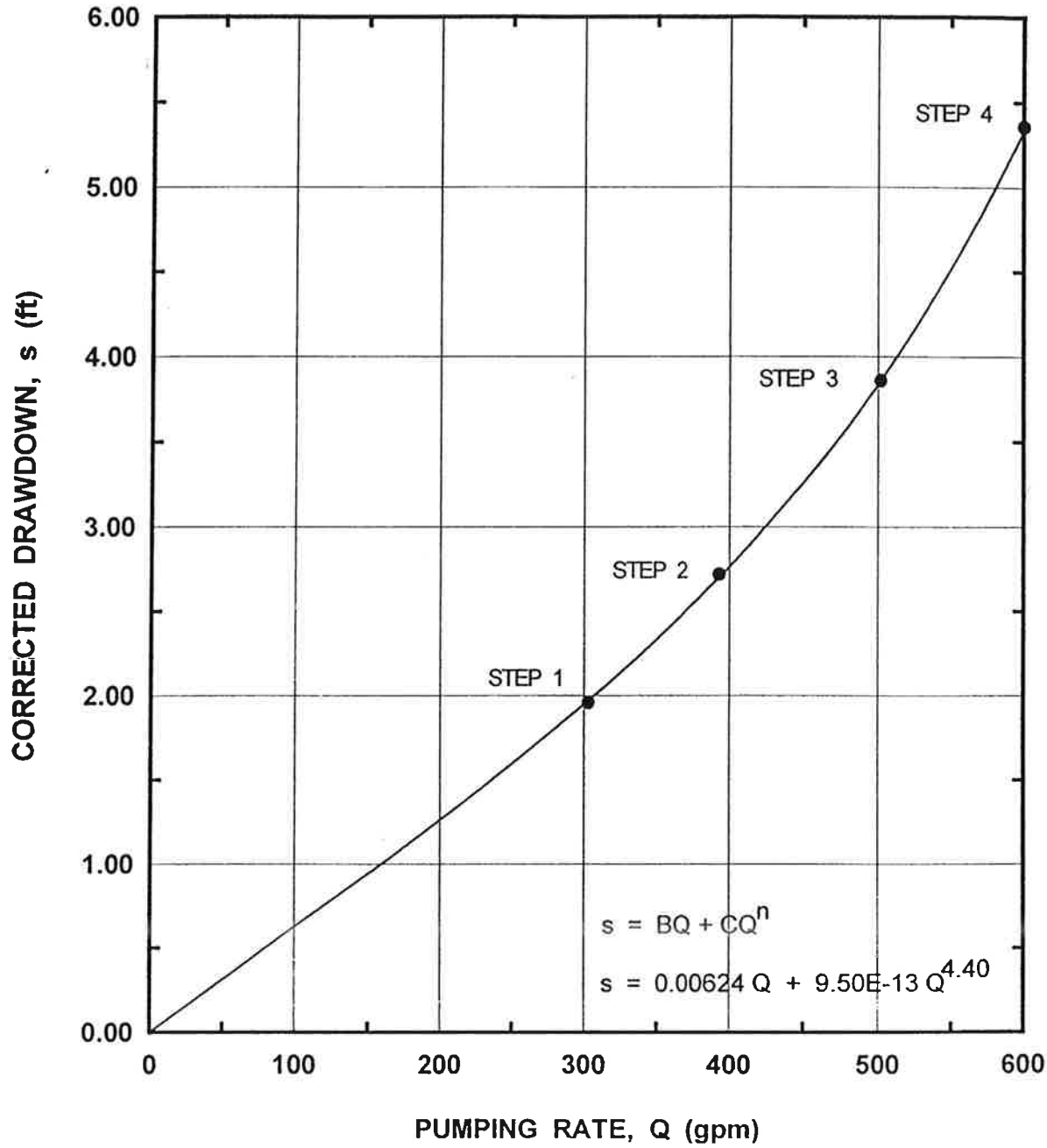

Layne Christensen Company

RANNEY METHOD

RANNEY DIVISION

Kennewick, Washington

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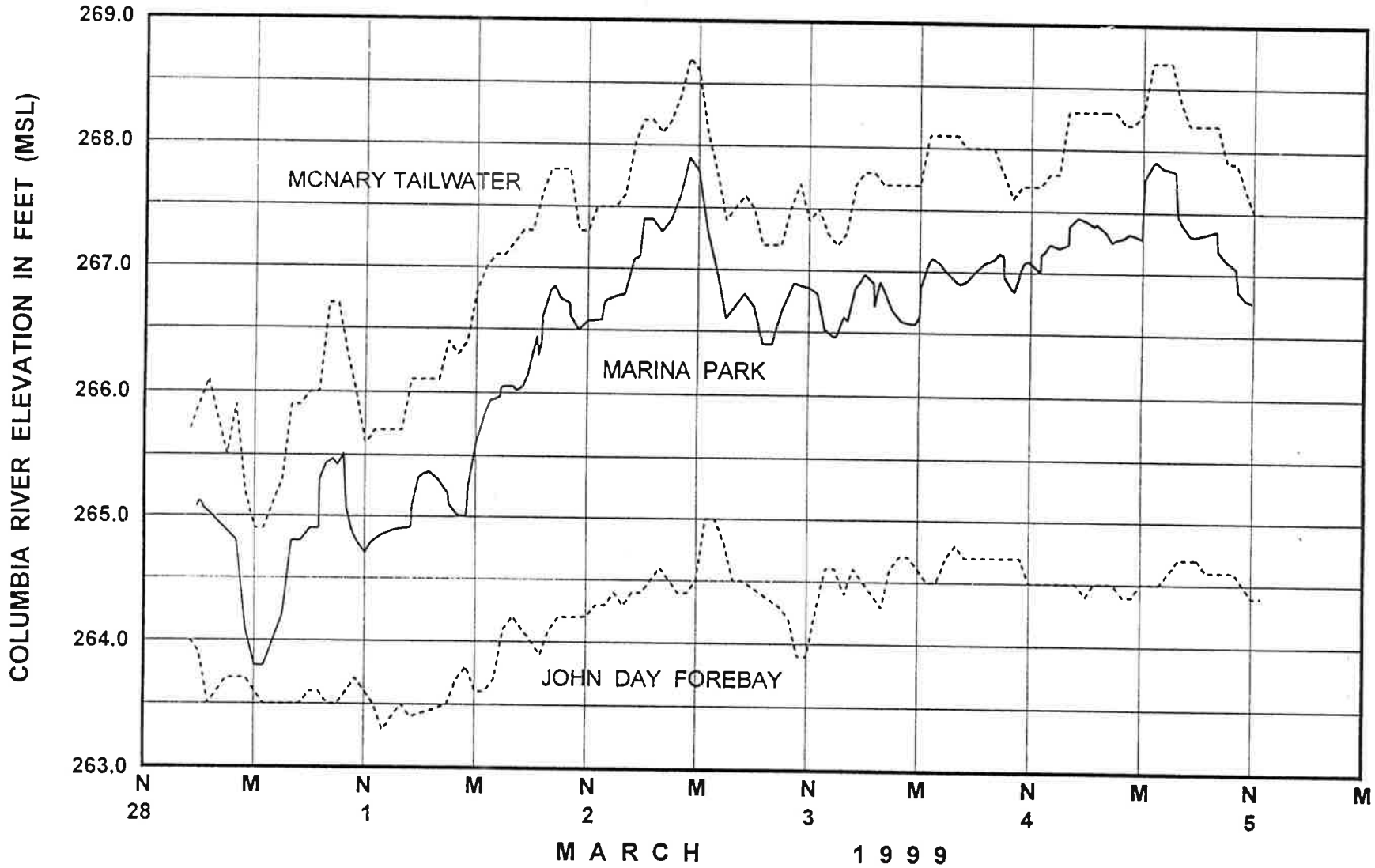
PROJECT: MARINA PARK AQUIFER TEST CITY of UMATILLA, OREGON	SHT. No. SW-137-04



Layne Christensen Company

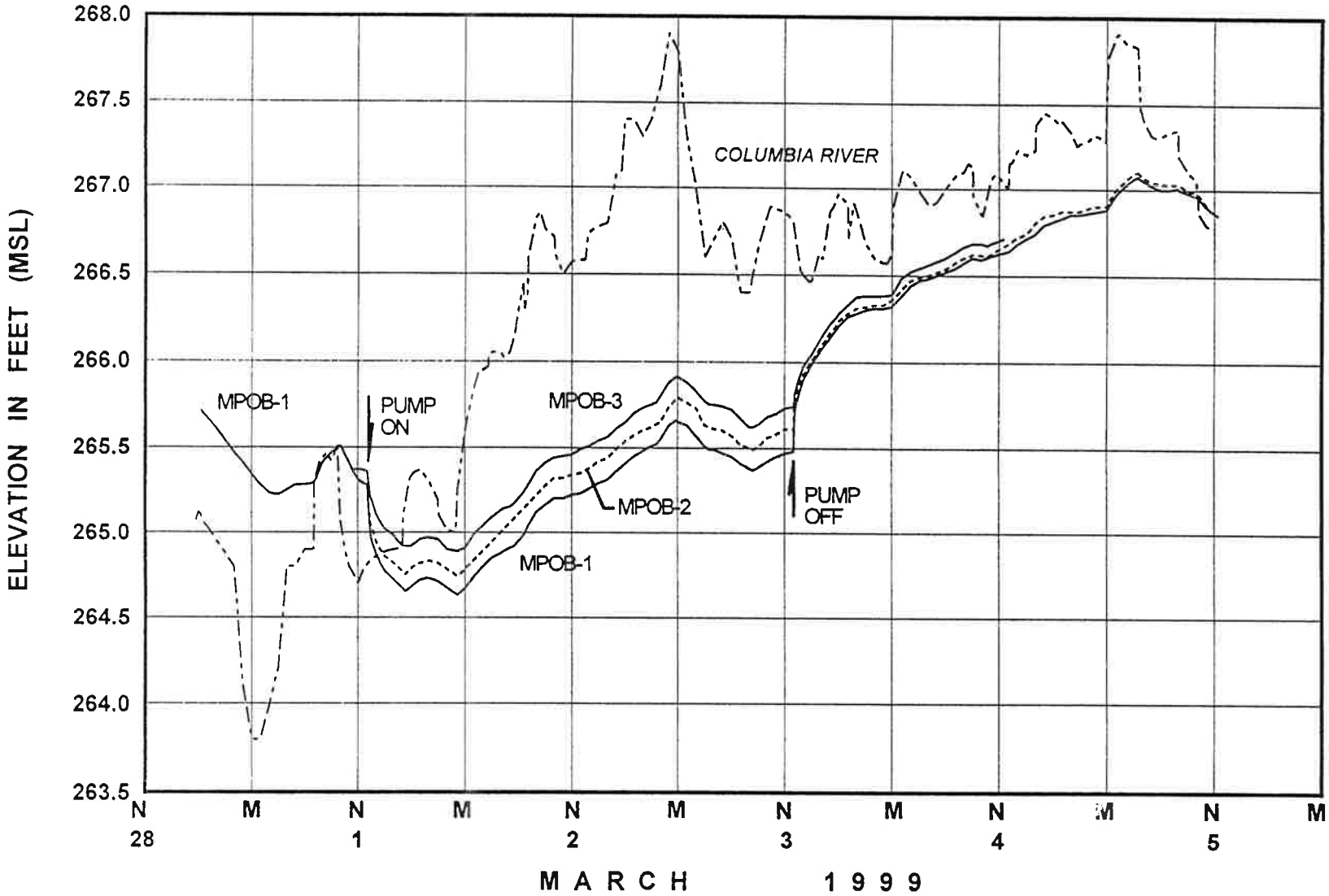
RANNEY METRO

RANNEY DIVISION
Kennewick, Washington

TITLE: COLUMBIA RIVER HYDROGRAPHS

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

SHT. No: SW-137-05



Layne Christensen Company

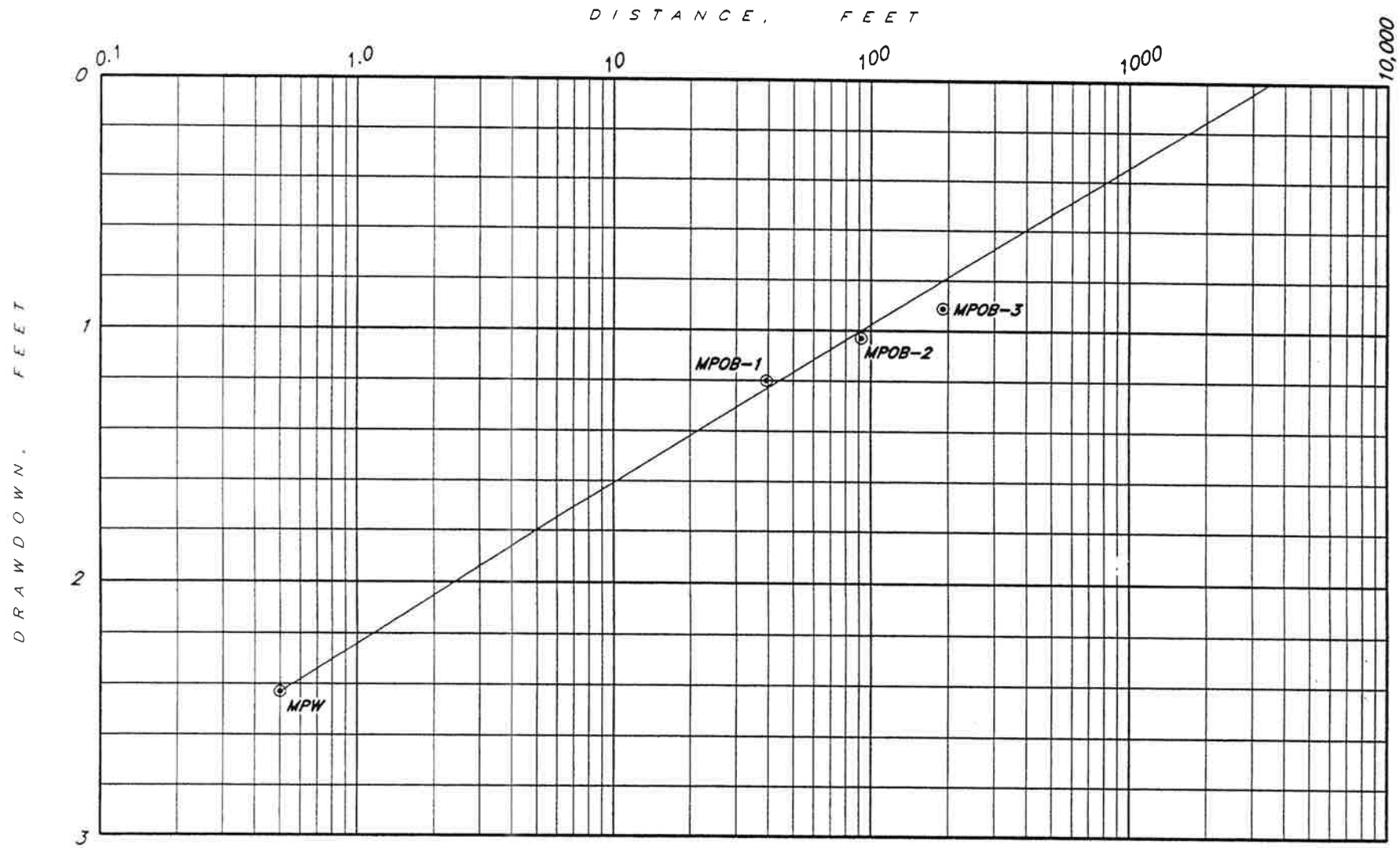
RANNEY METHOD

RANNEY DIVISION
Kennewick, Washington

TITLE: HYDROGRAPHS

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

SHT. No: SW-137-06



Layne Christensen Company

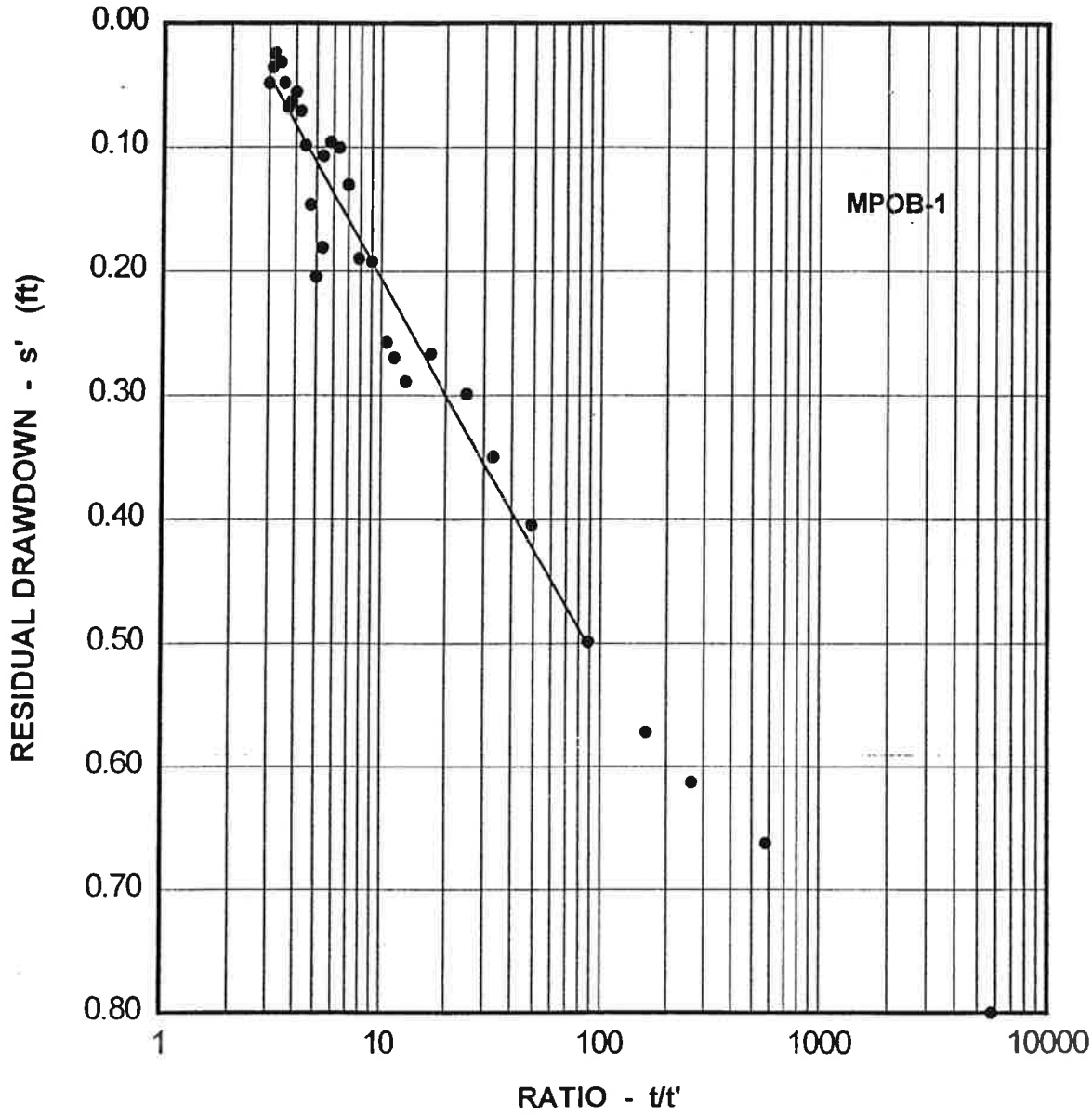
RANNEY METHOD

RANNEY DIVISION
Kennewick, Washington

TITLE: DISTANCE–DRAWDOWN GRAPH

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

SHT. No: SW–137–07



Governing Equation: $T = \frac{264\ Q}{\Delta s'}$

where, T = transmissivity in gpd/ft
Q = pumping rate in gpm
$\Delta s'$ = difference in residual drawdown per log cycle in ft

Solution: $T = \frac{264(847)}{0.32} = 699{,}000$ gpd/ft

Layne Christensen Company

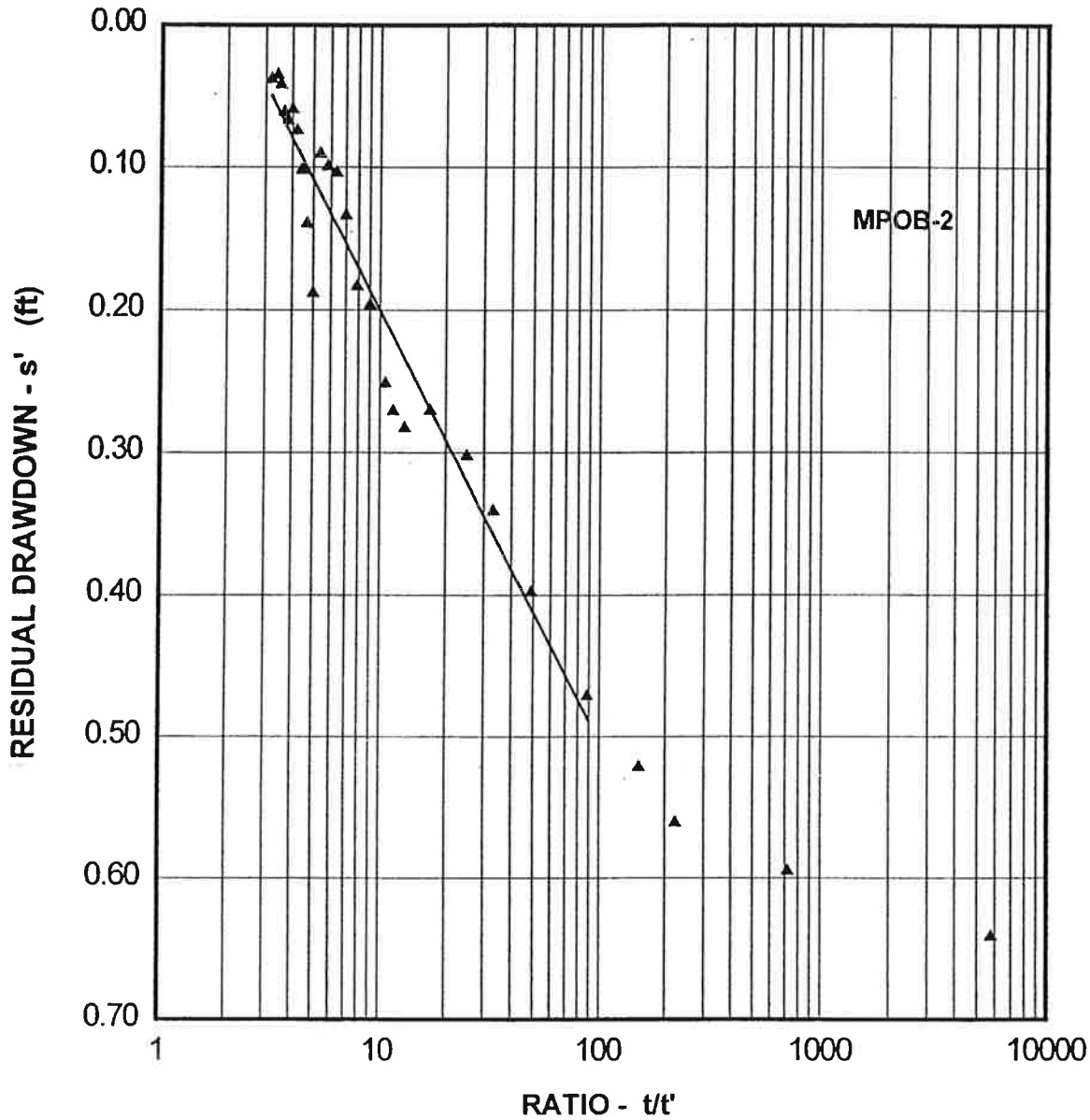
RANNEY METHOD

RANNEY DIVISION
Kennewick, Washington

TITLE: TIME–RESIDUAL DRAWDOWN, MPOB–1

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

SHT. No. SW–137–C



Governing Equation: $T = \frac{264\,Q}{\Delta s'}$

where, T = transmissivity in gpd/ft
Q = pumping rate in gpm
$\Delta s'$ = difference in residual drawdown per log cycle in ft

Solution: $T = \frac{264(847)}{0.28} = 799{,}000$ gpd/ft

Layne Christensen Company

RANNEY METHOD

RANNEY DIVISION
Kennewick, Washington

TITLE: TIME–RESIDUAL DRAWDOWN, MPOB–2

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

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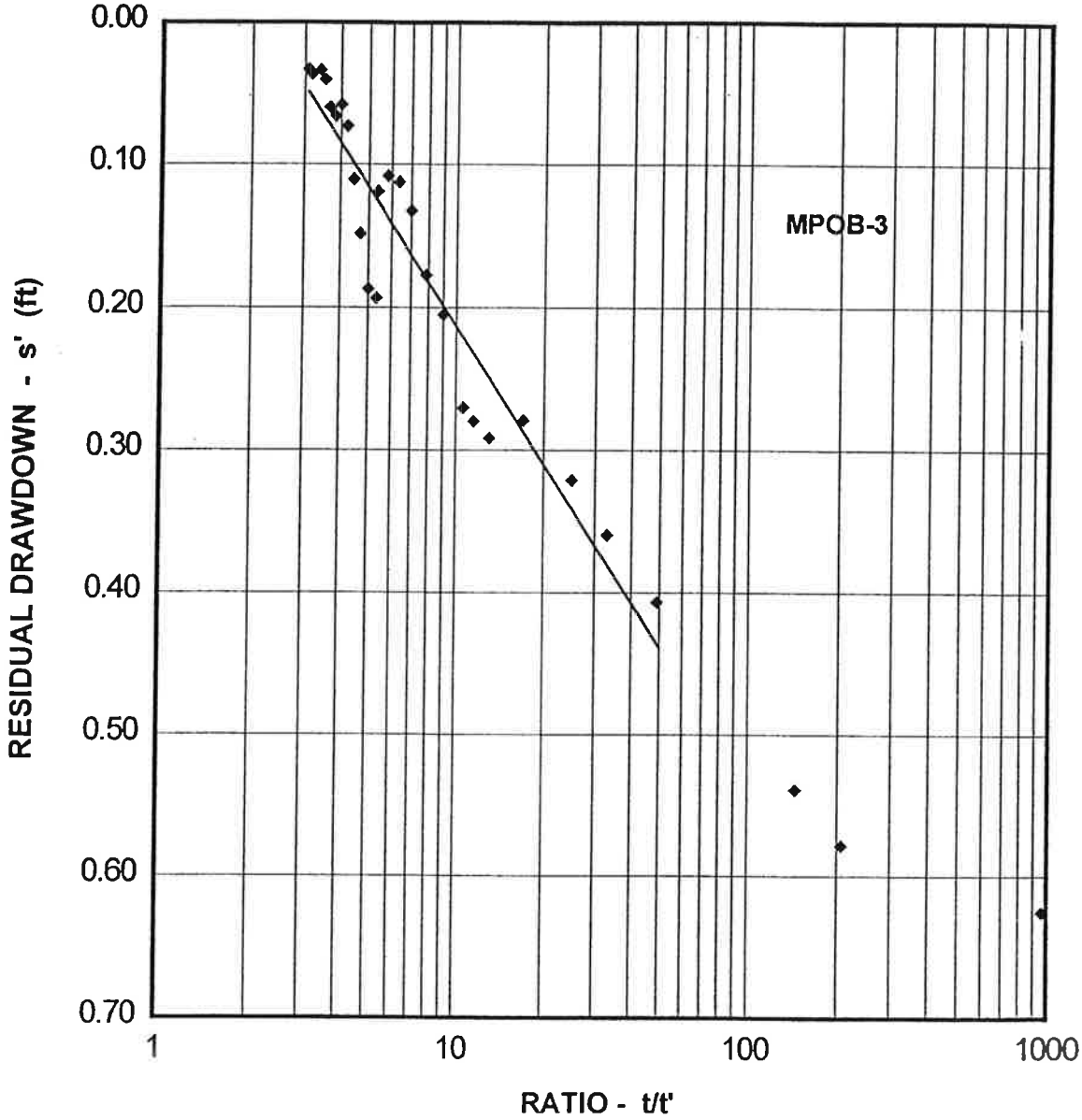

Governing Equation: $T = \frac{264\,Q}{\Delta s'}$

where, T = transmissivity in gpd/ft
Q = pumping rate in gpm
$\Delta s'$ = difference in residual drawdown per log cycle in ft

Solution: $T = \frac{264(847)}{0.33} = 678{,}000$ gpd/ft

Layne Christensen Company

RANNEY METHOD

RANNEY DIVISION
Kennewick, Washington

TITLE: TIME–RESIDUAL DRAWDOWN, MPOB–3

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

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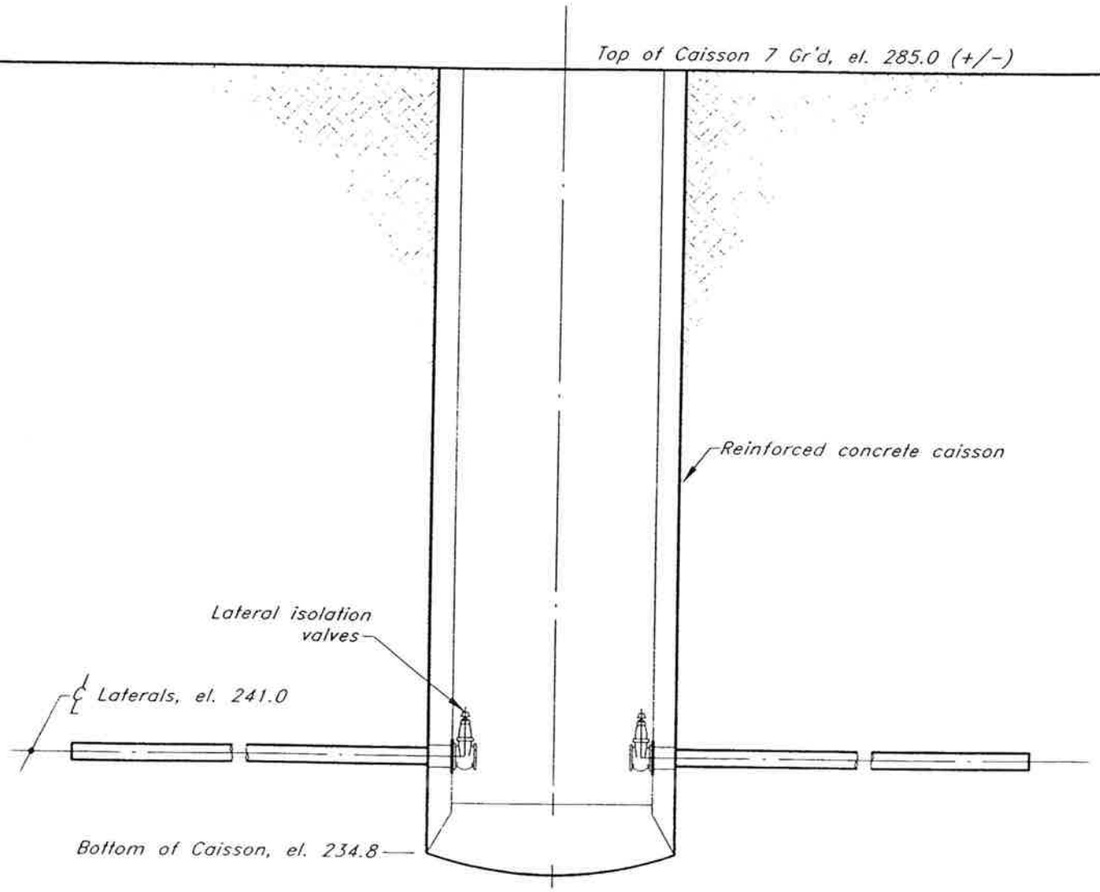
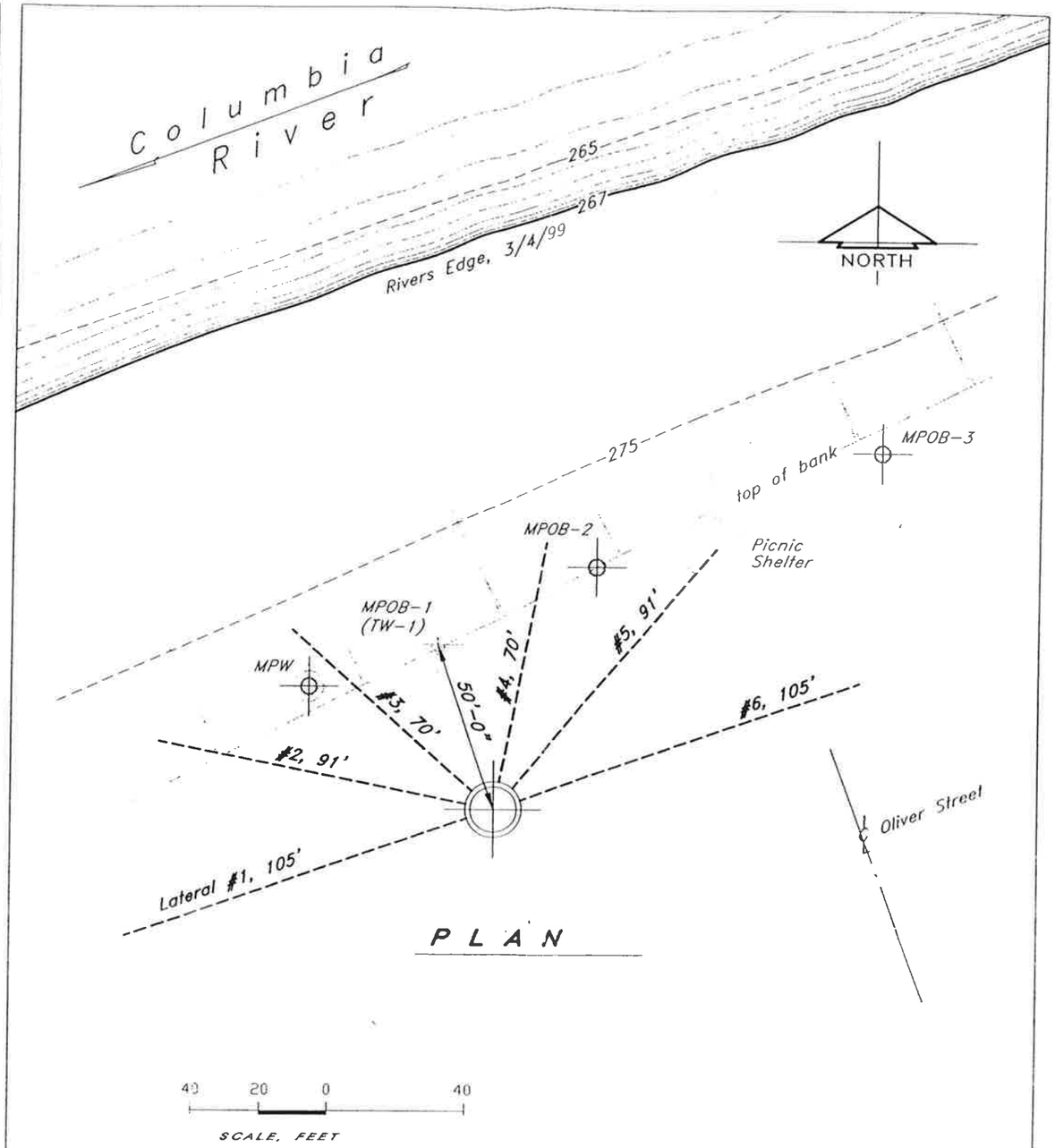


ELEVATION
Scale: 1" = 10'



PLAN

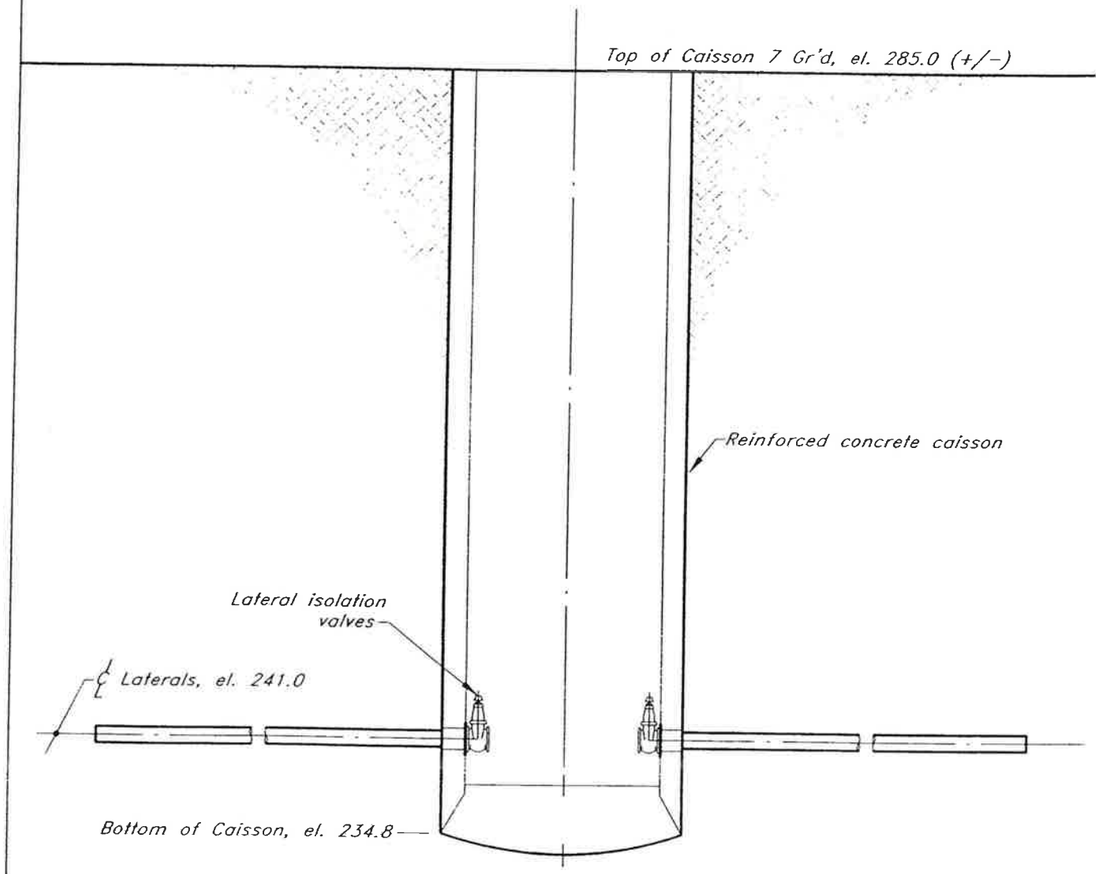
June 1999

Layne Christensen Company
RANNEY METHOD
RANNEY DIVISION
Kennewick, Washington

TITLE: PROPOSED RANNEY COLLECTOR WELL

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

SHT. No SW-137-11



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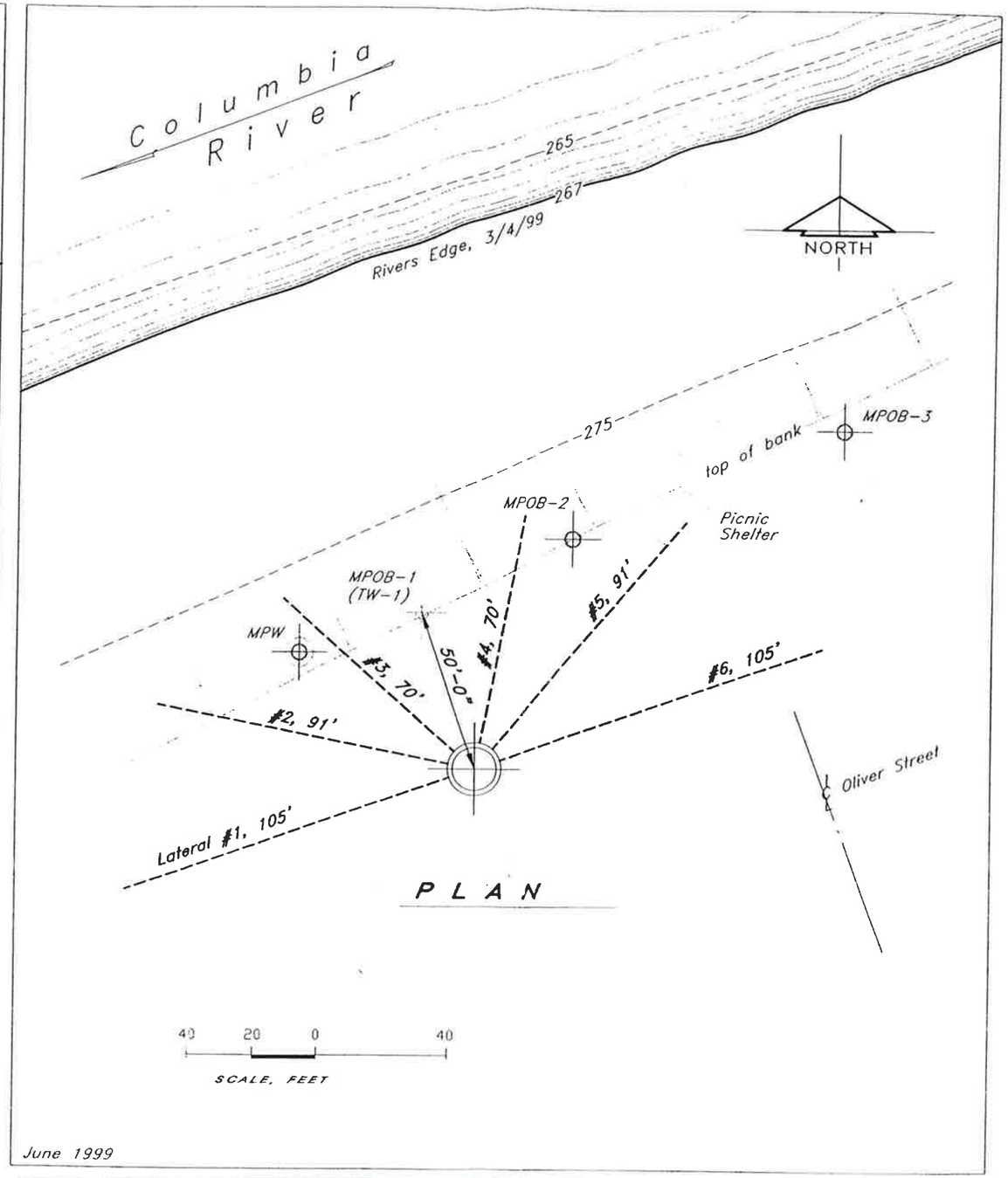

PLAN

June 1999

Layne Christensen Company
RANNEY METHOD
RANNEY DIVISION
Kennewick, Washington

TITLE: PROPOSED RANNEY COLLECTOR WELL

PROJECT: MARINA PARK AQUIFER TEST
CITY of UMATILLA, OREGON

SHT. No. SW-137-11

APPENDIX A - FIELD WELL LOGS

RANNEY METHOD

RANNEY DIVISION

Layne Christensen Company
Kennewick, Washington

Well No. TW-1 Survey No. SW-137

Owner City of Umatilla, OR Location Marina Park

Well Location ≈ 75 ft W of Picnic Gazebo, 125 ft from river's edge

Diameter 8-inch Depth ~~then~~ orig. 51.5 ft then 43 ft Total Casing

Screen Perforations: Top 33' Bottom 43' Slot size 90 SS

Elevations: Top of PVC 4.3 above grnd Top of Casing 3.0 above grnd Ground 280.4 ± Est. from River Elev

Static Water Level 12/15/98 2:05 pm 14.7' below ground surface

FROM	TO	DESCRIPTION OF MATERIAL
0	2	Top soil, sand + gravel
2	5	sand + gravel, g-med + coarse, well round
5	10	med. gravel ½"-1", round, sand some sand cem. on g. tight
10	15	med-coarse gravel, sand, cobbles (drove easier) gry-brn
15	26	med-coarse gravel, 1-3", round, cobbles (more @ 18-20')
		(drove easy) water @ 16' ±, no sand, gry-brn
26	27	sand + gravel w/trace brn clay, light brn color
27	31	fine-med sand, gravel, brn silt, cobbles
		hard drive 29-31' - lg angular basalt cobble
31	39	gravel - all sizes, sand, cobbles to 8", silt
		sand is dk gry, silt is brn, gravel is round + angular
39	44	coarse dk sand, fine gravel (more angular)
		drilled cobbles 42-44'
44	45	gry clayey gravel (or gravelly clay) lost H_2O
45	47	coarse dk sand + gravel; fairly clean, H_2O BACK (Heaves)

Driller Steve Vibbard, Staco Well Svcs. Date Started 12/8/98 pm

Report by Susan Mikels, Ranney Date Completed 12/14/98 (Drilling only)

RANNEY METHOD

RANNEY DIVISION

Layne Christensen Company
Kennewick, Washington

Well No. TW-1, pg. 2 Survey No. SW-137

Owner City of Umatilla Location Marina Park

Well Location

Diameter Depth Total Casing

Screen/Perforations: Top Bottom Slot size

Elevations: Top of Casing Ground

Static Water Level below ground surface

FROM	TO	DESCRIPTION OF MATERIAL
47	49	Coarse dk sand, fine gravel, cobbles
	NOTE:	WATER LEVEL BELOW CLAY LAYER
		IS 1.8 - 2.3 ft LOWER THAN PREVIOUS SWL
49	51	gravel, angular & round, dk sand, ang. basalt
		cobbles, brn silt
51	51½	drilled basalt, sand, pipe refusal at 51½ (±)
		chkd swl: 8" 15'-7"
		12" 14'-6" (surface seal casing to 20')
		decided to pull back to 43 ft (above clay)
		then bailed clean gravel & sand
		swl 14.7'

Driller Date Started 12/8/98

Report by Date Completed 12/14/98

RANNEY METHOD

RANNEY DIVISION

Layne Christensen Company
Kennewick, Washington

Well No. MPOB-2 Survey No. SW-137

Owner City of Umatilla, OR Location MARINA PARK

Well Location 51.4' Upstream from MPOB-1 (East)

Diameter 6-inch Depth 48'-9" Total Casing

Screen/Perforations: Top 42'-6" Bottom 48'-9" Slot size 4" PVC, 20 slot

Elevations: Top of Casing 283.37 ft-msl Ground 280.2 ft-msl

Static Water Level 2/3/99 14.0' below ground surface

FROM	TO	DESCRIPTION OF MATERIAL
0	13	fine brn sand, gravel 1/2"-2", round, brn silt
13	20	gravel, more coarse, cobbles, sand brn SWL 14.5'
20	25	Med. gravel, brn sand
25	35	Coarse gravel, cobbles, sand - brn
35	38 1/2	Coarse & med gravel, sand water slow
38 1/2	45	gravel, silt & sand color chg. gry-brn Low water, v. silty
45	47	sand, silt - heaving, gravel " "
47	48 3/4	sand + gravel water back ↑ OK

Driller Steve Vibbard, STACO Date Started 1/28/99

Report by Susan Mikels Date Completed 2/3/99

RANNEY METHOD

RANNEY DIVISION

Layne Christensen Company
Kennewick, Washington

Survey No. SW-137

Well No. MPOB-3

Owner City of Umatilla, OR Location Marina Park

Well Location 89.1' upstream from MPOB-2

Diameter 6-inch Depth ORIG. 56¼' FINAL 44' Total Casing

Screen/Perforations: Top 36½' Bottom 44' Slot size 20 slot PVC 4"

Elevations: Top of Casing 283.87 ft-msl Ground 280.7 ft-msl

Static Water Level 2/5/99 14.5' below ground surface

FROM	TO	DESCRIPTION OF MATERIAL
0	15	med-coarse gravel, 1"-3", cobbles
15	23	med gravel ½"-1", brown sand
23	25	med gravel, fine sand + silt, brn
25	30	coarse gravel + cobbles
30	35	fine-med gravel, sand, cobbles
35	40	med sand, fine-med gravel
40	45	fine-med sand, fine-med gravel
45	47	sand, gravel w/ some clay
47	56	Med sand dk gry, med gravel swl @ 15.5' bg
		↓ increasing sand
56	56¼	Basalt, refusal basalt chips
		pull pipe back to 44' to set screen
		swl @ 14.5' bg

Driller Steve Vibbard, STACO Date Started 2/3/99 pm

Report by Susan Mikels Date Completed 2/5/99

Set Screen 2/9/99

RANNEY METHOD

RANNEY DIVISION

Layne Christensen Company
Kennewick, Washington

Well No. MPW Survey No. SW-137

Owner CITY OF UMATILLA, OR Location MARINA PARK

Well Location 39.4' downstream from MPOB-1

Diameter 12-inch Depth ORIG. 48'4" / FINAL 43' Total Casing

Screen/Perforations: Top 33' Bottom 43' Slot size 100 slot

Elevations: Top of ~~Casing~~ PVC (FINAL) 282.45 ft-msl Ground 279.1 ft-msl

Static Water Level 2/16/99 13.8' below ground surface

FROM	TO	DESCRIPTION OF MATERIAL
0	10	med-coarse gravel, most 1/2"-1"
10	15	med-c. gravel, sand, cobbles 5"-6", brn. H_2O
15	20	coarse gravel, 1"-3" well-round
20	28	cobbles & coarse gravel, up to 8"
28	33	med-c. gravel, sand, few cobbles-8"
33	38	all sizes gravel, cobbles to 12", sand-brn
38	44	f-m-c gravel, med-c sand → dark
		weathered basalt cobbles, maybe tr. clay 42' ±
44	48	same as above, more angular cobbles
48	48'-4"	Basalt bedrock drilled basalt @ 48'
		ORIG set screen 38'4" - 48'-4", Step Test NG 2/18
		Reset screen 33'-43'

Driller STEVE VIBBARD, STACO Date Started 2/9/99

Report by Susan Mikels Date Completed 2/11/99

RESET SCREEN 2/22-23/99

APPENDIX B - LABORATORY REPORTS

ANALYSIS REPORT

C
L Susan Mikels
I Ranney Division
E P.O. Box 6387
N Kennewick WA 99336-0387
T

AMTEST OREGON L.L.C.
Oregon Certified Lab #ORO61

Professional Laboratory Services
9205 S.W. Nimbus Ave.
Beaverton, OR 97008
Tel 503 626 7424
Fax 503 643 1460

Date Sampled: 3/3/99
Date Received: 3/4/99
Date Analyzed: 3/9/99
Date Reported: 3/11/99
Job Number: 063/11
Page: 1

PWSID No.:
Sampler: Susan Mikels
Project: City of Umatilla
Sample Type - Drinking Water
Source - Well MPW
Sample Composition: Raw

Volatile Organic Compounds: EPA 524.2
Regulated Contaminants

		Results			
Laboratory Sample #		063/11			
Client Identification		Marina Park			
Contaminant	Code	mg/L (ppm)	MCL mg/L (ppm)	IPL mg/L (ppm)	MDL mg/L (ppm)
1,1,-Dichloroethylene	2977	ND	0.007	0.0005	0.0005
1,1,1-Trichloroethane	2981	ND	0.200	0.0005	0.0005
1,1,2-Trichloroethane	2985	ND	0.005	0.0005'	0.0005
1,2-Dichloroethane (EDC)	2980	ND	0.005	0.0005	0.0005
1,2-Dichloropropane	2983	ND	0.005	0.0005	0.0005
1,2,4-Trichlorobenzene	2378	ND	0.070	0.0005	0.0005
Benzene	2990	ND	0.005	0.0005	0.0005
Carbon Tetrachloride	2982	ND	0.005	0.0005	0.0005
cis-1,2-Dichloroethylene	2380	ND	0.070	0.0005	0.0005
Dichloromethane	2964	ND	0.005	0.0005	0.004
Ethylbenzene	2992	ND	0.700	0.0005	0.0005
Chlorobenzene	2989	ND	0.100	0.0005	0.0005
o-Dichlorobenzene	2968	ND	0.600	0.0005	0.0005
p-Dichlorobenzene	2969	ND	0.075	0.0005	0.0005
Styrene	2996	ND	0.100	0.0005	0.0005
Tetrachloroethylene	2987	ND	0.005	0.0005	0.0005
Toluene	2991	ND	1.000	0.0005	0.0005
Xylenes	2955	ND	10.00	0.0005	0.0005
trans-1,2-Dichloroethylene	2979	ND	0.100	0.0005	0.0005
Trichloroethylene	2984	ND	0.005	0.0005	0.0005
Vinyl Chloride	2976	ND	0.002	0.0005	0.0005

ND = None Detected
MCL = Maximum Contaminant Level
IPL = Interim Performance Level
MDL = Method Detection Limit

Reported By

Greg Bolt
Laboratory Director

RAN063DV1 3/12/99

ANALYSIS REPORT

CLIENT
Susan Mikels
Ranney Division
P.O. Box 6387
Kennewick WA 99336-0387

AMTEST OREGON L.L.C.
Oregon Certified Lab #ORO61

Professional Laboratory Services
9205 S.W. Nimbus Av
Beaverton, OR 9700
Tel 503 626 7424
Fax 503 643 1460

Date Sampled: 3/3/99
Date Received: 3/4/99
Date Analyzed: 3/9/99
Date Reported: 3/11/99
Job Number: 063/11
Page: 2

PWSID No.:
Sampler: Susan Mikels
Project: City of Umatilla
Sample Type - Drinking Water
Source - Well MPW
Sample Composition: Raw

Volatile Organic Compounds: EPA 524.2
Unregulated Contaminants

Laboratory Sample #		Results 063/11	
Client Identification		Marina Park	MDL
Contaminant	Code	mg/L (ppm)	mg/L (ppm)
1,1-Dichloroethane	2978	ND	0.0005
1,1-Dichloropropene	2410	ND	0.0005
1,1,1,2-Tetrachloroethane	2986	ND	0.0005
1,1,2,2-Tetrachloroethane	2988	ND	0.0005
1,2,3-Trichloropropane	2414	ND	0.0005
1,3-Dichloropropane	2412	ND	0.0005
1,3-Dichloropropene	2413	ND	0.0005
2,2-Dichloropropane	2416	ND	0.0005
Bromobenzene	2993	ND	0.0005
Bromodichloromethane	2943	ND	0.0005
Bromoform	2942	ND	0.0005
Bromomethane	2214	ND	0.0005
Chloroethane	2216	ND	0.0005
Chloroform	2941	ND	0.0005
Chloromethane	2210	ND	0.0005
Dibromomethane	2408	ND	0.0005
Dibromochloromethane	2944	ND	0.0005
m-Dichlorobenzene	2967	ND	0.0005
o-Chlorotoluene	2965	ND	0.0005
p-Chlorotoluene	2966	ND	0.0005
Bromochloromethane	2430	ND	0.0005
n-Butylbenzene	2422	ND	0.0005
Dichlorodifluoromethane	2212	ND	0.0005
Fluorotrichloromethane	2218	ND	0.0005
Hexachlorobutadiene	2246	ND	0.0005
Isopropylbenzene	2994	ND	0.0005
p-Isopropyltoluene	2030	ND	0.0005
Napthalene	2248	ND	0.0005
sec-Butylbenzene	2428	ND	0.0005
tert-Butylbenzene	2426	ND	0.0005
1,2,3-Trichlorobenzene	2420	ND	0.0005
1,2,4-Trimethylbenzene	2418	ND	0.0005
1,3,5-Trimethylbenzene	2424	ND	0.0005

ND = None Detected
MDL = Method Detection Limit

RAN063DV2 3/12/99

Reported By

Greg Bolt
Laboratory Director

ANALYSIS REPORT

CLIENT
Susan Mikels
Ranney Division
P.O. Box 6387
Kennewick WA 99336-0387

AMTEST OREGON L.L.C.

Professional Laboratory Services

9205 S.W. Nimbus Ave.
Beaverton, OR 97008

Tel 503 626 7424
Fax 503 643 1460

Analysis by: Oregon Certified Lab #ORO31

Date Sampled: 3/3/99
Date Received: 3/4/99
Date Analyzed: 3/11/99
Date Reported: 3/23/99
Job Number: 063/11
Page: 3

PWSID No.:
Sampler: Susan Mikels
Project: City of Umatilla
Sample Type - Drinking Water
Source - Well MPW
Sample Composition: Raw

Inorganic Compounds

Results

Laboratory Sample # 063/11
Client Identification **Marina Park**

Contaminant	Code	Method	mg/L (ppm)	MCL mg/L (ppm)	MDL mg/L (ppm)
Antimony	1074	200.9	ND	0.006	0.001
Arsenic	1005	200.9	0.005	0.050	0.002
Barium	1010	3111D	0.2	2.0	0.1
Beryllium	1075	200.9	ND	0.004	0.0005
Cadmium	1015	3113B	ND	0.005	0.0002
Chromium	1020	3113B	ND	0.1	0.002
Copper	1022	3111B	ND	1.3	0.01
Iron	1028	3111B	ND	0.3*	0.03
Lead	1030	200.9	0.002	0.015	0.001
Manganese	1032	3111B	ND	0.05*	0.01
Mercury	1035	245.1	ND	0.002	0.0003
Nickel	1036	3113B	ND	0.1	0.004
Selenium	1045	200.9	ND	0.05	0.001
Thallium	1085	200.9	ND	0.002	0.0004
Sodium	1052	273.1	35.5	20*	0.1
Fluoride	1025	4500F-C	ND	4.0	0.5
Nitrate	1040	4500NO3-D	3.2	10	0.50
Nitrite	1041	4500NO2-B	ND	1.0	0.01
Sulfate	1055	375.4	55	250*	5.0
Cyanide	1024	4500CN-C/E	ND	0.2	0.04
Hardness	1916	130.2	240	250*	4
T. Diss. Solids	1930	120.1	330	500	0.7
Odor	1920	SM2150B	ND	3.0 TON*	1.0 TON
Color	1905	SM2120B	ND	15c.u.*	5 color units

*Secondary Suggested Limit

ND = None Detected
MCL = Maximum Contaminant Level
MDL = Method Detection Limit

Reviewed By

Greg Bolt
Laboratory Director

RAN063inorg& 3/23/99

ANALYSIS REPORT

C
L Susan Mikels
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AMTEST OREGON L.L.C.

Professional Laboratory Services

9205 S.W. Nimb
Beaverton, OR

Tel 503 626 7424
Fax 503 643 1460

Analysis by: Certified Lab #CA065

Date Sampled: 3/3/99
Date Received: 3/4/99
Date Analyzed: 3/16/99
Date Reported: 3/23/99
Job Number: 063/11
Page: 4

PWSID No.:
Sampler: Susan Mikels
Project: City of Umatilla
Sample Type - Drinking Water
Source - Well MPW
Sample Composition: Raw

Synthetic Organic Compounds: EPA 515.1

	Results
Laboratory Sample #	063/11
Client Identification	Marina Park

Regulated Contaminants

Contaminant	Code	mg/L (ppm)	MCL mg/L (ppm	IPL mg/L (ppm)	MDL mg/L (ppm)
2,4,5-TP (Silvex)	2110	ND	0.05	0.005	0.0005
2,4,-D	2105	ND	0.07	0.007	0.0025
Dalapon	2031	ND	0.2	0.020	0.0025
Dinoseb	2041	ND	0.007	0.0007	0.001
Pentachlorophenol	2326	ND	0.001	0.0001	0.0001
Picloram	2040	ND	0.5	0.05	0.001

Unregulated Contaminants

Contaminant	Code	mg/L (ppm)	MDL mg/L (ppm)
Dicamba	2440	ND	0.0005

ND = None Detected
MCL = Maximum Contaminant Level
IPL = Interim Performance Level
MDL = Method Detection Limit

NCL
Reported By

Greg Bolt
Laboratory Director

RAN063Herb 3/23/99

ANALYSIS REPORT

CLIENT
Susan Mikels
Ranney Division
P.O. Box 6387
Kennewick WA 99336-0387

AMTEST OREGON L.L.C.
Professional Laboratory Services
9205 S.W. Nimbus Ave.
Beaverton, OR 97008
Tel 503 626 7424
Fax 503 643 1460

Analysis by: Certified Lab #CA065

PWSID No.:
Sampler: Susan Mikels
Project: City of Umatilla
Sample Type - Drinking Water
Source - Well MPW
Sample Composition: Raw

Date Sampled: 3/3/99
Date Received: 3/4/99
Date Reported: 3/23/99
Job Number: 063/11
Page: 5

	Results
Laboratory Sample #	063/11
Client Identification	Marina Park

Synthetic Organic Compounds

Regulated Contaminants

Contaminant	Code	Method	mg/L (ppm)	MCL mg/L (ppm)	MDL mg/L (ppm)	Analysis Date
Ethylene Dibromide	2946	504.1	ND	0.00005	0.00002	3/19/99
Dibromochloropropane	2931	504.1	ND	0.0002	0.00001	3/19/99
PCB's	2383	508	ND	0.0005	0.00010	3/19/99
PAH(as benzo(a)pyrene)	2306	550.1	ND	0.0002	0.00002	3/16/99
Diquat	2032	549.1	ND	0.02	0.0004	3/9/99
Glyphosate	2034	547	ND	0.7	0.005	3/16/99
Carbofuran	2046	531.1	ND	0.04	0.005	3/10/99
Oxamyl (Vydate)	2036	531.1	ND	0.200	0.005	3/10/99

Unregulated Contaminants

3-Hydroxycarbofuran	2066	531.1	ND		0.003	3/10/99
Aldicarb	2047	531.1	ND		0.003	3/10/99
Aldicarb Sulfoxide	2043	531.1	ND		0.003	3/10/99
Aldicarb Sulfone	2044	531.1	ND		0.004	3/10/99
Carbaryl	2021	531.1	ND		0.005	3/10/99
Methomyl	2022	531.1	ND		0.002	3/10/99

ND = None Detected
MCL = Maximum Contaminant Level
MDL = Method Detection Limit

NCL
Reported By

Greg Bolt
Laboratory Director

RAN063-99 3/23/99

ANALYSIS REPORT

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L Susan Mikels
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AMTEST OREGON L.L.C.

Professional Laboratory Services

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Beaverton, OR 97

Tel 503 626 7424
Fax 503 643 1460

Analysis by: Certified Lab #CA065

PWSID No.:
Sampler: Susan Mikels
Project: City of Umatilla
Sample Type - Drinking Water
Source - Well MPW
Sample Composition: Raw

Date Sampled: 3/3/99
Date Received: 3/4/99
Date Reported: 3/23/99
Job Number: **063/11**
Page: 6

	Results
Laboratory Sample #	063/11
Client Identification	**Marina Park**

Synthetic Organic Compounds: EPA 506 Analyzed: 3/8/99

Regulated Contaminants

Contaminant	Code	mg/L (ppm)	MCL mg/L (ppm)	IPL mg/L (ppm)	MDL mg/L (ppm)
Di(2-ethylhexyl)adipate	2035	**ND**	0.5	0.005	0.005
Di(2-ethylhexyl)phthalate	2039	**ND**	0.006	0.003	0.003

Synthetic Organic Compounds: EPA 548.1 Analyzed: 3/16/99

Regulated Contaminants

Contaminant	Code	mg/L (ppm)	MCL mg/L (ppm)	IPL mg/L (ppm)	MDL mg/L (ppm)
Endothall	2033	**ND**	0.1	0.05	0.05

ND = None Detected
MCL = Maximum Contaminant Level
IPL = Interim Performance Level
MDL = Method Detection Limit

NCL
Reported By

Greg Bolt
Laboratory Director

RAN063-APE 3/23/99

ANALYSIS REPORT

CLIENT
Susan Mikels
Ranney Division
P.O. Box 6387
Kennewick WA 99336-0387

AMTEST OREGON L.L.C.

Analysis by: Certified Lab #CA065

Professional Laboratory Services
9205 S.W. Nimbus Ave.
Beaverton, OR 97008
Tel 503 626 7424
Fax 503 643 1460

PWSID No.:
Sampler: Susan Mikels
Project: City of Umatilla
Sample Type - Drinking Water
Source - Well MPW
Sample Composition: Raw

Date Sampled: 3/3/99
Date Received: 3/4/99
Date Analyzed: 3/19/99
Date Reported: 3/23/99
Job Number: 063/11
Page: 7

Synthetic Organic Compounds

	Results
Laboratory Sample #	063/11
Client Identification	Marina Park

Regulated Contaminants

Contaminant	Code	Method	mg/L (ppm)	MCL mg/L (ppm)	IPL mg/L (ppm)	MDL mg/L (ppm)
Alachlor (Lasso)	2051	505	ND	0.002	0.0002	0.0002
Atrazine	2050	507	ND	0.003	0.0001	0.0001
Lindane	2010	505	ND	0.0002	0.00001	0.00001
Chlordane	2959	505	ND	0.002	0.0001	0.0001
Endrin	2005	505	ND	0.0002	0.00001	0.00001
Heptachlor Epoxide	2067	505	ND	0.0002	0.00001	0.00001
Heptachlor	2065	505	ND	0.0004	0.00001	0.00001
Hexachlorobenzene	2274	505	ND	0.001	0.00001	0.00001
Hexachlorocyclopentadiene	2042	505	ND	0.05	0.00005	0.00005
Methoxychlor	2015	505	ND	0.04	0.0001	0.0001
Simazine	2037	507	ND	0.004	0.00007	0.00007
Toxaphene	2020	505	ND	0.003	0.0005	0.0005

ND = None Detected
MCL = Maximum Contaminant Level
IPL = Interim Performance Level
MDL = Method Detection Limit

NCL
Reported By

Greg Bolt
Laboratory Director

RAN063RPEST 3/23/99

ANALYSIS REPORT

C
L Susan Mikels
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AMTEST OREGON L.L.C.

Professional Laboratory Services

9205 S.W. Nimbu
Beaverton, OR 97

Tel 503 626 7424
Fax 503 643 1460

Analysis by: Certified Lab #CA065

PWSID No.:
Sampler: Susan Mikels
Project: City of Umatilla
Sample Type - Drinking Water
Source - Well MPW
Sample Composition: Raw

Date Sampled: 3/3/99
Date Received: 3/4/99
Date Analyzed: 3/19/99
Date Reported: 3/23/99
Job Number: 063/11
Page: 8

Synthetic Organic Compounds

	Results
Laboratory Sample #	063/11
Client Identification	Marina Park

Unregulated Contaminants

Contaminant	Code	Method	mg/L (ppm)	MDL mg/L (ppm)
Aldrin	2356	505	ND	0.00001
Butachlor	2076	507	ND	0.00038
Dieldrin	2070	505	ND	0.00001
Metolachlor	2045	507	ND	0.0005
Metribuzin	2595	507	ND	0.00025
Propachlor	2077	507	ND	0.00025

ND = None Detected
MDL = Method Detection Limit

NCL
Reported By

Greg Bolt
Laboratory Director

RAN063UPEST 3/23/99

AmTest Oregon L.C.C.
13035 SW PACIFIC HWY.
TIGARD, OR 97223
503-639-9311 Fax 684-1588

Ranney Division
c/o Susan Mikels
P.O. Box 6387
Kennewick, WA 99336-0387

4/19/99

Lab Sample#: 063/11

GROSS ALPHA RADIATION IN WATER
****
Single Sample Sent to E.P.A. Approved Laboratory
(Truesdail Laboratories, Inc.) For Analysis

Project:	City of Umatilla
Source:	New Well - Well MPW
Date Collected:	3/3/99 12:10p
Date Recv'd:	3/4/99
Sampled At:	Marina Park
Sample Compostion:	Raw
Sample Type:	Single
Sampled By:	Susan Mikels

Contaminant	Code	MCL	Result	Method	Analyst
Gross Alpha	4000	15 pCi/L	1.21 pCi/L	SM7110C	CA062

MCL; Maximum Contaminant Level

Sample is less than 15.0 pCi/L limit and is considered satisfactory.

Reviewed By:
John Scholz

ANALYSIS REPORT

C
L Susan Mickels
I Ranney Division
E P.O. Box 6387
N Kennewick, WA 99336
T

AMTEST OREGON L.L.C.
Professional Laboratory Services
13035 S.W. Pacific Hwy.
Tigard, OR 97223
Tel 503 639 9311
Fax 503 684 1588

Analysis by: Oregon Certified Lab #ORO31

Date Sampled:	3/3/99
Date Received:	3/4/99
Date Analyzed:	3/12/99
Date Reported:	3/15/99
Job Number:	063/12
Page:	1

Project: Marina Park Aquifer Test
Location: Umatilla
Sample Type: River water

Inorganic Compounds (Regulated)

Laboratory Sample #		063/12		
Client Identification		**Columbia River**	MCL	MDL
Contaminant	Method	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)
Antimony	200.9	**ND**	0.006	0.001
Arsenic	200.9	**ND**	0.050	0.002
Barium	3111D	**ND**	2.0	0.1
Beryllium	200.9	**ND**	0.004	0.0005
Cadmium	3113B	**0.0004**	0.005	0.0002
Chromium	3113B	**ND**	0.1	0.002
Copper	3111B	**ND**	1.3	0.01
Lead	200.9	**ND**	0.015	0.001
Mercury	245.1	**ND**	0.002	0.0003
Nickel	3113B	**ND**	0.1	0.004
Selenium	200.9	**ND**	0.05	0.001
Thallium	200.9	**ND**	0.002	0.0004
Sodium	273.1	**13.08**	20*	0.05
Fluoride	4500F-C	**ND**	4.0	0.5
Nitrate	4500NO3-D	**1.2**	10	0.50
Nitrite	4500NO2-B	**0.02**	1.0	0.01
Sulfate	375.4	**29**	250*	5.0
Cyanide	335.2	**ND**	0.2	0.02

Miscellaneous Parameters

Iron	3111B	**1.14**	0.3*	0.03
Manganese	3111B	**0.04**	0.05*	0.01
Color	SM2120B	**30**	15 c.u.*	5 c.u.
TDS	120.1	**130**	500*	0.7
Hardness	130.2	**110**	250*	4.0

ND = None Detected
MCL = Maximum Contaminant Level for drinking water
MDL = Method Detection Limit
cu = color units

*recommended for drinking water

Reviewed By
Scott Dickman

ranneydiv 3/15/99

ANALYSIS FOR WATERBORNE PARTICULATES

CH Diagnostic & Consulting Service, Inc.
214 SE 19th Street, Loveland, CO 80537
Carrie M. Hancock, President Telephone (970) 667-9789

Invoice 9940126
3/4/99

Customer 88037
Ranney Division of Layne Christensen Company
PO Box 6387
Kennewick, WA 99336-0387
PWSID#

Laboratory Information

Federal Express; 3/4/99; 1545 Hrs; Wound; Excellent; Results submitted by:
Tricia Klmati

Sample Identification: Well MPW, Umatilla, OR

Sample Information: Source: Drilled well, 43' deep and 110' from river/stream/lake, unchlorinated, 59°F, pH 7.8, hardness 274 mg/L

Date/Start: 3/2/99; 1215 Hrs **Date/Stop:** 3/3/99; 1043 Hrs **Sampler:** Susan Mikels

Gallons: 1218 (4610 Liters) **Filter Color:** Brown **Centrifugate:** 0.1 mL/100 gals

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amorphous Debris:	Silt, clay and inorganic precipitate, 1-200 µM diameter aggregates
Other Algae:	600,000/100 gals, few species, predominantly Chlorophytes including Ankistrodesmus, Chlorella, Chlamydomonas and Tetraedron
Diatoms:	100,000/100 gals, few species, predominantly Centrales including Cyclotella and Melosira, some Pennales including Asterionella and Cymbella
Plant Debris:	ND
Giardia:	ND
Coccidia:	ND
Rotifers:	ND
Nematodes:	ND
Pollen:	ND
Ameba:	ND
Ciliates:	ND
Colorless Flagellates:	ND
Crustaceans:	ND
Insects/Larvae:	ND
Other:	ND

RESULTS OF *GIARDIA* & *CRYPTOSPORIDIUM* ANALYSIS

Floated Pellet: 0.001 mL/100 L **Amount of Sample Assayed:** 30.7 L

		Total IFA Count	Empty	Amorphous Structure	1 Internal Structure	≥2 Internal Structure	Internal Structure
Giardia	detected	0	0	0	0	0	
	#/100 L	<3.3	<3.3	<3.3	<3.3	<3.3	
Cryptosporidium	detected	0	0	0			0
	#/100 L	<3.3	<3.3	<3.3			<3.3

ND (None Detected)
Quality Control Batch #: 9909

[1]This sample was analyzed for particulates following the Environmental Protection Agency Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA)

[2]This sample was also analyzed for *Giardia* and/or *Cryptosporidium* by the method outlined in: ICR Laboratory Manual. 1996. USEPA, Washington, D.C., EPA/600/R-95/178. All limitations stated in the methods apply.

Comments: Score: 30-High Risk per EPA Consensus Method referenced above. Equivalent volume assayed for MPA: 25.8 L

ANALYSIS FOR WATERBORNE PARTICULATES

CH Diagnostic and Consulting Service, Inc.
214 SE 19th Street, Loveland, CO 80537
Carrie M. Hancock, President
(970) 667-9789

Invoice 9940126

Customer 88037
Ranney Division of Layne Christensen Company
PO Box 6387
Kennewick, WA 99336-0387

Laboratory Information
FedEx; 3/4/99; 1545 Hrs; Excellent; Wound
Results submitted by:
Tricia Klowski

Sample Identification: Columbia River @ Umatilla, OR, Raw Water

Sample Information: SOURCE: Stream or River; Unchlorinated; pH 8.5; 6.11°C

Sample Date & Time: 3/2/99 12:27 PM —» 3/3/99 10:48 AM **Sampler:** Susan Mikels

Amount: 4216.49 L (1114 gal) **Filter Color:** Dark brown **Centrifugate:** 0.213 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 0.1874 L

Amorphous Debris	silt (2-50 µm), clay (1-2 µm), inorganic precipitate
Algae	100,000/100 L, predominantly Chlorophytes including Ankistrodesmus, Scenedesmus, Chlamydomonas, some Cryptomonads including Cryptomonas, Chroomonas, some Dinoflagellates including Peridinium
Diatoms	2,000,000/100 L, predominantly Pennales including Asterionella, Synedra, Navicula, Cymbella, Diatoma, Nitzschia, Tabellaria, Surirella, some Centrales including Cyclotella, Melosira
Plant debris	ND
Rotifers	ND
Nematodes	ND
Pollen (pine)	ND
Ameba	ND
Ciliates	ND
Colorless Flagellates	1,000/100 L
Crustaceans	ND
Other Arthropods	ND
Other	ND

This sample was analyzed for particulates following the procedure outlined in: Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization. 1996. USEPA, Region 10, EPA 910-R-96-001. Particle free water used as wash water; organisms counted by natural unit count in a Palmer Maloney Counting Chamber.

RESULTS OF GIARDIA AND CRYPTOSPORIDIUM ANALYSIS

Floated Pellet: 0.011 mL/100 L

Amount of sample assayed: 9.37 L

		Total IFA Count	Empty	Amorphous Structure	1 Internal Structure	>=2 Internal Structure	Internal Structure
Giardia	detected	0	0	0	0	0	
	#/100 L	<11	<11	<11	<11	<11	
Cryptosporidium	detected	0	0	0			0
	#/100 L	<11	<11	<11			<11

This sample was analyzed for *Giardia* and/or *Cryptosporidium* by the method outlined in: ICR Laboratory Manual. 1996. USEPA, Washington, D.C. EPA/600/R-95/178. All limitations stated in the method apply.

From: E.P.A. Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA)

TABLE 1. Numerical range of each primary bio-indicator (particulate) counted per 100 gallons water.

Indicators of surface water[1]	EH[3]	H	M	R	NS
Giardia[2]	>30	16-30	6-15	1-5	<1
Coccidia[2]	>30	16-30	6-15	1-5	<1
Diatoms[4]	>150	41-149	11-40	1-10	<1
Other Algae[4]	>300	96-299	21-95	1-20	<1
Insects/Larvae	>100	31-99	16-30	1-15	<1
Rotifers	>150	61-149	21-60	1-20	<1
Plant Debris[4]	>200	71-200	26-70	1-25	<1

1. According to EPA "Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources", March, 1991 ed.

2. If Giardia cysts or coccidia are found in any sample, irrespective of volume, score as above.

3. Key= EH -extremely heavy M -moderate NS -not significant
   H -heavy R -rare

4. Chlorophyll containing

TABLE 2. Relative surface water risk factors associated with scoring of primary bio-indicators (particulate) present during MPA of subsurface water sources.

Indicators of surface water[1]	Relative Risk Factor[3]				
	EH[2]	H	M	R	NS
Giardia	40	30	25	20	0
Coccidia	35	30	25	20	0
Diatoms	16	13	11	6	0
Other Algae	14	12	9	4	0
Insects/Larvae	9	7	5	3	0
Rotifers	4	3	2	1	0
Plant Debris	3	2	1	0	0

1. According to EPA "Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources", March 1991 ed.

2. Refer to Table 1 for range of indicators counted per 100 gallons.

   Key= EH -extremely heavy M -moderate NS -not significant
   H -heavy R -rare

3. Risk of surface water contamination:
   ≥20 - high risk
   10-19 - moderate risk
   ≤9 - low risk

Layne Christensen Company *Ranney Division*

607 East Columbia Drive, P.O. Box 6387 • Kennewick, Washington 99336-0387 • Phone: (509) 586-6947 • Fax: (509) 586-0825

RECEIVED

NOV 3 0 1999

...SON • PERRY & ASSOC.

November 23, 1999

Mr. Roger Frances
City of Umatilla
P. O. Box 130
Umatilla, OR 97882

Dear Roger:

As you know, we have received the results of the recent microscopic particulate analysis conducted on the Marina Park test well, TW-1. We enclose a copy of the laboratory report (previously faxed) for your records.

Prior to collecting the sample, the well was disinfected with chlorine on Friday, October 8, 1999 by personnel from Purswells Pumps. Sufficient chlorine bleach was added to bring the chlorine concentration up to 100 mg/l (the state regulation calls for at least 50 mg/l). The water was allowed to stand over the weekend. On Sunday, October 10th, the well was pumped for about 30 minutes, a sample was collected and tested for chlorine. No chlorine was detected at that time.

For the test, TW-1 was pumped from 10:40 a.m. Monday, October 11th until 10:40 a.m. on Wednesday, October 13th, a period of 48 hours. According to measurements made by City staff the test pumping rate was approximately 65 gpm and remained fairly constant throughout the test period. At the end of the test period, the drawdown measured in the well was 0.44 ft. The average river stage during the test, measured at the McNary Dam tailwater, was 265.5 ft-msl.

The MPA sample was collected during the last 24 hours of the test. The sample was collected in accordance with procedures described in the USEPA document "Consensus Method for Determining Groundwater Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis" dated October 1992. Water from the well was run through a one micron polypropylene filter at a rate of approximately 1 gpm. An MPA sample was also collected from the Columbia River using a small submersible pump. The river sample was collected at the Marina dock, east and upstream of the test well site. At the end of the sampling period, both filters were bagged, sealed, and shipped cold overnight to the laboratory.

The samples were analyzed by CH Diagnostic & Consulting Service, Inc. of Loveland, Colorado. The analysis procedures used are referenced on the laboratory reports.

The analysis shows that there were no surface water particulates; that is, algae, diatoms, *Giardia*, coccidia, rotifers, etc., found in the water from well TW-1 and the relative risk factor from the EPA Consensus Method was zero or low risk. As would be expected, the sample from the Columbia River did contain large numbers of algae and diatoms.

Given these results, we conclude that the shallow alluvial aquifer adjacent to the Columbia River is not contaminated with microscopic organisms from the river. We further conclude that the results of the previous MPA sample (3/3/99) are invalid and hence, have no significance for the planned water supply development. We suspect that Well MPW was contaminated with surface water by the driller during drilling or the laboratory mislabeled the samples during processing and analyzed the wrong sample. We consider the first alternative most likely, but we can only speculate as to what really happened.

We reiterate our opinion that the lower pumping rate used for this MPA sample test was appropriate for the water quality information we were trying to obtain. The purpose of collecting a sample for MPA was to determine if the aquifer in the vicinity of the well was contaminated with surface water organisms. As explained in our memo dated 9/16/99 to Martin Davis, water from the Columbia River would not reach the test wells during short duration (48 hours) test periods, whether pumping 850 gpm or 65 gpm. This is because riverbed infiltration rates are typically very low and it takes days for the water to travel through the bed.

The high effective distance to the line of infiltration (1680 ft) computed for the March 1999 aquifer test indicates that the riverbed infiltration rate is very low and the hydraulic connection between the river and the aquifer is weak. (See page 8 of our report dated June 1999.) The relatively high hardness of the groundwater (240 mg/l versus 110 mg/l for the river) also indicates a weak hydraulic connection.

Although the weak hydraulic connection is a limiting factor with respect to collector well yield, it is a great advantage with respect to water quality. It means that the water will be traveling through the riverbed at a fraction of the rate typically used in the design of slow sand filters (1.0-5.0 mgd/acre or more), a well-accepted method of water treatment.

You and your consultants have expressed the concern that a collector well water supply may require additional filtration. Based on our knowledge of the site and experiences at the Cities of Boardman and Kennewick, which both have collector wells adjacent to the Columbia River, we believe it is extremely unlikely that additional treatment beyond disinfection will be required.

The Boardman and Kennewick collector wells are located in aquifers with hydrogeologic conditions similar to those of the Marina Park site in Umatilla. At both locations the aquifer transmissivity is high and the riverbed infiltration rate is low. The turbidity of the water produced by these wells is consistently very low, averaging 0.13 ntu at Kennewick and 0.04 ntu at Boardman. Additionally, both cities have taken numerous samples for MPA and the amounts of surface water indicator particulates have been insignificant.

For your review, we enclose the article "Characterizing the Influence of Surface Water on Water Produced by Collector Wells", which discusses water quality data for the Kennewick collector well. We also enclose MPA and turbidity data for the Boardman collector well together with a copy of a letter from the state indicating their source will be classified as groundwater. Our confidence that the water produced by a collector well constructed at the Marina Park site will not require treatment, other than disinfection, is based on the success and similarities of the Boardman and Kennewick collector wells.

Another item for consideration is that Oregon regulations allow sources that are determined to be under the direct influence of surface water to be evaluated for natural filtration credits. We enclose a copy of OAR 333-061-0032 and direct your attention to pages 27-31. Under these regulations, if the MPA risk scores are less than 20 the state will allow the water source to be evaluated to determine the log reduction of particles provided by the natural filtration process. The state will give up to 2.0 log removal for natural filtration. We are familiar with studies that show natural filtration typically provides a minimum of 3 log removal and more commonly provides on the order of 5 to 8 log removal of particulates.

In evaluating the development of a surface water source, the City should also consider that a collector well offers environmental and public health safety advantages over direct surface water intakes. Because all construction takes place onshore, there is no disturbance of the river during the construction process. Being on onshore installation, the well is not a hazard to navigation and is not subject to damage by floods and debris. Perhaps the most important environmental advantage of the collector well is that it has no effect on fish or other aquatic life.

From a public health viewpoint, the collector well provides an additional barrier to any substances that may be spilled into the river by some type of vehicle, train , or ship accident. We believe this is an important consideration in our section of the river.

We hope this discussion has answered most of your questions regarding the development of a collector well water supply. We will be pleased to meet with the City and its consultants, if desired, to further discuss a collector well water supply. Please let us know if we may be of service.

Sincerely yours,

RANNEY DIVISION
Layne Christensen Company

M. Susan Mikels

M. Susan Mikels, P.E.
Groundwater Engineer

Enclosures

c: (2) enclosed for distribution
Fred Ziari, IRA Consulting
Jess Holt, Anderson & Perry
Robert Huskisson, Ranney Division Ohio

ANALYSIS FOR WATERBORNE PARTICULATES

CH Diagnostic & Consulting Service, Inc.
214 SE 19th Street, Loveland, CO 80537
Carrie M. Hancock, President Telephone (970) 667-9789

Invoice 9901201

10/14/99

Customer 88037
Ranney Division of Layne Christensen Company
PO Box 6387
Kennewick, WA 99336-0387

PWSID#

Laboratory Information

Federal Express; 10/14/99; 900Hrs;
Wound; Excellent; Results submitted by:
Tricia Klonicki

Sample Identification: Marina Park, Umatilla, OR, TW-1 (well)
Sample Information: Source: Drilled well, 43' deep and 125' from river/stream/lake, unchlorinated, 61°F, pH 7.8, Hardness 308 mg/L
Date/Start: 10/12/99; 1028 Hrs **Date/Stop:** 10/13/99; 1040 Hrs **Sampler:** Susan Mikels
Gallons: 1250 **Filter Color:** White **Total Centrifugate:** 0.001 mL/100 gals

Amorphous Debris: Clay, silt and inorganic precipitate, 1-100 µM diameter
Other Algae: ND
Diatoms: ND
Plant Debris: ND
Giardia: ND
Coccidia: ND
Rotifers: ND
Nematodes: ND
[illegible]: ND
Ameba: ND
Ciliates: ND
Colorless Flagellates: ND
Crustaceans: ND
Insects/Larvae: ND
Other: ND

Floated Pellet: <0.001 mL/100 L **Amount of Sample Assayed:** 473.1 L

		Total IFA Count	Empty	Amorphous Structure	1 Internal Structure	≥ 2 Internal Structures	Internal Structure
Giardia	detected	0	0	0	0	0	
	#/ 100 L	<0.2	<0.2	<0.2	<0.2	<0.2	
Cryptosporidium	detected	0	0	0			0
	#/ 100 L	<0.2	<0.2	<0.2			<0.2

ND (None Detected)
Quality Control Batch #: 9941
[1]This sample was analyzed for particulates following the Environmental Protection Agency Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA).
[2]This sample was also analyzed for *Giardia* and *Cryptosporidium* by the method outlined in: ICR Laboratory Manual. 1996. USEPA, Washington, D.C., EPA/600/R-95/178. All limitations stated in the methods apply.

Comments: Score: 0-Low Risk per EPA Consensus Method referenced above.
Equivalent volume assayed for MPA: 34.5 L

ANALYSIS FOR WATERBORNE PARTICULATES

CH Diagnostic and Consulting Service, Inc.
214 SE 19th Street, Loveland, CO 80537
Carrie M. Hancock, President
(970) 667-9789

Invoice 9901201

Customer 88037
Ranney Division of Layne Christensen Company
PO Box 6387
Kennewick, WA 99336-0387

Laboratory Information
Federal Express; 10/14/99; 0900 Hrs; Excellent; Wound
Results submitted by:
Tricia Klimicki

Sample Identification:	Marina at Umatilla, OR, Columbia River, Raw water		
Sample Information:	SOURCE: Stream or River; Hardness 86 mg/L; Unchlorinated; pH 8.5; 64.5°F		
Sample Date & Time:	10/12/99 01:30 PM —» 10/13/99 11:15 AM	**Sampler:**	Susan Mikels
Amount:	2895.525 L (765 gal)	**Filter Color:**	Dark brown
Date/Time Eluted/Centrifuged:	10/15/99 12:00 PM	**Centrifugate:**	0.449 mL/100 L

RESULTS OF MICROSCOPIC PARTICULATE ANALYSIS

Amount of sample assayed: 0.04455 L

Amorphous Debris	clay (1-2 µm), silt (2-50 µm), sand (50-2000 µm), inorganic precipitate, aggregates
Algae	5,000,000/100 L, predominantly Chlorophytes including Chlamydomonas, Scenedesmus, Coelastrum, Ankistrodesmus, Pediastrum, some Cryptomonads including Campylomonas, some Cyanophytes including Oscillatoria, some Euglenophytes including Trachelomonas
Diatoms	20,000,000/100 L, predominantly Centrales including Melosira, Cyclotella, some Pennales including Fragilaria, Nitzschia, Asterionella
Plant debris	ND
Rotifers	ND
Nematodes	ND
Pollen (pine)	ND
Ameba	ND
Ciliates	2,000/100 L
Colorless Flagellates	10,000/100 L
Crustaceans	ND
Other Arthropods	ND
Other	ND

This sample was analyzed for particulates following the procedure outlined in: Microscopic Particulate Analysis (MPA) for Filtration Plant Optimization. 1996. USEPA, Region 10, EPA 910-R-96-001. Particle free water used as wash water; organisms counted by natural unit count in a Palmer Maloney Counting Chamber; Section 11.1.1 omitted. All limitations stated in the method apply. If capsule was received, method was modified by filtering sample through a Gelman Envirochek® capsule at the sample site. If *Giardia* and *Cryptosporidium* Analysis was also performed, then particulate extraction was modified.

RESULTS OF GIARDIA AND CRYPTOSPORIDIUM ANALYSIS

Floated Pellet: 0.022 mL/100 L

Amount of sample assayed: 2.2 L

		Total IFA Count	Empty	Amorphous Structure	1 Internal Structure	>=2 Internal Structure	Internal Structure
Giardia	detected	0	0	0	0	0	
	#/100 L	<45	<45	<45	<45	<45	
Cryptosporidium	detected	0	0	0			0
	#/100 L	<45	<45	<45			<45

This sample was analyzed for *Giardia* and *Cryptosporidium* by the method outlined in: ICR Laboratory Manual. 1996. USEPA, Washington, D.C., EPA/600/R-95/178. All limitations stated in the method apply. If capsule was received, method was modified by filtering sample through a Gelman Envirochek® capsule at the sample site. If Microscopic Particulate Analysis was also performed, then particulate extraction was modified.

Characterizing the Influence of Surface Water on Water Produced by Collector Wells

M. Susan Mikels

Waterborne particulates, turbidity, and temperature were used to characterize the influence of surface water on collector wells constructed in alluvial river valleys. No insects, other macroorganisms, *Giardia*, or other large-diameter pathogens were found in water from the collector wells, although *Giardia* were detected in adjacent rivers. The turbidity of the water produced by the collector wells remained virtually constant throughout the year and did not fluctuate with changes in river turbidity. These results support the conclusion that the influence of surface water on collector wells should not be characterized as "direct." Temperature data, however, show that the collector wells are influenced by the surface water, but these data alone are insufficient for deciding whether this influence is direct.

The US Environmental Protection Agency (USEPA) promulgated its Final Rule on Filtration and Disinfection[1] in June 1989. This rule, commonly known as the Surface Water Treatment Rule (SWTR), defines a new term "ground water under the direct influence of surface water" as

> . . . any water beneath the surface of the ground with (1) significant occurrence of insects or other macroorganisms, algae, or large-diameter pathogens such as *Giardia lamblia* or (2) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions.[1]

The SWTR further states that direct influence must be determined for individual sources in accordance with criteria established by the state. These determinations are to be made by June 29, 1994, for community water systems. Groundwater sources that have been determined to be under the direct influence of surface water will be subject to the requirements of the SWTR.

Literally thousands of wells, both vertical and horizontal, are located in alluvial river valleys. All of these groundwater supplies are influenced by surface water to some degree. In view of the new regulations, it will be important to determine whether the influence of surface water on these groundwater supplies should be characterized as "direct."

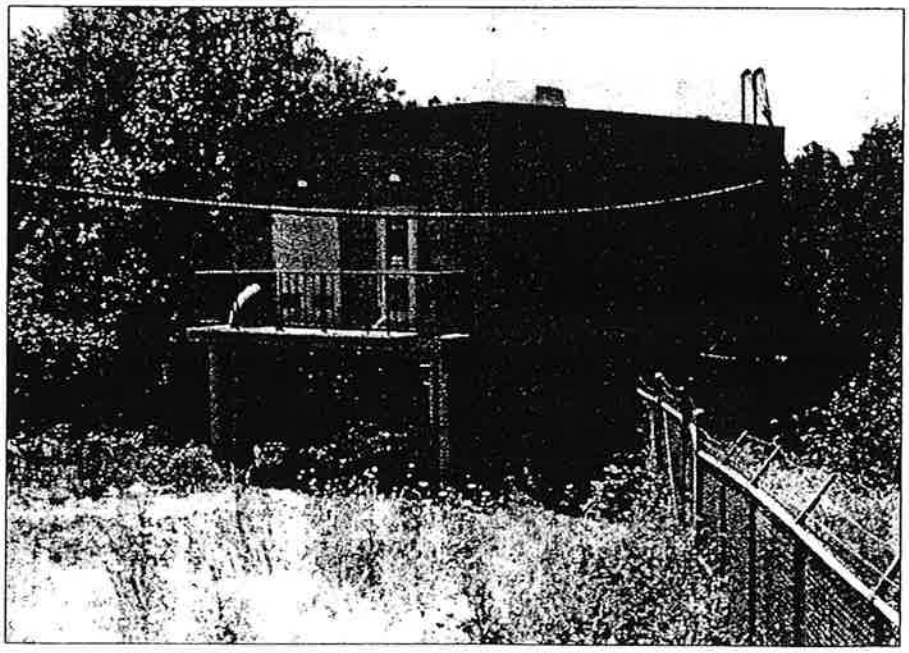
The purpose of this study was to characterize the influence of surface water on collector wells often constructed in alluvial river valleys. Given the USEPA definition for "ground water under the direct influence of surface water," the study focused on the following water quality parameters: waterborne particulates, turbidity, and temperature.

Water quality data were collected for two collector wells located in the state of Washington. The data were collected over a period of 15 months to obtain information on seasonal water quality fluctuations. Additional water quality data, provided by other collector well owners, have been incorporated into the study.

Collector wells used for more than 50 years

The collector well* typically consists of a large-diameter reinforced-concrete caisson from the bottom of which horizontal screens are projected in a radial pattern. Existing collector wells range

*Ranney Collector, Ranney Method Western Corp., Kennewick, Wash.



The pump house for the Kalama collector well, which draws water from the Kalama River in Washington state, is located in a remote rural area.

from 30 to 150 ft in depth. Horizontal screen laterals are hydraulically jacked, not trenched, into the aquifer, leaving the overlying, naturally deposited alluvial materials undisturbed. During projection of the horizontal screens, the static water head, together with compressed air, is used to remove the fine materials, leaving the coarse materials to form a natural gravel pack along the full length of the screens. Horizontal screens generally range from 50 to 250 ft in length.

These wells are usually, but not always, constructed adjacent to rivers or lakes to take advantage of induced infiltration. As the groundwater is pumped, it is replenished by recharge from the nearby surface water source, assuring permanence of supply.

Collector wells have been used for municipal and industrial water supplies since the 1930s. More than 150 are in use in the United States today. Their capacities range from 0.5 to 25.0 mgd for a single unit.

Two wells selected for study

Wells studied in different climates, environments. The two collector wells selected for study are located in the state of Washington. One is owned by the city of Kennewick and the other by the city of Kalama. Although both wells are located in Washington, there are significant differences in climatic and environmental conditions between the sites. The Kennewick collector well is located in the arid, desert southeast region of the state where the normal annual rainfall is 7.5 in., whereas the Kalama well is located in the wet, forested southwest region of the state where the normal annual rainfall is 46 in.

The Kennewick collector well is located adjacent to the Columbia River in a city park frequented by many visitors, including boaters, especially during the summer season. The majority of wildlife consists of ducks, geese, gulls, and various other birds. Many ground squirrels inhabit the area and probably also a few rabbits. Trees and brush are sparse on the banks of the Columbia River, which is approximately 2,200 ft wide at the well site. Because of the sparse foliage and the great width of the river, the area is not a natural habitat for beavers or other aquatic mammals.

The Kalama collector well is located adjacent to the Kalama River in a rural area remote from the city. The area includes a few homes with some cows, horses, and other farm animals. The Kalama River is a popular fishing spot. The region is heavy with brush and trees and is home to many rabbits, beavers, muskrats, and other small mammals. Ducks, geese, and other waterfowl are abundant in the area. The river is approximately 125 ft wide at the site of the collector well.

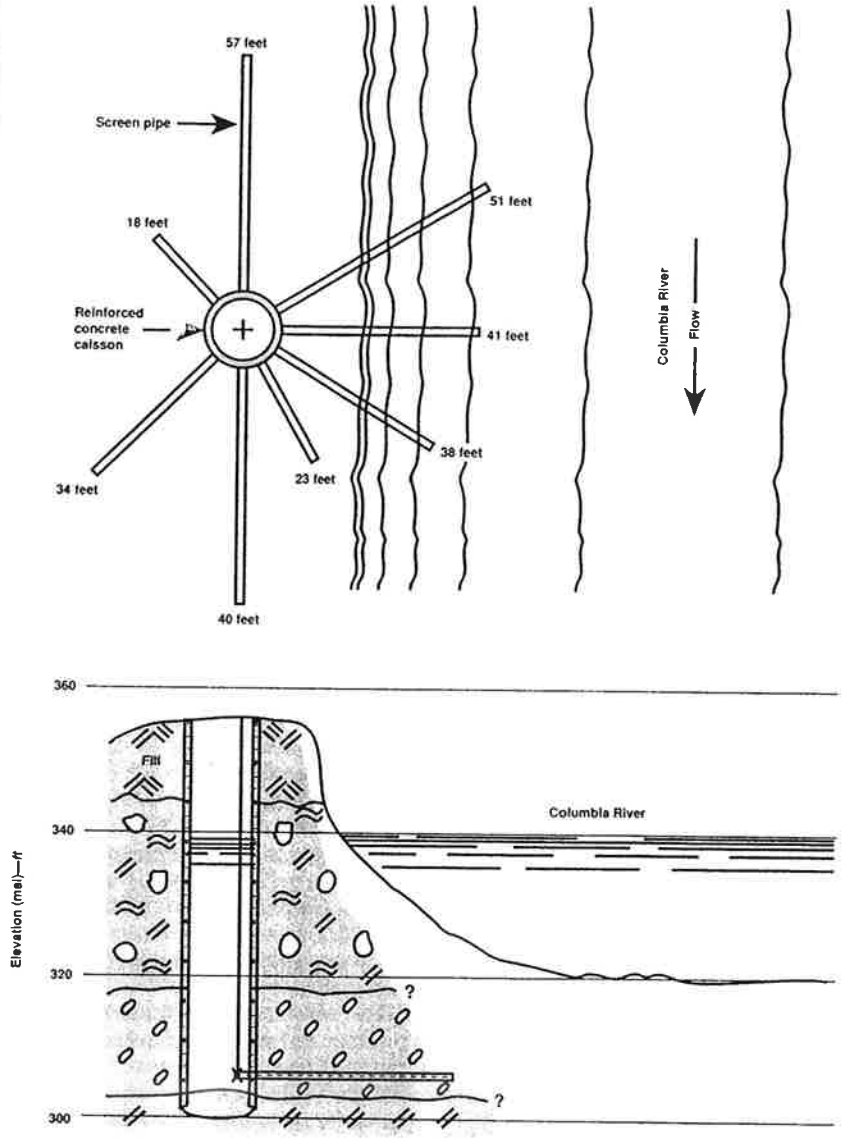


Figure 1. Kennewick collector well *(pump and pump house are not shown)*

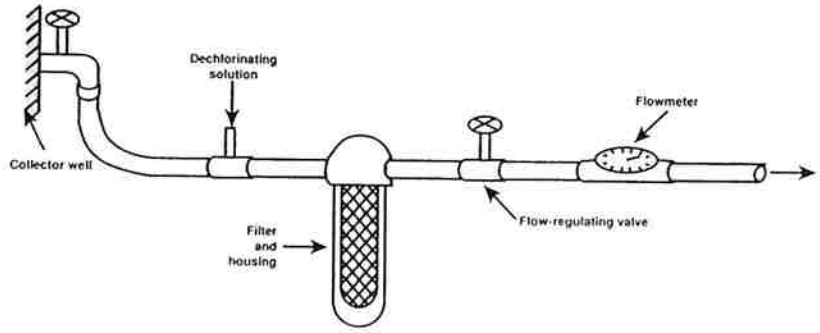


Figure 3. Sampling device for waterborne particulates

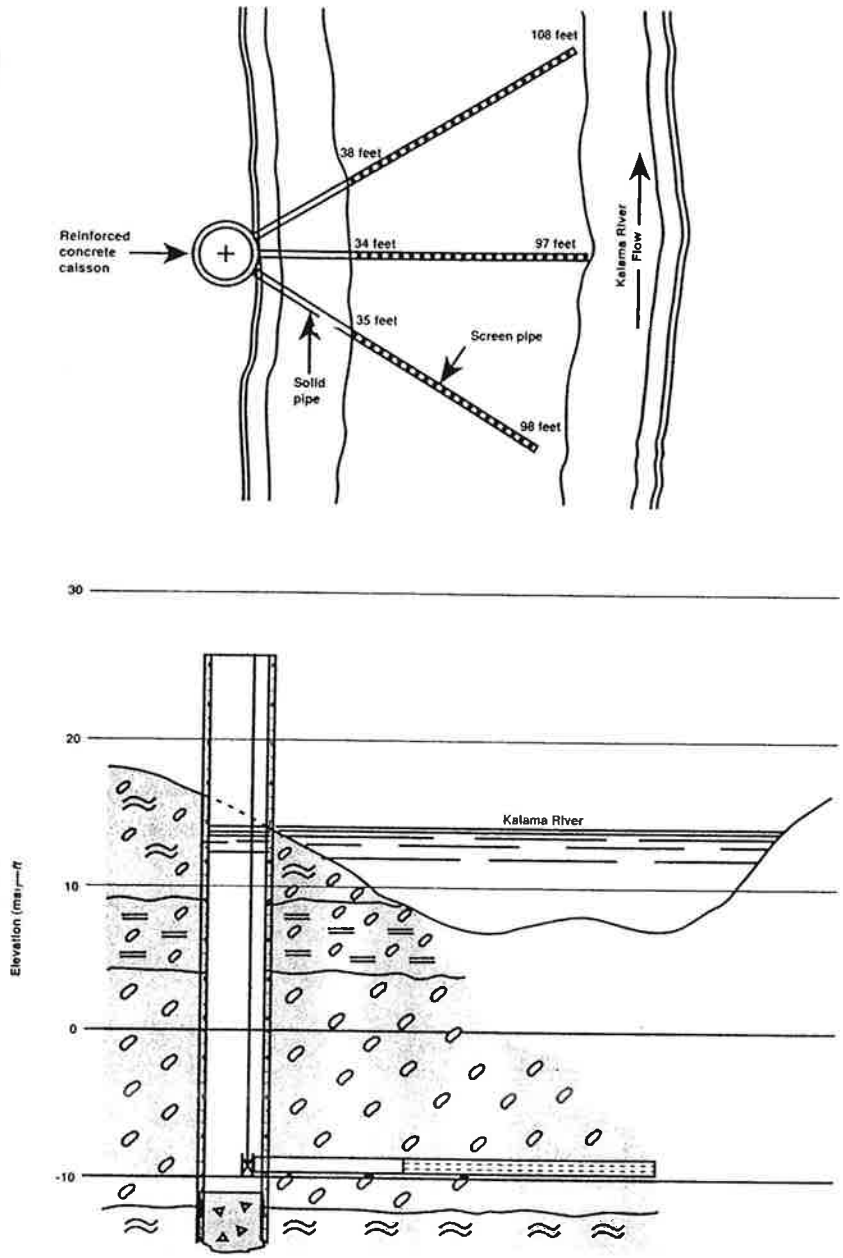


Figure 2. Kalama collector well *(pump and pump house are not shown)*

TABLE 1

Properties of aquifers determined from constant-rate pumping tests

Property	Kennewick	Kalama
Transmissivity (60°F)—*gpd/ft*	97,700	61,200
Permeability (60°F)—*gpd/sq ft*	6,510	2,780
Average saturated thickness—*ft*	15	22
Aquifer type	Confined	Unconfined
Depth to aquifer base—*ft*	42	28
Effective distance to the line of infiltration—*ft*	231	140
'erbed infiltration rate (60°F)—*gpd/acre*	23,900	227,000

Wells constructed in 1959, 1975. The Kennewick collector well was constructed in spring 1959 and is designed for a yield of 3 mgd. Currently, the center of the collector caisson is approximately 25 ft from the edge of the Columbia River. The caisson extends to a depth of 43.5 ft below ground, and the horizontal screen laterals are located 39 ft below ground. Plan and section views of the well are shown in Figure 1.

The Kalama collector well was constructed in 1975 and is designed for a yield of 2.6 mgd. The center of the collector caisson is now about 8 ft from the edge of the Kalama River. The caisson extends to a depth of 30.1 ft below ground, and the horizontal screen laterals are located 25.1 ft below ground. Plan and section views of the well are shown in Figure 2.

Hydrogeology of sites assessed before construction. Before these collector wells were constructed, hydrogeological surveys were conducted to determine the suitability of the site and the aquifer characteristics necessary for the design of the collectors. Generally, these surveys consisted of (1) drilling exploratory test holes to locate a potentially suitable site, (2) drilling a pumping well and several observation wells and conducting a constant-rate pumping test, (3) collecting water samples for complete chemical analysis, and (4) analyzing the data and predicting the quantity and quality of water available from a collector well constructed at the site.

Logs of the test wells at the Kennewick site show a confining layer of silt, clay, and boulders extending to a depth of 27 ft. The gravel and sand aquifer extends from a depth of 27 to 42 ft and is underlain by fine sand and clay. At the Kalama site, logs of test wells show silt, sand, and semiconsolidated sand and gravel extending to a depth of 12 ft, water-bearing sand and gravel with occasional clay from a depth of 12 to 28 ft, and silty sand below a depth of 28 ft. Although the upper 12 ft of material is less permeable than the material below, the aquifer is considered unconfined.

Aquifer properties for both sites, determined from analyses of the pumping test data, are given in Table 1.

Data collected for 15 months

Water quality data were collected over a period of 15 months, beginning in January 1989. Efforts were made to obtain samples for analysis for waterborne particulates on a monthly basis and for measurements of turbidity and temperature on a daily basis. This was not always possible because of other commitments of the investigators.

Modified Reference Method used to assess samples. The sampling procedures followed were those recommended by Hibler.[2] For each test, approximately

TABLE 2

Results of waterborne particulate analyses for Kennewick collector well and Columbia River

Parameter	12/15/87 Snow River at 339.33 ft msl		4/18/89 Partly Cloudy River at 339.11 ft msl		5/31/89 Clear River at 338.33 ft msl		6/29/89 Cloudy River at 338.58 ft msl		7/24/89 Clear River at 339.63 ft msl	
	Well	River	Well	River	Well	River	Well	River	Well	River
Water filtered—*gal*	924	674	989	893	1,005	1,083	1,000	960	989	944
Turbidity—*ntu*	0.19	4.2	0.11	8.6	0.12	2.6	0.15	5.3	0.10	2.6
Temperature—°*F*	58	46	55	50	57	58	57	63.5	58	68
Fine amorphous debris*	occ†	sm‡	vr§	vh**	r††	vh	r	vh	r	vh
Large amorphous debris‡‡	0§§	occ	0	0	0	0	vr	vr	0	0
Algae	0	occ	0	r	r	occ	vr	sm	0	occ
Diatoms	0	occ	vr†††	sm	0	mod	vr†††	sm	0	mod
Plant debris	0	sm	0	vr	0	0	0	vr	0	r
Giardia‡‡‡	0	35	0	0	0	0	0	0	0	0
Coccidia	0	0	0	0	0	0	0	0	0	0
Free-living nematodes	0	sm	0	r	0	vr	0	vr	0	r
Pollen	0	r	0	r	0	vr	0	vr	0	occ
Free-living amoebae	0	0	0	0	0	0	0	0	0	0
Ciliates	0	0	0	0	0	0	0	0	0	0
Flagellates	0	r	0	r	vr	vr	0	vr	0	occ
Crustaceans	0	r	0	0	0	0	0	vr	0	0
Rotifers	0	0	0	0	0	vr	0	0	0	r
Insects	0	0	0	0	0	0	0	0	0	0
Other	0	18 *Endamoeba coli*	0	0	0	0	0	0	0	0

*The fine amorphous debris is identified as silica (silt).
†occ—occasional, 1–10 present in every microscopic field examined at 100×
‡sm—small, at least 1 present in every microscopic field examined at 450×
§vr—very rare, 1–5 present in the subsamples examined
**vh—very heavy, 100—1,000 present in every microscopic field examined at 450×
††r—rare, 5–10 present in the subsamples examined
‡‡The large amorphous debris in the collector well is identified as biofilm, or fixed-growth slime, often found in wells.
§§0—none, none of the particulates were present in any of the subsamples examined.
***mod—moderate, at least 10 present in every microscopic field examined at 450×
†††Skeletons
‡‡‡*Giardia* expressed as the total number of cysts found in the concentrate

TABLE 3

Results of waterborne particulate analyses for Kalama collector well and Kalama River

Parameter	1/27/88 Cloudy Normal River		2/28/89 Light Rain Low River		3/28/89 Heavy Rain Normal River		4/24/89 Clear Low River		5/22/89 Clear Low River		7/31/89 Light Rain Very Low River	
	Well	River	Well	River	Well	River	Well	River	Well	River	Well	River
Water filtered—*gal*	1,000	825	817	813	978	0	996	980	1,024	1,121	1,123	1,033
Turbidity—*ntu*	0.34	1.3	0.35	1.8	0.35	4.6	0.33	1.7	0.38	1.6	0.27	2.3
Temperature—°*F*	45	44	45	44	46	45	48	48	51	51	59.5	58
Fine amorphous debris*	occ†	sm‡	r§	vh**	r		occ	vh	occ	mod††	r	vh
Large amorphous debris‡‡	tr§§	sm	0***	occ	0		0	sm	0	r	r	occ
Algae	0	occ	vr†††,‡‡‡	r	vr		r‡‡‡	r	r‡‡‡	r	0	occ
Diatoms	0	occ	vr	h§§§	vr****		occ	vh	vr****	vh	0	sm
Plant debris	0	vr	0	0	0		0	0	0	0	0	r
Giardia††††	0	175	0	0	0		0	0	0	0	0	0
Coccidia	0	r	0	r	0		0	0	0	0	0	0
Free-living nematodes	0	vr	0	0	0		0	r	0	r	0	r
Pollen	0	sm	0	vr	0		0	sm	0	r	0	occ
Free-living amoebae	0	0	0	0	r		0	0	0	0	0	0
Ciliates	vr	0	0	0	0		0	0	vr	0	0	0
Flagellates	0	vr	r	0	r		0	0	r	0	0	r
Crustaceans	0	0	0	0	0		0	r	0	0	0	occ
Rotifers	0	0	0	0	0		0	0	vr	r	0	occ
Insects	0	0	0	0	0		0	0	0	0	0	0
Other	0	0	0	0	0		0	0	0	0	0	r yeast

*The fine amorphous debris is identified as silica (silt).
†occ—occasional, 1–10 present in every microscopic field examined at 100×
‡sm—small, at least 1 present in every microscopic field examined at 450×
§r—rare, 5–10 present in the subsamples examined
**vh—very heavy, 100—1,000 present in every microscopic field examined at 450×
††mod—moderate, at least 10 present in every microscopic field examined at 450×
‡‡The large amorphous debris in the collector well is identified as biofilm, or fixed-growth slime, often found in wells.
§§tr—trace, the amount was essentially insignificant.
***0—none, none of the particulates were present in any of the subsamples examined.
†††vr—very rare, 1–5 present in the subsamples examined
‡‡‡Species growing in system different from those in river water
§§§h—heavy, at least 100 present in every microscopic field examined at 450×
****Skeletons
††††*Giardia* expressed as the total number of cysts found in the concentrate

TABLE 2, Continued

Results of waterborne particulate analyses for Kennewick collector well and Columbia River

Parameter	8/29/89 Partly Cloudy River at 338.94 ft msl		10/31/89 Clear River at 337.98 ft msl		1/24/90 Clear River at 339.38 ft msl		2/21/90 Clear River at 339.58 ft msl		3/28/90 Clear River at 338.70 ft msl	
	Well	River	Well	River	Well	River	Well	River	Well	River
Water filtered—*gal*	1,047	976	947	892	1,001	1,101	1,000	1,005	1,000	325
Turbidity—*ntu*	0.09	2.6	0.10	2.7	0.18	2.1	0.20	3.2	0.14	3.6
Temperature—°*F*	59	67.5	60	55	60	41	59	38	59	44
Fine amorphous debris*	r	vh	r	vh	r	vh	r	vh	r	vh
Large amorphous debris‡‡	r	0	0	0	0	0	0	0	0	r
Algae	0	r	0	occ	vr	mod***	r	sm	0	occ
Diatoms	0	vh	0	sm	0	mod	vr‡‡‡	mod	0	vh
Plant debris	0	r	0	occ	0	occ	0	r	0	occ
Giardia‡‡‡	0	0	0	0	0	0	0	0	0	0
Coccidia	0	0	0	0	0	r	0	0	0	r
Free-living nematodes	0	0	0	r	0	occ	0	occ	0	occ
Pollen	0	r	0	r	0	r	0	r	0	r
Free-living amoebae	0	0	vr	0	0	0	0	0	0	0
Ciliates	0	0	0	0	0	0	0	0	0	0
Flagellates	0	0	vr	r	0	r	r	r	0	occ
Crustaceans	0	0	0	0	0	0	0	0	0	occ
Rotifers	0	0	0	0	0	0	0	r	0	occ
Insects	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0

*The fine amorphous debris is identified as silica (silt).
†occ—occasional, 1–10 present in every microscopic field examined at 100×
‡sm—small, at least 1 present in every microscopic field examined at 450×
§vr—very rare, 1–5 present in the subsamples examined
**vh—very heavy, 100—1,000 present in every microscopic field examined at 450×
††r—rare, 5–10 present in the subsamples examined
‡‡The large amorphous debris in the collector well is identified as biofilm, or fixed-growth slime, often found in wells.
§§0—none, none of the particulates were present in any of the subsamples examined.
***mod—moderate, at least 10 present in every microscopic field examined at 450×
†††Skeletons
‡‡‡*Giardia* expressed as the total number of cysts found in the concentrate

TABLE 3, Continued

Results of waterborne particulate analyses for Kalama collector well and Kalama River

Parameter	8/31/89 Clear Very Low River		9/18/89 Clear Very Low River		10/22/89 Rain Very Low River		12/5/89 Cloudy Very High River		2/9/90 Light Rain High River	
	Well	River	Well	River	Well	River	Well	River	Well	River
Water filtered—*gal*	988	936	918	1,022	900	1,000	830	340	1,060	665
Turbidity—*ntu*	0.32	1.2	0.30	0.87	0.33	1.7	0.35	2.4	0.28	2.4
Temperature—°*F*	59	59	57	55.5	52.5	50	48	47	45	42
Fine amorphous debris*	r	vh	occ	vh	occ	mod	occ	vh	occ	vh
Large amorphous debris‡‡	r	0	0	occ	0	occ	0	0	r	0
Algae	0	r	0	occ	0	occ	r‡‡‡	r	occ‡‡‡	occ
Diatoms	0	vh	0	mod	0	vh	r****	occ	occ‡‡‡	r
Plant debris	0	r	0	vr	0	vr	0	r	0	vr
Giardia††††	0	11	0	58	0	274	0	0	0	90
Coccidia	0	0	0	r	0	r	0	0	0	r
Free-living nematodes	0	0	0	r	0	occ	0	r	0	r
Pollen	0	occ	0	occ	0	r	0	vr	0	occ
Free-living amoebae	0	0	0	r	r	r	vr	0	occ	0
Ciliates	0	0	0	0	r	0	occ	0	occ	0
Flagellates	0	r	vr	r	r	occ	occ	0	occ	0
Crustaceans	0	r	0	r	0	r	0	0	0	0
Rotifers	0	r	vr	r	0	occ	0	r	0	0
Insects	0	r	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0

*The fine amorphous debris is identified as silica (silt).
†occ—occasional, 1–10 present in every microscopic field examined at 100×
‡sm—small, at least 1 present in every microscopic field examined at 450×
§r—rare, 5–10 present in the subsamples examined
**vh—very heavy, 100—1,000 present in every microscopic field examined at 450×
††mod—moderate, at least 10 present in every microscopic field examined at 450×
‡‡The large amorphous debris in the collector well is identified as biofilm, or fixed-growth slime, often found in wells.
§§tr—trace, the amount was essentially insignificant.
***0—none, none of the particulates were present in any of the subsamples examined.
†††vr—very rare, 1–5 present in the subsamples examined
‡‡Species growing in system different from those in river water
§§§h—heavy, at least 100 present in every microscopic field examined at 450×
****Skeletons
††††*Giardia* expressed as the total number of cysts found in the concentrate

1,000 gal of water was filtered through a 1-µm polypropylene filter over a period of about 8 hours. The flow rate through the filter was typically 2 gpm. The collector wells and their adjacent rivers were sampled concurrently. Once the sampling was complete, the filters were packed in ice and shipped for analysis. All filters arrived at the laboratory* within the recommended 24 hours. The technique used to analyze the filters, known as the Modified Reference Method, has been described by Hibler.[3]

For the collector wells, the sampling device consisted of an influent hose, a filter housing, a valve for regulating flow, a residential water meter, and an effluent hose (Figure 3). A small submersible pump was added to the assembly for sampling the rivers. Because the city of Kalama chlorinates directly into the collector caisson, it was necessary to dechlorinate the water during the sampling procedure. Water was dechlorinated in-line, by means of a chemical-feed pump, with a solution of sodium thiosulfate.

Turbidity records and daily monitoring used to gather data. The city of Kalama continuously monitors the turbidity of the water from its collector well using a surface scatter turbidimeter. Data used for this study were taken from the daily readings recorded by the system operators. Daily turbidity measurements of the Kalama River were not available. Monthly measurements taken by the Washington State Department of Ecology and measurements recorded during sampling for waterborne particulates were used for the study.

The city of Kennewick does not continuously monitor turbidity at its collector well. Turbidity was measured daily using a portable turbidimeter, which was calibrated with secondary standards on a daily basis. The secondary standards were calibrated against formazin primary standards every three months. As the study progressed, it became apparent that even with careful calibration and sampling procedures, the accuracy of the instrument for low range values (<0.20 ntu) was questionable. The slightest difference in the positioning of the sample cell could produce a 0.05–0.10-ntu difference in turbidity. Thus, a change in turbidity of this magnitude may correspond to a change in sampling personnel, rather than to an actual change in turbidity.

Turbidity measurements for the Columbia River were obtained from the city of Pasco, Wash., which has a raw water intake approximately 1.7 mi downstream and across the river from the Kennewick collector well.

Water temperatures measured daily. System operators for the city of Kalama measure the temperature of the collector well water once daily. Temperature readings were taken from their daily records. Temperature data for the Kalama River were obtained from the Washington State Department of Fisheries, which operates a hatchery approximately 2 mi upstream from the collector well. Water temperatures for the Kennewick collector well and the Columbia River were measured once daily, at the same time as the sample for turbidity was collected.

TABLE 4
Average annual turbidity for collector wells in the western United States

Location	Year	Average Turbidity *ntu*	Standard Deviation *ntu*
Kennewick, Wash.	1989–90	0.13	0.04
Kalama, Wash.	1989	0.31	0.03
Sonoma County, Calif.	1988	0.12	0.04
Sonoma County, Calif.	1988	0.05	0.02
Fort Benton, Mont.	1988	0.05	<0.01
Boardman, Ore.	1988	0.04	0.02
Port Angeles, Wash.	1988	0.11	0.04

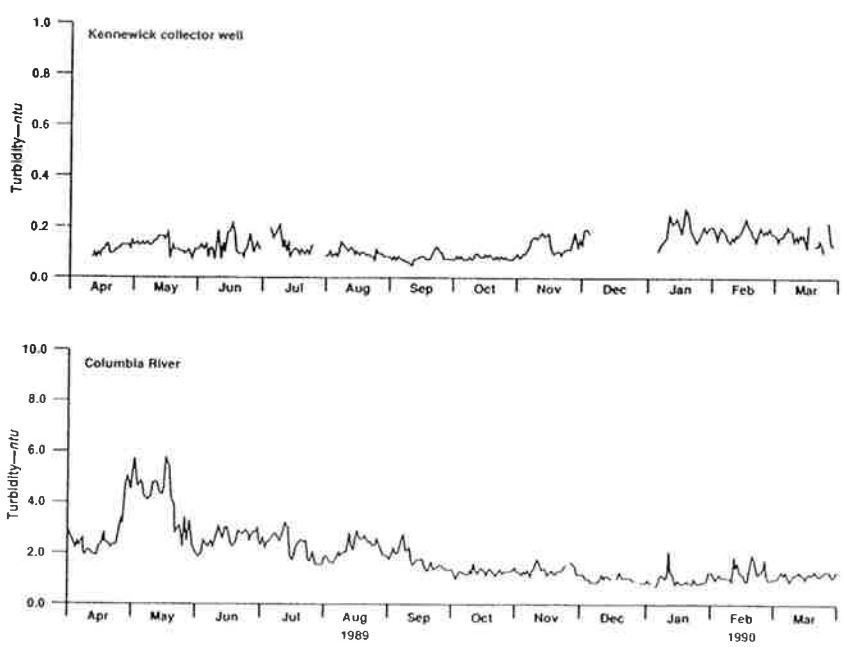


Figure 4. Turbidity data for Kennewick collector well and Columbia River

No large-diameter pathogens found

Results of the waterborne particulate analyses for the two sites are shown in Tables 2 and 3. According to the USEPA definition for groundwater under the direct influence of surface water, direct influence is indicated by "significant occurrence of insects or other macroorganisms, algae, or large-diameter pathogens such as *Giardia lamblia*."[1]

No insects, other macroorganisms, *Giardia*, or other large-diameter pathogens were found in the water from the two collector wells. In addition, no coccidia were found in any of the well water samples. Work by Vasconcelos et al[4] suggests that coccidia may be a good surrogate indicator for *Giardia*. *Giardia*, coccidia, or both were found in the samples from the Columbia and Kalama rivers. For example, the sample from the Kalama River on Oct. 22, 1989, contained 274 *Giardia* and a "rare" amount of coccidia. No *Giardia* or coccidia were found in the water from the collector well.

Very small amounts of algae were observed in some of the collector well samples. For most of the samples from the Kalama collector well, the analyst commented that the species of algae found in the well were different from those found in the river and that the algae were growing in the system. It was also noted that

*C.H. Diagnostic and Consulting Services Inc., Loveland, Colo.

the "very rare" to "rare" amounts of algae observed in the Kennewick collector well were species that grow on reservoir walls. This is not surprising because the collector caisson is essentially a small reservoir, occasionally open to sunlight. Although "significant occurrence" is not specifically defined in the SWTR, it is the opinion of the author (and the senior analyst agrees)[5] that the occurrence of algae in the water from the collector wells is insignificant.

A review of waterborne particulate data for two other collector well systems shows results similar to those for the Kennewick and Kalama systems. One system, located in California, collected 58 samples from five collector wells over a period of one year. No insects, other macroorganisms, *Giardia*, or other large-diameter pathogens were found in any of the samples. Another collector well system, located in Oregon, collected 15 samples from a collector well and the adjacent river over a period of 18 months. Again, no insects, other macroorganisms, *Giardia*, or other large-diameter pathogens were found in any of the samples from the collector well. *Giardia* were detected in four of the river samples. As with the Kennewick and Kalama collector wells, insignificant amounts ("very rare") of algae were observed in some of the collector well samples from these two systems.

Turbidity remained fairly constant

Turbidity data collected for the two sites are shown in Figures 4 and 5. The graphs show that the turbidity of the water from both of the collector wells remained relatively constant throughout the year. Significant changes in the turbidity of the rivers did not produce similar changes in the turbidity of the water from the wells. The average turbidity of the water from the Kennewick collector well was 0.13 ntu with a standard deviation of 0.04 ntu, and the average turbidity of the water from the Kalama collector well was 0.31 ntu with a standard deviation of 0.03 ntu.

Turbidity data provided by owners of other collector wells also show that the turbidity of the water from their collector wells remains virtually constant throughout the year and is not influenced by changes in river turbidity. Table 4 shows the annual average turbidity for five other collector well systems. The data show that although the average turbidity varies slightly from site to site, the standard deviations are consistently low, being 0.04 ntu or less for each of the collector well systems.

Temperature in collector wells lagged hind those in rivers

Water temperature data for Kennewick and Kalama are shown in Figures 6 and 7, respectively. The temperature of

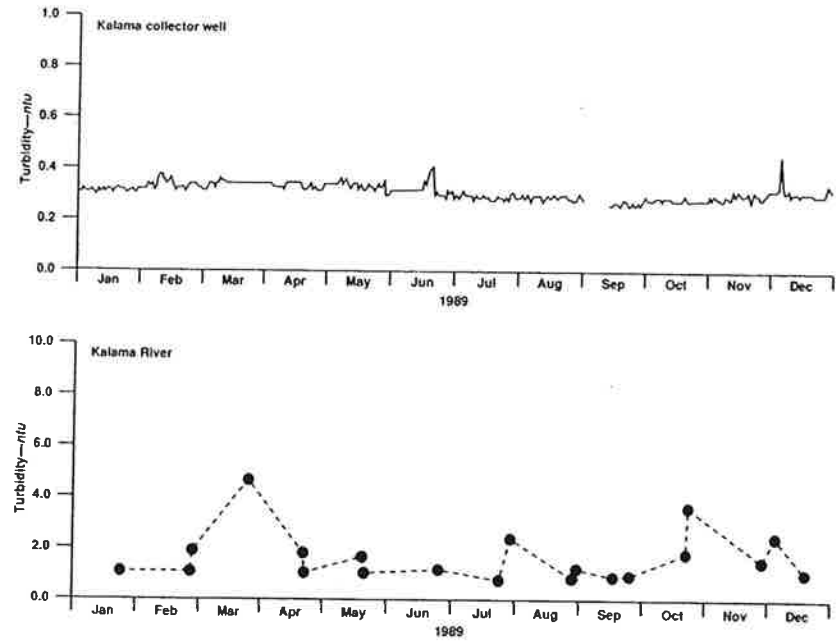


Figure 5. Turbidity data for Kalama collector well and Kalama River

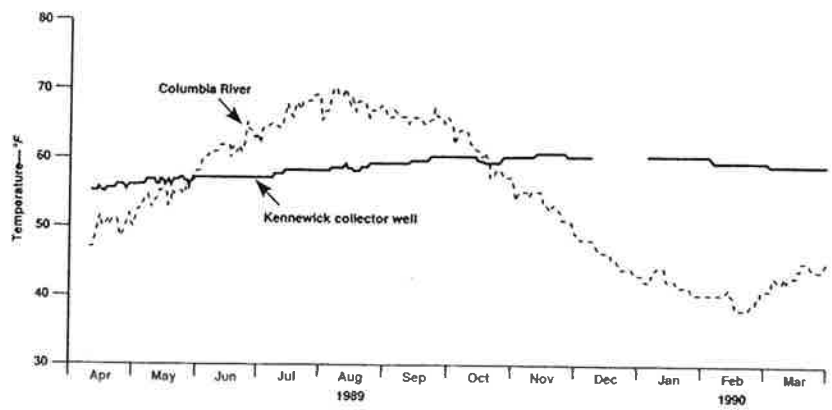


Figure 6. Temperature data for Kennewick collector well and Columbia River

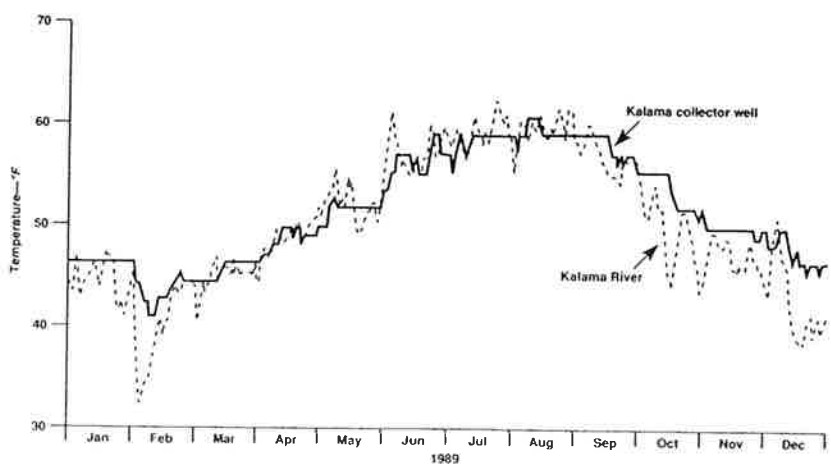
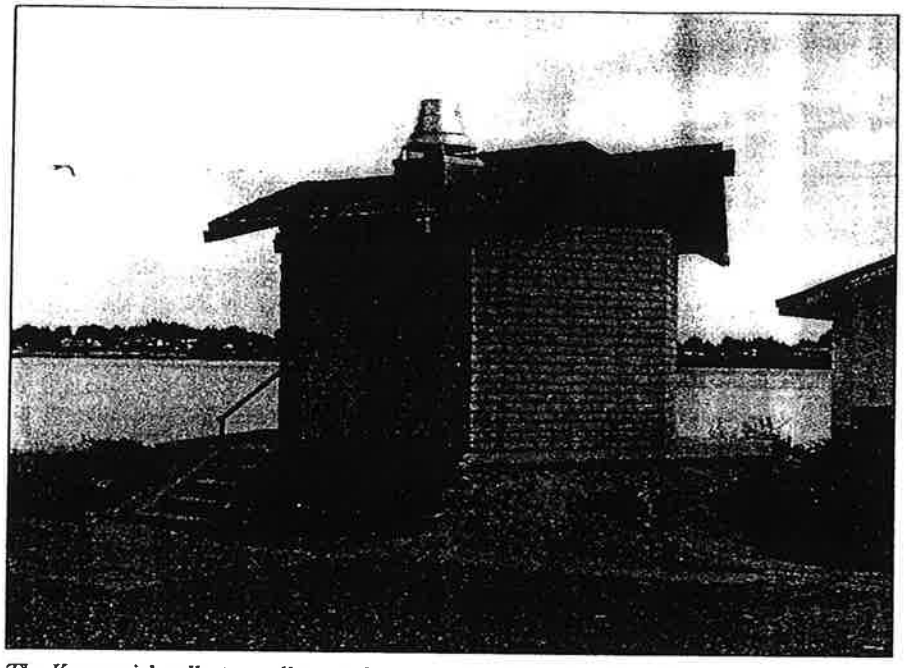


Figure 7. Temperature data for Kalama collector well and Kalama River



The Kennewick collector well pump house, on the Columbia River in the state of Washington, is in a city park that is frequented by many visitors.

the water from the Kennewick collector well ranged from a low of 55°F in April to a high of 60.5°F in November, whereas that of the Columbia River ranged from a low of 38°F in February to a high of 70°F in August. The seasonal temperature differential was 5.5°F for the collector well and 32°F for the river. The high and low temperatures for the collector well lagged behind those of the river by a period of two to three months.

In Kalama, the collector well water temperature ranged from a low of 41°F on February 7 to a high of 61°F on August 8, whereas that of the Kalama River ranged from a low of 32.5°F on February 4 to a high of 62.5°F on July 24. The seasonal temperature differential was 20°F for the collector well and 30°F for the river. The lag period varied from three to seven days.

In the author's experience these seasonal temperature differentials and lag periods are not unusual, nor unexpected, for groundwater supplies intentionally designed to induce infiltration from a nearby surface water source. The fact that the water temperature variation at the Kalama collector well is greater than that at the Kennewick collector well is attributed to the differences in site hydrogeology. The riverbed at the Kalama site consists of fine to medium sand with some silt and gravel, whereas the riverbed at the Kennewick site consists of clay and silt with gravel and cobbles.

Although the temperature data show that both of these groundwater supplies are influenced by surface water, the temperature data alone are insufficient for deciding whether the influence of the surface water should be characterized as direct. Vasconcelos et al[4] also concluded that "water temperature alone cannot be fully applied to source classifications."

Riverbed infiltration rates lower than slow sand filtration

The author believes that the riverbed infiltration rate, the microbiological activity within the riverbed, and the thickness of the natural filter medium control the quality of water produced by wells relying on induced infiltration. Riverbed infiltration rates at Kennewick and Kalama are extremely low: 23,900 and 227,000 gpd/acre, respectively. Walton[6] has computed riverbed infiltration rates for several induced infiltration systems; the rates range from 9,800 to 418,000 gpd/ acre.

All of these rates are significantly lower than those of slow sand filters, which have been shown to remove *Giardia* effectively.[7] Bellamy et al[7] also showed that the microbiological maturity of the bed of a slow sand filter is important for achieving complete *Giardia* removal. Similarly, the microbiological activity within the riverbed probably plays an important role in the natural filtration process. However, little research has been done on the subject. The mechanics of the microbiological filtration of water through a riverbed and refined methods of determining riverbed infiltration rates in situ are areas that warrant further research.

Direct influence must be determined

A common misconception is that groundwater sources that show any signs of surface water influence will be subject to the requirements of the SWTR. This is not true. In the preamble to the SWTR,[1] USEPA explains that the term "ground water under the direct influence of surface water" is intended to identify those groundwater sources that are subject to *Giardia* contamination and not those that are merely influenced by surface water.

Turbidity and waterborne particulate data support the conclusion that the influence of surface water on the Kennewick and Kalama collector wells should not be characterized as direct; i.e., the collector wells are not subject to *Giardia* contamination. Water temperature data show that a surface water influence exists, but these data alone are insufficient for deciding whether the surface water influence should be characterized as direct.

Acknowledgment

The cooperation and assistance of Jack Clark, superintendent, and Mike Smith, crew leader, both of the city of Kennewick, and Carl McCrary, director of public works of the city of Kalama, are gratefully acknowledged.

References

1. US Environmental Protection Agency. National Primary Drinking Water Regulations; Filtration and Disinfection; Turbidity, *Giardia Lamblia*, Viruses, *Legionella*, and Heterotrophic Bacteria; Final Rule. *Fed. Reg.*, 54:124:27486 (June 29, 1989).
2. HIBLER, C.P. Protocol—Sampling Water for the Detection of Waterborne *Giardia*. CH Diagnostic and Consulting Services, Loveland, Colo. (1987).
3. HIBLER, C.P. An Overview of the Techniques Used for Detection of *Giardia* Cysts in Surface Water. *Advances in Giardia Research* (P.M. Wallis and B.R. Hammond, editors). Univ. of Calgary Press, Calgary, Alta. (1988).
4. VASCONCELOS, J. ET AL. Use of Particulate Analysis and Other Parameters in the Evaluation of Subsurface Water Sources. Proc. 1989 AWWA WQTC, Philadelphia, Pa.
5. HIBLER, C.P. Personal communication (June 3, 1992).
6. WALTON, W.C. *Groundwater Resource Evaluation*. McGraw-Hill, New York (1970).
7. BELLAMY, W.D. ET AL. Removing *Giardia* Cysts With Slow Sand Filtration. *Jour. AWWA*, 77:2:52 (Feb. 1985).

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Oregon

DEPARTMENT OF HUMAN RESOURCES

HEALTH DIVISION

September 15, 1995

Barry Beyeler
Public Works Director
City of Boardman
P.O. Box 229
Boardman, Oregon 97818

Dear Barry:

The Health Division has reviewed the results of the microscopic particulate analyses (MPAs) of waters representing Boardman's water system. The relative risk factors for these samples are as follows:

9/7/93	13	6/14/94	11
8/2/94	16	9/13/94	6

Our current protocol states that if any MPA is greater than 19, or if two or more are greater than 14, the water is considered under the direct influence of surface water. The above scores, coupled with your concerns of the validity of the August, 1994 sample, the hydrogeologic modeling that has been accomplished at your site and the development of your wellhead protection program, indicate to us that your system is at low risk from *Giardia* and should be classified as groundwater for purposes of the Surface Water Treatment Rule.

However, because the hydrogeologic modeling indicates a significant interaction between the aquifer supplying your water and the stage of the Columbia River, any substantial change in water levels in the Columbia may significantly affect the natural filtration and travel times that your MPAs currently reflect. Consequently, if there are significant changes in the pool level, we believe that the hydraulics of your system may change and additional MPAs to reassess the situation will be in order.

Sincerely,

Dennis O. Nelson
Groundwater Coordinator
Drinking Water Program

c: Gary Burnett, OHD

John A. Kitzhaber
Governor

800 NE Oregon Street # 21
Portland, OR 97232-2162
(503) 731-4030 Emergency
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N .LS

CITY OF BOARDMAN, OR

Parameter	River	Collector	%Removal	Log Removal	River	Collector	%Removal	Log Removal
Date	9/7/93	9/7/93			6/14/94	6/14/94		
Gallons in sample	437	558			176	580		
Centrifugate (sediment)	5.1mL	0.0036mL	99.92941177	Three (3)	28.4 mL	0.003 mL	99.9894366	Three (3)
Non-diatomaceous Algae	50,000,000	4	99.999992	Seven (7)	600,000,000	10	99.9999983	Seven (7)
Diatoms	500,000,000	6	99.999998	Seven (7)	800,000,000	3	99.999999	Eight (8)
Plant Debris	1	0	100	Total Reduction	0	0		
Rotifers	100,000	96	99.904	Three (3)	60,000	19	99.968	Three (3)
Nematodes	2	3			0	4		
Pollen	0	8			0	12		
Amoeba	0	0			0	0		
Ciliates	20,000	0	100	Total Reduction	100,000	1	99.999	Five (5)
Colorless Flagellates	200,000	1	99.9995	Five (5)	100,000	0	100	Total Reduction
Crustaceans	2	6			0	4		
Insects/Larvae	NA	NA				0		
Other Arthropods	20,000	6	99.97	Three (3)	30,000	2	99.9933333	Four (4)
Other	0	40			0	4		
Giardia cysts	*Not Detected*	*Not Detected*			*90.9**	*Not Detected*	*100*	*Total Reduction*
Cryptosporidum oocysts	*NA*	*NA*			*181.8**	*Not Detected*	*100*	*Total Reduction*

Date	8/2/94	8/2/94			9/13/94	9/13/94		
Gallons in Sample	580	641			480	575		
Centrifugate	6.25	0.003	99.952	Three (3)	7.8	0.017	99.782	Two (2)
Non-diatomaceous Algae	300,000,000	1,610	99.99946	Five (5)	400,000,000	2	99.9999995	Eight (8)
Diatoms	200,000,000	0	100	Total Reduction	300,000,000	0	100	Total Reduction
Plant Debris	0	0			0	0		
Rotifers	20,000	25	99.875	Two (2)	30,000	52	99.827	Two (2)
Nematodes	0	3			0	6		
Pollen	0	0			0	0		
Amoeba	0	0			0	0		
Ciliates	0	0			0	0		
Colorless Flagellates	0	0			0	0		
Crustaceans	0	2			0	3		
Insects/Larvae	0	0			0	0		
Other Arthropods								
Other	0	28			0	14		
Giardia cysts	*77.5**	*0*	*100*	*Total Reduction*	*41.3**	*0*	*100*	*Total Reduction*
Cryptosporidium oocysts	*0*	*0*	*N/A*		*82.6**	*0*	*100*	*Total Reduction*

* = Presumptive count per 100 L

333-061-0032 TREATMENT REQUIREMENTS AND PERFORMANCE STANDARDS FOR SURFACE WATER, GROUNDWATER UNDER DIRECT INFLUENCE OF SURFACE WATER [INFLUENCE], AND GROUNDWATER

(1) General requirements:

(a) The requirements of this rule apply to all public water systems supplied by a surface water source or a groundwater source under the direct influence of surface water beginning January 1, 1992 or 18 months following determination by the Division of the source to be under the direct influence of surface water, whichever is later, for systems which do not provide filtration treatment, and June 29, 1993 or when filtration is installed, whichever is later, for systems which do provide filtration treatment. Systems which do not provide filtration treatment and fail to meet the requirements of sections (2) and (3) of this rule must install filtration and meet the requirements of sections (4) and (5) of this rule within 18 months of the failure. These regulations establish criteria under which filtration is required and treatment technique requirements in lieu of maximum contaminant levels for the following contaminants: *Giardia lamblia*, viruses, heterotrophic plate count bacteria, Legionella, and turbidity. Each public water system with a surface water source or a groundwater source under the direct influence of surface water must provide treatment of that source water that complies with these treatment technique requirements. The treatment technique requirements consist of installing and properly operating water treatment processes which reliably achieve:

(A) At least 99.9 percent (3-log) removal and/or inactivation of *Giardia lamblia* cysts between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer, and

(B) At least 99.99 percent (4-log) removal and/or inactivation of viruses between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer.

(b) A public water system using a surface water source or a ground water source under the direct influence of surface water is considered to be in compliance with the requirements of this rule if:

(A) The system meets the requirements for avoiding filtration in section (2) of this rule and the disinfection requirements in section (3) of this rule or,

(B) The system meets the filtration requirements in section (4) of this rule and the disinfection requirements in section (5) of this rule.

(c) Water system sources that have been determined to be under the direct influence of surface water according to section (7) of this rule, have 18 months to meet the requirements of this rule. During that time, the system must meet the following Interim Standards:

(A) The turbidity of water entering the distribution system must never exceed 5 NTU. Turbidity measurements must be taken a minimum of once per day. If

to guidelines in OAR 333-061-0075. The public water system must demonstrate through ownership and/or written agreements with landowners within the watershed that it can control all human activities which may have an adverse impact on the microbiological quality of the source water. The system must submit an annual report to the Division identifying any special concerns about the watershed, the procedures used to resolve the concern, current activities affecting water quality, and projections of future adverse impacts or activities and the means to address them. At a minimum, the watershed control program must:

(i) Characterize the watershed hydrology and land ownership;

(ii) Identify watershed characteristics and activities which have or may have an adverse effect on source water quality, and

(iii) Monitor the occurrence of activities which may have an adverse effect on source water quality.

(C) Be subject to an annual on-site inspection of the watershed control program and the disinfection treatment process by the Division. The on-site inspection must indicate to the Division's satisfaction that the watershed control program and disinfection treatment process are adequately designed and maintained. The inspection must include:

(i) A review of the effectiveness of the watershed control program;

(ii) A review of the physical condition of the source intake and how well it is protected;

(iii) A review of the system's equipment maintenance program to ensure there is low probability for failure of the disinfection process;

(iv) An inspection of the disinfection equipment for physical deterioration;

(v) A review of operating procedures;

(vi) A review of data records to ensure that all required tests are being conducted and recorded and disinfection is effectively practiced; and

(vii) Identification of any improvements which are needed in the equipment, system maintenance and operation, or data collection.

(D) Shall Not have been identified by the Division as a source of waterborne disease outbreak under the system's current configuration. If such an outbreak occurs, the system must sufficiently modify the treatment process, as determined by the Division, to prevent any future such occurrence.

(E) Comply with the maximum contaminant level (MCL) for total coliform bacteria in OAR 333-061-0030(4) at least 11 months of the 12 previous months that the system served water to the public on an ongoing basis, unless the Division determines that failure to meet this requirement was not caused by a deficiency in treatment of the source water.

(F) Comply with the requirements for trihalomethanes as prescribed in OAR 333-061-0030(2)(b) and 333-061-0036(3)(b).

treatment by the prescribed dates is a violation of the treatment technique requirements.

(b) Conventional filtration treatment or direct filtration.
Systems using conventional filtration treatment or direct filtration treatment shall meet the turbidity requirements prescribed in OAR 333-061-0030(3)(b)(A).

(c) Slow sand filtration
Systems using slow sand filtration treatment shall meet the turbidity requirements prescribed in OAR 333-061-0030(3)(b)(B).

(d) Diatomaceous earth filtration.
Systems using diatomaceous earth filtration treatment shall meet the turbidity requirements prescribed in OAR 333-061-0030(3)(b)(C).

(e) Other filtration technologies.
Systems using other filtration technologies shall meet the turbidity requirements prescribed in OAR 333-061-0030(3)(b)(D).

(5) Disinfection requirements for systems with filtration:

(a) The disinfection treatment must be sufficient to ensure that the total treatment processes of that system achieve at least 99.9 percent (3-log) inactivation and/or removal of *Giardia lamblia* cysts and at least 99.99 percent (4-log) inactivation and/or removal of viruses as determined by the Division.

(b) The residual disinfectant concentration in the water entering the distribution system, measured as specified in OAR 333-061-0036(4)(b)(B), cannot be less than 0.2 mg/l for more than 4 hours.

(c) The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified is OAR 333-061-0036(4)(b)(C) cannot be undetectable in more than 5 percent of the samples each month, for any two consecutive months that the system serves water to the public.

(6) Disinfection requirements for systems using ground water:

(a) Systems using ground water sources shall provide continuous disinfection as prescribed in OAR 333-061-0050(6) under the following conditions:

(A) When there are consistent violations of the total coliform rule attributed to source water quality;

(B) When a potential health hazard exists as determined by the Division.

(b) When continuous disinfection is required, in addition to the requirements prescribed in OAR 333-061-0050(6)(c)(A) through (C), the facilities shall be designed so that:

(A) The disinfection treatment must be sufficient to ensure that the system achieve at least 99.99 percent (4-log) inactivation and/or removal of viruses as determined by the Division, or;

(B) There is sufficient contact time provided to achieve disinfection under all flow conditions between the point of disinfectant application and the point of first water use:

(i) Weekly measurements for a period of 12 months, unless otherwise determined by the Division, of precipitation in the source area;

(ii) Weekly measurements for a period of 12 months, unless otherwise determined by the Division, of temperature and either specific conductance or pH of water from the groundwater source(s) and surface water source(s). Other parameters may be substituted with Division approval;

(iii) Measurements of the groundwater source(s) must be conducted on samples collected from the source as opposed to within the distribution system. If the source is a well, it should be pumped for a minimum of 15 minutes, or until the temperature has stabilized, before the measurements are taken;

(iv) To the extent practical, samples of the surface water source(s) should be collected within 0.5 miles of the point nearest to the groundwater source, and at the same place and same time for each sampling event;

(v) Monitoring equipment must be able to provide data as follows: temperature to the nearest degree centigrade, temperature-compensated specific conductance to the nearest micro-siemens per centimeter and pH to the nearest 0.1 pH unit. Instruments shall be tested for accuracy at least monthly;

(vi) At least quarterly, the water system shall evaluate the precision of their analysis procedure by collecting, during one sampling event, a minimum of six separate and consecutive samples, recording the parameters separately;

(vii) At the end of 12 months, or earlier at the Division's discretion, water systems must submit the water quality data as either a paper copy or as an electronic ASCII file (space delimited). The table must include the source sampled, the date and time of sampling, and the parameter values. The water system must also submit the map showing the location of the surface water sampling point (subsection (7)(b)(B)(iv) of this rule) and the determination of the analytical precision (subsection (7)(b)(B)(vi) of this rule).

(C) Emergency groundwater sources that meet the criteria of (a) can either be pumped continuously and evaluated as prescribed in (b) of this section, or the evaluation can be waived if the a public notice as prescribed in 333-061-0042 is issued each time the source is used. The notice must explain that the source has been identified as potentially under the direct influence of surface water, but has not been fully evaluated, and therefore may not be treated sufficiently to inactivate pathogens such as giardia lamblia.

(c) The water quality data submitted by the water system will be analyzed by the Division. The Division will determine if the water system's groundwater source(s) is(are) in hydraulic connection with surface water. Water system sources that are determined as not in hydraulic connection with surface water will be classified as

(i) If four or all MPA risk scores are less than 15, the water system source is classified as groundwater;

(ii) If two or more MPA risk scores are greater than 14, or one or more is greater than 19, the water system source is classified as under the direct influence of surface water;

(iii) Two additional MPAs must be taken if only one of four MPA risk scores is greater than 14. Scores will be evaluated according to (g)(C) of this section, or by further evaluation by the Division.

(h) If an infiltration gallery, Ranney well, or dug well has been determined to be classified as groundwater under this rule, the turbidity of the source must be monitored and recorded daily and kept by the water system operator. If the turbidity exceeds 5 NTU or if the surface water body changes course such that risk to the groundwater source is increased, an MPA must be taken at that time. Re-evaluation may be required by the Division.

(i) The Division can determine a groundwater source to be under the direct influence of surface water if the criteria in (7)(a) are true and there are significant or relatively rapid shifts in groundwater characteristics, such as turbidity, which closely correlate to changes in weather or surface water conditions.

(j) If geologic conditions, water quality trends, or other indicators change, the Division can require re-evaluation, as detailed in this section, of a source despite any data previously collected or any determination previously made.

Table 6: Modified Scoring of Microscopic Particulate Analyses

Indicators of Surface Water					
Diatoms		Other Algae		Insects / Larvae	
Abundance	Risk Score	Abundance	Risk Score	Abundance	Risk Score
1-10	6	1-20	4	1-15	3
11-16	7	21-32	5	16-22	4
17-22	8	33-48	6	23-30	5
23-28	9	49-64	7	31-65	6
29-34	10	65-80	8	66-99	7
35-40	11	81-95	9	100-130	8
41-100	12	96-160	10	>130	9
101-149	13	161-220	11		