CITY OF VENETA

WATER MASTER PLAN

DECEMBER 1998

Prepared for:

CITY OF VENETA
P.O. Box 458
Veneta, Oregon 97487

REGISTERED PROFESSIONAL ENGINEER
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OREGON
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ABBREVIATIONS

Below are abbreviations used in this report.

ADD	Average Daily Demand
AWWA	American Water Works Associations
CDBG	Community Development Block Grant
DEQ	Oregon Department of Environment Quality
DIP	Ductile Iron Pipe
DWR	Oregon Department of Water Resource
EDA	Economic Development Administration
EDU	Equivalent Dwelling Unit
EPA	Environmental Protection Agency
EWEB	Eugene Water & Electric Board
FmHA	Farmers Home Administration (now RUS)
ft	feet
gal	gallons
GO Bond	General Obligation bonds
gpcd	gallons per capital per day or gallons per person per day
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
gpy	gallons per year
hp	horse power
in	inches
ISO	Insurance Service Office
LCOG	Lane Council of Governments
MCL	Maximum Contaminant Level
MDD	Maximum Day Demand
MMD	Maximum Month Demand
MG	Million Gallons
mgd	million gallons per day
mg/L	milligrams per liter = part per million
MHI	Median Household Income
NTU	Nephelometric Turbidity Unit
O&M	Operation and Maintenance
OAR	Oregon Administrative Rules
OCDBG	Oregon Community Development Block Grant
ODWR	= DWR
OEDD	Oregon Economic Development Department
OHD	Oregon Health Division
OMRR	Operation, Maintenance, Repair and Replacement
OSHA	Occupation Safety and Heath Administration
PHD	Peak Hour Demand
PKHR	Peak Hour

ABBREVIATIONS (Cont.)

PRV	Pressure Reducing Valve
psi	pounds per square inch of pressure
RECD	Rural Economic and Community Development (interim name for RUS)
RIF	Rural Investment Funds
RPBP	Reduced Pressure Backflow Preventer
RUS	Rural Utility Services
SCADA	Supervisory Control and Data Acquisition
SDC	Systems Development Charge
SDWA	Safe Drinking Water Act
SDWRLF	Safe Drinking Water Revolving Loan Fund
SELP	Small Scale Energy Loan Program
SMCL	Secondary Maximum Contaminant Level
SWTR	Surface Water Treatment Rule
UFC	Uniform Fire Code
ug/L	micrograms per liter = parts per billion
UGB	Urban Growth Boundary
USEPA	=EPA
VOC	Volatile Organ Carbon
WDLF	Water Development Loan Fund
WTP	Water Treatment Plant
yr	year or years

Section 1
EXECUTIVE SUMMARY

This document updates a 20 year old water facility plan for the City of Veneta. The updated plan describes the existing system, summarizes pertinent planning data evaluates system performance, and makes recommendations relative to performance and service deficiencies. The plan also provides for expanded service to account for anticipated growth. Finally, a financing strategy plan is included.

Section 1 includes a brief summary of the plan. More detailed descriptions are included in following sections.

1.1 SYSTEM DESCRIPTION

Since the city's inception in the early 1960's the city drilled nine wells. Many have been abandoned or failed to provide sufficient quantity or adequate quality. The city's water supply is now dependent on two operating wells. Both wells produce a satisfactory quality water except that excess iron is encountered. The well water is treated in a 30-year old water treatment plant to remove the iron. It has been estimated that as many as 400 private wells may exist within the city limits. Any activity which affects the integrity of these private wells has the potential to affect the city's water supply.

Primarily because fire flow requirements have been modified over the last 20 years, there are areas within the city which cannot provide the recommended fire suppression quantity. These deficiencies were identified using a computer-based hydraulic model. The model identifies six areas in the city where satisfactory fire flow cannot be obtained under all service conditions.

The city generally has adequate storage, but in the wrong location. Elevated storage provides higher reliability and is scheduled as a part of plan implementation. A complete list of system deficiencies is provided below.

Water Source:

1. In the event of well mechanical failure or some downhole problem, the city would be dependent on one well for water supply. The single well cannot meet peak maximum day demand during the summer months.

2. Down-hole conditions of the wells are not currently monitored. If a well is over pumped, the operator would not be aware of it until something has gone wrong.

3. Well water supply lines (especially well 9) may be accumulating solids.

Water Treatment:

1. The treatment plant is marginally capable of handling water system demand greater than 350 gpm (1/2 of maximum day demand during summer season).

2. The treatment plant is showing outward signs of wear.

3. The sludge management system has completely failed. Water from the backwash cycle flows to daylight allowing water highly concentrated in iron to be released to the forest located east of the treatment plant. The city does not have a permit from DEQ for this operating practice.

4. Raw and treated piping systems are cross-connected.

5. Treatment plant master meters do not accurately indicate flow.

6. Valve failure has caused significant pressure drops in the distribution system.

Transmission and Distribution:

1. Dead-end waterlines exist on Huston Road and Jeans Road and other parts of the system. These pipes should be connected to form a loop.

2. Shallow cover is reported over a 12" waterline on 8th Street. (Length = 3,300 ft.) This pipe is at risk of failure from traffic loading.

3. High water flows, as in the event of a fire requiring sustained high flows, draw pressures down below 20 psi in high service elevations.

4. Service pressures are less than state required minimums at higher elevations near the southerly end of 10th Street and at the southern end of 9th Street.

5. 2" and 3" waterlines should be replaced with larger diameters.

6. There is no piping system to provide fire and water service to the elevated area of Bolton Hill within the UGB.

7. Water service is not provided in the southwest and southeast areas within the city limits.

8. The 100 hp pump is not operated by the reservoir telemetry system. Replacement pump station controls are extremely difficult to locate which suggests these components are out of date.

9. Leakage has exceeded 12 percent although currently is less than 6 percent. Meter systems should be checked and calibrated.

10. Single pipe service across the railroad and Highway 126 makes a precarious link to ensure service to the north portion of the city.

Storage:

1. A small volume of upper level water is available for fighting a fire in the event of power failure.

2. The exterior of the 0.5 MG reservoir needs to be re-coated.

3. Exterior coating of the 2.0 MG reservoir needs to encapsulate those areas where lead based primer is exposed.

Control System:

1. Reservoir level indicators at the treatment plant have failed and should be replaced.

2. The operation control system fails to provide immediate notification of system changes.

3. A program has not been initiated to determine if the system is compatible with the year 2000 computer change (Y2K).

1.2 PLANNING REQUIREMENTS

Table 1-1 shows population, average daily demand, maximum monthly demand, maximum day demand, and peak hour planning criteria for Veneta.

These demand factors were used in the development of the plan. It is recognized that water conservation may allow for more modest peaking factors, but there is no history in the city to identify how successful such conservation measures may be. The city has been able, due to the reliability of their current water supply, to provide water which meets state and federal quality standards.

TABLE 1-1

FUTURE WATER DEMAND (GPD)

YEAR	1990-1996	2010	2020	2050
Population		4,262	5,727	10,374
ADD (gpd)	357,000	588,000	791,000	1,433,000
MMD (gpd)	597,000	984,000	1,322,000	2,395,000
MDD (gpd)	854,000	1,408,000	1,893,000	3,428,000
PKHR (gpd)	1,708,000	2,817,000	3,786,000	6,857,000
ADD (gpm)	248	409	549	995
MDD (gpm)	593	978	1,310	2,380
PKHR (gpm)	1,200	2,000	2,600	4,800

(Rounded numbers)

1.3 ALTERNATIVES

Five alternative sources of supply for Veneta were evaluated for future service. It was determined that continued reliance on groundwater is the most reliable and economic water supply option available. However, the reliance on groundwater needs to be coupled with a conservation program and a groundwater protection program to ensure a reliable supply.

With the reliance on groundwater, the city will need to continue to provide water treatment for iron removal. Three treatment alternatives were evaluated. Although other alternatives had lower capital costs, it is recommended that the city continue the use of chlorination and filtration for management of iron in their groundwater supply. The operations staff is familiar with the requirements of this technology, and it is often recommended for systems operated like Veneta's.

Seven pipeline improvement segments are required to ensure satisfactory water service. The seven scheduled water main improvements are:

- 12-inch transmission main loop from Houston north to Jeans Road.
- 12-inch transmission main loop from Westland Center to 8th Street.
- 12-inch connection between Hunter to East Bolton road along existing Pine Street.
- Connection between Territorial Highway and Woodland Avenue.
- An 8-inch loop between Territorial Highway and Blek Drive.
- Improvements and a connection between Territorial Highway and Territorial Court.
- Upper system improvements to serve the new reservoir and high level piping.

The plan also calls for the development of a future reservoir to provide adequate upper level service. Concrete and steel reservoirs were examined, with the final selection of materials to be made following geologic assessments.

1.4 IMPROVEMENT PLAN

The selected plan for the City of Veneta is separated into three distinct periods of activity. The activities are:

- Field assessments,
- Year 2000 improvements, and
- Year 2010 improvements.

1.4.1 Field Assessments

Field assessments are scheduled during the year 1999 and include six activities. Three activities are associated with water source protection and development, two with storage and one with pipeline improvements. The water source elements include a geologic assessment which would search the Veneta area for selection of possible additional well sites. The geologic assessment would include professional geological evaluation of field conditions, drilling three pilot holes, and testing of those holes for water yield and quality. The assessment program would culminate in a recommendation for a new supply well. The new supply well is scheduled for drilling under the 1999 program.

To assure reliable service, the 1999 schedule includes the flushing of the water supply line from well 9 to the treatment facilities. There is considerable concern that the lack of routine maintenance on this line may require exceptional effort to remove accumulated deposits.

The preparation of this master plan included a brief examination of the coatings on the existing reservoirs. However, the interior and exterior of these reservoirs needs to be examined by coating specialists. Their examination will more carefully define the cost requirements and schedule for corrosion control. In addition to the coating examinations, a geologic survey needs to be conducted to help select possible upper level reservoir sites. The geologic survey will consist of field reviews of possible sites at the selected elevation and subsurface geotechnical examinations for tank foundation suitability.

The final element scheduled as a part of the 1999 program is the completion of a pipeline connection between Territorial Highway and Woodland Avenue. This connection was recognized as necessary in 1994 during highway improvements, and a tap and valve was installed. Now, improvements to the Fern Ridge Library require that this connection be made as soon as possible. Table 1-2 shows the program elements and estimated cost.

1.4.2 Year 2000 Improvements

Table 1-2 also shows the improvement program scheduled for year 2000. The plan provides for the connection of the 1999 well into the system with required treatment, the addition of one million gallons of upper level storage along with the necessary service, and connection piping and pressure control stations. The year 2000 program will also include installation of all of the pipelines identified in the plan along with improved system monitoring and control.

1.4.3 2010 Improvements

Growth and service level changes will require some phased improvement for the year 2010. Implementation of these improvements will increase the reliability of the water supply, expand or alter the iron removal facilities, increase pipe network connections within the system and upgrade controls.

TABLE 1-2 PROGRAM SCHEDULE & ESTIMATED COSTS			
YEAR	1999	2000	2010
Water Source			
Geologic Assessment	$ 36,000		
Flush Well 9 Service Line	$ 8,000		
Well Drilling	$ 30,800		
Well Equipment, Bldg, Piping		$224,000	
Initiate Well Protection		$ 40,000	
2nd Well			$291,200
Well Land Requirements		$ 15,000	$ 19,500
Water Conservation Plan Review			$ 9,000
SUBTOTAL	$ 74,800	$279,000	$319,700
Treatment			
Replace Existing Plant		$380,000	
Well Treatment For Future Wells		$380,000	$383,000
SUBTOTAL		$675,000	$383,000
Storage			
Upper Level Tank		$1,190,000	
Reservoir Coating & Examination	$ 5,000	$ 68,000	$178,360
Reservoir Site Selection Study	$ 32,000		
Upper Level Service Piping/Pumping		$484,500	
Pressure Control Stations		$ 18,000	$ 19,500
Land Acquisition & Easement		$ 15,000	
SUBTOTAL	$ 37,000	$ 1,775,500	$ 197,860
Distribution Improvements	$ 23,000	$839,000	
SUBTOTAL	$ 23,000	$839,000	
Control Requirements		$179,000	$ 15,600
SUBTOTAL		$179,000	$ 15,600
TOTAL	**$134,800**	**$ 3,832,500**	**$ 916,160**

1.5 FINANCING

The plan draws from a variety of funding sources for implementation. It is recommended that reserve funds be used to implement the 1999 program components. This allows a quick start to facility improvements and sets the requirements for additional plan implementation. The 1999 program will increase the reliability of the cost estimates provided in this report and position the city to use OCDBG funds for design and construction of the year 2000 facilities. In addition to the OCDBG funds, the city will draw upon the payment capacity of the urban renewal funds and will need to borrow an additional 1.1 million dollars to fund all scheduled improvements. Table 1-3 shows the program elements, costs, and the resulting consumer water rate required to fund this plan.

TABLE 1-3

YEAR 2000 REQUIRED RATES

Program Element	Cost
Year 2000 Program Costs	$3,832,500
*Program element funded through Urban Renewal (10 Year 5.5%)	- $2,027,621
OCDBG	- $700,000
Remaining Costs	$1,104,879
Loan Payment (20 yr 5.5%)	$92,456
Loan Reserve (10%)	$9,246
Sinking fund for year 2010 improvements	$71,200
O,M, R&R Costs	$281,451
Total Annual Costs/Payments	$454,353
SDC Revenue (10 connections/yr)**	- $19,370
Remaining revenue reqd	$434,983
Average #EDU connections 1st 10 years	1,100
$/connection	$396
$/month	$33

* Payment capacity based upon current assessment.
** Projected connections are greater, this is a conservative estimate.

Section 2
INTRODUCTION

2.1 NEED FOR PLAN

The City of Veneta last completed a water system master plan in 1979. Since then, the city has experienced considerable growth and continues to receive pressure from development interests. In addition, the 1979 plan fails to address modern standards of practice for water systems, does not address system improvements made since 1979, and cannot serve as a planning document for the future water system of Veneta.

Identified deficiencies related to water system operation and planning for the city are:

- Insufficient background data or baseline information to fully assess system deficiencies.
- Lack of an identified schedule of improvements and method to prioritize those improvements.
- Insufficient planning to establish system development charges.
- The plan is out of compliance with OHD requirements for master plan updates.
- The plan is out of compliance with Oregon State Water Policy (OAR 690 Division 86) administered by the DWR.

This report will present a plan to address the above identified deficiencies. In addition, the report will provide the following benefits:

- Provide a single source of data and information related to the water system design, operation and performance.
- Identify and prioritize required improvements.
- Serve as a practical reference tool for managers, engineers and operators.

2.2 STUDY OBJECTIVE

The primary objective of this study is to plan system capacity to meet consumer and regulatory service requirements for water to the year 2020. Water system deficiencies are identified based on an assessment of the existing system and its ability to provide uninterrupted service into the future. This study outlines a program for future water system developments which meets acceptable service goals, protects public health, and appropriately stages capital improvements. A financial plan is also provided.

2.3 PLAN CONTENTS AND SCOPE OF STUDY

A work plan and scope of work for the water master plan for the City of Veneta was furnished in a proposal provided November 18, 1996 to the city and subsequently included in a grant application to the Oregon Economic Development Department (OEDD). A grant was awarded under the Oregon Community Development Block Grant (OCDBG) program. The basic requirement of the grant is that the city receive a plan that complies with Oregon Health Division (OHD) requirements. The work program contains the following elements:

Description of Existing System: The existing system is described in Section 3. The section identifies sources of information, reviews system operation and sources of supply, and presents a discussion of the treatment plant including management of backwash, distribution, and storage and service issues.

Basic Planning Data: Section 4 presents the basic planning data and assumptions used in the development of the plan. Population and associated demand characteristics are presented along with general planning data such as environmental, social, and cultural factors which may affect water system planning.

System Analysis: This aspect of the study reviews the future capacity of the system related to supply, treatment requirements, delivery standards and the regulatory environment.

Resource Protection: Resource Protection issues are discussed relative to existing and proposed water supply options in Section 3.

Improvement Program: Following analysis of the system, a detailed improvement program is presented in Section 6. Section 5 reviews various alternatives considered as part of the improvement program.

Financial Program: Financial considerations are an important component of the assessment of alternatives. In addition to financial assessments of alternatives, the plan outlines costs of implementation and recommends an appropriate grant and loan program. This program is provided in Section 7.

Conservation Program: The impact of conservation is reviewed in the planning criteria and is included in the review of available alternatives.

Operations Program: An operation program is provided as part of the recommended plan.

Execution: The work program was separated into 12 consultant tasks and a city action task (Task 13). These tasks are briefly described below.

Task 1: Project Kick-off Meeting and Data Gathering. Obtain and review existing water quality, quantity, treatment, distribution, storage, metering, and cost of service data. Meet with city and Health Division to establish study milestones, submittal requirements, expectations and goals and delineate consultant, city and health division responsibilities. Obtain maps, diagrams and record drawings.

Task 2: Water Quality and Service Goals. Establish with the city administrator, public works, and city officials criteria for the water supply system. Outline requirements of the Safe Drinking Water Act for community leaders. Prepare a water quality and service goals document.

Task 3: Existing Water System Assessment and Description. Examine well metering, treatment configuration and capacity, storage, and distribution. Examine service metering systems, revenue, and fiscal obligations. Establish the existing service area, population served, and compliance with regulatory standards, and research repair records for trouble spots or deficiencies. Consult with public works staff on problem areas, complaints and operation and maintenance requirements. Field verify existing treatment system and piping configuration. Prepare AutoCAD based system graphics using existing record drawings. Examine water rights. Define existing system hydraulic performance. Field calibrate the system model.

Task 4: Water Supply Requirements. Examine existing water supply sources. Determine present and long term capacity. Estimate continued service life. Establish economic and population conditions and trends. Determine water demand. Determine water supply requirements for a 20-year planning period.

Task 5: Regulatory Environment. Examine existing city water system conditions and improvement requirements in the context of 1996 amendments to the federal Safe Drinking Water Act and State regulations. Link the regulatory climate with the city's own water quality and service goals. Identify potential future regulatory requirements that may impact the city water system.

Task 6: Distribution, Pumping and Storage. Using modeling software, examine the performance of the existing distribution, pumping, and storage systems under current and projected demand conditions. Develop future distribution, pumping and storage system requirements. Examine the system for earthquake susceptibility. Determine effects of upper elevation storage and supply requirements on the lower system.

Task 7: Alternative Development. Identify alternative water system concepts for source, supply, treatment, distribution, pumping, storage and metering. Evaluate alternatives with emphasis on deficiencies noted in previous tasks. Assess the feasibility of various proven technologies and techniques to provide long-term quality service for the city. Prepare concept level cost estimates for alternatives examined. Examine opportunities for cooperative and coordinated water supply and service with adjacent jurisdictions. Review concepts evaluated with city and state regulatory officials. Evaluate alternatives for upper-level (above 450 feet) service.

Task 8: Selected Plan. Recommend a selected water plan which addresses deficiencies and system requirements. The plan will be generated from analysis and recommendations developed in Tasks 2 through 7. Prepare detailed cost estimates for the selected plan.

Task 9: Financing and Implementation of the Plan. Prepare an implementation plan. Outline financing options including OEDD, Rural Utility Services, and potential revolving fund money as allocated by Congress. Balance the requirements of various funding agencies with user rates, system development charges and other financing assistance programs. Determine appropriate system development charges for the upper and lower water systems.

Task 10: Draft Master Plan. Prepare a written plan that documents the task described above. Provide the draft to the District and the Oregon Health Division. Present the draft plan to the City of Veneta.

Task 11: Public Hearing. Submit results of the draft report in a community public hearing. Receive public comments.

Task 12: Final Report. Incorporate comments from public hearing and agency review into a final water master plan. The final master plan will meet the requirements of a preliminary engineering report as required for Rural Utility Services funding and the requirements of OAR 333-61 and OAR 660-11.

Task 13: City and Agency Acceptance. Obtain formal acceptance by the Oregon Health Division and adoption of the plan by the City of Veneta.

2.4 AUTHORIZATION

The City of Veneta was awarded an OEDD grant to complete the Water Master Plan. Systems West Engineers was authorized to begin work on the project in September, 1997.

2.5 ACKNOWLEDGEMENTS

First, Systems West would like to acknowledge the leadership of Mayor Bill Smigley (retired) who recognized the need for a reliable water supply for the City of Veneta over 30 years ago. In addition, this study would not have been possible without the cooperation and dedication of the staff and current leadership of the City of Veneta.

Section 3
EXISTING FACILITIES

3.1 INTRODUCTION

This section reviews the physical facilities associated with Veneta's water system. Section 4 presents the socio, political, geographic and regulatory framework in which the system must operate.

A municipal water distribution system is typically comprised of the following major components:

- Water source
- Water treatment
- Transmission and distribution (includes pumping and piping)
- Storage
- Controls

This section will review the existing nature of and performance of these water system components. Each of the components was analyzed using a variety of resources. The 1979 Water Master Plan was an important source of historical information and technical assessment. This report was supplemented with plans and other improvement documents, operation and maintenance manuals, interviews with the operators and facility tours. Since Systems West Engineers has been providing professional services to the community for over five years, first hand experience in the community provided additional information. These sources were augmented with notes, photographs and records of the system. A summary of deficiencies is provided at the end of this section.

3.2 SYSTEM OPERATION

Veneta's water system is comprised of two primary wells as water source, a water filtration plant for iron removal, two pump stations, distribution piping, and 0.5 and 2.0 million gallon (MG) reservoirs. The system is operated by the city public works department which currently consists of a supervisor, senior operations staff and two support technicians. Details of the water supply, distribution and storage systems are reviewed below.

The system is fully metered, and meters are read monthly. City clerical staff enter the meter data into an accounting software package, and users are billed monthly. Routine operations consist of monitoring tank levels, treatment status, and pump operation. Routine operations are conducted and monitored at the public works shop located adjacent to the 2.0 mg water storage tank and the treatment plant.

3.3 WATER SUPPLY

Wells supply system water. Nine wells have been drilled and each has produced water of varying quantity and quality. Of these nine, wells 4 and 9 are currently used by the city. A summary of each well's original construction data and other statistics are provided in Table 3-1. As far as we are aware, the inactive wells listed in the table have not been abandoned in accordance with Oregon's well abandonment standards. Figure 3-1 illustrates the locations of these wells. Well logs and water rights data are compiled in Appendix A.

TABLE 3-1

WELLS DEVELOPED IN THE CITY OF VENETA

Well #	Date Drilled	Permit #	Casing Size (in)/& Dept (ft)	Original/ Current Capacity (gpm)	Currently Used
1	08-11-67	G-3968	10/124	180/90	No
2	09-22-67	G-3968	10/120	185/?	No
3	05-28-64	Unknown	6/120	100/?	No
4	10-08-73	G-6355	8/166	300/~~224~~ 200	Yes
5	03-27-77	Unknown	8/150	85/1.5	No
6	Unknown	Unknown	*NR	*NR	No
7	06-02-78	Unknown	6/285	30/?	No
8	01-17-84	Unknown	8/185	170/?	No
9	09-20-91	G-11551	10/180	498/350	Yes

*NR= No Record

Wells 4 and 9 vary in terms of quality, quantity and cycle of use. For each active well, meters are used to record daily flow. These records are submitted to ODWR annually (in accordance with OAR 690, Division 85).

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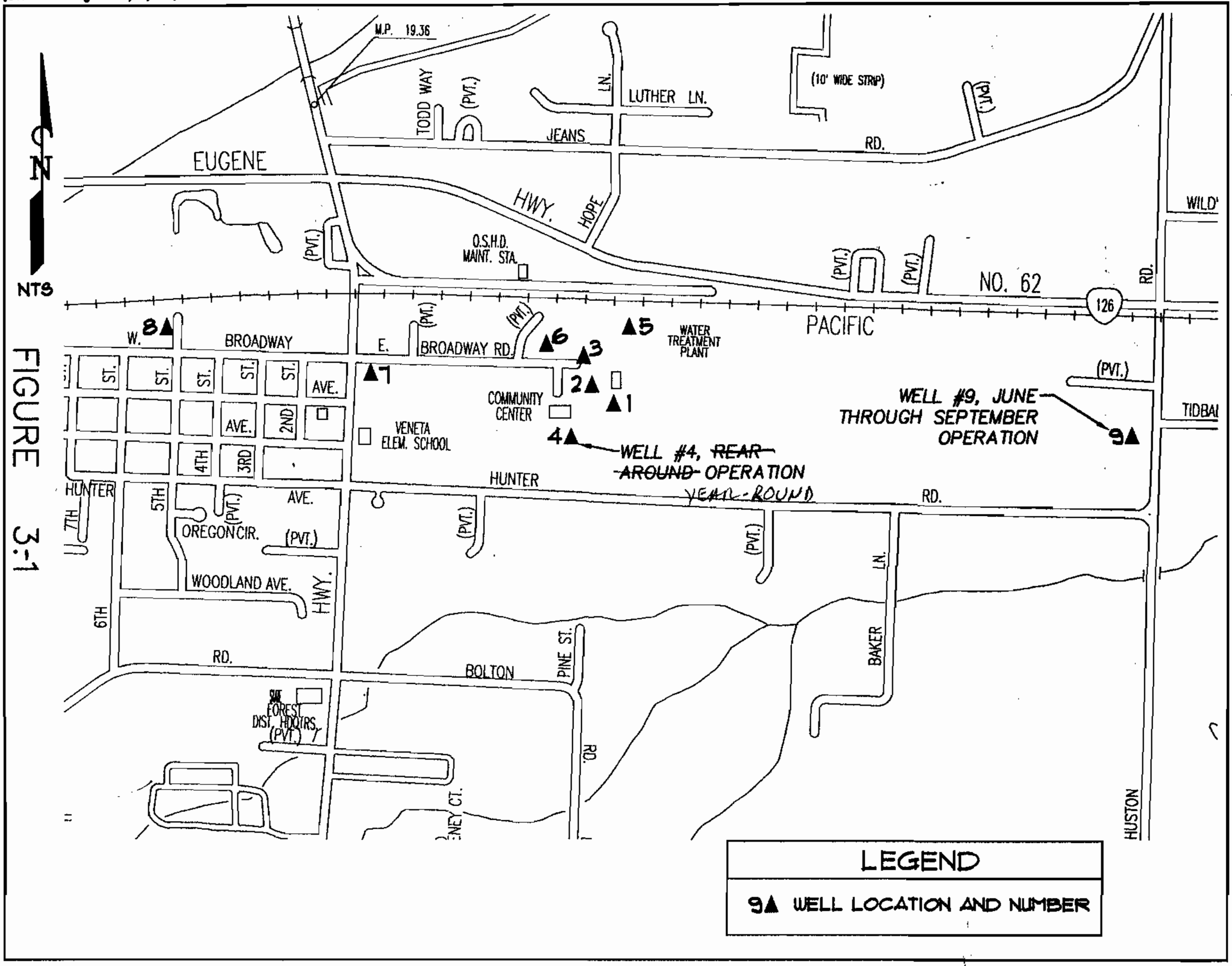

FIGURE 3-1

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CITY OF VENETA
WATER MASTER PLAN
WELL LOCATION MAP

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The quality of water that is pumped from wells 4 and 9 is generally good. There is no record of either well exceeding state or federal primary water quality standards for any regulated constituent. These wells do produce water which is high in iron. There are no known health effects related to concentrations of iron at the levels found in Veneta's water supply. Regulations encourage that iron concentrations be kept below 0.3 mg/L because, above this level, the water carries a red color. This color can stain plumbing fixtures, dye laundry, and generally be a nuisance to the water user. The OHD has set 0.3 mg/L as the recommended maximum iron concentration. Because well 4 water is close to the iron standard, it is generally introduced directly into the storage reservoir during summer months without treatment. During winter, with well 9 off line, well 4 water is run through the treatment plant. This ability to switch source and treatment enables the system to meet peak demand during the summer season while maintaining acceptable water quality.

Well 9, according to the water right certificate, has a capacity of 500 gpm. However, the high iron concentration of 3.5 mg/L imparts a deep red color to the water from this source. The iron and color are treated by the treatment plant (see section 3.4). The treatment plant lacks sufficient capacity to filter 500 gpm at this high of an iron concentration, so well 9 is pumped at 350 gpm during the three-month peak season so as not to overload the treatment plant and to achieve acceptable water quality.

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As part of this study, a well test was completed on well 9 for the purpose of estimating its sustainable production. The test showed that well 9 can sustain flow rates of 600 gpm. These results are tabulated in Appendix B. The 600 gpm pumping rate did however produce sand. The sand was found in the test equipment when disassembled after the test. No visible sand was noted in the effluent stream of water during the test. Particulates such as sand, indicate that water is passing through the well screens at high velocities. Over time, this operating practice would likely clog the well screens as larger particles migrate toward the screens replacing the voids once occupied by coarser materials. If the water right were expanded, the water pumped from well 9 would require monitoring to ensure that particulate buildup does not become a problem.

During the production test, a monitoring well or piezometer well, (see Appendix B) was established for the purpose of measuring draw down influence effects of long-term pumping. The effects on this monitoring well, located 200 feet from the test well, were significant. The monitoring well water level dropped 13.9-feet with a pumping level of 90.0-feet in the primary well. The test indicates that well 9 would be expected to have an influence on wells located within 1,000-feet. This distance should be considered to be the lower limit when considering new sites for well development. The well recovered to within 84% and 92% of its initial static level within 2 and 12 hours, respectively. This calculates to estimated full recovery within 22 hours. This far reaching drawdown effect of well 9 indicates there exists potential for ground water contamination from local wells that are not properly sealed or abandoned in accordance with ODWR requirements.

Before the city water system was developed in the 1960's, approximately 1200 people lived in Veneta, all served by private wells. It is estimated that as many as 400 wells were drilled. Not all of these wells were properly recorded with the DWR, and we are aware of some that continue to be used for irrigation. Based upon examination of aerial photographs, it is estimated that as many as 50 private wells are located within the UGB, and at least another 50 private wells exist within one-half mile of the city limits. Some of these shallow private wells were contaminated via private septic systems. The contamination potential remains, since a number of existing wells have not been properly abandoned. The existence of substandard wells is a strong reason for the city to continue to be the water supplier for the entire community and to encourage, by ordinance, that all residents within the UGB be connected to the city's water supply. Any private well that is not currently used should be abandoned in accordance with DWR regulations.

It is beyond the scope of this study to evaluate geologic records and define Veneta's groundwater watershed. We know that the city has developed 9 wells over a period of 30 years with widely varying degrees of production and quality. The first cluster of wells (wells 1 - 5) were quite close together yet ranged in production from less than 30 gpm to 200 gpm. For all nine wells, the system is spread out almost a mile and a half, generally running east and west parallel and south of the railroad. These factors combine to emphasize that mapping the aquifer or aquifers which supply the city's wells is likely to be a complex task.

Typically, a well head protection program seeks to secure the integrity and quality of existing groundwater sources of supply. Where groundwater production can be easily mapped, a well head protection program can specifically define protective measures including but not limited to zoning and other actions to ensure system protection. For Veneta, given the current status of the system, a watershed protection program cannot be so accurately defined. However, it is important that the city begin to take steps to protect their water source from contamination. Included in this program should be a procedure for well abandonment in accordance with ODWR approved guidelines. To encourage well abandonment, the city could initiate a well abandonment program including the following elements:

- Use a contractor that is city approved.
- Cash reimbursement for well abandonment.
- A well head protection incentive that gives the resident a reduced water rate equivalent to some set value if they protect their well from contamination.

A minority of customers complain about the "mineral taste" of the city's water when well 9 is the primary source. They have expressed concern about the palatability of the water and its suitability for drinking. All water quality analysis data indicates that this well produces water which meets drinking water standards. The taste is probably related to chlorine used to oxidize the iron which results in a higher than normal chlorine residual.

Well 4 was rehabilitated in 1995. The process consisted of down-hole investigations, aquifer reconditioning, and production testing. The down hole investigation was conducted using a submersible video camera lowered into the well. The examination revealed that the bottom 8 feet of the well had been filled with concrete. There was no written record of the concrete fill. According to the well log, the fill closed some parts of the producing aquifer. Following the video examination, the well was infused with sulfamic acid. The acid was surged into and through the well casing and aquifer to loosen mineral deposits. The rehabilitation program was quite successful in that production testing revealed that the well was able to produce 220 gpm with less drawdown than was previously experienced at a production rate of 178 gpm. The results of the test are included in Appendix B.

Well 9 is configured so that two chemical feeds can be added at the well discharge. In the past Alum and permanganate were fed at the well head for iron control. However, the city has had good success with iron treatment using just chlorine for iron oxidation. As a result, only chlorine is added at this time.

Video inspections and production testing indicate that wells 4 and 9 are in generally good condition. Mechanically, well 9 was upgraded in 1997 with a variable speed drive to maximize the efficiency of the pump. Each well has also been retrofitted with liquid hypochlorite (chlorine) injection at the well head instead of chlorine gas to improve safety.

Each of the two active wells is equipped with a discharge meter.

3.4 TREATMENT

Veneta's pressure filtration system was constructed in 1967 to remove iron found in the groundwater. These pressure filters are still in use today, and comprise one of the major weaknesses of the city water system. The filters are ten feet in diameter with a combined surface area of 157 square feet. The filters have a manufacturers rating of 500 gpm at 3.2 gpm per square foot of filter surface area. (The comparative performance of the filters relative to each source of supply is shown in Table 3-2). The 350 gpm filter rate is low for typical pressure filtration rates. Filter rates as high as 5 gpm/square foot are common. The city must operate at the lower rate because of the high iron concentration floc and short filter runs. As a result, there is more water available for treatment than the filtration system can process. The capacity of the filters at 350 gpm is 30 percent less than the capacity of well 9.

A schematic of the treatment process is provided in Figure 3-2. Water flows from the wells into treatment plant piping where it is directed through the filters under pressure from the well pumps. Polymer is injected into the water ahead of the pressure filters to enhance filtration. After filtration, water is injected with soda ash to adjust pH. Water is then routed from the treatment plant building to the 2.0 MG storage reservoir. Raw and treated water systems are cross connected; i.e., untreated water can potentially flow into the treated water system in the event of mechanical or electrical failure. This is shown in Figure 3-2.

During peak demand periods, water from well 4 is not filtered. It is disinfected and delivered directly to storage and is mixed with treated water from well 9. This method of water production enables the system to meet peak demand conditions and provides a blended water with an acceptable iron concentration. During the non-peak season, well 4 becomes the primary water source, which is directed through the treatment plant and then to storage.

A backwash from system water is used to clean the filters. Backwash frequency is shown on Table 3-2. The distribution system provides pressure for the backwash cycle. Table 3-2 shows more water is required for backwash per month when well 9 is in use (1996 values). Well 9 also produces considerably more iron sludge that well 4.

The water treatment plant, having been in continuous operation for 30 years, shows significant signs of distress. During maintenance service in 1991, the pressure filters were observed to have noticeable interior deterioration. At that time, one of the surface washers inside of the pressure filter was welded back into place. Before this service, water had been directly bypassing the filtration media in one of the filters for an unknown length of time. In addition, the exterior surface of the pressure filter tanks has large areas of deteriorating and flaking paint.

TABLE 3-2

WELL AND TREATMENT COMPARISON

	WELL 4	WELL 9
PARAMETER		
Yield (gpm)	200	600
Max. water right capacity	300	500
Months of primary use	November - April	June - September
Production (gpm)	200	350**
Production (gallons/day)	285,000	478,000
Iron concentration	0.35 mg/L	3.5 mg/L
Backwash frequency (hours)	20	4
Backwash (gallons/cycle)	18,300	26,300
Backwash (gallons/day)	21,900	157,800
Sludge produced (lbs/day) @2%	42	714
Sludge produced (lbs/MG) @2%	147	1490
Filter loading (gpm/ft^2)	1.3	2.2

* Some sand production. ** Limited by filter performance.

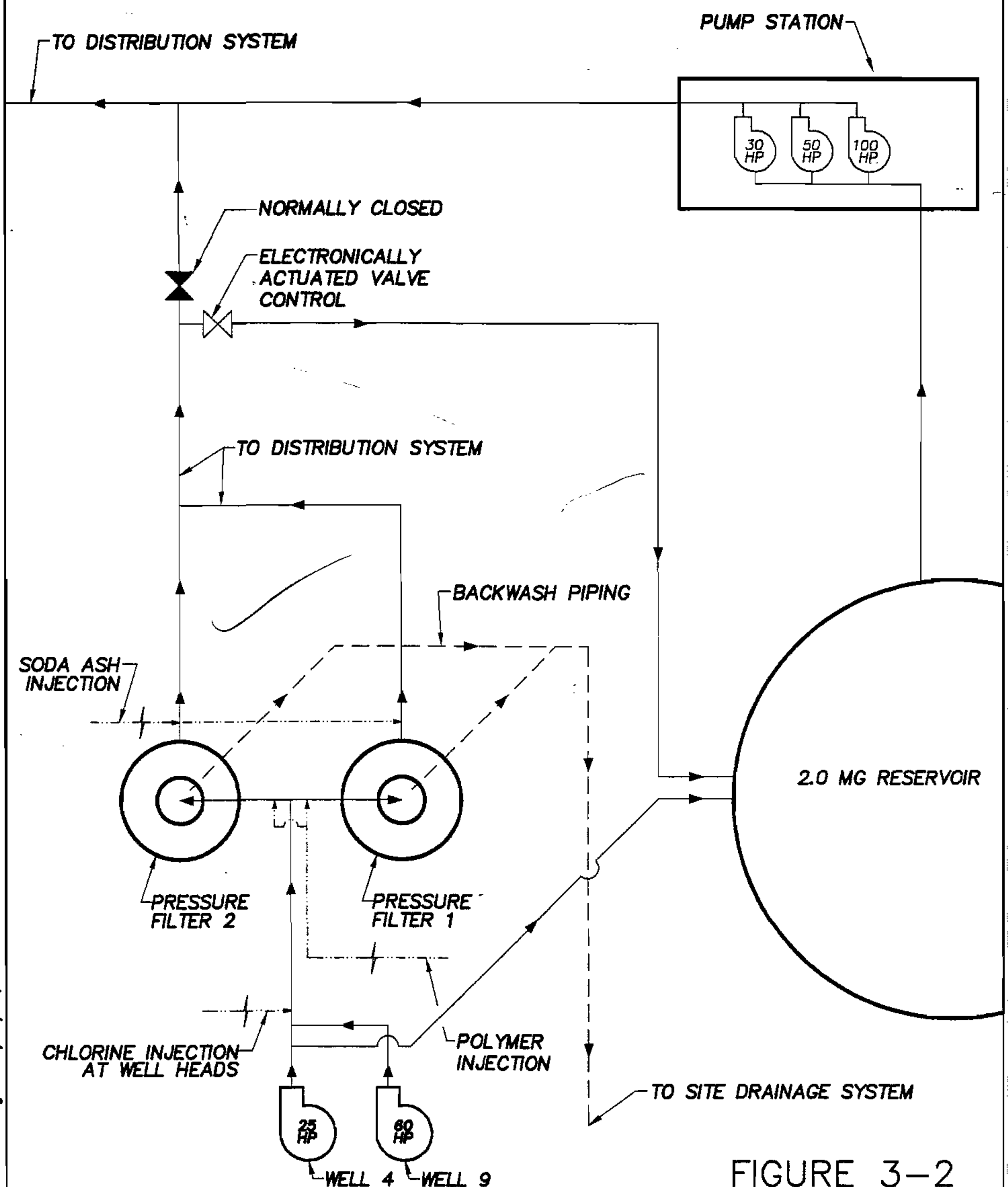

FIGURE 3-2

SYSTEMS WEST ENGINEERS, INC.
PROJECT: 3033.19

CITY OF VENETA
WATER MASTER PLAN
TREATMENT PROCESS SCHEMATIC

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The master meter at the treatment plant was found to be in error. Because of this finding, daily water production is now recorded from meters located at each well site. The master meter was indicating higher flows from the treatment plant than were actually produced. This led to the conclusion of higher leakage rates when flow data was evaluated.

The backwash pond, or settling pond, was originally sized to accommodate water with lower concentrations of iron such as water from well 4. Well 9 was developed with much higher iron content. The treatment of well water with high iron concentration has contributed to failure of the original settling pond. The settling basin was clogged with backwash effluent precipitates and abandoned in 1997. Because of the settling pond failure, backwash water is now pumped to outside of the treatment plant building and allowed to flow into the drainage system and into the forest located east of the treatment plant site. This is not an approved system.

In February of 1998, local water users began to complain of sudden sustained drops in pressure throughout the system. At first the pressure drops seemed to be random and in isolated parts of the city. As the problem became more defined, however, and more citizens notified the city of pressure fluctuations, a pattern was noted. After installation of pressure sensing equipment, the city's operators and engineer determined that a control valve at the treatment facility was remaining open during filter backwash. The open valve was allowing system water to flow back into the 2.0 MG reservoir and caused significant system-wide pressure drop during the backwash cycle. The valve has since been repaired, but the incident remains a reminder of system susceptibility.

3.5 TRANSMISSION AND DISTRIBUTION

3.5.1 Pipe

Veneta's water piping system was initially constructed in 1967, primarily with asbestos cement pipe. Since this initial construction, system piping has been expanded considerably. The water system now includes differing materials such as PVC and ductile iron.

The total length of pipe in the distribution system is approximately 70,800 feet or 13.5 miles. Over half of the pipe is 6-inch waterline, which, historically, is the diameter of pipe most often specified in residential streets. Table 3-3 provides pipe lengths and diameters in the water distribution system. A comprehensive map of the water distribution system, compiled from as-built drawings and record maps, is provided and is located in the folder at the back of this study.

Water systems with a leakage rate from 3 to 7 percent are considered acceptable. Veneta's waterline leakage in recent years was calculated at about 12%. This high leakage rate has decreased to a current average of approximately 6%. This decrease in leakage is the result of an aggressive program implemented by the public works director. The program consists of on-going service connection and/or meter replacement, leak location and repair, and line replacement. Much of this city's service connection pipe consist of polybutylene plastic which was a pipe of choice in the 60's and 70's. However, after about 30 years of use, polybutylene pipe begins to fail. Service repairs of polybutylene pipe have been a significant source of leak reduction.

Long, dead-end pipe runs exist on some streets in the water distribution system. This piping configuration significantly inhibits the pressure and flow capabilities of the system. Also, dead-end piping configurations do not allow water to circulate well which can lead to bacteria build up within the pipeline. Examples of long dead-end piping runs are located on Jeans and Hunter roads. These pipe runs, if connected or looped, would provide greater service pressure, higher flows for fire protection, and enhanced water circulation. The modification would also provide the added benefit of reducing service disruptions when parts of the system are removed for maintenance.

TABLE 3-3	DISTRIBUTION SYSTEM INVENTORY CITY OF VENETA	
Pipe Size	**Pipe Length**	**% of total**
2	2,515	4%
3	70	.01%
4	1,125	2%
6	37,716	53%
8	9,648	14%
10	5,327	8%
12	6,695	9%
14	2,540	4%
16	5,158	7%
TOTALS	**70,794**	**100%**

Because of dead-end pipe connections in the system and the increased flow requirements of the National Fire Code, the city engineer has established a minimum transmission pipe diameter of eight inches for all service lines in Veneta. Some minor variations to this minimum size have been allowed where adequate looping has been assured. Clearly the pipes smaller than 4-inch are substandard.

AWWA standards call for waterline to be buried a minimum of 30" from finish grade to the top of the pipe. The 12-inch pipe located on 8th Street has been reported to be covered by as little as 18-inches of backfill material. This section of pipe should be pot holed and evaluated for minimal cover. Replacement or protection may be necessary.

3.5.2 Water System Modeling

Performance of the piping system was evaluated using Cybernet water-modeling software (version 2). The software was used to evaluate the water system main piping. The computer model is not intended for the evaluation of individual services. A map of the water system is included in the appendix. The map indicates hydrant locations, junction locations, and piping structure. Possible locations for storage reservoirs and piping for future phases of development are shown separately. The model allowed for estimation of pipeline development required beyond the year 2020.

3.5.3 Process

The process of developing a computer water system model involved a number of steps. The first was to obtain a suitable computer map to serve as a scaled graphic from which pipelines and other system components, such as existing hydrants and reservoirs, were taken. Once the map was complete, the computer software program converted the computer graphic information to numerical data from which the modeling software produced hydraulic analyses.

Water demand based on the current development of the city was determined by counting dwellings from an aerial map of the city and using spreadsheet software to estimate associated demand across the water system.

Water system performance was then evaluated based upon actual measurements of system hydraulic performance. This process calibrates the model which ensures that water system hydraulic trends can be reasonably predicted. The process of calibration involves the verification of pressure and flow of model results compared to actual hydrant tests. The water system model was calibrated to static and dynamic residual water pressures determined from fire flow tests conducted by the Lane Rural Fire District #1 in 1991. After model calibration, system improvements installed after 1991 were added to the model. A selected compilation of water system model data is included in Appendix C.

Once the water system was defined and calibrated, various demand scenarios were developed to serve as a basis to evaluate system performance including:

- Existing system hydraulic performance for average-day, maximum-day and peak-hour demand.
- Future system hydraulic performance for average-day, maximum-day and peak-hour demand.
- Existing and future fire-flow availability at hydrants.

3.5.4 Current Condition Results

The results of the Cybernet modeling process indicate the following deficiencies:

- The piping system fails to provide the minimum required fire flow in some residential areas.
- The distribution system in the higher service area of Bolton Hill is not capable of supplying adequate fire flow.

Piping sections known to not provide sufficient fire flow during actual testing in 1991 by the Fire Department have been confirmed by the modeling process. These pipes and their locations are listed below:

- Hunter & Huston Road. Approximately 1800-ft of 6-inch pipe on Hunter and the east portion of this dead end pipe run which continues on Huston Road.
- The east end of Woodland Avenue.
- At the intersection of Forest Court and 10th Street.
- The north end of Blek drive.
- Territorial Court (4-inch and 2-inch pipe).
- The 10 homes served by the small pump station above the 0.5-mg reservoir (Bolton Hill area).

The model verified that fire flows could not be met even when system supply pressures were allowed to come down to 20 psi everywhere in the water system. The model identified six locations where fire flow was inadequate. The specific nodes are referenced in Appendix C.

The results of the fire flow analysis indicate that field assessed fire flow can vary dramatically depending on whether the distribution pumps at the treatment yard are on or off. However, field data does not indicate pump status. For example, field tests for hydrant 69 produced a fire flow of 860 gpm. The model, allowing for the maximum residual pressure, shows the hydrant to have a capacity of over 1,000 gpm. The computer model confirms that, with the service pumps on, satisfactory flow is available. However, modeled results can yield information of limited accuracy. Other hydrants were tested yielding higher field flow rates than produced using the model.

The 0.5 MG reservoir has a water surface elevation of 576 feet. The upper service elevation at around 10th and Parkside is about 480 feet. This provides a service pressure of 41 psi during routine conditions. However, under conditions of high demand or a fire flow the service pressure in this area drops dramatically. Because state regulations require that system water pressure be maintained above 20 psi at all times, the conditions in the Parkside area limit the fire flow availability to the entire community. The model identified 61 hydrants in which performance was limited by the requirement to sustain pressure.

Also of concern is the possibility that system pressure in these high areas will fall to below zero and create a vacuum. If the system is operating with a vacuum, contaminates may be drawn into the water system. A plausible scenario would involve a large pipe break and an individual with a garden hose filling a car radiator at a higher elevation. With the sudden large demand created by the pipe break, a negative pressure at higher elevations can cause the garden hose to draw antifreeze into the water distribution system. A major fire could also cause this to happen. This model suggests that in the event of a major fire, pressures at services located in the Bolton Hill area are at risk of becoming negative; i.e., there is a high potential for contaminates to enter the water system.

3.5.5 Pump Stations

The city has two pump stations. The main pump station is located at the water treatment plant and the other is located adjacent to the 0.5 MG reservoir in the Bolton Hill area. The main pump station serves the entire city while the Bolton Hill pump station is sized to provide service to 10 residents.

The pump station at the treatment plant was constructed in the early 1980's concurrent with the 2.0 MG reservoir. Each of the three motor and pump combinations is comprised of a Century motor and Jacuzzi pump. Stainless steel rod level sensors at the 0.5 MG reservoir control the pump cycles. The three constant speed pumps, with ratings of 30, 50 and 100 horsepower, are activated in turn from smallest to largest based on the 0.5 MG reservoir water surface elevation. The cumulative hours of operation, as of October 1997, are listed below.

CUMULATIVE HOURS OF OPERATION

PUMPS	HOURS OF OPERATION	% OF HOURS	ESTIMATED TOTAL PRODUCTION (million gallon)
30 hp pump	10,631	62	239
50 hp pump	6,372	37	184
100 hp pump	202	<1	10

The list shows that most demand is supplied by the 30 hp pump and indicates that the 100 hp pump has provided very few service hours during its 15 years of connection (less than 2/10 of a percent). Currently, the 100 hp pump can only be operated manually. Parts were borrowed from the 100 hp pump to service the 50 hp pump, and replacement parts to put the 100 hp pump back to automatic operation could not be located. Note that when the 100 hp pump does operate, system velocities increase to such a level that iron deposits in the distribution system break loose and red colored water exists throughout the system.

The pump station located on Bolton Hill has a pneumatic tank and is sized to supply water to services at an elevation equal to or higher than the 0.5 MG reservoir. The capacity of this small pump station is limited, providing approximately 25 psi to the home at the highest elevation. The operation of this small system has been satisfactory but does require considerable operator attention. The delivery pipe is 2-inch and is too small.

3.6 STORAGE

The city currently has two welded-steel reservoirs. A 2.0 MG reservoir is located at the water treatment plant site and a 0.5 MG reservoir is located adjacent to the intersection of Bolton Hill Road and Dogwood Lane.

Both reservoirs are in good condition. In 1994, each received interior cleaning and patching on areas where the existing coating had deteriorated. Sand was also cleaned away from the inlet of the 2.0 MG reservoir. Apparently, at some time, sand entered the water process stream and made its way into the storage tank. This could have occurred when the surface washer broke inside of the pressure filter and was stuck vertically in the filter media. The sand that settled inside of the reservoir was forming a small cone around the inlet pipe possibly restricting flow.

The exterior of the 2.0 MG reservoir is in good condition aside from some discoloration of the exterior shell. The 0.5 MG reservoir is in similar condition; however, small areas of the tank coating are peeling. There are numerous points on the surface where rust can be seen through the exterior coating. This problem should be corrected.

Paint samples were collected from both storage tanks to evaluate the lead content of the coating. Each sample was tested by Pacific Northwest Laboratories. The 0.5 MG and 2.0 MG paint samples contain 5,500 and 82,000 parts per million lead content, respectively. The lead in both samples is at levels typical of the paint used during the time period that each reservoir was constructed. Most likely the lead content is a result of using "red lead" primer as a part of the exterior coating. The most prevalent technique for management of this hazardous material is to provide a surface coating which effectively encapsulates the lead and prevents environmental leakage. In the event the reservoirs are repainted in the future, paint removal from areas which receive prep work must be collected and disposed of properly.

Volatile Organic Carbon (VOC) contamination did occur in the 2.0 MG reservoir in 1994. This was apparently the result from chemicals leaching into the water from the patching materials used to recoat the interior of the reservoir. Flushing and testing corrected the problem. This condition is checked on a routine basis and has not reoccurred.

The functions of an elevated reservoir are to provide pressure to the distribution system when pumps are off-line, to provide water storage reserves in the event of power failure, and to provide storage for an emergency event such as fire. If a long-term power failure occurred, the city would be reliant upon the 0.5 MG reservoir for service. In the event of power outage, and assuming average day use, the reservoir located on Bolton Hill would provide sufficient demand for approximately 40 hours. During the summer season this time duration would decrease to just over 24 hours. The 2.0 MG reservoir would not support system demand in the event of fire because it is at too low of an elevation.

during power outage

In the event of fire, the Uniform Fire Code requires that residential developments have the capacity of providing 1,000 gpm for two hours duration (120,000 gallons). Fire flow requirements for larger buildings, such as the Fern Ridge School or Fern Ridge Center buildings, would require fire storage volumes of approximately 4,750 gpm for 4 hours or 1.14 MG total volume. Currently, sufficient storage is available to accommodate these fire-flow requirements at the 2.0 MG reservoir in terms of volume only. The worst case scenario would be a major fire event that occurs during a power failure. This situation, although unlikely, would leave the 2.0 MG reservoir out of service and would drain the 0.5 MG reservoir in a little less than 2 hours at a flow rate of 4,750 gpm. In practical terms, during a power outage, the system can not deliver 4750 gpm and the duration at the actual flow rate would be nearer 4 hours, according to maximum fire flow rate tests completed by the Lane County Fire District and predicted by the system model.

3.7 SYSTEM CONTROL

The water system operates in the following sequence:

- Level sensors in the 0.5 MG reservoir control the three pumps at the treatment plant pump station. As the water surface level drops, pumps are activated one at a time starting with the 30 hp pump. The 50 and 100 hp pumps follow in turn as the reservoir level continues to drop. Level control telemetry for the 0.5 MG reservoir is routed through overhead power lines.

- Level sensors in the 2.0 MG reservoir control the well pumps in a similar manner. As the water surface level drops in the 2.0 MG reservoir, the well pumps are activated and begin to fill the 2.0 MG reservoir via the pressure treatment process. Level control telemetry for well controls is underground.

- Backwash system pressure is provided by the distribution system. Two valves are repositioned to direct water from the distribution system back through the pressure filters.

This control system is somewhat awkward and requires field assessment for many alarm conditions. Finally, the city needs to run their existing system through some analysis to verify that it will be compatible in the year 2000, i.e., Y2K assessment.

3.8 DEFICIENCIES

A summary of the city's water system deficiencies are listed below based on the various categories.

3.8.1 Water Source:

1. In the event of well mechanical failure or some downhole problem, the city would be dependent on one well for water supply. The single well cannot meet peak maximum day demand during the summer months.

2. Down-hole conditions of the wells are not currently monitored. If a well is over pumped, the operator will not be aware of it until something has gone wrong.

3. Well water supply lines (especially well 9) may be accumulating solids.

3.8.2 Water Treatment:

1. The treatment plant is marginally capable of handling water system demand greater than 350 gpm (1/2 of maximum day demand during summer season).

2. The treatment plant is showing outward signs of wear.

3. The sludge management system has completely failed. Water from the backwash cycle flows to daylight allowing water highly concentrated in iron to be released to the forest located east of the treatment plant. The city does not have a permit from DEQ for this operating practice.

4. Raw and treated piping systems are cross-connected.

5. Treatment plant master meters do not accurately indicate flow.

6. Valve failure has caused significant pressure drops in the distribution system.

3.8.3 Transmission and Distribution:

1. Dead-end waterlines exist on Huston Road and Jeans Road and other parts of the system. These pipes should be connected to form a loop.

2. Shallow cover is reported over a 12" waterline on 8th Street. (Length = 3,300 ft.) This pipe is at risk of failure from traffic loading.

3. High water flows, as in the event of a fire requiring sustained high flows, draw pressures down below 20 psi in high service elevations.

4. Service pressures are less than state required minimums at higher elevations near the southerly end of 10th Street and at the southern end of 9th Street.

5. 2" and 3" waterlines should be replaced with larger diameters.

6. There is no piping system to provide fire and water service to the elevated area of Bolton Hill within the UGB.

7. Water service is not provided in the southwest and southeast areas within the city limits.

8. The 100 hp pump is not operated by the reservoir telemetry system. Replacement pump station controls are extremely difficult to locate which suggests these components are out of date.

9. Leakage has exceeded 12 percent although currently is less than 6 percent. Meter systems should be checked and calibrated.

10. Single pipe service across the railroad and Highway 126 makes a precarious link to ensure service to the north portion of the city.

3.8.4 Storage:

1. A small volume of upper level water is available for fighting a fire in the event of power failure.

2. The exterior of the 0.5 MG reservoir needs to be re-coated.

3. Exterior coating of the 2.0 MG reservoir needs to encapsulate those areas where lead based primer is exposed.

3.8.5 Control System:

1. Reservoir level indicators at the treatment plant have failed and should be replaced.

2. The operation control system fails to provide immediate notification of system changes.

3. A program has not been initiated to determine if the system is compatible with the year 2000 computer change (Y2K).

Section 4
PLANNING CRITERIA

The planning criteria for a capital improvement program is based upon the study area, other planning efforts, the history of the system, growth, and population dynamics. The regulatory environment also plays a key role. Outside factors such as conservation, service period, and standards of service further contribute to the foundation upon which a plan is constructed. This section reviews these factors and establishes the basis for the development of alternatives and the selected plan.

4.1 STUDY AREA

Veneta is located on Highway 126, approximately 13 miles west of the city of Eugene in central Lane County (see Figure 4-1). The main business and residential portion of the city is located about one-quarter mile south of the highway. The Central Oregon and Pacific Railroad runs parallel to and south of Highway 126. Highway 126 is the primary transportation corridor from the Eugene area to the Oregon coast.

Veneta primarily serves as a bedroom community for industrial and commercial enterprises located in the Eugene/Springfield metropolitan area. Existing land use in Veneta is mainly residential, with a modest mix of commercial and industrial uses. Future land use is expected to follow this historic trend. Development interests in the city are mainly limited to proposals for residential expansion, although some commercial and industrial developments will likely occur in the future. Gas stations, fast food restaurants, mini-grocery stores, and a shopping center line the Highway 126 corridor and provide commercial services for residents and travelers.

The city currently has an art gallery, dollar store, tanning salon, video store, four restaurants, two banks, two convenience stores, a florist, cleaners, deli, antique and second-hand clothing shops. The most visible retail development is the 103,000 square-foot West Lane Shopping Center north of and along Highway 126. The Fern Ridge School District is also a significant employer. The school district has two schools within the city limits and has discussed the possibility of a third.

The Water Master Plan study area is contiguous to the urban growth boundary (UGB) and is shown in Figure 4-2. The UGB is also the planning area for the city's wastewater facility plan which contains a more detailed description of the UGB area.

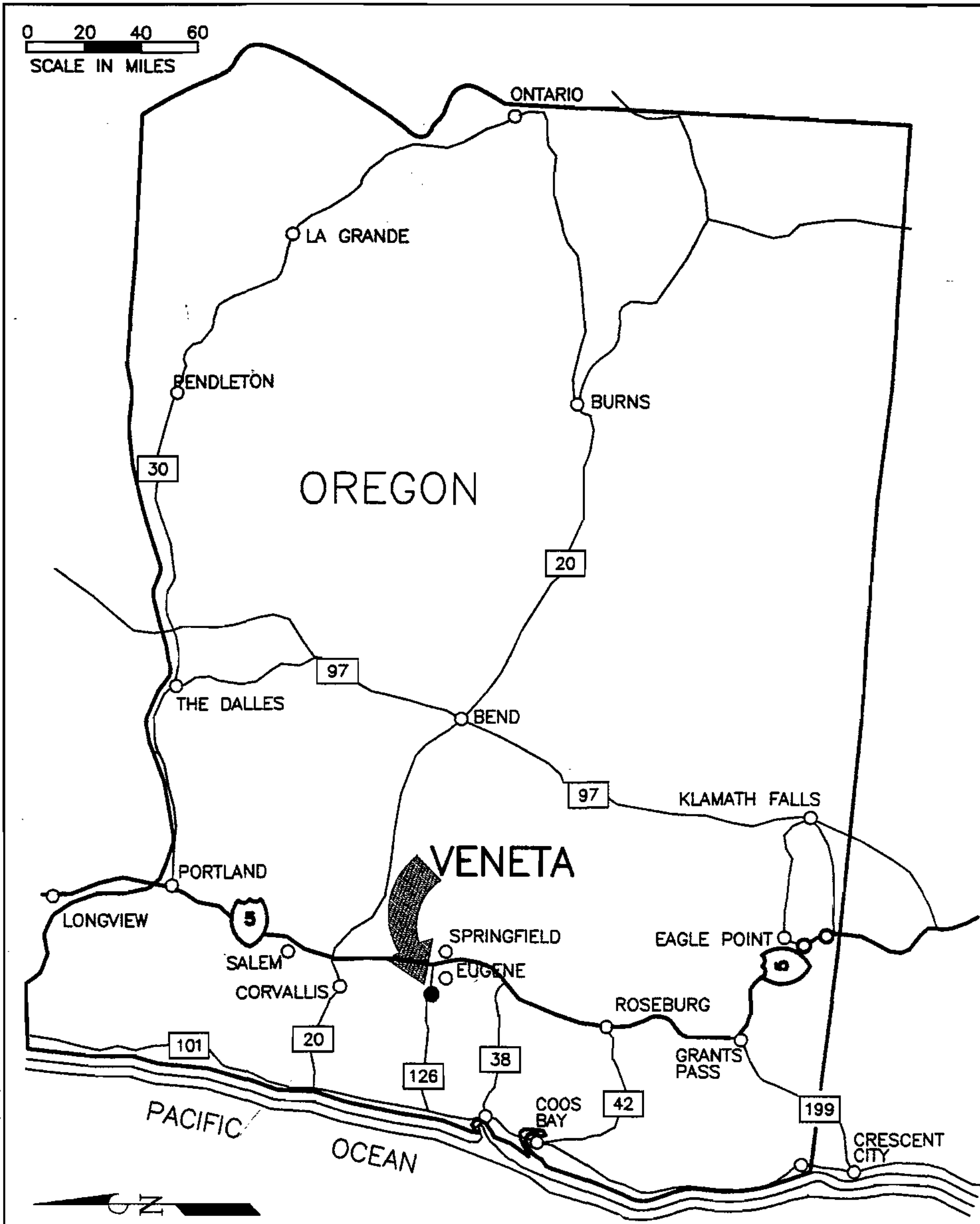

FIGURE 4-1

SYSTEMS WEST ENGINEERS, INC.

PROJECT: 3033.19

CITY OF VENETA
WATER MASTER PLAN
PROJECT LOCATION MAP

Page 4-2

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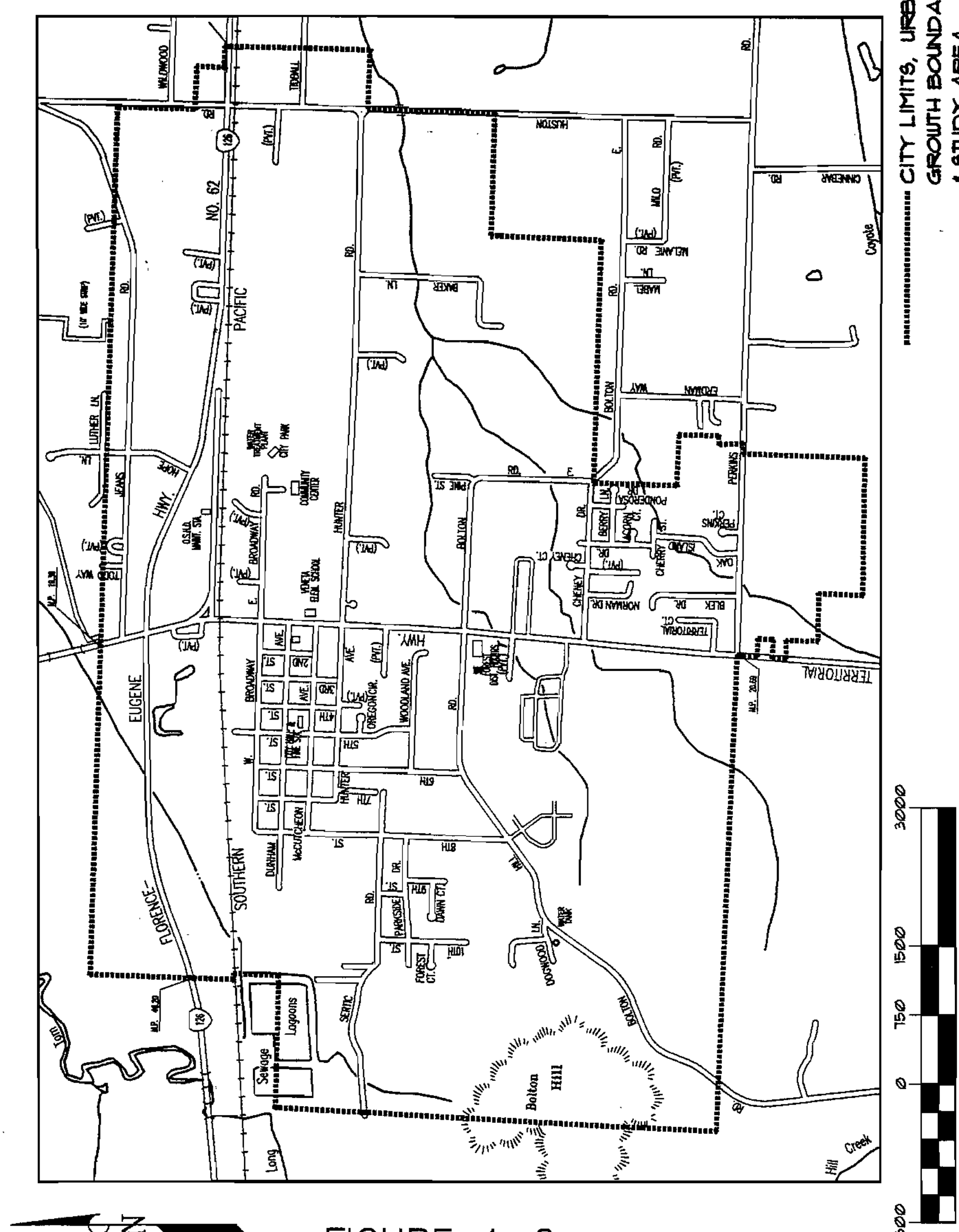

FIGURE 4-2

SYSTEMS WEST ENGINEERS, INC.

PROJECT: 3033.19

CITY OF VENETA
WATER MASTER PLAN
STUDY AREA LIMITS

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4.2 RELATED PLANNING DOCUMENTS

The city adopted a wastewater master plan in September of 1997. This plan outlines the wastewater collection and treatment facilities required through the year 2020. The plan includes a detailed discussion of the physical environment and the socio-economic environment within the UGB. The reader is referred to that document for presentation of these issues. Population, a critical planning component, is also discussed in the wastewater master plan. The population estimates for water planning are discussed in Section 4.4 below.

The city has authorized development of a transportation master plan. This plan, which is being developed by the Lane Council of Governments (LCOG), has been issued for community review in draft form. New streets proposed in the plan are integrated with proposed water line loop requirements of this plan.

The city is also conducting State of Oregon required periodic review of the comprehensive plan. That review includes an inventory of buildable lands, wetlands, and other periodic review assessments. Periodic review, scheduled for completion in 1999, will include integration of facility requirements developed in this water plan.

The city recently authorized the development of a storm drainage master plan scheduled for completion in spring of 1999.

4.3 SYSTEM HISTORY

The City of Veneta's water system was originally constructed in 1967. The initial system consisted of a well (well 1), a pressure-filter filtration plant, backwash settling basin, system piping and a 0.5 MG storage reservoir.

While planning for the new water system in the early 60's, approximately 20 people within Veneta were infected with hepatitis at nearly the same time. The cause was attributed to septic tank leach fields that tainted the ground water source. Shallow private wells that the citizens of Veneta relied upon at the time were considered causative factors for the hepatitis outbreak. While planning had already begun for the water system, this outbreak was a convincing reason to pursue a reliable source of safe drinking water. The water system was installed during the years Bill Smigley was a councilman of Veneta. He is credited, along with other community leaders, for implementing the water and sanitary systems improvements.

Water system expansion in the early 80's included a pump station, a 2.0-MG storage reservoir and transmission/distribution piping upgrades. These improvements were the result of implementation of recommendations outlined in the 1979 master plan.

4.4 POPULATION AND SERVICE CONNECTIONS

As of July 1997, the City of Veneta had 872 meters serving approximately 1,084 dwellings. The estimated population at that time was 2,870. This population figure is taken from estimates provided annually by the Center for Population Research and Census, Portland State University.

The city experienced considerable variation in population through the 1980's. The estimated low for that decade was in 1986 with a population of 2,290. Since then, the community has shown a steady increase in population at greater than a 3% annual rate. A significant growth rate is anticipated because of Veneta's appeal as a bedroom community to serve commercial and industrial development in the Eugene/Springfield area.

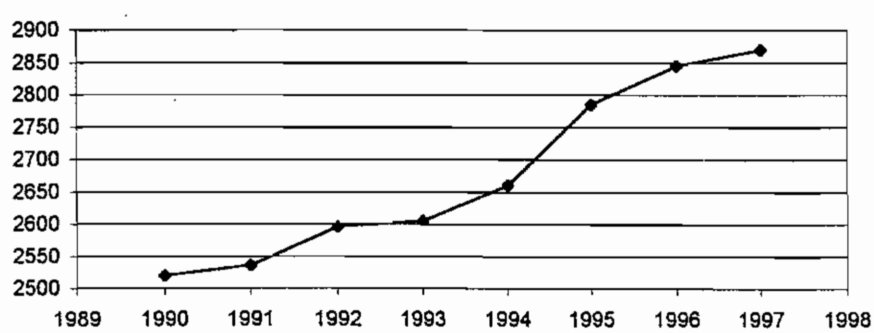
The following discussion of population dynamics mirrors the study recently completed for the wastewater facilities plan. The wastewater facilities plan predicts population to the year 2017. The planning period for this water study is from 1998 to 2020. For completeness, portions from the wastewater facilities plan are repeated here with charts and tables indicating future population increases to the year 2020.

4.4.1 Historic Population

The population of Veneta remained relatively constant through the late 1960's when the population declined dramatically due to a downward trend in the wood products industry. Comparatively, Lane County population increased steadily until the early 1980's, then dropped until 1987. The population of Veneta and Lane County reflects the rise and decline of the forest products industry. Production slowdowns in Veneta did not affect the overall population figures of Lane County, but recessions in the late 60's and early 80's hit the entire region hard.

Veneta became incorporated in 1962. There is no prior census data specific to Veneta. In 1962, the city's population was 1,125. The city experienced steady growth throughout the 60's and 70's. In 1980 a population of 2,449 was reached. The population declined to a low of 2,290 in 1986 and then climbed to 2,470 by 1989. The population growth from 1990 to 1997 is shown on Figure 4-3 below.

FIGURE 4-3
CITY OF VENETA POPULATION FOR 1990 - 1997



4.4.2 Future Population

Population growth is the basis for determining future water demand and the associated sizing of water system components. To estimate future populations, past trends need to be taken into account. Predicting the population trends for Veneta is complicated by adjustments for sporadic growth patterns, an economy subject to flux, and changing development interests. As of spring 1995, a total of over 500 housing units were being planned for development within the city. Discussions in early 1996 with developers have suggested as many as 680 additional housing units are in some stage of progression. Most of these units were proposed for the southwest portion of the city. However, by late 1995, only two subdivisions (a total of 40 lots) had been submitted for tentative approval to the planning commission. This seemingly low figure for new construction is attributed to the city having imposed a new construction moratorium because of the limited ability of the wastewater treatment facility to handle additional growth. The wastewater issue is scheduled for resolution in the year 2000.

Lane County planners and population estimators for the state of Oregon have generally acknowledged a 2 percent annual increase in population as reasonable. The City of Veneta's 1989 comprehensive plan estimated an urban service area population of 5,944 by the year 2010 based on a 3 percent annual growth rate.

Table 4-1 lists the projected growth rate for the City of Veneta that will be used in this Water Master Plan for the period from 1997 through 2020. This population growth scenario and others were presented to and discussed by the Veneta City Council on February 12, 1996 as part of the wastewater facilities plan. The council determined that the selected growth estimate through the year 2020 most likely projects the future population growth.

TABLE 4-1
PROJECTED WATER SERVICE POPULATION FOR THE CITY OF VENETA

YEAR	ANTICIPATED	PROJECTED
1997	5%	2,902
2000	3%	3,171
2010	3%	4,261
2020	3%	5,727
2021 to 2050	2%	10,374

This figure conveys fast initial growth followed by moderately high growth. At this time, there are an estimated 400 homes and businesses within the city limit which are served by private wells. These private water sources are assumed, over the life of this plan, to transfer to the city system.

4.5 ECONOMIC CONDITIONS AND TRENDS

The basic economic sectors of a community manufacture and produce goods for consumption by the people. Employment in these basic sectors generate capital for the purchase of other goods and services. Non-basic sector establishments provide goods and services to the community such as retail stores and restaurants. Non-basic sector businesses are highly dependent on the basic sector industries.

The City of Veneta has a modest commercial and industrial base. A variety of commercial enterprises can be found within the city limits including gas stations, fast-food restaurants, storage units, mini-grocery stores and a shopping center. Additionally, Veneta serves in part as a bedroom community to Eugene. Veneta offers a small-town feel by comparison to Eugene's ever increasing urbanization. By virtue of Eugene's growth, as seen especially in recent years, it is reasonable to assume that Veneta will continue to experience growth as well.

4.6 WATER DEMAND

The sizing of water system components is based on estimates of future water demand. The objective of this section is to identify current water consumption and to project future water requirements. Future water demand is then used to size major system components. The projections of future water demand will be based, impart, on the population growth and economic predictions discussed in this section.

Water system demand is the amount of water delivered from the source of supply to the distribution system over a given period. In most water systems, the rate of demand varies considerably throughout the year and during each day. The demand rate is typically lower during winter months, and then increases significantly during the summer due to warmer temperatures, irrigation requirements, and seasonal increases in population. Another factor that increases the demand for water are special events. During the 2nd weekend of July, the Oregon Country Fair event occurs in the area directly north of the city. This popular annual event is attended by approximately 10,000 people per day and lasts for four days. During this event, local economic activity increases which affects water demand. Water is not furnished by the city to the fair directly.

Per capita demand data is generally used to evaluate and compare system demands. The per capita demand rate is the system demand divided by the population served and is expressed in units of gallons per capita per day (gpcd). Demand rates may also be expressed in million gallons per day (mgd), gallons per day (gpd) or gallons per year (gpy).

Annual Demand represents total water consumption for a 365-day (one-year) period. The annual demand is used to compare water use for various classifications of users and is also used to help set water rates.

Average Day Demand (ADD) is defined as the average daily rate of demand for a 24-hour period or annual demand divided by 365. Average day demand is useful as a guide for sizing reservoirs and can also be used to determine annual operating costs.

Maximum Month Demand (MMD) is the total sum of water production for the peak month (the month with the highest amount of water produced). This demand is expressed in terms of total monthly demand or average daily demand during the maximum month. The maximum month demand is useful in evaluating storage requirements and source reliability.

Maximum Day Demand (MDD) is equal to the largest volume of water delivered to the system during a single day. Typically, the maximum day demand occurs during the summer and in some cases during a holiday. Maximum day demand is used to determine the capacity of water supply facilities including wells, pump stations, treatment plants and transmission mains.

Peak Hour Demand (PHD) is the maximum instantaneous demand during a single hour. Peak hour demand determines the capacity of the distribution pipelines when fire flow is not a consideration. Peak hour demand can also be used for reservoir sizing.

4.6.1 Present Water Demand

Water demand is often expressed in terms of a water year. The water year runs from October 1 through September 30. Annual water year consumption is plotted from 1985 to 1996 in Figure 4-4. The figure illustrates that annual water consumption is increasing. The highest annual water consumption occurred in 1994 with a demand of 144.5 million gallons. Tables 4-2, 4-3, and 4-4 define water system demand for average day, maximum month, maximum day and peak hour respectively. Table 4-5 summarizes current water demand information. These tables produce ratios or peaking factors relative to the ADD. These ratios are then applied to future populations.

FIGURE 4-4

ANNUAL WATER CONSUMPTION: 1985 – 1996

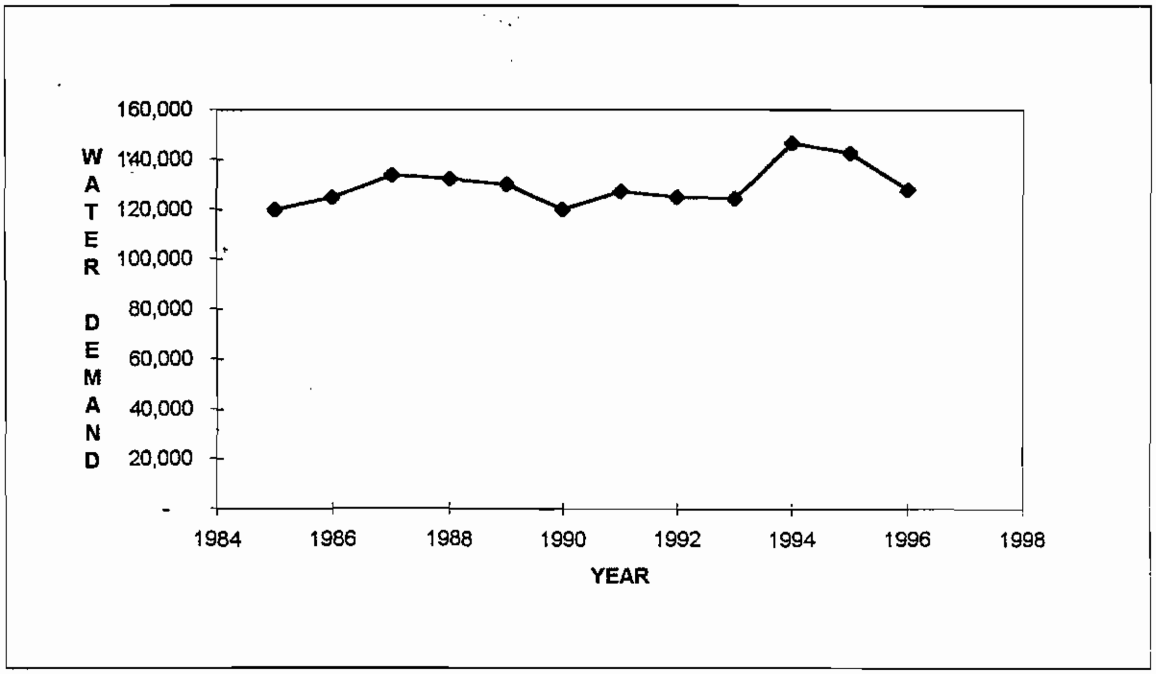


TABLE 4-2

ANNUAL WATER-YEAR CONSUMPTION FOR THE CITY OF VENETA (1990 - 1996)

Water Year	Total Annual Water Use (*1000) (KGAL)	ADD (gpd *1000) (KGAL)	Population (capita)	Capita Flow (gpcd)
1990-91	115,879	317	2,535	125
1991-92	130,219	357	2,595	137
1992-93	116,807	320	2,605	123
1993-94	146,695	402	2,660	151
1994-95	139,866	383	2,785	138
1995-96	129,460	355	2,845	125
				AVERAGE 133

* Excludes those not served by the water system.

TABLE 4-3

MAXIMUM MONTHLY TOTAL WATER CONSUMPTION (1990 - 1996)

Water Year	Month	Maximum Monthly Demand (gpm x 1000)	MMD/days per month (gpd x 1000)	MMD/ADD
1990-91	July	15,285	493	1.56
1991-92	August	16,947	547	1.53
1992-93	August	17,832	575	1.80
1993-94	July	24,036	775	1.90
1994-95	July	19,347	624	1.63
1995-96	July	17,865	576	1.61
				AVERAGE 1.70

TABLE 4-4

MAXIMUM DAY & PEAK HOUR WATER CONSUMPTION (1993 - 1996)

Water Year	Month	Maximum Daily Demand (gpd)	MDD/ADD	Peak Hour Demand (gpd)	PHD/ADD
1993 to 1994	July	974,000	2.4	1,948,000	4.8
1994 to 1995	July	856,000	2.2	1,712,000	4.5
1995 to 1996	July	911,000	2.6	1,822,000	5.1
			Average 2.4		**Average 4.8**

TABLE 4-5 SUMMARY OF CURRENT WATER DEMAND IN THE CITY OF VENETA			
DEMAND PARAMETER	**TOTALS (gpd)**	**PEAKING FACTORS**	**PER CAPITA (gpcd) ***
Average Day (ADD) gpd	357,000	-	138
Maximum Month (MMD) gpd	597,000	1.7	231
Maximum Day MDD	854,000	2.4	330
Peak Hour Demand (PHD)	1,708,000	4.8	661

* = Based on a population of 2,521 and includes only the population served.

4.6.2 Future Water Demand

An accurate estimate of future water demand allows for the economic sizing and phased installation of facilities and helps to establish a user charge system which encourages reasonable conservation of water and acceptable consumption rates. Analysis of future water demand also helps to determine the adequacy of existing facilities and the capacity of proposed improvements. Current water demand is identified and future demand estimated by applying a reasonable growth factor.

There is a degree of uncertainty associated with projecting future water demand because of estimates used to define the community's current water use and assumptions made about anticipated growth. The impact of water conservation measures on a community's future water consumption is also difficult to predict. Accordingly, the selection of future water demand parameters is based on engineering judgment which takes into consideration the above uncertainties and reasonable unforseen circumstances.

Future population and service water demand within the city for 1997 and the design years 2010, 2020 and 2050 are presented in Tables 4-6 and 4-7, respectively. The per capita values are assumed to be constant and do not include any reductions in use as a result of water conservation policies.

TABLE 4-6				FUTURE POPULATION & SERVICES
Year	1997	2010	2020	2050
Population	2,870	4,262	5,727	10,374
# of Services	872	1,330	1,788	3,238
Net Increase		458	916	2,379

TABLE 4-7				FUTURE WATER DEMAND (GPD)
YEAR	1990-1996	2010	2020	2050
Population		4,262	5,727	10,374
ADD (gpd)	357,000	588,000	791,000	1,433,000
MMD (gpd)	597,000	984,000	1,322,000	2,395,000
MDD (gpd)	854,000	1,408,000	1,893,000	3,428,000
PKHR (gpd)	1,708,000	2,817,000	3,786,000	6,857,000
ADD (gpm)	248	409	549	995
MDD (gpm)	593	978	1,310	2,380
PKHR (gpm)	1,200	2,000	2,600	4,800

Rounded numbers.

4.7 WATER CONSERVATION

Water conservation or the lack of conservation can have significant impact on the long range water supply plan. As the demand for water increases and the availability of supply decreases, conservation may be a viable option available to meet long-term resource needs. Implementation of appropriate water conservation measures can result in the following benefits.

- Avoid, postpone or reduce capital costs associated with new facilities.
- Reduce ongoing operation and maintenance costs and requirements.
- Provide for increased distribution and transmission system efficiency.
- Decreased hydraulic load to the wastewater treatment facilities.

State regulations require, in conjunction with the city well #9 water rights permit, that the city review feasible and appropriate water conservation. The city does not currently have a water conservation plan.

State water conservation plans must include an assessment of both water conservation and water curtailment strategies. Water conservation measures and water curtailment are reviewed in Appendix F.

4.8 DESIGN LIFE AND PLANNING PERIOD

This segment establishes preliminary design criteria for water system components based on the capacity and sizing criteria developed in Section 4.6 and water demand projections. Design criteria over the next 50 years are examined.

4.8.1 Design Life

The design life of a water system component is sometimes referred to as its useful life. The selection of a design life is a matter of judgment based on the facility and intensity of use, type and quality of materials used in construction, and the quality of workmanship. The estimated and actual design life for any particular component may vary depending on the above factors.

The establishment of a design life provides a realistic projection of service upon which to base an economic analysis of new capital improvements. The design life of each water system component is discussed more fully below.

4.8.2 Planning Period

The planning period is a time frame, beginning at the present time and extending to the future, during which the recommended water system is expected to provide sufficient capacity to meet the needs of all anticipated users. The required system capacity is based on population, water demand projections, and land-use considerations.

The planning period is determined by the ability and/or desire of a community to finance improvements. The selected planning period must have a sufficiently short duration for the current users to derive the benefits of a water project and long enough to provide reserve capacity for future growth and water demand. A planning period of 20 years has been selected. Additional projections for population growth and water demand will also be made for 10 and 50-year periods to satisfy the short and long-range supply requirements contained in the rules on municipal water planning. The base for all of these planning periods will be year 2000.

The planning period for a water system and design life for its components may not be identical. For example, a properly maintained steel reservoir may have a design life of 60 years, but its size is determined by the projected fire flow and water consumption demand for a planning period of 20 years. At the end of the initial 20-year planning period, the water demand may be such that an additional reservoir is required. However, the existing reservoir, with a design life of 60 years, would still be useful and remain in service for another 40 years.

4.9 DESIGN LIFE AND CAPACITY/SIZING CRITERIA

Each component of a water system must have sufficient capacity to meet the water demand during the planning period and, optimally, over its design life. The design life and capacity sizing requirements for the water system components are given below.

4.9.1 Source

Ideally, the water source(s) must be capable of meeting the maximum system demand on a daily basis far into the future and require minimal treatment. Also, the source(s) should provide for increased water demand over time to accommodate community growth. Selecting a water source which meets these criteria must be balanced with the investment required for development.

The water source planning should provide for sufficient water to meet the city's MDD for 50 years. In addition, the source must be capable of offering supply continuity for the maximum month demand (MMD). Based on population projections given in Section 4.6.2, the MMD is estimated to be 3,428,000 gpd in the year 2050.

4.9.2 Intake/Pumping Facilities

Intake piping and wet wells are not easily expanded and should be sized to meet the anticipated maximum daily demand well into the future. A design life of 50 years for such facilities is common.

Pumps and associated equipment can be expected to last no more than 20 years before extensive maintenance or replacement is necessary. Commonly, two pumps are installed in a pumping station, each having a capacity equal to the current maximum daily demand or the capacity of the water treatment plant. Typically, the pumps alternate after each cycle. As demand increases, both pumps can be used to meet the increased water use.

4.9.3 Water Treatment Facilities

Major structures and buildings should have a design life of about 50 years. Treatment facilities are commonly designed for a 20-year demand period because such facilities can be expanded. Process equipment would initially operate part-time to meet the average daily demand. In the future, the treatment plant would operate on a full-time basis to meet the expected higher demand.

4.9.4 Storage Reservoirs

Distribution storage reservoirs should have a design life of 60 years (steel construction) to 80 years (concrete construction). The actual reservoir life will depend on the quality of the materials and workmanship during the original installation, as well as the quality of maintenance. Several practices, such as the use of cathodic protection, regular maintenance and frequent painting can extend or ensure the design life of steel reservoirs.

4.9.5 Water Main and Appurtenances

Water distribution mains should have a design life of 40 to 60 years. The mains are typically sized for fire flow and 20-year population demand, or fire flow and saturation development demand. The mains should be at least 8 inches in diameter to ensure fire flow capacity. All pipelines should be large enough to sustain the state of Oregon required minimum pressure of 20 psi at all service connections.

Water transmission mains should have a useful life similar to distribution mains. Sizing of these mains should, however, be based on a 50 to 60 year planning period, especially if the mains are long and cannot be economically paralleled in the future. Generally, transmission mains should be sized for peak fire flows plus average daily demand.

The city has experienced isolated pipe failure problems. Most of these pipe failures have been due to construction activity close to or involving the city's old AC water mains but other incidents have involved PVC pipe failure, poor tapping success on PVC pipe and problems with fittings. For these reasons, and because the city is projecting a water distribution grid to service the city for up to 50 years, it is recommended that the pipe material of choice for the city should be ductile iron pipe (DIP). DIP has an exemplary history of performance (in some locations over 100 years), greater interior diameter, requires less care during installation and is far less suspectable to damage. These factors coupled with less stringent trenching and backfilling requirements generally offset the greater front end cost of DIP. DIP will be the pipe material used for Veneta's water supply needs. Use of a single pipe material assures compatible fittings, assists with pipe material inventory management, and helps operators maintain the system.

In addition to the above criteria, the following guidelines are recommended for the design of water distribution systems:

Six-inch diameter lines (6") - Only acceptable in densely looped, well interlaced systems and short cul-de-sacs of less than 200 feet.

Eight-inch diameter lines (8") - Minimum size for permanently dead-ended mains supplying fire hydrants and for minor trunk mains. Required where systems grid length is more than 300 feet. City minimum pipe diameter unless approved by engineer.

Twelve-inch diameter and larger (12" & up) - As required for trunk (feeder) mains.

The distribution system lateral mains should be looped whenever possible. A lateral main is defined as a main not exceeding eight inches in diameter that is installed to provide water service and fire protection for a local area including the immediately adjacent property. The normal size of lateral mains for single-family residential, commercial, industrial and multiple family areas is eight inches in diameter.

The installation of dead-end mains and single mains that serve relatively large areas should be avoided. Furthermore, an eight-inch main should be used as a minimum when placing a hydrant on a permanently ended pipe run. An exception to these rules applies to six-inch mains that are used to supply internal building fire protection. Mains with this designated use cannot exceed 500 feet.

4.9.6 Water Treatment Plant (WTP)

The water treatment facilities should have a nominal capacity of 1.7 mgd to meet the 20-year MDD. Consideration should be given to the expansion of the plant after 20 years.

4.9.7 Pumps

The distribution pumps should have sufficient capacity to deliver the MDD flow of 1.7 mgd over a 20-year design period.

4.9.8 Water Reservoirs

Reservoirs are designed to provide equalizing storage, emergency storage and fire reserve storage. These design criteria are used to ensure proper reservoir capacity. Each is discussed below with volume requirements shown in Table 4-8.

Equalizing storage is used to meet immediate fluctuations of the supply and demand in the water system over a 24 hour period. Equalizing storage will generally require 25 percent of the maximum daily demand of the water system.

Emergency storage is required to protect against a total loss of water supply which, for example, could occur as a result of a broken water main, electrical outage, treatment plant breakdown or source contamination. At a minimum, emergency storage should be equal to one maximum day of demand. This storage quantity is based on the assumption that a supply disruption will occur on a day of maximum demand and be corrected within 24 hours.

Fire reserve storage is needed to supply fire flow throughout the water system to confine a major fire. The fire reserve storage is based on the maximum flow and duration of flow required to confine a major fire. The guidelines published in "Fire Suppression Rating Schedule" by the Insurance Services Office (ISO) are typically used to determine the required fire flow and fire reserve storage. Generally, fire flows of 1000 gpm are sufficient for one or two family dwellings not exceeding two stories in height.

Commercial, industrial and institutional buildings require higher flows. Determination of these flows are unique to each building and involve detailed surveys of construction (type and area), occupancy (combustibility), exposure (construction type, distance, length/height of wall) and communications (openings). Fire flow was determined for the building with the highest requirement for fire protection, namely the Fern Ridge Center. The center would require 4750 gpm for four hours. Storage requirements for other planning targets are given in Table 4-8.

The ISO also classifies a city's fire protection capabilities on a numerical basis, called the Public Protection Classification. This classification is used within the insurance industry for various purposes. The Public Protection Classification is determined from a complex analysis of the city's capabilities to receive and handle fire alarms, of the strength of the fire department and of the adequacy of the water supply system. Analysis of the water supply system is further divided into equal parts of: 1) supply capabilities, 2) hydrant size, type, and installation and 3) inspection and condition of hydrants.

Sufficient storage capacity is sometimes considered that storage capacity equal to three days of average daily demand, or 1.5 days of maximum daily demand or a combination of fire reserve, equalizing storage, and emergency reserve.

TABLE 4-8

WATER STORAGE REQUIREMENTS FOR THE CITY OF VENETA

YEAR	1997	2010	2020	2050
EQUALIZING (gal.)	213,500	352,000	473,000	857,000
EMERGENCY (gal.)	854,000	1,408,000	1,893,000	3,428,000
FIRE (gal.)	1,140,000	1,140,000	1,140,000	1,140,000
TOTAL	2,207,500	2,900,000	3,506,000	5,425,000

For 1997, Table 4-8 indicates that existing storage provide for the sum of equalizing, emergency storage and fire flow. However, it is located at the public works operation yard and must be pumped to distribution. Future requirements for 2020 indicate a net storage need of 1 MG. Because so much of the city's storage is located at the treatment yard we believe any additional storage should be elevated.

Another important design parameter for reservoirs is elevation. Distribution reservoirs should be located at an elevation which maintains adequate water pressure throughout the system, sufficient water pressures at high elevations, and reasonable pressures at lower elevations. The pressure range in the system should stay within the range of 35 to 80 psi.

4.10 REGULATORY ENVIRONMENT

The Oregon Health Division establishes health regulations which affect municipal water systems. In addition the Oregon Department of Water Resources and the Oregon Department of Environmental Quality have regulations which affect system operations. This sub-section reviews the various applicable regulations as they pertain to Veneta. Appendix G includes the Oregon drinking water quality standards and results of water quality testing. Appendix F reviews ODWR requirements.

4.10.1 Water Quality Regulations

Water quality is monitored by the city on a regular basis. Bacterial analysis reports the presence or absence of total coliforms, fecal coliforms and E. coli. Microbiological water testing is completed semi-weekly. For the past five years, coliforms have not been detected in the water system. Appendix D includes the results of sampling analysis completed in March of 1997 for well 4. Contaminants that were detected and their allowable levels are presented.

As seen in the Appendix D, each contaminant that was detected is below the allowable maximum. Appendix G provides a summary of water quality standards. Veneta's treated water is of excellent quality.

4.10.2 Department of Water Resources - Municipal Water Management Plans

The Oregon Water Resources Department has drafted rules (September 1994) which govern municipal water management planning (OAR 690, Division 86). The rules cover public and private water suppliers and require municipalities to provide the Department with the following:

- Description of the system (See Section 3).
- Water curtailment plan.
- Water conservation plan.
- Long-range water supply plan.

A summary of the requirements specified in the municipal water management plan is provided in Appendix F. The city's water curtailment water conservation and long-range water supply plan is provided as a part of the recommended plan.

Section 5
ALTERNATIVES

5.1 GENERAL

This section identifies various alternatives and compares each for resolution of identified deficiencies. Alternatives were identified and examined to address the following components:

- Source of supply - quality reliability, conservation elements.
- Treatment requirements.
- Storage - existing structures, locations, and materials.
- Water mains - routing and sizing.
- System control.

The procedure used in evaluating alternatives consisted of the following steps:

- Identification of alternatives.
- Screening out of non-viable alternatives.
- Detailed analysis of the most viable alternatives.
- Comparison of alternatives.
- Selection of cost-effective and environmentally acceptable alternatives.

Many factors must be considered in the evaluation and comparison of alternatives. The primary consideration is capital improvement cost and on-going operation and maintenance (O&M) cost. Sometimes a higher first-cost alternative may be the most cost-effective over the life of a system if anticipated operating cost is lower over time. Accordingly, alternatives should be evaluated over the life of the facility, taking into account the value of both capital and O&M costs.

Affordability is another factor which must be considered. A facility or improvement which has a cost which exceeds the available budget is considered to be a nonviable option. Non-cost factors to be considered include ease of implementation, risk, political acceptability, and environmental impact.

5.2 WATER SOURCES

Another water source must be developed for Veneta. The maximum day demand for the year 2020 is predicted to be 1.8 million gallons, almost twice that of the current maximum day demand. In the near term, the additional water source will provide backup in the event of well or mechanical failure. During the summer season, both well sources (wells 4 & 9) are required to meet water demand. Should one fail, Veneta would not be able to maintain water service.

The following water source options are considered:

- Fern Ridge Reservoir
- Long Tom River
- Eugene Water & Electric Board
- Water Conservation
- Well Development

5.2.1 Fern Ridge Reservoir

Fern Ridge Reservoir is operated by the U.S. Army Corps of Engineers as a flood control basin. Municipal water supply is not an approved activity connected to this body of water. The quality of this water is poor due to high summer water temperatures combined with nutrient rich influents from local feeder streams. This type of water can be very difficult to treat and the product water often contains undesirable taste or odors.

The cost to develop the Fern Ridge Reservoir as a source of water is relatively high. As indicated in the 1979 water master plan, the cost to develop the necessary treatment and transmission facility would be 2.9 million dollars (1979 dollars). The equivalent cost today would be approximately 4.6 million dollars assuming 3% inflation per year for 20 years.

In light of the high cost, reservoir management practices and poor quality of the Fern Ridge Reservoir, it is not considered to be a viable option for source water development.

5.2.2 Long Tom River

The Long Tom River is also a poor quality source of water and experiences low flows during the period of highest demand for the city. Flows in 1977 averaged less than 1.0 million gallons per day (1.55 cubic feet per second) for 21 consecutive days. To meet future maximum day demand for the city, a 1.0 cubic feet per second source must be developed. This implies that during periods of severely low river flows, Veneta would require 65% of the water available in the river. Some water is required to sustain life in the river and existing water rights upstream could easily leave water unavailable for Veneta during low flow conditions. The Long Tom River is not a viable water source.

5.2.3 Eugene Water & Electric Board (EWEB)

Conversations with EWEB engineering personnel have indicated that maximum day water demand for the City of Eugene is very near the maximum day production capability of their water treatment facilities. This means that water may not be available for sale from EWEB when Veneta's water demand is at its peak; this would be especially true in the event of hot weather lasting for several consecutive days.

EWEB is currently developing their master plan and the agency does plan to expand their treatment facilities. If Veneta were to enter into a contractual relationship with EWEB for water service, EWEB could expand to provide service. EWEB would assess service development charges to build the necessary infrastructure to meet Veneta's water demand. SDC charges have been estimated at $3.5 million dollars.

The cost to provide water from EWEB is another major factor when considering this option. This project would require approximately 10 miles of pipe, a master meter and vault, a booster pump station and control system to transfer the water to Veneta from Eugene's most westerly appropriately-sized water main. A cost estimate for this project is tabulated below:

Piping (16" DI, Trenching, Backfill @ $62.00/ft)	$ 3,274,000
Valves/Fittings ($1.50/ft)	79,000
Asphalt ($42.00/ton)	42,000
Traffic Control ($1000.00/day; 400 ft/day prod.)	132,000
Pump Station (Building, Property & Equip.)	250,000
Master Meter (Vault, Meter & Land)	35,000
Total:	$ 3,812,000
Contingencies (20%):	762,000
Engineering, legal & Inspection (20%):	762,000
Total Estimated Project Construction Cost:	$ 5,336,000
System Development Charges	3,500,000
Total Cost to Veneta	$ 8.8 Million

Clearly this option would be far too costly to pursue.

5.2.4 Water Conservation

While a water conservation can be instrumental in helping to manage resources, conservation is not recommended as an alternate to source development since the city has an immediate need to secure a reliable source to ensure water service in the event of failure of either of the existing wells. In addition, conservation, as a water supply alternative, would require a considerable period of data acquisition followed by implementation to ensure reliability.

5.2.5 Well Development

The city currently has water rights to 722 gpm or 1.15 mgd; this is 760,000 gallons shy of the 1.8 mgd required to meet Veneta's year 2020 water demand. This is equivalent to a well which can produce 448 gpm, similar to that of well 9. Note that Veneta currently has sufficient water supply to meet estimated maximum day use until the year 2001.

OHD regulations and prudent utility management requires that a water service utility be capable of providing uninterrupted service during the maximum daily demand with the most productive source out of service. For Veneta this would mean well 9 out of service. Sometimes a standard of meeting peak demand conditions for three days is considered adequate. However, most engineers prefer to plan for full supply redundancy from a second source in order to assure reliable service following a catastrophic event such as well failure, water quality deterioration or sabotage. Given these standards of service Veneta is in immediate need for a new supply source. The source should supply a minimum of 450 gpm to meet immediate service and redundancy requirements.

Based on the future water demand requirements shown in Table 4-7 the city will require a fourth water supply well capable of providing 350 gpm by year 2010 and a fifth reliable supply well capable of proving 350 gpm in year 2020.

The cost to develop a well for Veneta is outlined in Table 5-1. These estimates reflect the cost of well development, building, equipment installation, electrical service, site development, the land required to build the facility, and piping.

TABLE 5-1

WELL DEVELOPMENT COSTS

# OF WELLS	1	2	3	4
Production	500 gpm	250 gpm	125 gpm	<100 gpm
Well	30,000	60,000	90,000	120,000
Building & Equipment	56,000	107,000	151,000	197,000
Piping	109,000	208,000	313,000	418,000
Total	195,000	375,000	554,000	735,000
Contingency	38,000	75,000	111,000	147,000
Engineering	38,000	75,000	111,000	147,000
TOTAL SUM	$271,000	$525,000	$776,000	$1,029,000

1x271K 2x262K 3x259K 4x257K

Table 5-1 shows the costs of development in proportion to how successful each well is in terms of the water it ultimately produces; i.e., if one well is developed that produces 500 gpm then its cost of development is $271,000. This would serve immediate needs. If two wells were required, each with a capacity of 250 gpm, then the cost to develop these wells would be $525,000, etc. The fourth column in Table 5-1 is a case where well drilling efforts located aquifers or sources of supply at less than 100 gpm per source. This would require as many as four wells to meet current supply requirements and another three wells by year 2010 and yet another three by the end of the planning period. Total well supply costs over the life of the plan could sum to over 2.5 million dollars.

5.3 IRON AND MANGANESE TREATMENT ALTERNATIVES

Iron and manganese are two of the most common contaminates found in drinking water supplies. These metals in drinking water present an aesthetic problem not a health problem. Iron and manganese are objectionable because they impart a brownish color to laundered goods and plumbing fixtures and affect the taste of beverages such as tea and coffee.

Experience has shown that some consumers find water objectionable when iron is present in amounts greater than 0.2 mg/L and when manganese is present in amounts greater than 0.1 mg/L. The 1981 National Secondary Drinking Water Regulations which recognizes aesthetic qualities of drinking water established standards for iron and manganese in drinking water. The secondary maximum contaminant levels (SMCL) for iron and manganese are set at 0.3 mg/L for iron and 0.05 mg/L for manganese. Given the water quality history of Veneta, it is likely that a new well water source would have raw water with unacceptable concentrations of iron or manganese. Use of wells as a source will require treatment.

5.3.1 *Alternatives Considered*

This section reviews treatment alternatives for the removal of iron and manganese in the water supply. Advantages and disadvantages of various alternatives are presented.

5.3.2 *Iron and Manganese Treatment Alternatives*

Aeration, Detention and Filtration: Aeration is a necessary first step in the removal of iron from drinking water. Aeration results in the rapid adsorption of oxygen from the atmosphere and releases carbon dioxide which promotes the precipitation of iron.

In operation, well water is pumped through an aerator where iron and manganese are oxidized by oxygen. Oxygen is introduced into the aerator by a blower. The oxygen flows upward, contacting the thin films of water flowing downward over a series of staggered trays. Following the aerator, a detention basin is used to provide time for reaction. Whether the water is acidic or alkali (pH) has a direct bearing on the detention time required. Detention time can vary from 1 minute to 1 hour. After detention, a pressure filter is used to remove suspended solids in the water. Water is pumped through the filter under relatively high pressures eliminating the need for additional pumping facilities.

Advantages	Disadvantages
► Low capital costs.	► May be difficult to operate because of complex reaction factors.
► Commonly used method.	► Not effective on removal of manganese.
► Pilot studies are recommended but generally not required.	► Requires consistent monitoring.
	► Performance improves with presence of alkalinity but Veneta waters have low alkalinity.

Manganese Greensand Zeolite Filter System: The mechanism for iron and manganese removal in this process is oxidation by the addition of potassium permanganate followed by physical removal of the resulting precipitates by filtration through a manganese greensand and anthracite dual media bed.

Potassium permanganate is fed to the source water by a chemical feed unit linked with well controls. The point of chemical application should be as close as possible to the well to allow greater contact time. Iron and manganese are oxidized in the pipe line prior to the manganese greensand filter. The oxidation products and precipitates are removed in the greensand filter primarily in the upper layer of anthracite. Since chemicals are fed on an average demand basis, when overfed the potassium permanganate is absorbed on the manganese greensand After either a predetermined number of gallons or when the headloss reaches a preset level, the bed must be backwashed to remove the filtered particles. In addition, an air wash is generally required to minimize the formation of mud balls and channeling by maintaining the filter in a loose, clean condition.

<u>Advantages</u>

- Reliability, flexibility and ease of operation.
- Minimum detention time required.
- Continuous regeneration during service.
- Provides pressure air saturator with single pump.
- Less backwash water used compared to other processes.

<u>Disadvantages</u>

- Limited to small systems because of greensand's small effective size.
- Manganese greensand zeolite is currently produced by only one manufacturer.
- Detailed information lacking on existing systems.
- Beds can clog rapidly with high iron concentrations.

<u>Chlorination and Filtration:</u> This is Veneta's current system for iron removal. Well water containing iron and manganese is oxidized by the automatic addition of chorine. Manganese is also precipitated by chlorination but is more sensitive to the amount of acid in the water. This process provides a free chlorine residual, which is the excess or unreacted portion of the applied chlorine, to the water distribution system. A catalyst is sometimes introduced to accelerate the reaction and condition the water for filtration. The iron and manganese in their hydroxide forms are then collected by filtration. The filter is cleaned by reversing the flow using processed water.

Advantages	Disadvantages
► Simple to operate.	► Potential formation of chlorinated organic compounds.
► Low capital and operational costs.	► May require longer contact times due to presence of insoluble material.
► Minimal maintenance requirements.	► Sludge may be retained in the delivery pipe.
► Compact system.	
► Highly efficient.	
► Commonly used method with good track record.	
► Veneta operators are familiar with procedure.	

Initial costs for installation of iron and manganese treatment is generally lower than cost associated with the aeration, detention and filtration option discussed previously. However, use of this technology would require complete refit of all treatment facilities as well as implementing changes in operations. For these reasons, the selected treatment regime for iron and manganese removal should remain as the current practice of using chlorination followed by filtration.

The cost of a chlorination/filtration facility is dependent on the flow rate and the concentrations of iron and manganese present in the raw water. Of course, without water quality data on future wells, it is impossible to accurately determine facility costs. For purposes of the analysis, we have assumed that future well development will produce water of similar quality to well #9. The cost table shown as Table 5-2 was generated for such a facility.

The estimated costs for treatment will be dependent upon the location and size of the well water source placed into the system. Table 5-2 estimates facility requirements for a single facility to serve one well. A large, centrally located plant installed at the existing water plant location to serve the MMD is estimated to cost $524,000. The existing plant could be replaced at an estimated construction cost of $260,000 and serve one well. For satisfactory service, a third iron removal plant will need to be installed in year 2010.

Table 5-2

TABLE 5.2: Evaluation of Probable Costs - Iron Removal Facility

Chlorination and Filtration

PRODUCT DESCRIPTION	# of Units	Unit Type	COST Cost /Unit	Total Cost
pH Adjustment	1	EA	$4,000	$4,000
Inline mixer	1	EA	$7,000	$7,000
Chlorination	1	EA	$15,300	$15,300
Contact vessel	2	EA	$9,200	$18,400
Filter	3	EA	$18,000	$54,000
Installation of equipment	1	EA	$16,000	$16,000
Backwash Tank	1	EA	$15,000	$15,000
Fittings/valves	1	EA	$9,000	$9,000
Connection to system	100	L.F.	$70	$7,000
Controls/Telemetry	1	EA	$7,500	$7,500
Electrical Service	1	EA	$5,400	$5,400
Residuals Management	1	EA	$18,400	$18,400
Disinfection Monitoring	1	EA	$6,600	$6,600
Structure	1000	S.F.	$60	$60,000
Site Development	6000	S.F.	$2.4	$14,400
Land	6000	S.F.	$2.3	$13,506
SUBTOTAL ESTIMATED COSTS				$271,510
Engineering			0.20	$54,302
Contingency			0.20	$54,302
TOTAL COST				$380,114
			Rounded Costs	**$380,000**

5.4 DISTRIBUTION SYSTEM

Potential improvements to the Veneta distribution system include installation of new water mains, removal of undersized piping, and installation of a high-level water system piping including an upper level reservoir. These improvements are shown in Figure 6-1 & Figure 6-2 provided in the back jacket of this report. The following discussion outlines these projects. The improvements listed resolve the deficiencies outlined in Section 3.8.3.

5.4.1 Water Main Improvements

Piping Improvements needed to address the existing fire flow deficiencies are described below.

> *Houston Road and Jeans Road.* Install 12" transmission main loop. This piping will increase fire flow rates on Hunter Road to the required level of 1,000 gpm.
>
> *8TH and Westlane Center:* Install 12" transmission main. This piping alignment will also form a loop and provide water service to existing commercial property. The installation of the Houston and Jeans Road and 8th and Westlane Loop helps assure reliable service to the area north of the railroad and Highway 126.
>
> *Pine Street and Hunter Road:* Install a 12" transmission main. This piping alignment also forms a loop and would be the first leg to support development of the area south and east of Hunter and Territorial Highway, respectively. This area is scheduled in the wastewater facility plan for improved sanitary service and the water improvements are needed to support other infrastructure needs.
>
> *Woodland Avenue and Territorial Highway:* Install a loop to enhance fire flows on Woodland above the required level of 1,000 gpm.
>
> *Blek Drive:* Provide a looped connection from Territorial Highway to the north end of Blek. This improvement is scheduled in association with development plans in this area.
>
> *Territorial Highway and Territorial Court:* Install an 8" distribution main. This piping alignment would form a loop to enhance fire flows on Territorial Court to above 1,000 gpm.
>
> *High-Level Reservoir Piping System:* Install 8" and 12" piping. These pipeline improvements would provide service to the elevated regions of Bolton Hill and define the high-system service boundary. Piping replacement on the south end of 10th Street and Forest Court Street and installation of individual pressure reducing devices on existing service meters would be required to ensure the reliability of this upper system.

The effect of the pipe modifications on fire flows are provided in Table 5-3. Fire flow capacity is increased an average of 60% by adding these pipes. Table 5-3 reflects fire flow testing conditions which allow residual pressure to drop to 20 psi at the test hydrant. The model predicts minimum flow based on maintaining 20 psi everywhere in the water system. Hydrant 29, which is located at the intersection of Forest Court & 10th Street, is the worst case shown. This model predicts that a fire flow test at this location of approximately 500 gpm draws the pressure in the water system below 20 psi. To maintain 20 psi at these higher elevations a new reservoir is required at a higher location than the existing 0.5 MG reservoir. In turn, this requires the creation of high and low level water system pressure zones.

TABLE 5-3 SUMMARY OF FIRE FLOWS WITH INITIAL SYSTEM IMPROVEMENTS

Hydrant No./Node	Field Tested Flow (gpm)	Residual Pressure at the Hydrant	Cybernet Model Result (gpm)	Minimum Water System Residual Pressure (psi) (in the system)
21/365	920	30	1,463	20
29/529 **	750	20	487	20
52/231	860	26	1,418	20
53/233	820	24	1,395	20
54/235	750	20	1,460	20
55/237	750	20	1,460	20
65/767	980	34	1,168	20
69/763	860	26	929	20

* Based on 1997 ADD.
** The model predicts performance with pumps off. Field tests apparently had pumps on.

The model predicts locations in the water system that do not produce hydrant flows of 1,000 gpm. Hydrant 69, located at the end of Blek Drive is fed from a long run of 6-inch pipe and was modeled for continuance of 6-inch pipe. While the fire flow at this location is improved by the 6-inch piping modifications, it still will not reach 1,000 gpm. An 8-inch piping connection between Blek Drive and Territorial Highway is therefore required.

5.4.2 Future Demand Effects

The effects of future demand on the existing system including the piping and upper service modifications outlined above and the future high-level system are shown in Table 5-4. The high-level system refers to those services connected to the new reservoir. All other services are considered to be "low".

The future system was modeled in the year 2010 to have high and low level service zones and piping improvements referred to earlier. By 2020, a second low level reservoir and a second upper level reservoir will likely be required. The hydrants shown were selected to represent the different service regions across the city. The table shows performance for average day demand conditions only. Additional fire flow analysis is included in Appendix C.

The model results indicate that, when year 2020 average day demand is applied to existing piping conditions with the scheduled piping improvements (no high-level system), fire flows remain over 1,000 gpm throughout most of the city. However, the effects of this increased demand on higher elevations clearly indicates that adding the piping modifications alone does not improve fire flows at high elevations. Fire flows are dramatically improved only when higher elevation hydrants are fed from a high-level reservoir.

Both scenarios with high level systems were modeled with a pressure regulating valve (PRV) separating the zones. The PRV acts to provide water from the high reservoir to the low water system in the event of fire or extremely high demand. The PRV is not intended to deliver water to the lower level system during periods of normal service.

TABLE 5-4			FUTURE DEMAND/HIGH LEVEL SYSTEM EFFECTS		
Hydrant /Node	**Location**	**1997 Fire Flow new piping (gpm)**	**2020 Fire Flow new piping only (gpm)**	**2010 Fire Flow w/high level system & new piping (gpm)**	**2020 Fire Flow w/high level system & new piping (gpm)**
54/235	East end on Hunter	1,460	1,181	1,635	3,340
35/149	Jeans Rd. & Todd Way	1,460	1,181	2,782	4,738
4/301	W. Broadway & 5th	1,456	1,178	2,959	3,982
8/321	7th & Dunham	1,454	1,176	3,793	6,000
62/751	Oak Island & Cherry St.	1,461	1,182	1,675	2,157
23/393	8th & Bolton Hill Rd.	1,584	1,295	3,667	4,700
29/529	10th & Forest Ct.	487	431	2,020	2,037

5.4.3 Storage

Supplemental storage is recommended to increase the volume of available water to the 2020 level of 3.5 MG. This is equivalent to a one million gallon reservoir given that the city has an existing reservoir capacity of 2.5 MG. The high level reservoir is key to the operation and proper performance of the upper level distribution piping.

5.4.4 High-Level Reservoir Effects on System Performance

As seen in Table 5-4, fire-flows are significantly enhanced when fed from a high-level reservoir system. Fire flows for years 2010 and 2020 show an increase of over 2 to 4 times, while system pressure is maintained at 20 psi. These increases are, in part, due to the PRV which connects the upper and lower service zones. Some individual service meters will require separate PRV's in the high system when boundaries are set for high and low level service.

5.4.5 Site Selection for a Future Reservoir

The site selection for a distribution reservoir is based on the factors discussed below.

Elevation: There generally exists a preferred elevation for a reservoir which will provide acceptable pressure to customers located within the widest range of elevations. If the reservoir is located too high, pressures in the lowest elevations may be excessive. If the reservoir is too low, there may be insufficient pressure to serve customers at the higher elevations or additional cost must be incurred to provide a higher level reservoir.

As a general guideline, the following constraints apply to high and low-level reservoirs:

1. Static pressure at the lowest elevation should not exceed 100-105 psi when the reservoir water surface is at its upper operating level.

2. Pressure at the highest service elevation should not be less than 20 psi when the water surface is at its lower level.

In some cases the elevation differential within the service area cannot meet both constraints. Also, limited availability of sites often prevents the optimum placement and installation of storage facilities. Pressure boosting systems or pressure reducing devices are often necessary to provide service to some customers.

Topography: The optimum site is flat or gently sloping. Sites with steep topography require extensive earthwork, may have geotechnical limitations and higher cost. Generally, the site should accommodate the reservoir and a perimeter access road. Locating tanks on cut/fill sections can result in differential settlement and is not an accepted practice.

Proximity to Other Land Uses: Locating a reservoir close to other types of land use, including residential areas, is considered acceptable. Coating color, reservoir height, and landscaping are all considerations for sites within residential areas.

Access: The tank site must be accessible by road. Generally, this provision favors sites where nearby road access already exists.

Security: Tank site must be fenced. Locating the tank adjacent to a water plant or other frequently visited sites will ensure better security.

5.4.6 Reservoir Material

Reservoirs for water storage are usually constructed with one of the following materials:

- Concrete - poured in place or pre-stressed.

- Steel - structural steel, welded or bolted.

A general comparison of these two material alternatives, in terms of maintenance, site location, useful life, and cost are discussed below.

Maintenance: Steel tanks usually require more maintenance than concrete tanks. Steel reservoirs require interior and exterior coating on all surfaces. Many engineers specify some form of cathodic protection to further control corrosion. Painting of concrete tanks is not mandatory, although it may be desirable to paint the exterior for aesthetic reasons. Steel and concrete tanks should be drained for removal of any accumulated solids every five years. Steel tanks require comprehensive inspection for corrosion every five years.

Site Location: Concrete reservoirs are advantageous when the terrain dictates back filling or partial back filling of the reservoir site. Steel tanks cannot be partially or completely buried since it is not possible to access buried portions for maintenance. Consequently, additional site work is required to construct a steel tank on a site with sloping terrain.

Concrete tanks are heavier and apply greater loads to the underlying soil. Steel tanks apply a lesser load, have greater flexibility to resist differential settlement, and require less foundation.

Useful Life: Concrete tanks generally have a longer service life than steel tanks (80 years vs. 60 years). The actual life is dependent upon the quality of materials and workmanship during the installation, and the maintenance schedule. Concrete tanks are less affected by unfavorable weather during construction.

Cost: The cost for any reservoir is dependent upon the size, foundation conditions, and construction climate. The cost of materials and tank erection for steel reservoirs is generally less than that for comparable concrete structures.

Recommendation: Generally, system hydraulics and waterline costs can be minimized by using a site close to the areas intended for service. Since this reservoir is to be part of the high-level water system, a realistic location is at or near the 720 foot elevation on Bolton Hill. To meet the city's water storage requirements for the next 20 years, the new reservoir should be sized at a nominal capacity of one million gallons. Additional equipment required to put high-level water service in place includes a pump station and pressure regulating valve (PRV) units. The pump station would be located near the existing 0.5 MG reservoir, the PRV would be located in a vault which has been installed in conjunction with the Sherwood Forest Subdivision development near Parkside and Ninth. Site maps containing these existing elements of the water system design are included in Figure 6-1 & Figure 6-2 provided in the back jacket of this report. Because of the long service life and minimal coating requirements, we generally recommend concrete reservoirs where the capital is available.

5.4.7 Evaluation of Existing Reservoirs

The existing 500,000 gallon reservoir on Bolton Hill requires exterior re-coating. Cost estimates for this routine maintenance are outlined in Section 6.

A detailed interior and exterior examination of both reservoirs should be conducted in budget year 2000.

5.5 SYSTEM CONTROL

The existing control system relies heavily on manual operation, requires extensive labor for routine maintenance, and fails to provide the type and level of information required for an increasingly complex water system. The city has two alternatives relative to continued control. It can continue to rely on mostly manual and "hands on" management or incorporate into the facilities a Supervisory Control and Data Acquisition (SCADA) System.

The current trend for water system management is to use SCADA systems to monitor and control water system operations. SCADA systems typically bring all of the available information on current operations into a central station or computer. The operator can then go to the computer to receive information on current operating parameters and make adjustments in the controls as required. Information is delivered to the control computer either by conventional telephone lines, dedicated telephone lines, or a radio signal.

SCADA systems offer many advantages to the more hands-on type of control and management currently used at Veneta. Depending on the level of sophistication, the SCADA system can automatically monitor well flow rates, well performance, treatment operations, distribution pump performance, tank levels, system pressure and other less critical operation parameters.

The installation and efficient use of a SCADA control system provides for up to the minute operator knowledge of system operation, quick response to alarm conditions, and can be a management tool to reduce overtime and monitoring requirements.

Section 6
IMPROVEMENT PLAN

6.1 PLAN SELECTION

The proposed Water System Improvement Plan for the City of Veneta is presented in Figure 6-1 and 6-2 and is outlined in Table 6-1. A more detailed description of the plan elements is provided below. The improvements recommended in the plan address the city's projected water demand for 20 years. Estimates of the capital cost and operation and maintenance expenses for the recommended improvements are also discussed. The plan requires city action in 1999, 2000, and 2010.

6.1.1 Source

To resolve the issue of source and ensure adequate water supply over the life of this plan, a four way approach is recommended. The approach includes (1) evaluation of source location, (2) acquiring the source, (3) protection of existing and future sources, and (4) implementation of a water conservation program to reduce the peak demand.

1. Geologic Assessment: A well source investigation program is recommended for immediate implementation. The program would consist of employing the services of a professional geologist to review the well history in the city and to recommend possible future well sites. The well sites would be reviewed with the city engineer, public works staff and others knowledgeable of local groundwater conditions. Three possible drilling sites would be selected. Following site selection and negotiations with land owners for site access, a six inch pilot hole will be drilled, and the subsurface geology would be recorded along with the aquifers encountered. Upon completion of the hole, the well would be test pumped to estimate yield. This process would be repeated at three selected sites. Based upon these subsurface explorations, the city could determine the best well site, more accurately predict well production, assess treatment and connection costs, and provide valuable information on the site of a future well which may be required in ten years.

2. Source: Following the geologic assessment, the most cost-effective well site given estimated drilling, equipping, production and treatment costs would be recommended. A new source well would be drilled the year following the geologic assessment. The plan also provides for a second new well in year 2010.

3. Source Protection: The vulnerability of the city's well system to outside influences has been reviewed. To protect the investment the city has and will put into wells, it is imperative that an ongoing and proactive well head protection program be implemented. The program would include public education and acquisition and abandonment of substandard wells within and adjacent to the community. A component of source protection is the flushing of the delivery line from well 9 to the treatment plant. This line is most likely partially plugged with iron sediments and is capable of jeopardizing supply operations due to line failure. This flushing should be completed as early as possible to prevent loss of pipeline capacity and possible damage to the treatment facility.

4. Water Conservation: An effective water conservation program may allow the city to delay or avoid the costs of another supply well, treatment facility and associated equipment. The cost estimate for source development in year 2010 is over $310,000. An expenditure of 3 percent of this amount ($9300) to implement water conservation elements which delay the capital expenditure would increase the water fund by $6,200 (assuming 3 percent inflation and 5 percent return on investment).

6.1.2 Treatment

The city has managed to get over 25 years of service out of a mechanical treatment facility normally scheduled for 20 years of service. They have done this while treating ten times the design concentration of iron in the water source for four months each year. A new, properly sized, equipped and controlled iron removal facility is required. The plan also assumes that water treatment will be required for the new well constructed in year 2000. Because the geologic assessment has not been conducted it is not known if it will be possible to integrate the new well's treatment facilities with the existing plant or if a satellite plant will be required. The estimate assumes a satellite plant. Some economies of scale would be available if the new well treatment requirements could be brought to the central public works yard. Yet a third treatment facility is scheduled when the year 2010 well is required. If the treatment facility costs can be delayed because of an effective water conservation program, another $7,600 per year could be available (using the same assumptions as above). The geologic assessment program with associated water quality analysis will allow a more refined estimate of the treatment requirements.

6.1.3 Reservoir

Construction of a new reservoir is recommended to ensure sufficient storage. A one million gallon high-level steel reservoir located on Bolton Hill will provide for sufficient storage to the year 2020. The installation of a high-level storage tank will provide the following benefits:

- Improved overall storage volume for fire protection (1.5 MG total elevated).

- High and low level pressure zones that can be configured to optimize service pressures in the Bolton Hill area.

- Greater flexibility for reservoir maintenance activity.

The 0.5 MG steel reservoir requires re-coating. The 2.0 MG steel reservoir should receive a detailed interior and exterior examination and recoating should be scheduled as necessary. Table 6-2 indicates that the recoating of the large reservoir would be scheduled for year 2010. The actual recoating may need to be scheduled earlier depending on the results of the coating investigation conducted in year 1999. Table 6-3 includes increase capital outlay to account for the requirements of reservoir maintenance.

6.1.4 Transmission and Distribution System

The recommended improvements for the city's transmission and distribution system are detailed in Section 5.4. The improvements are scheduled for year 2000 with some minor exceptions.

- **Houston and Jeans Road.** Install 12" transmission main loop.

- **8th and Westlane Center.** Install 12" transmission main loop.

- **Pine Street and Hunter.** Install a 12" transmission main interconnection for improved service to areas around the Cheney Lift Station.

- **Woodland and Territorial.** Install distribution main loop. Because of scheduled development, this pipeline is recommended for immediate installation.

- **Blek.** Complete loop with scheduled development.

- **Territorial and Territorial Court.** Install an 8" distribution main.

- **High-Level Reservoir Piping System.** Install 8" and 12" piping and associated pressure reducing devices.

6.1.5 Controls

The need for a higher level of control monitoring and sophistication as the system gets more complex has been identified. The plan budgets for a computer monitored SCADA control system installed with the major improvements in year 2000 and incremental technological upgrades and additions with the 2010 improvements.

6.2 CAPITAL COST ESTIMATES

The construction cost estimates for the recommended long-range improvement plan are presented in Table 6-1. These estimates are preliminary and are based on the level and detail of planning presented in this document. As the project proceeds forward, it will be necessary to update estimates to reflect the current understanding.

6.2.1 Construction Costs

The estimated construction costs are based on construction bidding results for similar work, published cost estimating guidelines, consultation with contractors and equipment suppliers, and related construction cost experience. The construction cost estimates are based on construction commencing during the summer of 2000. Short-term updating can be extrapolated by increasing the estimates by 3-4 percent per year to account for inflation.

6.2.2 Contingencies

Since cost estimates are based on conceptual design, allowances must be made for variations in final quantities, bidding market conditions, possible adverse construction conditions, and unanticipated specialized investigations and studies. Contingencies also allow for other unforeseeable difficulties which may tend to increase final costs. Contingency factors equal to 5-25 percent of the estimated construction cost are typical. A 20 percent contingency was used to formulate this plan.

6.2.3 Engineering

The cost of engineering services for major projects typically includes special investigations, predesign report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, start-up services, and preparation of operation and maintenance (O&M) manuals. Depending on the size, type, location and service required by a project, engineering costs may range from 15 to 25 percent of the construction cost. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated remote or specialized projects. Cost estimates for this document assume 20 percent engineering.

6.2.4 Land Acquisition and Easements

Costs associated with land acquisition and the obtaining of easements are an essential component of most infrastructure improvement projects. The amount budgeted varies widely but generally falls in the range of 3-10 percent. In this report, incidental land acquisition and easement costs are included in project contingencies unless these requirements have been identified.

TABLE 6-1

CONSTRUCTION COST ESTIMATE
LONG-RANGE IMPROVEMENT PLAN

YEAR	1999	2000	2010
Water Source			
Geologic Assessment	$ 36,000		
Flush Well 9 Service Line	$ 8,000		
Well Drilling	$ 30,800		
Well Equipment, Bldg, Piping		$224,000	
Initiate Well Protection		$ 40,000	
2nd Well			$291,200
Well Land Requirements		$ 15,000	$ 19,500
Water Conservation Plan Review			$ 9,000
SUBTOTAL	**$ 74,800**	**$279,000**	**$319,700**
Treatment			
Replace Existing Plant		$380,000	
Well Treatment For Future Wells		$380,000	$383,000
SUBTOTAL		**$675,000**	**$383,000**
Storage			
Upper Level Tank		$1,190,000	
Reservoir Coating & Examination	$ 5,000	$ 68,000	$178,360
Reservoir Site Selection Study	$ 32,000		
Upper Level Service Piping/Pumping		$484,500	
Pressure Control Stations		$ 18,000	$ 19,500
Land Acquisition & Easement		$ 15,000	
SUBTOTAL	**$ 37,000**	**$ 1,775,500**	**$ 197,860**
Distribution Improvements	$ 23,000	$839,000	
SUBTOTAL	**$ 23,000**	**$839,000**	
Control Requirements		$179,000	$ 15,600
SUBTOTAL		**$179,000**	**$ 15,600**
TOTAL	**$134,800**	**$ 3,832,500**	**$ 916,160**

6.2.5 Legal and Administrative

An allowance has been added for legal and administrative costs. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, legal services, review fees, permits, legal advertising, and other related expenses associated with the project. These costs are generally in the range of 5 percent of the construction cost and are considered in the general contingency of 20 percent unless specified otherwise.

6.3 RECOMMENDED IMPLEMENTATION PROCESS AND SCHEDULE

The plan is segmented into elements scheduled for 1999, year 2000 and year 2010.

6.3.1 Year 1999 - Geologic Assessment

The significant unknown in the development of a reliable water supply plan for the City of Veneta is the success the city will have in locating a suitable supply and the total cost of connection of that supply into the system. For this reason, we believe that the implementation of the water master plan should begin with a water source study. The water source study should be conducted in 1999 and would include of the following tasks:

- Select a geologic consultant to advise the city on possible well drilling sites.
- Review possible sites and select three sites for pilot hole drilling.
- Drill pilot holes, monitor lithology, test well yield, and analyze the zone of influence.
- Select optimal drilling site.
- Design and drill potable water well.
- Design and install equipment for new well and place in service.

Other assessments associated with the tank site selection need to be completed as part of the 1999 program. The tasks associated with this evaluation include:

- Field and mapping evaluations of suitable sites.
- Ownership assessment.
- Review access requirements.
- Field survey of possible reservoir sites.
- Selection of most likely site.
- Geologic assessment including bore holes to determine site suitability.
- Geotechnical report and recommendations.

The final assessment involves the detailed interior examination of both tanks. These assessments involve the use of trained divers to assess the tank interior and make recommendations regarding the interior coatings and required recoat or touch up.

The results of these assessments need to be integrated into a preliminary engineering report to refine the improvements and budget requirements for implementation.

6.3.2 Year 2000 - Design and Construction

Year 2000 will be the most significant period of implementation. Designs can be authorized for all of the improvements scheduled in year 2000. This will include the well equipment schedule, well housing, replacement and new treatment unit(s), additional storage and piping facilities and the upgrading of the control system. In addition, we feel it is highly likely that the smaller reservoir will need to be scheduled for recoating within this program. Total anticipated costs for the year 2000 program are shown in Table 6-1.

6.3.3 Year 2010 - Necessary Service Expansion

To ensure reliable service through the 20 year planning horizon, additional facilities will be required in about a decade. The improvements scheduled include another well and required treatment, and increased connection between the upper system and the lower service system along with control upgrades. A recoating of the 2.0 MG reservoir will likely be required by the year 2010. These future improvements will be required as population and use dynamics of the system change. Their implementation schedule will depend on the success of water conservation elements. We recommend that prior to implementing the year 2010 improvements, the water conservation plan be reviewed and updated to reflect system consumption and the success of water conservation programs implemented through year 2010. A detailed review of the conservation plan's success may allow for delayed expenditures for water source and treatment development.

6.4 OPERATION, MAINTENANCE, REPAIR & REPLACEMENT (OMRR)

Prudent utility management provides for ongoing operation and maintenance requirements and establishes the necessary reserves to provide for repairs and facility replacement over the long term service needs of the utility. Without providing for sufficient reserve funds, the utility is placed in a continual position of requiring rate increases, additional bonds or other administrative costs to maintain service. Table 6-2 shows the existing operation budget along with a recommended budget for years 2000 and 2010.

A basic assumption relative to the development of OMRR costs for Table 6-2 is that the existing operations are appropriately funded. Since the city has been able to acquire reserves of $200,000, it appears that the assessments have been reasonable. Much of this reserve will be allocated during implementation of this plan.

The values provided in Table 6-2 reflect nominal inflation changes for all categories of expenditure except maintenance. In addition to the increases in maintenance, the OMRR program allocates a specific amount for meter replacement and provides a line item relative to Well Head protection.

TABLE 6-2
OPERATION, MAINTENANCE, REPAIR AND REPLACEMENT PROGRAM COSTS

	1998	2000	2010
Personnel Services (Salary)			
Administrative Employees	$ 40,505	$ 42,935	$ 55,816
Labor Payroll and Overtime	60,856	64,507	116,113
Salary Burden	34,586	36,661	68,772
SUBTOTAL SALARY COST	**$ 135,947**	**$ 144,103**	**$ 240,701**
Materials and Services			
Administration Expenses	$ 3,500	$ 3,710	$ 4,823
Vehicles and Equipment Rental	5,300	5,618	7,303
Maintenance (Wells, System, Reservoir & Building)*	14,165	31,960	41,547
Insurance and Audit	4,319	4,578	5,952
Engineering Services	5,000	5,300	6,890
Legal Services	1,000	1,060	1,378
System Operations Supplies	10,000	10,600	19,080
Power	28,500	30,210	54,378
Communications (telephone & telemetry)	3,500	3,710	6,678
Schools, Training and Safety	2,300	2,438	3,169
Miscellaneous	100	3,600	6,480
System Quality Test	3,300	3,600	5,400
Miscellaneous (inventory and small tools	8,040	4,522	7,235
Meter Replacement Programs		4,000	7,200
SUBTOTAL	**$ 89,024**	**$114,906**	**$ 177,513**
Other (Estimated Minimum)			
Capital Outlay	$ 15,115	$ 16,022	$ 20,828
Well Head Protection		1,200	1,920
Water Conservation		800	1,800
Public Works Equipment Fund	4,000	4,420	6,784
SUBTOTAL OTHER	**$ 19,115**	**$ 22,442**	**$ 31,332**
TOTAL ANNUAL BUDGET	**$244,086**	**$281,451**	**$449,546**

* Includes sinking fund for year 2010 reservoir recoat

This maintenance budget is increased substantially from 1998 levels to reflect sinking fund requirements for reservoir recoating and other future reservoir maintenance requirements. A meter replacement program has been strongly encouraged over the last four years but indications are that only about five percent of the meters have been replaced. The city should be replacing meters at a schedule of at least five percent a year and preferably closer to seven percent a year. The meter replacement and testing program should also include the source and treatment facility meters. By making this a line item in the budget, we believe it is more likely that this important maintenance activity will be maintained at the recommended pace. The OMRR requirements also include the beginnings of a well head protection program. Money is allocated for purchase of and formal abandonment of existing wells. The estimated amount should be considered minimal and the budget adjusted following completion of the well head program development indicated in Section 7.

6.5 WATER CURTAILMENT PLAN

The city needs to have a plan in place to address temporary or sustained periods of water supply shortage. The following plan is a guide for implementing a curtailment procedure.

Level 1 curtailment will be experienced when the city experiences the loss of service of a supply well during the peak summer season or system demand occurs such that full reservoir recovery is not achieved overnight. Level 1 procedures should also be implemented when a "drought" year is predicted. During such drought periods the announcement of Level 1 curtailment actions will need to be repeated throughout the season.

Level 1 actions should include the following:

> Radio and newspaper public service announcements regarding the nature of the deficiency including a plea to water users to optimize water use, decrease landscape watering, and postpone or decrease water use for vehicle cleaning and other non-necessary water uses. Odd-even watering restrictions would be encouraged.

Level 2 curtailment procedures should be initiated when the water service reservoirs are unable to sustain a service level which allows for full fire flow and emergency storage. For Veneta, this would be total reservoir storage at less than half of existing capacity.

> Level 2 procedures should be implemented when there is concern that industrial water demands can not be sustained (loss of jobs) or agriculture production will be lost. Typically, for Veneta, this would involve placement of notices on all service connections, public service announcements and newspaper reminders. Odd-even watering restrictions would be enforced.

Level 3 procedures should be initiated when the water service system is in severe jeopardy. Such service conditions might occur when well production is reduced to less than half of the demand, sustained drought or other water supply curtailment conditions exist.

In addition to implementing all of the conditions of Levels 1 and 2, the city would also likely need to impose a limit on all outdoor watering, reduce service delivery pressure and limit all extraneous water uses other than those required for public health.

Section 7
IMPLEMENTATION AND FINANCING

City of Veneta water improvements may be financed through federal and state funding programs and/or local funding sources. Since the financing of improvements solely with grants is rarely possible, some level of local funding is almost always required. Appendix H reviews applicable funding programs and potential means of securing local funding. This section reviews a financing strategy suited to Veneta's requirements.

7.1 FINANCING STRATEGY

A financing strategy must provide a mechanism to generate capital funds in sufficient amounts to pay for the proposed improvements over the relatively short duration of design and construction, generally about two years. The financing plan must also identify the manner in which annual revenue will be generated to cover the expense for long-term debt repayment and the ongoing operation and maintenance of the system.

The objectives of a financing plan are: 1) identify the capital improvement cost for the project and the estimated expense for operation and maintenance, 2) evaluate the potential funding sources and select the most viable program, 3) determine the availability of outside funding sources and identify the local cost share.

Existing Finance

The city currently has 872 meters and they are assessed at the following base rate:

Meter	Number	Base Rate	Yearly Revenue
Residential	859	$ 7.00	$ 72,156
Commercial	13	$ 14.00	$ 2,184
Total			$ 74,340

The city revised their water charges in June of 1995. Metered water is charged at the rate of $1.75 per 1000 gallons plus the base rate. Commercial accounts have a $14.00 base rate and senior citizen accounts get a $1.00 reduction or $6.00 base rate. Total metered plant production has averaged about 130 million gallons per year. The city's 1999 budget estimates water production revenue at $289,000 or $27.62 per connection per month. A typical Veneta household of four using 80 gallons per person per day would experience the following bill:

Typical Bill

Base Rate	$ 7.00
Water Usage 9,600 gallons	16.80
Total Water Costs	$ 23.80

The 130 million gallons annual production allocated over the 1084 equivalent dwelling units (EDU) results in an average monthly use of 9950 gallons.

A 1997 water rate survey conducted by the Oregon Association of Water Utilities showed that the average base rate for 26 small communities and water districts was $12.33. That survey also assessed the typical rate for a family which used 12,000 gallons of water in a month. The average family rate was $22.00. A City of Veneta family using 12,000 gallons would pay $28.00. The highest family rate noted in the survey was about $60.00 per month.

OCDBG rules and requirements for RUS funding require that the utility rates meet or exceed the state average before funding under their programs will be granted. The current state average for water system service is about $32.00 per month per EDU.

The budget revenue projection anticipates approximately $74,000 from base rates and another $215,000 from water sales.

Financing Plan

The financing plan developed below reviews the financing capacity of the Urban Renewal Agency, increases rates to set Veneta at the state average for water services and provides for the capacity to receive OCDBG funding and possibly RUS funding. SDC assessments are also revised. The city's current water fund has approximately $200,000 in available reserves. It is recommended that these cash reserves be used to fund the studies and plan components scheduled for 1999. With the use of these funds for the requisite studies and assessments, the year 2000 program requirements can be reevaluated but are currently estimated at $3.833 million.

Financing can be summarized with the information provided below:

Plan Requirement	Costs	Funding Source
Reservoir Maintenance	$ 68,000	Reserve Funds
Year 1999 Program Elements	$ 134,800	Reserve Funds
Year 2000 Program Elements	$3,832,500	$ 700,000 OCDBG Funds $2,027,600 Urban Renewal $1,104,900 Other Loan Funds
Year 2010 Program Elements	$ 916,160	SDC

This plan recommends that the city continue to request financial assistance from the Oregon Community Development Block Grant Program, that Urban Renewal support as much as $2,027,600 of the capital improvement costs, and that rate structure and SDC assessment provide for the remaining fund requirements.

7.2 SDC

Table 7-1 indicates the capital improvement program and those segments which are allocated for future expansion and SDC. The table allocates a specific percentage of each improvement to future requirements. The future costs are allocated to SDC fees. The looping of water service lines to the north of Highway 126 and in other areas will significantly improve water service flexibility, increase fire flow capability and thereby provide for public safety. For these reasons only 50 percent of the total cost of these improvements is scheduled under the SDC program.

From the summary provided in the table, a recommended SDC assessment per EDU would be $1,937. This allocation uses Urban Renewal funds to assist in the financing of the overall program. Collected SDC funds will be used to accumulate a sinking fund for year 2010 requirements and to pay off the "other loan" requirements shown on the finance plan.

7.3 RATES

Table 7-2 shows the total project costs, funding sources, number of EDU and indicates required rates to ensure that the plan is appropriately funded. With increased SDC revenue, the cost per connection could be somewhat lowered. Rates should be reviewed annually and adjusted to capital improvement requirements and inflation influences.

TABLE 7-1
SDC ALLOCATION OF COMPONENTS OF THE CAPITAL IMPROVEMENT PLAN

Product Description	Capital Costs	% SDC	SDC Eligible Costs
Water Source			
Geologic Assessment	$ 36,000	50%	$18,000
Flush Well 9 Service Line	$ 8,000	0%	$0
Well Drilling/Well Equipment, Bldg, Piping, Land	$ 269,800	0%	$0
Initiate Well Protection	$ 40,000	0%	$0
2nd Well & Land Requirements	$ 310,700	100%	$310,700
Water Conservation Plan Review	$ 9,000	50%	$ 4,500
Subtotal	**$ 673,500**		**$ 333,200**
Treatment			
Replace Existing Plant & 1999 Well	$ 675,000	0%	$0
2nd Well Treatment	$ 383,000	100%	$ 383,000
Subtotal	**$ 1,058,000**		**$ 383,000**
Storage			
Upper Level Tank, Piping & Plumbing	$ 1,674,500	80%	$1,339,600
Reservoir Coating Work	$ 251,360	0%	
Reservoir Site Selection Study	$ 32,000	80%	$ 25,600
Pressure Control Stations	$ 18,000	50%	$ 9,000
Pressure Control Station (future)	$ 19,500	100%	$ 19,500
Land Acquisition & Easements	$ 15,000	90%	$13,500
Subtotal	**$ 2,010,360**		**$1,407,200**

TABLE 7-1 (Continued) SDC ALLOCATION OF COMPONENTS OF THE CAPITAL IMPROVEMENT PLAN			
Distribution Improvements			
1999 Improvements	$ 23,000	50%	$ 11,500
2000 Improvements	$ 839,000	90%	$ 419,500
Subtotal	**$ 862,000**		**$ 431,000**
Control Requirements			
SCADA Control Network	$ 179,000	0%	
SCADA Control Future Upgrade	$ 15,600	100%	$ 15,600
Subtotal	**$ 194,600**		**$ 15,600**
TOTAL (Costs are Rounded)	**$ 4,800,000**		**$ 2,570,000**
Urban Renewal Payment on SDC			$ 795,960
Project Costs Assumed by SDCs			$ 1,774,040
# New Connections			916
SDC			$ 1,937

7.4 PROJECT IMPLEMENTATION

The City of Veneta submitted a preapplication to OEDD for funding assistance. Following council, OEDD and OHD approval of this Water System Development Plan, the application should be completed and the engineering phase of the project initiated.

TABLE 7-2	YEAR 2000 REQUIRED RATES
Program Element	**Cost**
Year 2000 Program Costs	$3,832,500
*Program element funded through Urban Renewal (10 Year 5.5%)	- $2,027,621
OCDBG	- $700,000
Remaining Costs	$1,104,879
Loan Payment (20 years @ 5.5%)	$92,456
Loan Reserve (10%)	$9,246
Sinking fund for year 2010 improvements	$71,200
O,M, R&R Costs	$281,451
Total Annual Costs/Payments	$454,353
SDC Revenue (10 connections/yr)**	- $19,370
Remaining revenue required	$439,983
Average #EDU connections 1st 10 years	1,100
$/connection	$396
$/month	$33

* Payment capacity based upon current assessment.
** Projected connections are greater, this is a conservative estimate

Following is a tentative schedule identifying the key activities and approximate implementation dates for the initial project:

• Submit plan for OHD approval	January 16, 1999
• Council adoption of OHD & OEDD approved plan	February 14, 1999
• Begin 1999 program	March 1999
• Review geologic assessment drill pilot hole	July 1999
• Start detailed design	September 1999
• OEDD obligation of funds	March 2000
• Complete design and review	May 2000
• Receive construction bids	June 2000
• Start construction	July 2000
• Complete project	June 2001

The above schedule represents an aggressive approach to project implementation and requires expeditious review by the city board, grant agencies, and review agencies.

APPENDIX A
WELL LOGS WATER RIGHTS

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.

#1

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

State Well No. ....
State Permit No. ....

(1) OWNER:
Name CITY OF VENETA
Address VENETA, 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 ☐

(5) CASING INSTALLED: Threaded ☐ Welded ☐
[illegible]" Diam. from 0 ft. to 75 ft. Gage .250
[illegible]" Diam. from 72 ft. to 77 ft. Gage .250
[illegible]" Diam. from 115 ft. to 125 ft. Gage .250

(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.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☐ No
Manufacturer's Name JOHNSON
Type STAINLESS STEEL Model No. [illegible]
Diam. [illegible] Slot size [illegible] Set from 79 ft. to [illegible] ft.
Diam. [illegible] Slot size [illegible] Set from [illegible] ft. to 119 ft.

(8) WATER LEVEL: Completed well.
Static level 51 ft. below land surface Date 8-3-67
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? CARTER'S
Yield: [illegible] gal./min. with [illegible] ft. drawdown after [illegible] hrs.
" " "
" " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(10) CONSTRUCTION:
Well seal—Material used CEMENT
Depth of seal [illegible] ft.
Diameter of well bore to bottom of seal 16 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 LANE Driller's well number
¼ ¼ Section [illegible] T. 17S R. [illegible] W.M.
Bearing and distance from section or subdivision corner

(12) WELL LOG: Diameter of well below casing [illegible]
Depth drilled 125 ft. Depth of completed well 125 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
TOP SOIL	0	4	
YELLOW CLAY	4	65	[illegible]
SAND- COARSE GRAVEL	65	67	
FINE SAND	67	[illegible]	[illegible]
COARSE SAND	[illegible]	79	
COARSE SAND- GRAVEL	79	125	[illegible]
JOB ANALYSIS REPORT			
DRILLING HRS.			
OTHER HRS.			
TOTAL JOB HRS. =			
AVER. INCOME P/HR =			
AVER. FT. P/HR =			
CD/C			

Work started 7-15-67 19 Completed 8-3-67 19
Date well drilling machine moved off of well 8-3-67 19

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] .... Date 8-15-67, 19
(Drilling Machine Operator)
Drilling Machine Operator's License No. [illegible]

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 CARTER'S DRILLING & PUMP SERVICE
(Person, firm or corporation) (Type or print)
Address 325 So. 2ND ST., SPRINGFIELD, OREGON
A-1
[Signed] ....
(Water Well Contractor)
Contractor's License No. 12[illegible] Date 8-11-67 19

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date of well completion.

WATER WELL REPORT

STATE OF OREGON

(Please type or print)
(Do not write above this line)

I-2

State Well No. ....

State Permit No. ....

(1) OWNER:

Name: CITY OF [illegible]

Address: [illegible], 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 ☐

(5) CASING INSTALLED:

Threaded ☐ Welded ☐

[illegible]" Diam. from [illegible] ft. to 13 ft. Gage .250
[illegible]" Diam. from [illegible] ft. to 75 ft. Gage .250
[illegible]" Diam. from 115 ft. to 125 ft. Gage .250

(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.
.... perforations from .... ft. to .... ft.
.... perforations from .... ft. to .... ft.

(7) SCREENS:

Well screen installed? ☐ Yes ☐ No

Manufacturer's Name: Johnson

Type: Stainless Steel [illegible] Model No. [illegible]

Diam. [illegible] Slot size [illegible] Set from 75 ft. to 115 ft.

Diam. .... Slot size .... Set from .... ft. to .... ft.

(8) WATER LEVEL: Completed well.

Static level [illegible] ft. below land surface Date 9-22-57

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? Carver's

Yield: 185 gal./min. with 54 ft. drawdown after 24 hrs.

Bailer test .... gal./min. with .... ft. drawdown after .... hrs.

Artesian flow .... g.p.m. Date ....

Temperature of water .... Was a chemical analysis made? ☐ Yes ☐ No

(10) CONSTRUCTION:

Well seal—Material used: CEMENT

Depth of seal: [illegible] ft.

Diameter of well bore to bottom of seal: 13 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: [illegible] Driller's well number ....

¼ ¼ Section [illegible] T. [illegible] R. [illegible]

Bearing and distance from section or subdivision corner

(12) WELL LOG:

Diameter of well below casing [illegible]

Depth drilled [illegible] ft. Depth of completed well [illegible]

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
Top Soil	0	6
Yellow Clay	6	[illegible]
Red Clay-Gravel [illegible]	[illegible]	[illegible]
Sand-Gravel [illegible]	[illegible]	[illegible]
Sand-Gravel	[illegible]	[illegible]
Sand-Coarse Gravel	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

JOB ANALYSIS REPORT

DRILLING HRS.
OTHER HRS.
TOTAL JOB HRS. =
AVER. INCOME P/HR =
AVER. FT. P/HR =
COST

Work started 7-[illegible]-57 19 Completed [illegible]

Date well drilling machine moved off of well [illegible]

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] .... Date [illegible]
(Drilling Machine Operator)

Drilling Machine Operator's License No. [illegible]

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: Carver's Drilling & Pump Service
(Person, firm or corporation) (Type or print)

Address: [illegible]

A-2

[Signed] [illegible]
(Water Well Contractor)

Contractor's License No. 125 Date 9-28-57

(USE ADDITIONAL SHEETS IF NECESSARY)

Test Well

Well #3

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

State Well No. ....

State Permit No. ....

(1) OWNER:

Name City of Veneta

Address Veneta, Oregon

(2) LOCATION OF WELL:

County Lane Driller's well number

¼ ¼ Section 31 T. 17 R. 5W W.M.

Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐

Irrigation ☐ Test Well ☒ Other ☐

(5) TYPE OF WELL:

Rotary ☐ Driven ☐

Cable ☒ Jetted ☐

Dug ☐ Bored ☐

(6) CASING INSTALLED: Threaded ☐ Welded ☒

6" Diam. from 0 ft. to 80 ft. Gage 250

" Diam. from ft. to ft. Gage

" Diam. from ft. to ft. Gage

(7) 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.

(8) SCREENS: Well screen installed? ☒ Yes ☐ No

Manufacturer's Name Johnson

Type Armco Model No. Telescope

Diam. 6" Slot size 100 Set from 80 ft. to 120 ft.

Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Well seal—Material used in seal Bentonite

Depth of seal 21 ft. Was a packer used? No

Diameter of well bore to bottom of seal 6 in.

Were any loose strata cemented off? ☐ Yes ☒ No Depth

Was a drive shoe used? ☒ Yes ☐ No

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? depth of strata

Method of sealing strata off

(10) WATER LEVELS:

Static level 11 ft. below land surface Date 5/6/64

Artesian pressure 17 lbs. per square inch Date

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? Carter's

Yield: 100 gal./min. with 47 ft. drawdown after 2[illegible]

" " "

" " "

Bailer test gal./min. with ft. drawdown after

Artesian flow g.p.m. Date

Temperature of water Was a chemical analysis made? ☐ Yes

(12) WELL LOG: Diameter of well below casing

Depth drilled 120 ft. Depth of completed well 120

Formation: *Describe by color, character, size of material and structure show thickness of aquifers and the kind and nature of the material stratum penetrated, with at least one entry for each change of form*

MATERIAL	FROM	
Top Soil	0	
Yellow Clay	5	
Fine Sand & Gravel	45	
Fine Sand	55	
Medium Sand	65	
Sand & Gravel	115	

Work started 4/28/ 19 64 Completed 5/

Date well drilling machine moved off of well 5/

(13) PUMP:

Manufacturer's Name

Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this r true to the best of my knowledge and belief.

NAME Carter's Drilling & Pump Service
(Person, firm or corporation) (Type or print)

Address 325 South 2nd St. Springfield, O

Drilling Machine Operator's License No. 148

A-3

[Signed] ....
(Water Well Contractor)

Contractor's License No. 126 Date 5/28/

(USE ADDITIONAL SHEETS IF NECESSARY)

The original and ... copies of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

State Well No.
State Permit No.

Well #4

(1) OWNER:
Name: City of Veneta
Address: Veneta, 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 ☐

(5) CASING INSTALLED:
Threaded ☐ Welded ☐
[illegible]" Diam. from [illegible] ft. to [illegible] ft. Gage [illegible]
[illegible]" Diam. from 135' ft. to 166' ft. Gage [illegible]
" Diam. from ft. to ft. Gage

(6) PERFORATIONS:
Perforated? ☐ Yes ☐ No.
Type of perforator used: Torch
Size of perforations: 1/8 in. by 4 in.
[illegible] perforations from 145 ft. to 165 ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☐ Yes ☐ No
Manufacturer's Name: [illegible]
Type [illegible] Model No.
Diam. [illegible] Slot size [illegible] Set from [illegible] ft. to [illegible] 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? [illegible]
Yield: [illegible] gal./min. with [illegible] ft. drawdown after [illegible] hrs.
" [illegible] " [illegible] " [illegible] "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used: Cement
Well sealed from land surface to [illegible] ft.
Diameter of well bore to bottom of seal [illegible] in.
Diameter of well bore below seal [illegible] in.
Number of sacks of cement used in well seal [illegible] 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: [illegible]
Gravel placed from [illegible] ft. to [illegible] ft.

(10) LOCATION OF WELL:
County: Lane Driller's well number
[illegible] ¼ [illegible] ¼ Section 21 T. 17S R. [illegible] W.M.
Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.
Depth at which water was first found: 95
Static level: 52 ft. below land surface. Date 10/[illegible]
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing
Depth drilled: 166 ft. Depth of completed well: 166

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
[illegible] clay	[illegible]	[illegible]	
[illegible] sandy clay	[illegible]	[illegible]	
[illegible] sand	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible] clay	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	

Work started [illegible] 19[illegible] Completed [illegible]
Date well drilling machine moved off of well [illegible]

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] .... Date ....
(Drilling Machine Operator)
Drilling Machine Operator's License No. [illegible]

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 [illegible]
(Person, firm or corporation) (Type or print)
Address [illegible]
A-4
[Signed] ....
(Water Well Contractor)
Contractor's License No. .... Date ....

(USE ADDITIONAL SHEETS IF NECESSARY)

SP

RECEIVED

Well #4

City of Veneta

Water System; # 1259
POD: # 12304
Permit: # G 6355
Water Rights Certificate #: 52376 Priority date 1/9/75 .670 CFS
Location: South of Community Center
Township 17 S Range 5 West Section 31

Date of Drilling: 1973
Type of Drilling: Rotary 18" Bore
Casing size: 8" 227 gage 166'
Perforations: 1/8" x 4" (Torch)
Well screen: Johnson Stainless 8" 100 slot size from 110' to 135'

Original Well test: 400 GPM / 45' draw down @ 10 hours
310 GPM / 32' draw down @ 24 hours

Annular seal: Cement 30' depth with 16" diameter

		From	To
Well Log:	Yellow Clay	0'	38'
	Brown sandy clay	38'	40'
	Brown sand	40'	52'
	Brown cemented gravel	52'	85'
	Brown sandy clay	85'	90'
	Loose small gravel	90'	132'
	Brown sandy clay	132'	138'
	Blue sandy clay	138'	145'
	Sand and gravel blue cemented	145'	166'

Rehabilitated: Oct., 1995 Christensen Brothers, Coburg

Pump: Grundfos 375S submersible installed 1/13/90
HP: 25 4 stage
Voltage: 460 volts
Amps: 33.5
SF: 1.5
Phase: 3
Setting: 138 ft.

The original and first copy of this report are to be filed with the

STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

WATER WELL REPORT

STATE OF OREGON

(Please type or print)

(Do not write above this line)

#5

State Well No. ....

State Permit No. ....

(1) OWNER:

Name City of Veneta

Address Veneta, 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 ☐

(5) CASING INSTALLED:

Threaded ☐ Welded ☐

12 " Diam. from 0 ft. to 30 ft. Gage .250
8 " Diam. from 0 ft. to 90 ft. Gage .250
8 " Diam. from 120 ft. to 150 ft. Gage .250

(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 Irrigator Model No.

Diam. 8 Slot size 100 Set from 90 ft. to 120 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? W. W.

Yield: 84 gal./min. with 30 ft. drawdown after 8 hrs.

" " " "

" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m.

Temperature of water Depth artesian flow encountered .... ft.

(9) CONSTRUCTION:

Well seal—Material used Cement

Well sealed from land surface to 30 ft.

Diameter of well bore to bottom of seal 16 in.

Diameter of well bore below seal 16 in.

Number of sacks of cement used in well seal 30 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 A-6

Method of sealing strata off

Was well gravel packed? ☒ Yes ☐ No Size of gravel: 1/4 - 3/4

Gravel placed from 0 ft. to 150 ft.

(10) LOCATION OF WELL:

County Lane Driller's well number

SE ¼ NW ¼ Section 31 T. 17S R. 5W W.M.

Bearing and distance from section or subdivision corner

(11) WATER LEVEL: Completed well.

Depth at which water was first found

Static level 65 ft. below land surface. Date 2/18/77

Artesian pressure lbs. per square inch. Date

(12) WELL LOG:

Diameter of well below casing ....

Depth drilled 65 ft. Depth of completed well 150

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
Top soil	0	4'	
Brown clay	4	12'	
Yellow clay	12	20	
Gray clay	20	30	
Brown clay	30	40	
Sand -gravel (small)	40	45	
Sand, gravel & clay	45	60	
sand & gravel (large)	60	70	
Sand, gravel & clay	70	90	
Sand & gravel (large)	90	112	
Blue clay & gravel	112	120	
Blue clay	120	150	65'

Work started 2/21 19 77 Completed 2/28/ 19

Date well drilling machine moved off of well 2/28 19

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] .... (Drilling Machine Operator) Date 3/18, 1977

Drilling Machine Operator's License No. 404

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 W. W. Drilling & Pump Service (Person, firm or corporation) (Type or print)

Address 2320 Main St. Springfield, Ore.

[Signed] Walt Wilson (Water Well Contractor)

Contractor's License No. 268 Date 3/25, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-

RECEIVED

FEB 14 1984

WATER RESOURCES DEPT.
SALEM, OREGON

WATER WELL REPORT
STATE OF OREGON

State Well No.

PLEASE TYPE or PRINT IN INK

State Permit No.

(1) OWNER:

Name City of Veneta
Address 24951 McCutcheon
City Veneta, State 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 Air ☐ Driven ☐ Rotary Mud ☐ Dug ☐ Cable ☒ Bored ☐

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☒ Irrigation ☐ Test Well ☐ Other ☐ Thermal: Withdrawal ☐ Reinjection ☐

(5) CASING INSTALLED: Steel ☒ Threaded ☐ Plastic ☐ Welded ☒

16" Diam. from +1 ft. to 60 ft. Gauge .312
8" Diam. from +18" ft. to 185 ft. Gauge .312

LINER INSTALLED:

" Diam. from ft. to ft. Gauge

(6) PERFORATIONS: Perforated? ☐ Yes ☒ No

Was Well Screen Installed Yes

Manufactures Name: Johnson

Type: Stainless Steel 304 Model No. Pipe Size

Diam 8" Slot Size Set From 75' - 80' 5'

Diam 8" Slot Size 100 95' - 105' 10'

115' - 120 5'

125' - 135' 10'

160' - 165' 5'

Was a pump test made? ☒ Yes ☐ No If yes, by whom? Ramsey Waite

Yield: 170 gal./min. with 95 ft. drawdown after 4 hrs.

Air test gal./min. with drill stem at ft. hrs.

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m.

Temperature of water 52° Depth artesian flow encountered ft.

(9) CONSTRUCTION: Special standards: Yes ☐ No ☒

Well seal—Material used Type III Cement

Well sealed from land surface to 20 ft.

Diameter of well bore to bottom of seal 20 in.

Diameter of well bore below seal 16 in.

Number of sacks of cement used in well seal 17 sacks

How was cement grout placed? Forced Pump 20 Feet

Was pump installed? no Type HP Depth ft.

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: 3/8

Gravel placed from 185 ft. to 0 ft.

(10) LOCATION OF WELL:

County Lane Driller's well number 1503/22.

NE ¼ NE ¼ Section 35 T. 17 R. 6W W.M.

Tax Lot # Lot Blk Subdivision

Address at well location: Street Varinace Granted @ 5th & Waldo - Next to Tax Lot 1000

(11) WATER LEVEL: Completed well.

Depth at which water was first found 65 ft.

Static level 48 ft. below land surface. Date 1/ -0/84

Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 16

Depth drilled 185 ft. Depth of completed well 185 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
Top Soil	0	4	
Red Clay	4	26	
Red Clay Mixed With Gravel	26	40	
Blue Sand- Graveel & Clay	40	46	
Coarse Gravel Mix Clay Cemented	46	72	48
Med. Gravel	72	78	48
Fine Gravel	78	90	48
Coarse Gravel - Small Cobbles	90	106	48
Red Clay Gravel Coarse	106	112	48
Coarse Gravel Clean	112	117	48
Small Gravel With Clay	117	126	48
Coarse Gravel	126	133	48
Med Gravel Mixed Clay	133	150	48
Gray Clay, Gravel	150	154	48
Gravel, Heavey Clay	154	162	48
Gray Clay	162	170	48
Gray Sandy Shale, Small Gravel	170	185	48

Work started 10/31/ 1983 Completed 1/16/ 1984

Date well drilling machine moved off of well 1/17/ 1984

(unbonded) Water Well Constructor Certification (if applicable):

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] [signature] Date 1/17/ 1984

Bonded Water Well Constructor Certification:

Bond U3-66353 (number) Issued by: United Pacific Insurance (Surety Company Name)

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Name Carter's Drilling & Pump Service (Person, firm or corporation) (Type or print)

Address 330 S. 3rd - P.O. Box 46 Sofd? Oregon

[Signed] [signature] Water Well Constructor

A-7

Date 1/17/84 19

NOTICE TO WATER WELL CONSTRUCTOR
The original and first copy of this report are to be filed with the

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

SP*45292-690

Well #9

City of Veneta

Water System: #1259
POD: # 28429
Water Rights Certificate: 0 Priority Date 2/18/92 1.110 CFS
Permit : #G 11551
Location: 88120 Huston Road
Township 17 S Range 5 West Section 31

Date of Drilling: 7/11/91
Type of Drilling: Roarty Air
Casing Size: 10" Steel Welded 180' deep
Perforations/Screens: 10"SS 100 slot size 75-80'/105-110/150-160/169-179

Original Well test: 300 GPM / 21' draw down @ 1 Hr.
500 GPM / 66' draw down

Annular Seal: Cement 19' with 24" diameter

		From	To
Well Log:	Light brown clay	0'	41'
	Med. sandy some cobbles	41'	51'
	Light gray clay w/some sand	51'	60'
	Black sand med.	60'	90'
	Gray sand	90'	91'
	Course Sand	91'	135'
	Gray Sand	135'	138'
	Course Sand	138'	176'
	Sand and Gravel	176'	180'

Rehabilitated: No

Pump: Groundfos 600s600-4
HP: 60 HP
Voltage: 460 V
Amps:
SF:
Phase: 3
Setting: 161'
Air line: 161'

* * * WATER RIGHT INFORMATION * * *

Application #: G-6783 Permit #: G-6355 Certificate #: 52376

Well Owner:
DON HAGLE, PUBLIC WORKS DIR — USER-ID: 1259
CITY OF VENETA
PO BOX 458
VENETA OR 97487

Original Water Right Holder:
CITY OF VENETA
PO BOX 458
VENETA OR 97487

WELLS ASSOCIATED WITH RIGHT

Note: The POD-ID is an arbitrary number used for computer purposes only.)

WELL 4 (POD-ID 12304)
Permitted Use of Water: MUNICIPAL
Rate of Use: 0.6700 cubic feet per second
Priority Date: 1/ 9/1975
Well Location Information:
Township 17 S Range 5 W
SW Quarter of NW Quarter of Section 31
475 FT N & 1190 FT E FM W1/4 COR, S31
Possible Tax Lot # (LANE COUNTY)

* * * * * * * * * *
PUMP TEST DUE ON
1/ 9/1995
* * * * * * * * * *

* * * WELL OWNERSHIP VERIFICATION FORM * * *

Please complete this form (noting name or address corrections) and return to the Water Resources Department by JAN- 2-1995.

OWNER: DON HAGLE, PUBLIC WORKS DIR
CITY OF VENETA
PO BOX 458
VENETA, OR 97487

USER-ID: 1259

Signed ______________________________

(If you are not the owner of one or more of the wells, an adjacent landowner may be. Indicate the current owner on the back of this page, if known.)

POD-ID 12304 WELL 4 PERMIT #: G-6355 CERTIFICATE #: 52376

[ ] I am the owner of this well and am aware of the pump test requirements.

[ ] I am the owner of this well and water right, but I am no longer using the well or I am using it only for household purposes. I wish to cancel the water right. (If someone else is using this well, please list name and address:

____)

[ ] I am not the owner of this well.

IF YOU HAVE ANY QUESTIONS PLEASE CALL 1-800-624-3199 ext 245 or 303.

OREGON WATER RESOURCES DEPARTMENT
SUMMARY OF WATER RIGHTS FOR DETAILED WATER-USE REPORT

Reporting Entity	CITY OF VENETA Attn: DON HAGLE, PUBLIC WORKS DIR PO BOX 458 VENETA, OR 97487	USER-ID: 1259

[ ] POD-ID 12302 FACILITY:

Certificate : 41536
Permit : G 3968
Source : WELL #2
Tributary to: LONG TOM R
Priority : 7/18/1968
Permitted Rate: 0.180 CFS
Permitted Use : MUNICIPAL
Prim/Alt/Supp : PRIMARY
POD Location: TOWNSHIP 17 S RANGE 5 W SECTION 31 NENW
1322.9 FT N & 1779 FT E FM W1/4 COR, S31

[ ] POD-ID 12303 FACILITY:

Certificate : 41536
Permit : G 3968
Source : WELL #1
Tributary to: LONG TOM R
Priority : 7/18/1968
Permitted Rate: 0.400 CFS
Permitted Use : MUNICIPAL
Prim/Alt/Supp : PRIMARY
POD Location: TOWNSHIP 17 S RANGE 5 W SECTION 31 SENW
852.7 FT N & 1544 FT E FM W1/4 COR, S31

[ ] POD-ID 12304 WELL #4 FACILITY:

Certificate : 52376
Permit : G 6355 ✓
Source : WELL 4
Tributary to: LONG TOM R
Priority : 1/ 9/1975
Permitted Rate: 0.670 CFS 300 gpm
Permitted Use : MUNICIPAL
Prim/Alt/Supp : PRIMARY
POD Location: TOWNSHIP 17 S RANGE 5 W SECTION 31 SWNW
475 FT N & 1190 FT E FM W1/4 COR, S31

11/ 6/1995

OREGON WATER RESOURCES DEPARTMENT
SUMMARY OF WATER RIGHTS FOR DETAILED WATER-USE REPORT

Reporting Entity | CITY OF VENETA
Attn: DON HAGLE, PUBLIC WORKS DIR
PO BOX 458
VENETA, OR 97487

RECEIVED

USER-ID: 125

[ ] POD-ID 12302 FACILITY:

Certificate : 41536
Permit : G 3968
Source : WELL #2
Tributary to: LONG TOM R
POD Location: TOWNSHIP 17 S RANGE 5 W SECTION 31 NENW
1322.9 FT N & 1779 FT E FM W1/4 COR, S31

Priority : 7/18/1968
Permitted Rate: 0.180 CFS
Permitted Use : MUNICIPAL
Prim/Alt/Supp : PRIMARY

[ ] POD-ID 12303 FACILITY:

Certificate : 41536
Permit : G 3968
Source : WELL #1
Tributary to: LONG TOM R
POD Location: TOWNSHIP 17 S RANGE 5 W SECTION 31 SENW
852.7 FT N & 1544 FT E FM W1/4 COR, S31

Priority : 7/18/1968
Permitted Rate: 0.400 CFS
Permitted Use : MUNICIPAL
Prim/Alt/Supp : PRIMARY

[ ] POD-ID 12304 FACILITY:

Certificate : 52376
Permit : G 6355
Source : WELL 4
Tributary to: LONG TOM R
POD Location: TOWNSHIP 17 S RANGE 5 W SECTION 31 SWNW
475 FT N & 1190 FT E FM W1/4 COR, S31

Priority : 1/ 9/1975
Permitted Rate: 0.670 CFS
Permitted Use : MUNICIPAL
Prim/Alt/Supp : PRIMARY

[ ] POD-ID 28429 FACILITY:

Certificate : 0
Permit : G 11551
Source : A WELL
Tributary to: W FK COYOTE CR
POD Location: TOWNSHIP 17 S RANGE 5 W SECTION 31 SESE
NORTH 0 DEGREES 01 MINUTES 15 SECONDS WEST 518 FEET FROM E1/4 CORNER, SECTION

Priority : 2/18/1992
Permitted Rate: 1.110 CFS 500 gpm
Permitted Use : MUNICIPAL
Prim/Alt/Supp : PRIMARY

must be well 9 @ 500 gpm (1.11 cfs)

APPENDIX B
WELL TEST RESULTS

APPENDIX B1
Well #4

Oregon Water Resources Department

PUMP TEST COVER SHEET

Well Owner:
Name City of Veneta
Address 24951 McCutcheon Avenue
City, State, Zip Veneta, Oregon 97487
County Lane

Well Location:
Twnshp 17S (N or S), Range 5W (E or W)
Section 31 1/4,1/4,1/4 SW NW
Well Depth 146 Date Drilled 10/73
Owner's Well No. (if any) #4
POD-ID

Water Right Information:
Application No. ______ Permit No. G-6355 Certificate No. ______
Is this well used for more than one water right? N (Y/N) If Yes, fill out numbers below:
App. No. ______ Permit No. ______ Cert. No. 52376
App. No. ______ Permit No. ______ Cert. No. ______

Pump Test:
Test conducted by City of Veneta Staff Well Owner? Y (Y/N)
Company City of Veneta
Address 24951 McCutcheon Avenue Date of Test 12/6/95
City, State, Zip Veneta, OR 97487

Method of Discharge Measurement Water meter
Method of Water Level Measurement Conductance probe
Depth of Air Line (if used) NA
Pump Type (Turbine, Submersible, etc.) Submersible
Was pump test conducted during normal use of the well N (Y/N)

Description of point from which water level was measured Flange face top of well casing
Is measuring point above or below ground level? 23" above ground level
Distance between measuring point and ground level (correction factor) 1.92 ft.

Are you aware of any wells, other than domestic or stock wells, pumping within 1000 feet of the tested well during the test or within 24 hours prior to the test? N (Y/N) If yes, give approximate distances to each and approximate pumping rate of each. If, possible, indicate if they were turned on or off during the test ______

Is there a lake, stream or other surface water body within 1/4 mile of the tested well? N (Y/N)
If yes, give approximate distance from the well and approximate elevation difference between the surface water and the well head: Approximate distance NA
Approximate elevation difference NA
Is well elevation above or below the surface water body? NA

Static Water Level Measurements: (Three measurements at least 20 minutes apart are required in the hour before pumping begins):

Time	Depth to Water (ft/in)
8:40 a.m.	73'-2"
9:00 a.m.	73'-2"
9:20 a.m.	73'-2"

Discharge Measurements: (A discharge measurement is required at the start of pumping and once an hour during the test): Discharge provided on attached spreadsheet

Time	Discharge Rate (gpm)

Pump turned on: Date: 12/6/95 Time: 9:30 a.m. Pump turned off: Date: 12/7/95 Time: 10:00 a.m.
Total pumping time: 24 hours, 30 minutes.

Note: Well must be idle for at least 16 hours prior to the test.
See attached letter and data report. B1-1

OWRD 11/90

Well #4 Performance

Well Test of 12/6/95 & 12/7/95

Well static Level 73.17

Note: Pump On minimum of 20 seconds for 36 feet of drawdown

Time	Time Since Pump Start	Depth to Water	Drawdown		Drawdown	Correction 1.92	Depth from Ground	Discharge
9:30	0	109.42	36.25	12/6/95	36.25		107.5	282
9:32	2	111	37.83		37.83		109.08	280
9:34	4	111.83	38.66		38.66		109.91	280
9:36	6	112.42	39.25		39.25		110.5	280
9:38	8	113.38	40.21		40.21		111.46	279
9:40	10	114.83	41.66		41.66		112.91	278
9:45	15	115.25	42.08		42.08		113.33	277
9:50	20	115.33	42.16		42.16		113.41	277
9:55	25	116.33	43.16		43.16		114.41	277
10:00	30	115.58	42.41		42.41		113.66	276
10:15	45	115	41.83		41.83		113.08	277
10:30	60	117.42	44.25		44.25		115.5	275
10:45	75	118	44.83		44.83		116.08	275
11:00	90	118	44.83		44.83		116.08	272
11:30	120	119.08	45.91		45.91		117.16	274
12:00	150	119.83	46.66		46.66		117.91	270
12:30	180	119.25	46.08		46.08		117.33	270
13:00	210	118.67	45.5		45.5		116.75	270
13:30	240	120.25	47.08		47.08		118.33	270
14:30	300	121.17	48		48		119.25	270
15:30	360	120.83	47.66		47.66		118.91	265
16:30	420	121.25	48.08		48.08		119.33	265
17:30	480	121.67	48.5		48.5		119.75	260
18:30	540	122	48.83		48.83		120.08	260
19:30	600	122	48.83		48.83		120.08	260
20:30	660	122	48.83		48.83		120.08	260
21:30	720	122	48.83		48.83		120.08	260
22:30	780	122.5	49.33		49.33		120.58	260
23:30	840	122.75	49.58		49.58		120.83	260
0:30:00	900	123.17	50	12/7/95	50		121.25	260
1:30:00	960	122.83	49.66		49.66		120.91	260
2:30:00	1020	122.75	49.58		49.58		120.83	260
3:30:00	1080	123.08	49.91		49.91		121.16	262
4:30:00	1140	122.83	49.66		49.66		120.91	258
5:30:00	1200	123	49.83		49.83		121.08	255
6:30:00	1260	123.17	50		50		121.25	258
7:30:00	1320	123.25	50.08		50.08		121.33	257
8:30:00	1380	123	49.83		49.83		121.08	258
9:30:00	1440	123.75	50.58		50.58		121.83	252
								10439
							Average	274.71

8" Diameter casing, 16" bore, Gravel packed. 100 slot Screen from 110 feet to 135 feet

Original Well drilled to 166 feet. Bottom of well cemented to 146 feet. Record does not say when

Systems West Engineers - City of Veneta

B 1-2

Well #4 Performance RECOVERY

Time	Time Since Pump off	Depth to Water
10:00	0	83.5
10:02	2	82.5
10:04	4	81.67
10:06	6	81.67
10:08	8	81.17
10:10	10	81
10:15	15	80.75
10:20	20	80.5
10:25	25	80.42
10:30	30	80.25
10:45	45	79.5
11:00	60	79.17
11:15	75	78.83
12:00	120	78
12:30	150	77.75
1:00	180	77.42

Systems West Engineers - City of Veneta

Recovered ~~4~~ in 4.25 ft in 3 hours time after 24 hour test.

Well #4 Performance								
Well static Level		73.17						
	Time Since	Depth to				Correction	Depth from	
Time	Pump Start	Water	Drawdown		Drawdown	1.5	Ground	Discharge
9:30	0	109.42	36.25		36.25			282
9:32	2	111	37.83		37.83			280
9:34	4	111.83	38.66		38.66			280
9:36	6	112.42	39.25		39.25			280
9:38	8	113.38	40.21		40.21			279
9:40	10	114.83	41.66		41.66			278
9:45	15	115.25	42.08		42.08			277
9:50	20	115.33	42.16		42.16			277
9:55	25	116.33	43.16		43.16			277
10:00	30	115.58	42.41		42.41			276
10:15	45	115	41.83		41.83			277
10:30	60	117.42	44.25		44.25			275
10:45	75	118	44.83		44.83			275
11:00	90	118	44.83		44.83			272
11:30	120	119.08	45.91		45.91			274
12:00	150	119.83	46.66		46.66			270
12:30	180	119.25	46.08		46.08			270
13:00	210	118.67	45.5		45.5			270
13:30	240	120.25	47.08		47.08			270
14:30	300	121.17	48		48			270
15:30	360	120.83	47.66		47.66			265
16:30	420	121.25	48.08		48.08			265
17:30	480	121.67	48.5		48.5			260
18:30	540	122	48.83		48.83			260
19:30	600	122	48.83		48.83			260
20:30	660	122	48.83		48.83			260
21:30	720	122	48.83		48.83			260
22:30	780	122.5	49.33		49.33			260
23:30	840	122.75	49.58		49.58			260
24:30:00	900	123.17	50		50			260
25:30:00	960	122.83	49.66		49.66			260
26:30:00	1020	122.75	49.58		49.58			260
27:30:00	1080	123.08	49.91		49.91			262
28:30:00	1140	122.83	49.66		49.66			258
29:30:00	1200	123	49.83		49.83			255
30:30:00	1260	123.17	50		50			258
31:30:00	1320	123.25	50.08		50.08			257
32:30:00	1380	123	49.83		49.83			258
33:30:00	1440	123.75	50.58		50.58			252
								10439
							Average	274.71
*								

B1-4

N:\N\3033.xx\WATER\~Fil

Analysis of Well Number 4 - Drawdown & Recovery					
	Cumulative		Drawdown		Log D
Time	Time		Measure	Log T	
9:30	00:00	0.00	109.42	0.	2.039
9:32	02:00	2	111	0.301	2.045
9:34	04:00	4	111.83	0.602	2.049
9:36	06:00	6	112.42	0.778	2.051
9:38	08:00	8	113.38	0.903	2.055
9:40	10:00	10	114.83	1.	2.06
9:45	15:00	15	115.25	1.176	2.062
9:50	20:00	20	115.33	1.301	2.062
9:55	25:00	25	116.33	1.398	2.066
10:00	30:00	30	115.58	1.477	2.063
10:15	45:00	45	115	1.653	2.061
10:30	60:00	60	117.42	1.778	2.07
10:45	75:00	75	118	1.875	2.072
11:00	90:00	90	118	1.954	2.072
11:15	105:00	105	119	2.021	2.076
11:30	120:00	120	119.08	2.079	2.076
11:45	135:00	135	119.33	2.13	2.077
12:00	150:00	150	119.83	2.176	2.079
12:15	165:00	165	119.25	2.217	2.076
12:30	180:00	180	119.25	2.255	2.076
12:45	195:00	195	119.5	2.29	2.077
13:00	210:00	210	118.67	2.322	2.074
13:15	225:00	225	120.08	2.352	2.079
13:30	240:00	240	120.25	2.38	2.08
13:45	255:00	255	120.42	2.407	2.081
14:00	270:00	270	120.58	2.431	2.081
14:15	285:00	285	120.75	2.455	2.082
14:30	300:00	300	121.17	2.477	2.083
14:45	315:00	315	121.58	2.498	2.085
15:00	330:00	330	121.42	2.519	2.084
15:15	345:00	345	120.75	2.538	2.082
15:30	360:00	360	120.83	2.556	2.082
15:45	375:00	375	121.25	2.574	2.084
16:00	390:00	390	121.25	2.591	2.084
16:15	405:00	405	121.25	2.607	2.084
16:30	420:00	420	121.25	2.623	2.084
16:45	435:00	435	121.25	2.638	2.084
17:00	450:00	450	121.25	2.653	2.084
17:15	465:00	465	121.25	2.667	2.084
17:30	480:00	480	121.67	2.681	2.085
17:45	495:00	495	121.67	2.695	2.085
18:00	510:00	510	122	2.708	2.086
18:15	525:00	525	122	2.72	2.086
18:30	540:00	540	122	2.732	2.086
18:45	555:00	555	122	2.744	2.086
19:00	570:00	570	122	2.756	2.086
19:15	585:00	585	122	2.767	2.086

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Analysis of Well Number 4 - Drawdown & Recovery						
	Cumulative		Drawdown		Log D	
Time	Time		Measure	Log T		
19:30	600:00	600	122	2.778	2.086	
19:45	615:00	615	122	2.789	2.086	
20:00	630:00	630	122	2.799	2.086	
21:00	690:00	690	122	2.839	2.086	
22:00	750:00	750	122.5	2.875	2.088	
23:00	810:00	810	122.5	2.908	2.088	
24:00	870:00	870	123	2.94	2.09	
25:00	930:00	930	123	2.968	2.09	
26:00	990:00	990	122.83	2.996	2.089	
27:00	1050:00	1050	122.83	3.021	2.089	
28:00	1110:00	1110	122.83	3.045	2.089	
29:00	1170:00	1170	122.92	3.068	2.09	
30:00	1230:00	1230	122.92	3.09	2.09	
31:00	1290:00	1290	122.92	3.111	2.09	
32:00	1350:00	1350	122.67	3.13	2.089	
33:00	1410:00	1410	122.92	3.149	2.09	
33:30	1440:00	1440	123.75	3.158	2.093	

APPENDIX B2
Well #9

CHRISTENSEN WELL DRILLING CO.

33132 COLEMAN ROAD, EUGENE, OREGON 97408
PHONE (541) 344-4205 FAX (541) 344-0360

VENETA WELL #9
PUMP TEST
FEBRUARY 1998

PUMP TESTING OF VENETA WELL #9
PERFORMED BY CHRISTENSEN WELL DRILLING CO.
FEBRUARY 1998

==

PRIMARY WELL

WELL: State Grid #LANE 2340 @ 44 03.002N LAT 123 19.829W LONG

18" cased well drilled to 180'. The well log shows 10" screen set at four intervals between 75' and 179'. Fine gravel was used as filter pack around the outside of the 10" screen to the surface. The well log may be in error showing 18" casing to bottom of hole and 10" screen set inside without perforations shown in casing. Most likely the 18" was pulled back to 40' (depth noted for shoe) exposing the formation to the filter pack & screen. The middle water bearing zone 120'-145' in item #11 "Water Bearing Zones" does not correspond with formations logged in item #12 nor screen placement in item #7. A 19' surface seal with cement is listed. Please reference attachment labeled "Water Well Report".

PIEZOMETER WELL

Located at 25640 Tidball Lane, 198' from primary well. The well is cased with 4" casing suggesting construction in the early 50's. The top of casing is a measured 6.47' higher in elevation that the flange of the primary well. The well has a measured depth of 79' and currently has the base and pipe of a vertical two pipe jet pump installed to approximately 60'. The land owner reported that due to a lack of a hole in the roof of the outbuilding structure, the pump had not been pulled out, and had not been in service for an extended time. The well lacks a well seal on top of the casing. For testing purposes, a transducer was installed along side the existing pump piping.

TEST PROCEDURE

TASK A: Setup data logger on well #9 with bubbler tube and transducer, install second transducer in well at 25640 Tidball Lane, log background.

TASK B: Connect to existing plumbing at well #9 and discharge water to street ditch through orifice tube.

TASK C: Run 4 step pump test up to 1 hour each step @ 200 gpm, 400 gpm, 600 gpm and 725 gpm flow rate.

TASK D: Review data, allow well to stabilize, determine extended pump test rate.

TASK E: Run constant rate test monitoring primary well and adjacent piezometer well water level, discharge pressure and test sand content.

TASK F: Record well recovery at end of test.

TESTING EQUIPMENT

Water level in primary well was monitored using the existing bubbler tube supplied by flow regulated air at less than .1 cubic feet per minute. Back pressure on the bubbler tube was measured by a 4-20 ma strain gauge transducer connected to the data logger.

Water level in piezometer well was measured using an immersed strain gauge transducer with barometric equalization connected to the data logger.

Water flow was observed using a 8" orifice tube with 4" orifice at discharge point into road ditch. Water rate was adjusted using existing variable frequency drive control for the pump.

Flow rate was compared to the existing water meter and noted.

Data logger used was a Terra Sciences Model 8 equipped with Standard 5 software.

PRECIPITATION

Rain as recorded during the testing period for Eugene by the National Weather Bureau:

DATE	RAIN	TESTING ACTIVITY
2/17	.06"	none
2/18	.15"	background data
2/19	.26"	step test/pump test
2/20	.75"	pump test/recovery
2/21	1.40"	background
2/22	.13"	background
2/23	.00"	background
2/24	trace	background
2/25	.14"	background

The majority of the recorded rainfall occurred after the completion of the pump test. The recorded rainfall is for the Eugene Airport and may vary to some degree for the Huston Road area. Please reference the attachment labeled "Preliminary Local Climatological Data".

PUMP TEST DATA REVIEW

Background: Data shows stability in water levels and no noticeable influence from adjoining wells in the area.

Step Test #1: Pumping rate 200 gpm, existing meter reads 240 gpm
Start: 13:02 2/19/98
Finish: 14:04 2/19/98
Calculated specific capacity 12.52 gal/ft drawdown

Step Test #2: Pumping rate 400 gpm, existing meter reads 370 gpm
Start: 14:08 2/19/98
Finish: 15:28 2/19/98
Calculated specific capacity 15.40 gal/ft drawdown

Step Test #3: Pumping rate 600 gpm, existing meter reads 720 gpm
Start: 15:30 2/19/98
Finish: 16:30 2/19/98
Calculated specific capacity 11.67 gal/ft drawdown

Step Test #4: Pumping rate 725 gpm, existing meter reads 820 gpm
Start: 16:32 2/19/98
Finish: 17:18 2/19/98
Calculated specific capacity 11.17 gal/ft drawdown

Constant Rate Pump Test: Pumping rate 600 gpm

Start: 19:02 2/19/98
Finish: 16:02 2/20/98
Calculated specific capacity 9.68 gal/ft drawdown

Primary well stabilized approximately halfway through test with a drawdown of 61.97' at the end of the test. The piezometer well demonstrated an immediate affect from the primary well and had a -13.87' change in static by the end of the pumping test of the primary well.

RECOVERY

Recovery was rapid in both the primary well and the piezometer well. The primary well reached 84% recovery in 2 hours and 92% in 12 hours.

CONCLUSIONS

<u>SAND</u> During the testing, sand was not visible but during disassembly of test equipment, tablespoon amounts of sand were found. Any increase in pumping rate should be monitored for excessive sand production.

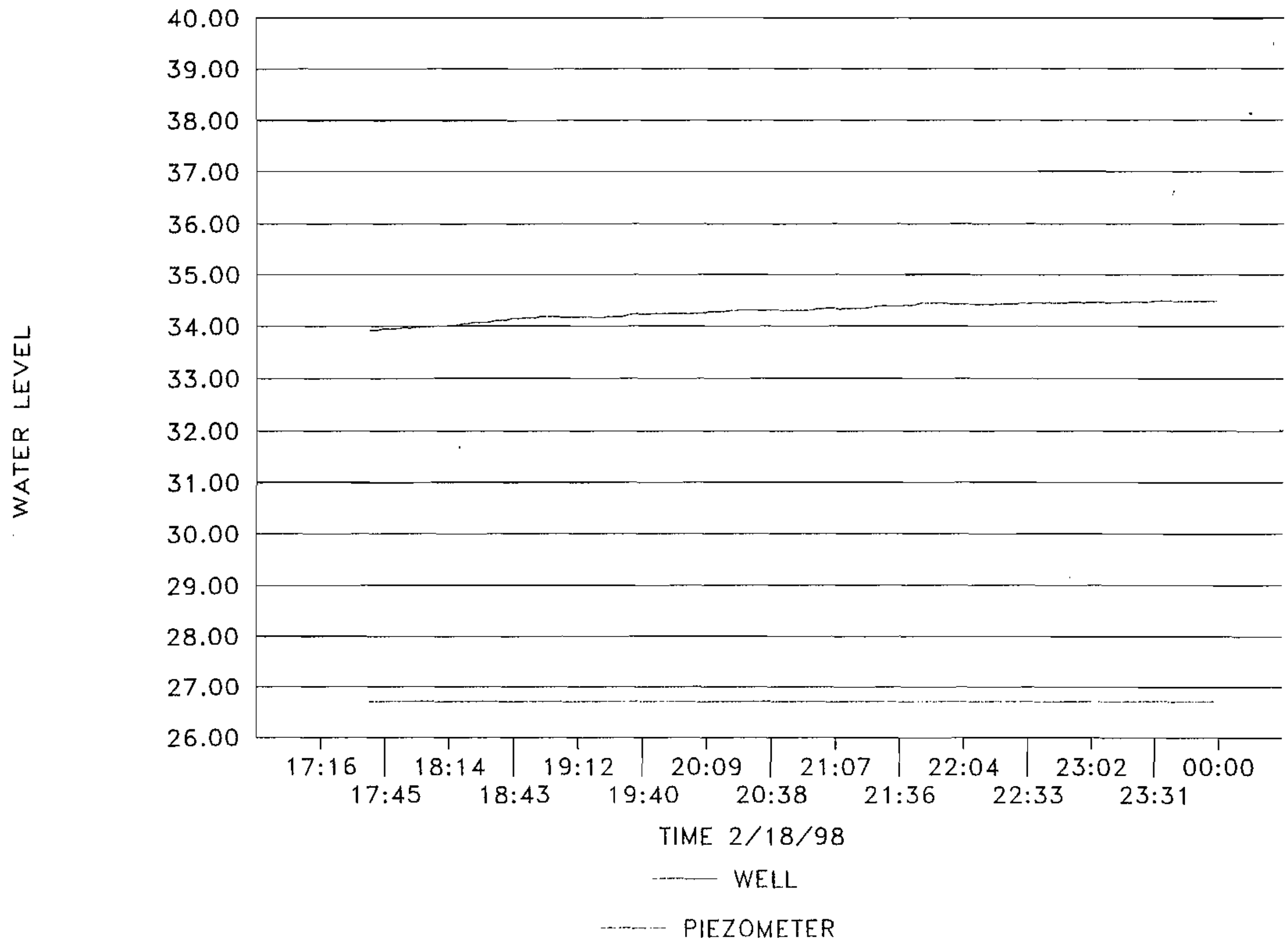
<u>FLOW</u> The well stabilized at 600 gpm with a pumping level of 90' exposing one screen located at 75'-80'. Although the well can sustain flow rates of 600 gpm, care should be taken in monitoring the seasonal effect that would occur in late August through October. As the pumping level is lowered below the screens, cascading and iron encrustments can increase resulting in higher maintenance in both the pump and well.

<u>AREA OF INFLUENCE</u> The geology of the area is comprised of stratas of clay, weathered small gravels and sand. Data from the piezometer well indicated an influence of 13.86' with a pumping level of 90' in the primary well. We would anticipate measurable influence in surrounding wells located 1000' or more from the primary well. It is our opinion that all older wells not being maintained nor currently in use in the immediate area should be abandoned as per State Water Resources requirements to reduce possible paths of contamination. The piezometer well was probably drilled prior to well logs being required (prior to 1964) as there is no record of this well. Several similar wells may currently exist and require a door-to-door survey to locate them.

Attachments:

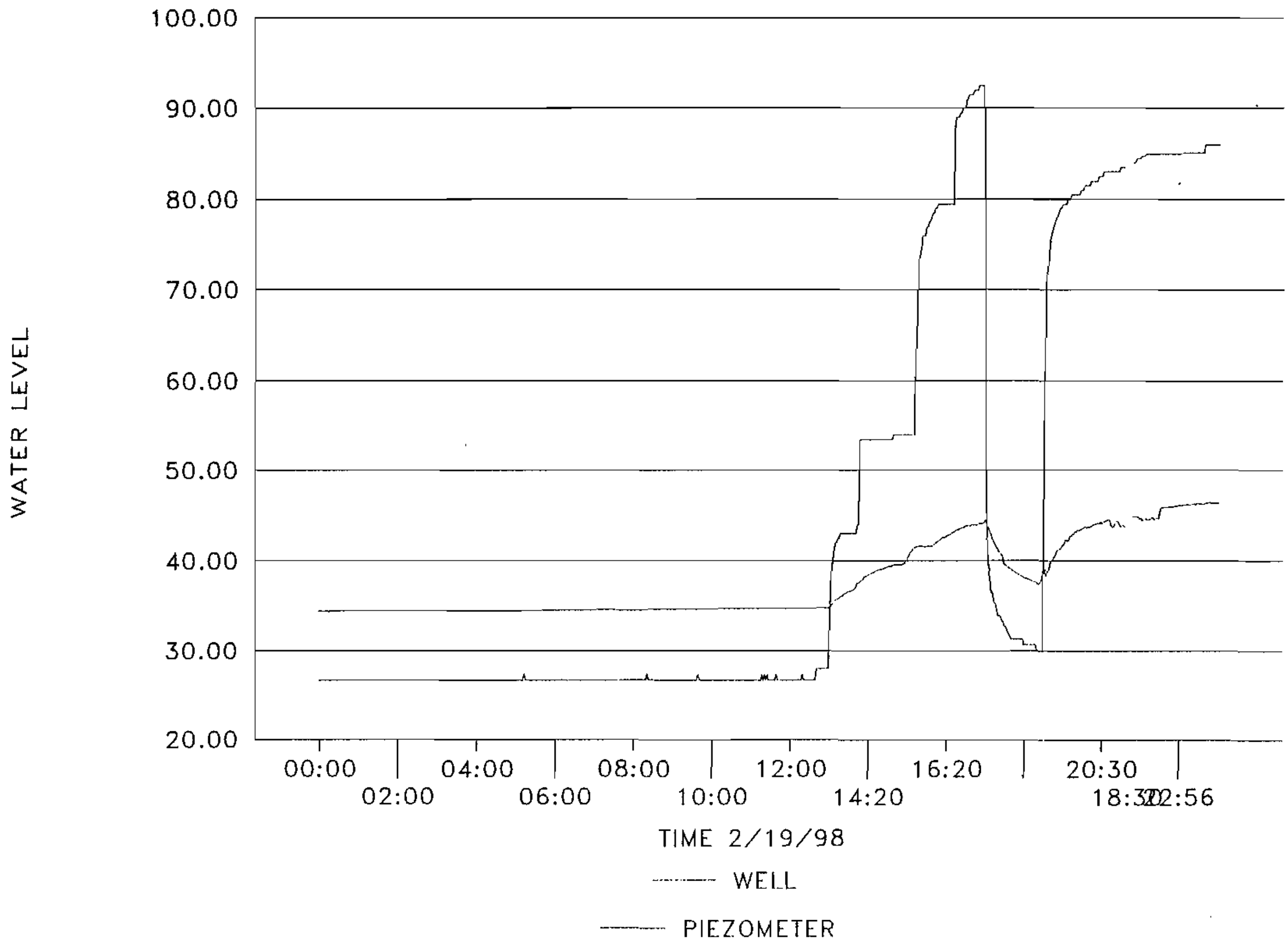
- Graphs of Water Level vs. Time
- Copy of Collected Data
- Water Well Report
- Preliminary Local Climatological Data

VENETA WELL #9

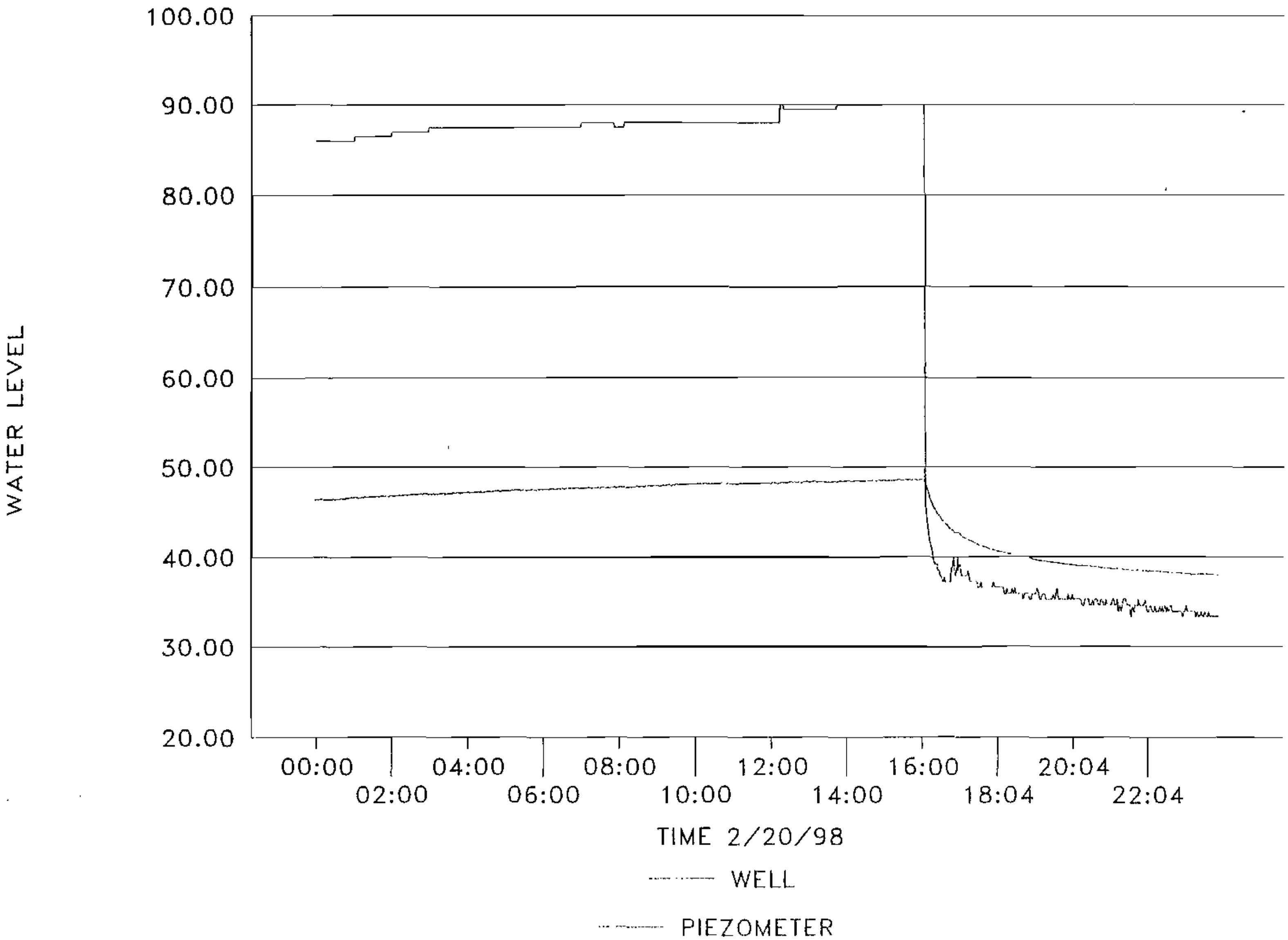


B3-6

VENETA WELL #9

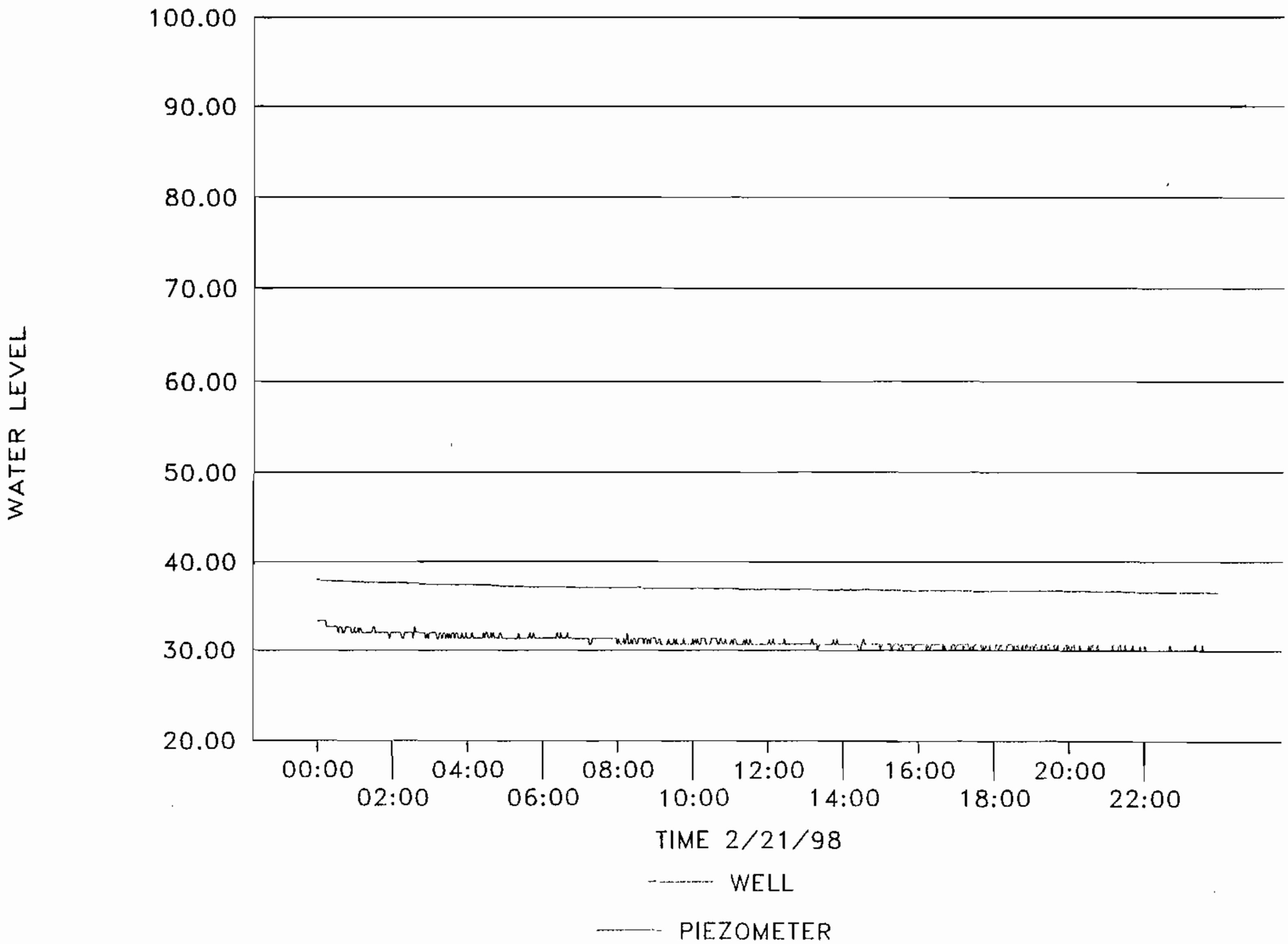


VENETA WELL #9



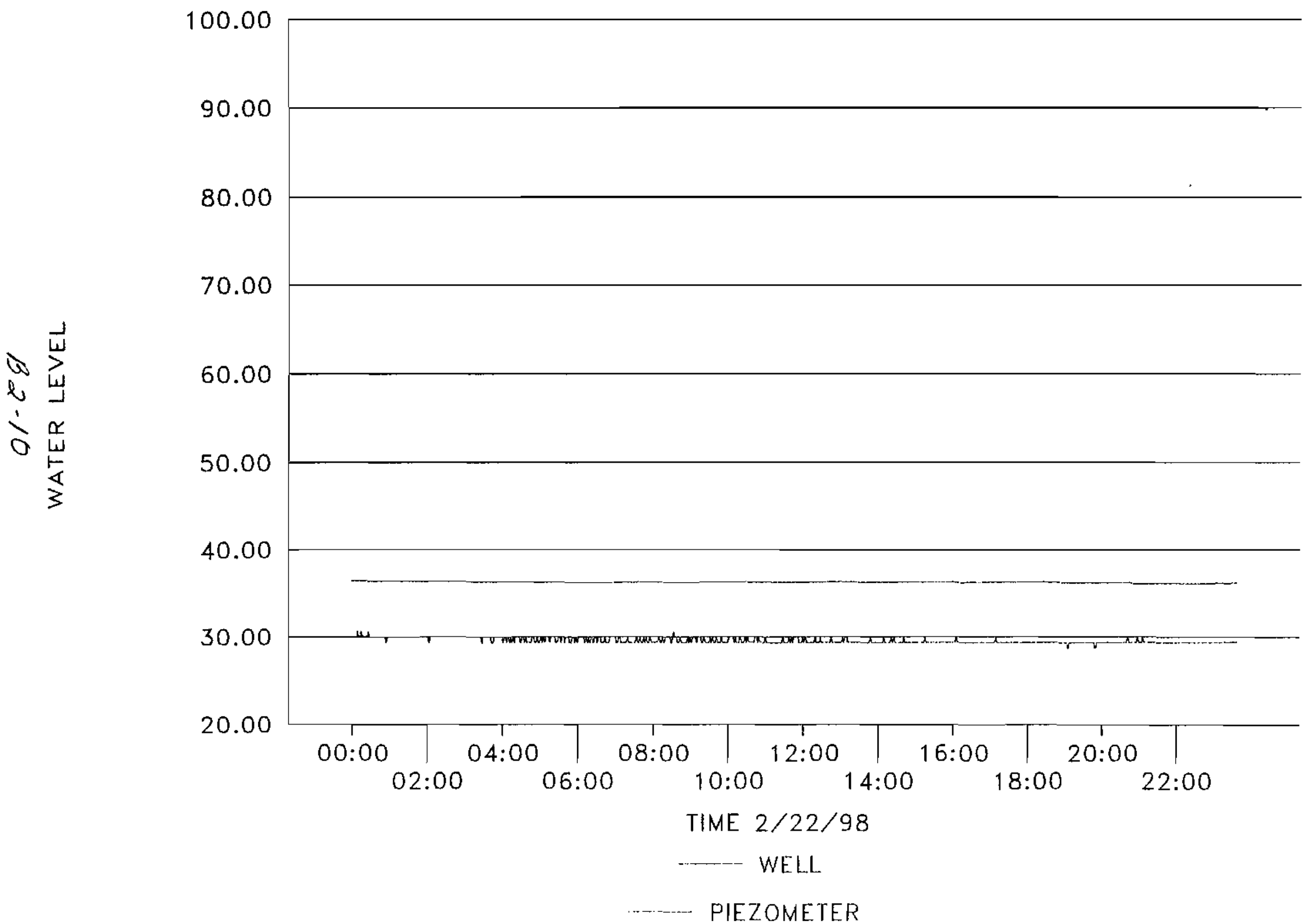
B2-8

VENETA WELL #9



B2-9

VENETA WELL #9



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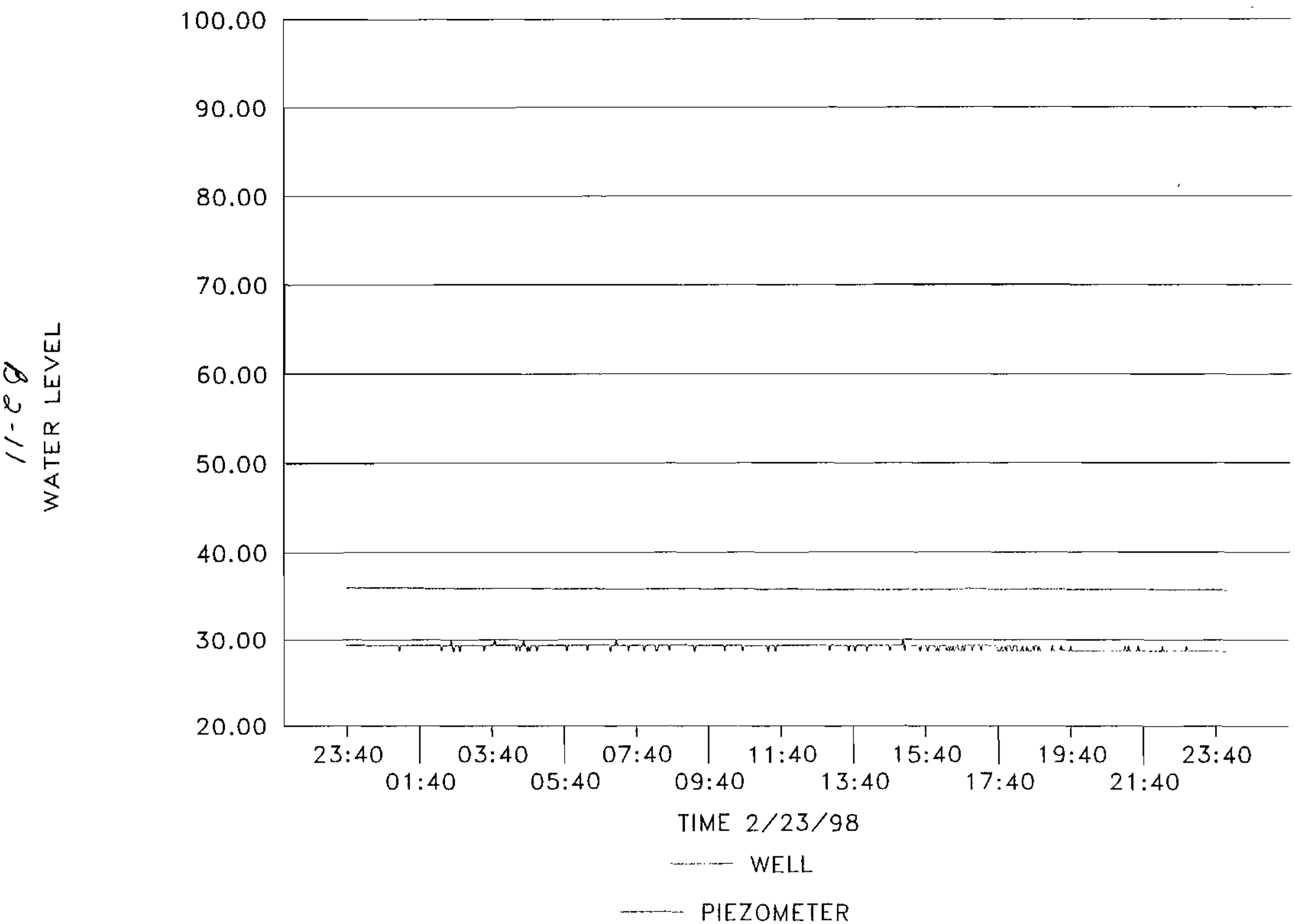

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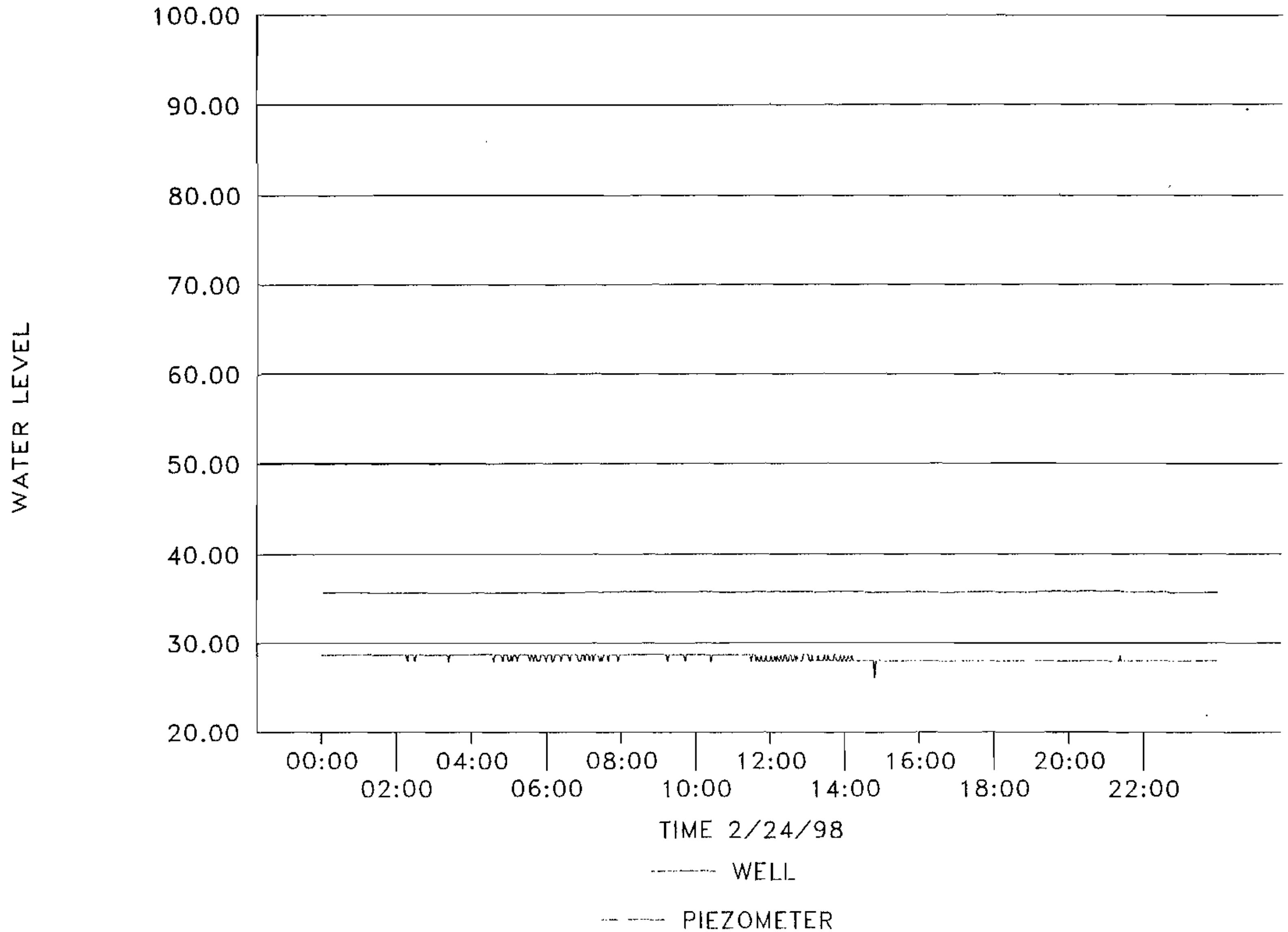

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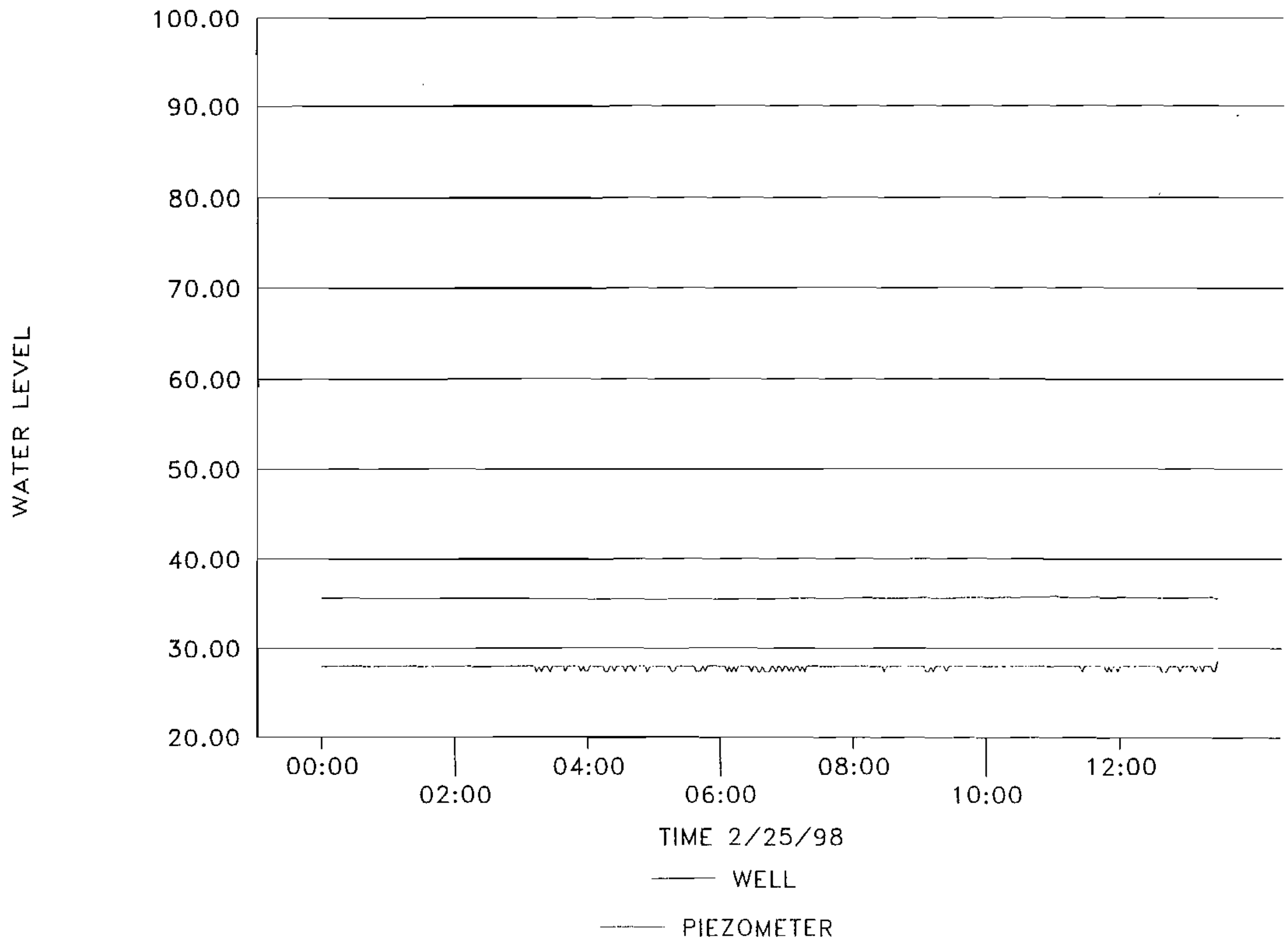

APPENDIX C
WATER SYSTEM MODEL

[illegible]

[illegible]

HYD	NODE	TIME OF DAY TESTED	DATE OF TEST	TESTED FLOW GPM	TESTED STATIC PRESSURE	TESTED RESIDUAL	MODELED FLOW	MODELED STATIC PRESSURE	FLOW DIFFERENCE	PRESSURE DIFFERENCE	CALIBRATION SCENARIO	PUMPS ON/OFF
1	125	1419	8	1250	68	54	1215	68	-35	0	ADD	OFF
2	127	1437	8	1180	65	48	1225	64.5	45	-0.5	ADD	OFF
42	137	1525	14	1300	75	60	1398	75.2	98	0.2	ADD	OFF
37	144	857	16	1300	85	60	1326	82.9	26	-2.1	MDD	OFF
38	146	845	16	1300	85	60	1334	83.4	34	-1.6	MDD	OFF
39	143	825	16	1300	80	60	1254	79	-46	-1	MDD	OFF
36	147	1355	14	1300	80	60	1242	78.4	-58	-1.6	MDD	OFF
35	149	1345	14	1300	80	60	1120	78	-180	-2	MDD	OFF
34	151	1325	14	1205	70	52	1212	70	7	0	ADD	OFF
33	155	1310	14	1880	65	50	1170	65	-710	0	ADD	ON
71	157	1448	21	1300	***82***	60	1156	82	-144	0	ADD	OFF
72	159	1508	21	1300	80	60	1188	78.6	-112	-1.4	ADD	ON
73	161	1522	21	1300	70	60	1155	78.7	-145	8.7	ADD	ON
41	167	1510	14	1110	80	44	1188	85	78	5	ADD	OFF
40	169	1455	14	1060	75	40	958	86	-102	11	ADD	OFF
12	199	1109	9	1275	68	58	1167	69	-108	1	ADD	OFF
11	203	1054	9	1275	68	58	1070	68	-205	0	ADD	OFF
48	217	1000	16	1180	66	52	1144	66	-36	0	ADD	OFF
49	219	1018	16	1180	67	52	1292	67	112	0	ADD	OFF
50	227	1032	16	1110	65	44	992	65	-118	0	ADD	OFF
51	229	1045	16	1030	65	38	952	65	-78	0	ADD	OFF
52	231	1059	16	860	60	26	854	60	-6	0	ADD	OFF
53	233	1145	16	820	60	24	728	60	-92	0	ADD	OFF

HYD	NODE	TIME OF DAY TESTED	DATE OF TEST	TESTED FLOW GPM	TESTED STATIC PRESSURE	TESTED RESIDUAL	MODELED FLOW	MODELED STATIC PRESSURE	FLOW DIFFERENCE	PRESSURE DIFFERENCE	CALIBRATION SCENARIO	PUMPS ON/OFF
54	235	1130	16	750	60	20	676	60	-74	0	ADD	OFF
55	237	1148	16	750	60	20	665	60	-85	0	ADD	OFF
4	301	1507	8	1205	65	56	1223	65	18	0	ADD	ON
5	303	15523	8	1275	68	58	1197	67.3	-78	-0.7	ADD	ON
6	305	1538	8	1300	68	60	1221	67.3	-79	-0.7	ADD	ON
7	309	1355	8	1275	68	58	1127	68	-148	0	ADD	OFF
9	313	1023	9	1205	65	52	1126	62	-79	-3	ADD	OFF
10	317	1037	9	1275	68	58	1085	68	-190	0	ADD	OFF
8	321	1625	8	1275	65	58	1349	64.3	74	-0.7	ADD	ON
13	329	1118	9	1205	65	52	1071	64.4	-134	-0.6	ADD	ON
14	331	1131	9	1230	63	54	1291	62.4	61	-0.6	ADD	ON
15	335	1145	9	1250	65	56	1060	65	-190	0	ADD	OFF
18	339	1358	9	1205	68	52	1334	68	129	0	ADD	OFF
17	343	1340	9	1250	66	56	1023	66	-227	0	ADD	OFF
19	347	1413	9	1275	68	58	1083	68	-192	0	ADD	OFF
43	353	1604	14	1250	68	56	1198	68	-52	0	ADD	OFF
44	355	1615	14	1135	68	46	1728	67.5	593	-0.5	ADD	OFF
70	357	1435	21	1250	75	56	1575	74.5	325	-0.5	ADD	OFF
22	359	1528	9	1180	65	50	1222	65	42	0	ADD	OFF
31	361	1452	10	1150	65	48	1297	65	147	0	ADD	OFF
20	363	1430	9	1230	68	54	1119	68	-111	0	ADD	ON
21	365	1448	9	920	65	30	821	65	-99	0	ADD	OFF
32	371	1515	10	1180	65	50	983	65	-197	0	ADD	OFF

HYD	NODE	TIME OF DAY TESTED	DATE OF TEST	TESTED FLOW GPM	TESTED STATIC PRESSURE	TESTED RESIDUAL	MODELED FLOW	MODELED STATIC PRESSURE	FLOW DIFFERENCE	PRESSURE DIFFERENCE	CALIBRATION SCENARIO	PUMPS ON/OFF
16	387	1321	9	1250	73	56	1278	73	28	0	MDD	OFF
30	391	1430	10	1105	70	52	1118	70	13	0	MDD	OFF
23	393	1545	9	1145	65	48	1271	62.5	126	-2.5	MDD	OFF
3	405	1452	8	1205	70	52	1215	70	10	0	ADD	OFF
25	501	1620	9	1135	70	46	1123	70	-12	0	ADD	OFF
26	507	1640	9	1060	70	40	931	70	-129	0	ADD	OFF
27	515	1333	10	1110	70	44	1303	70	193	0	ADD	OFF
28	517	1342	10	1090	65	42	1014	65	-76	0	ADD	OFF
29	529	1412	10	750	50	20	793	50	43	0	ADD	OFF
24	533	1607	9	530	15	10	THIS NODE AT THE BASE OF THE 0.5 MG RESERVOIR					
58	703	951	21	1230	70	54	1108	69.5	-122	-0.5	ADD	ON
57	709	935	21	1135	70	46	1090	69.5	-45	-0.5	ADD	ON
60	713	1021	21	1180	70	50	1182	69.5	2	-0.5	ADD	ON
67	715	1346	21	1110	70	44	1229	70	119	0	ADD	OFF
59	719	1007	21	1230	70	54	1167	70	-63	0	ADD	ON
45	733	1630	14	1130	65	54	1145	65	15	0	ADD	OFF
46	737	1638	14	1180	65	52	1098	64.5	-82	-0.5	ADD	ON
47	739	945	16	1110	65	44	1036	64.4	-74	-0.6	ADD	ON
64	743	1035	21	1150	65	42	974	64.4	-176	-0.6	ADD	ON
63	747	1123	21	1110	65	44	884	67.6	-226	2.6	ADD	ON
68	749	1405	21	1110	70	44	1078	70	-32	0	ADD	ON
62	751	1110	21	1155	70	48	1066	70	-89	0	ADD	ON
61	755	1043	21	1180	75	50	1166	75	-14	0	ADD	OFF
66	761	1330	21	1090	70	42	1005	70	-85	0	ADD	OFF
69	763	1420	21	860	75	26	962	75	102	0	ADD	OFF
65	765	1148	21	980	70	34	1001	70	21	0	ADD	ON
56	771	925	21	1205	75	52	1084	74.5	-121	-0.5	ADD	ON

MAXIMUM DIMENSIONS	
Number of pipes	250
Number of pumps	62
Number junction nodes..................	250
Flow meters	62
Boundary nodes	25
Variable storage tanks	62
Pressure switches	62
Regulating Valves.......................	62
Items for limited output	250
limit for non-consecutive numbering ..	7143

Cybernet version 2.18. SN: 1132180497-250

Extended Description:

U N I T S   S P E C I F I E D

FLOWRATE .... = gallons/minute
HEAD (HGL) .... = feet
PRESSURE .... = psig

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

S Y S T E M   C O N F I G U R A T I O N

NUMBER OF PIPES ....(p) = 218
NUMBER OF JUNCTION NODES ....(j) = 187
NUMBER OF PRIMARY LOOPS ....(l) = 30
NUMBER OF BOUNDARY NODES ....(f) = 2
NUMBER OF SUPPLY ZONES ....(z) = 1

****
S I M U L A T I O N   R E S U L T S
****

The results are obtained after 10 trials with an accuracy = 0.00008

S I M U L A T I O N   D E S C R I P T I O N

CyberNet Version 2.18. Copyright 1991,92 Haestad Methods Inc.
Run Description: '97 ADD, PUMPS OFF
Drawing: W-STUDY

P I P E L I N E   R E S U L T S

ATUS CODE: XX -CLOSED PIPE BN -BOUNDARY NODE PU -PUMP LINE
CV -CHECK VALVE RV -REGULATING VALVE TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft)
1000-BN	101	0	0.00	0.00	0.00	0.00	0.00	0.00
1002	101	103	0.00	0.00	0.00	0.00	0.00	0.00
1004	103	105	0.00	0.00	0.00	0.00	0.00	0.00
1006	105	107	0.00	0.00	0.00	0.00	0.00	0.00
1008-XXPU	103	109						
1010-XXPU	105	111						
1012-XXPU	107	113						
1013	110	109	0.00	0.00	0.00	0.00	0.00	0.00
1014	115	110	0.00	0.00	0.00	0.00	0.00	0.00
1015	112	111	0.00	0.00	0.00	0.00	0.00	0.00
1016	117	112	0.00	0.00	0.00	0.00	0.00	0.00
1017	114	113	0.00	0.00	0.00	0.00	0.00	0.00
1018	119	114	0.00	0.00	0.00	0.00	0.00	0.00
1020	115	117	0.00	0.00	0.00	0.00	0.00	0.00
1022	117	119	0.00	0.00	0.00	0.00	0.00	0.00
1024	119	121	0.00	0.00	0.00	0.00	0.00	0.00
1026	123	121	2.48	0.00	0.00	0.00	0.02	0.00
1028	123	125	-2.48	0.00	0.00	0.00	0.02	0.00
1030	125	171	-3.20	0.00	0.00	0.00	0.02	0.00
1032	127	129	-6.80	0.00	0.00	0.00	0.04	0.00
1034	129	131	-7.52	0.00	0.00	0.00	0.05	0.00
1036	131	133	-14.73	0.00	0.00	0.00	0.09	0.01
1038	131	135	15.10	0.00	0.00	0.00	0.02	0.00
1040	135	137	14.38	0.00	0.00	0.00	0.02	0.00
1042	137	139	13.66	0.00	0.00	0.00	0.02	0.00
1043	140	139	-5.17	0.00	0.00	0.00	0.01	0.00
1044	141	140	-3.17	0.00	0.00	0.00	0.01	0.00
1045	140	144	1.00	0.00	0.00	0.00	0.01	0.00
1046	141	143	1.45	0.00	0.00	0.00	0.00	0.00
1047	141	146	1.00	0.00	0.00	0.00	0.01	0.00
1048	143	145	0.72	0.00	0.00	0.00	0.00	0.00
1050	139	147	7.76	0.00	0.00	0.00	0.02	0.00
1052	147	149	7.04	0.00	0.00	0.00	0.03	0.00
1054	149	151	6.32	0.00	0.00	0.00	0.03	0.00
1056	151	153	5.60	0.00	0.00	0.00	0.02	0.00
1058	153	155	3.73	0.00	0.00	0.00	0.02	0.00
1060	155	157	2.80	0.00	0.00	0.00	0.01	0.00
1062	157	159	1.87	0.00	0.00	0.00	0.01	0.00
1064	159	161	0.93	0.00	0.00	0.00	0.00	0.00
1066	153	163	0.93	0.00	0.00	0.00	0.00	0.00
1068	133	165	2.17	0.00	0.00	0.00	0.01	0.00
1070	165	167	1.45	0.00	0.00	0.00	0.02	0.00
1072	167	169	0.72	0.00	0.00	0.00	0.01	0.00
1074	127	171	6.08	0.00	0.00	0.00	0.04	0.00
076	171	179	2.16	0.00	0.00	0.00	0.01	0.00
1082	175	179	-0.72	0.00	0.00	0.00	0.00	0.00
1084	179	183	0.72	0.00	0.00	0.00	0.00	0.00
1100	193	197	-16.06	0.00	0.00	0.00	0.03	0.00
1102	197	211	-86.73	0.00	0.00	0.00	0.14	0.01

1104	199	201	-68.81	0.00	0.00	0.00	0.11	0.00
1106	201	131	8.61	0.00	0.00	0.00	0.01	0.00
1108	133	203	-5.50	0.00	0.00	0.00	0.04	0.00
1110	203	205	-6.22	0.00	0.00	0.00	0.04	0.00
112	205	315	4.45	0.00	0.00	0.00	0.03	0.00
1114	207	209	15.77	0.00	0.00	0.00	0.10	0.01
1116	199	211	68.09	0.00	0.00	0.00	0.11	0.00
1118	209	211	19.37	0.00	0.00	0.00	0.12	0.01
1120	209	213	-4.32	0.00	0.00	0.00	0.03	0.00
1122	213	215	23.67	0.00	0.00	0.00	0.15	0.02
1124	215	197	-69.95	0.00	0.00	0.00	0.11	0.01
1126	215	217	5.37	0.00	0.00	0.00	0.03	0.00
1128	217	219	4.65	0.00	0.00	0.00	0.03	0.00
1130	219	221	-15.66	0.00	0.00	0.00	0.18	0.03
1132	221	193	-15.34	0.00	0.00	0.00	0.03	0.00
1134	221	223	-1.04	0.00	0.00	0.00	0.00	0.00
1136	223	225	-1.76	0.00	0.00	0.00	0.00	0.00
1138	225	121	-2.48	0.00	0.00	0.00	0.01	0.00
1140	219	227	19.58	0.02	0.00	0.00	0.12	0.01
1142	227	229	17.53	0.01	0.00	0.00	0.11	0.01
1144	229	231	15.48	0.02	0.00	0.00	0.18	0.04
1146	231	233	8.21	0.01	0.00	0.00	0.09	0.01
1148	233	235	6.16	0.00	0.00	0.00	0.07	0.01
1150	235	238	4.10	0.00	0.00	0.00	0.02	0.00
1152	238	237	2.05	0.00	0.00	0.00	0.01	0.00
3000	133	405	-12.12	0.01	0.00	0.00	0.14	0.02
3002	301	303	-21.84	0.02	0.00	0.00	0.25	0.05
3004	303	305	-23.30	0.02	0.00	0.00	0.26	0.05
3006	305	307	-24.77	0.01	0.00	0.00	0.16	0.01
3008	307	309	1.46	0.00	0.00	0.00	0.00	0.00
3010	205	311	-11.39	0.03	0.00	0.00	0.13	0.02
3012	311	301	-6.79	0.00	0.00	0.00	0.08	0.01
3014	311	313	-6.06	0.00	0.00	0.00	0.07	0.01
3016	207	315	-6.37	0.00	0.00	0.00	0.04	0.00
3018	201	315	-78.14	0.00	0.00	0.00	0.22	0.02
3020	315	317	-81.53	0.01	0.00	0.00	0.23	0.02
3022	317	313	-82.99	0.02	0.00	0.00	0.24	0.02
3024	313	319	-82.97	0.03	0.00	0.00	0.24	0.04
3026	319	321	-83.98	0.00	0.00	0.00	0.24	0.04
3028	321	323	-85.44	0.01	0.00	0.00	0.24	0.04
3030	323	325	-88.37	0.01	0.00	0.00	0.25	0.05
3032	325	307	27.70	0.00	0.00	0.00	0.08	0.0
3034	323	327	1.46	0.01	0.00	0.00	0.15	0.10
3036	207	329	-10.13	0.01	0.00	0.00	0.11	0.0
3038	329	331	-11.59	0.02	0.00	0.00	0.13	0.03
3040	331	333	-13.49	0.03	0.00	0.00	0.15	0.04
3042	333	335	-22.01	0.03	0.00	0.00	0.25	0.07
3044	335	337	-4.80	0.00	0.00	0.00	0.05	0.0
3046	337	325	117.53	0.01	0.00	0.00	0.33	0.0
3048	333	319	0.46	0.00	0.00	0.00	0.05	0.01
3050	331	314	8.54	0.00	0.00	0.00	0.10	0.0
3051	313	314	-7.54	0.00	0.00	0.00	0.09	0.0
3052	213	339	-28.71	0.03	0.00	0.00	0.18	0.03
3054	339	341	-30.17	0.01	0.00	0.00	0.19	0.0
3056	341	343	-35.92	0.02	0.00	0.00	0.23	0.0
058	343	345	-29.21	0.01	0.00	0.00	0.19	0.03
3060	345	333	-6.60	0.00	0.00	0.00	0.04	0.00
3062	341	331	8.11	0.00	0.00	0.00	0.09	0.0
3064	215	347	87.54	0.00	0.00	0.00	0.14	0.0
3066	347	349	86.07	0.00	0.00	0.00	0.14	0.01

3068	349	351	84.61	0.00	0.00	0.00	0.14	0.01
3070	351	353	83.15	0.00	0.00	0.00	0.13	0.01
3072	353	355	81.68	0.00	0.00	0.00	0.13	0.01
3074	355	357	80.22	0.00	0.00	0.00	0.13	0.01
076	357	356	-11.76	0.00	0.00	0.00	0.13	0.03
3077	359	356	18.58	0.08	0.00	0.00	0.21	0.05
3078	359	361	24.22	0.01	0.00	0.00	0.15	0.02
3080	361	363	14.08	0.01	0.00	0.00	0.16	0.03
3082	363	365	1.46	0.00	0.00	0.00	0.02	0.00
3086	363	369	11.15	0.00	0.00	0.00	0.13	0.02
3088	369	371	9.69	0.00	0.00	0.00	0.11	0.02
3090	371	373	8.23	0.00	0.00	0.00	0.09	0.01
3092	373	375	6.76	0.00	0.00	0.00	0.08	0.01
3094	375	341	3.83	0.00	0.00	0.00	0.04	0.00
3096	375	377	1.46	0.02	0.00	0.00	0.15	0.10
3098	362	343	8.17	0.01	0.00	0.00	0.09	0.01
3099	361	362	8.67	0.00	0.00	0.00	0.10	0.01
3102	381	1000	24.08	0.03	0.00	0.00	0.27	0.07
3103	1000	1001	24.08	0.03	0.00	0.00	0.27	0.07
3104	381	335	18.68	0.04	0.00	0.00	0.21	0.05
3105	1001	345	24.08	0.01	0.00	0.00	0.27	0.07
3108	337	385	-123.80	0.05	0.00	0.00	0.35	0.06
3110	385	387	20.10	0.00	0.00	0.00	0.23	0.06
3112	387	381	44.22	0.01	0.00	0.00	0.50	0.27
3114	387	389	-25.58	0.03	0.00	0.00	0.29	0.10
3116	389	391	-26.49	0.03	0.00	0.00	0.30	0.10
3118	391	393	-27.96	0.07	0.00	0.00	0.32	0.10
3119	393	394	-27.96	0.01	0.00	0.00	0.32	0.10
3120	395	394	72.22	0.01	0.00	0.00	0.82	0.57
3122	395	397	170.23	0.12	0.00	0.00	0.48	0.11
124	397	389	0.55	0.00	0.00	0.00	0.01	0.00
3126	397	385	152.59	0.02	0.00	0.00	0.43	0.09
3128	394	359	44.26	0.19	0.00	0.00	0.50	0.23
3134	395	399	5.04	0.00	0.00	0.00	0.01	0.00
3136	399	401	1.25	0.00	0.00	0.00	0.01	0.00
3137	401	404	0.48	0.00	0.00	0.00	0.01	0.00
3138	401	399	-0.90	0.00	0.00	0.00	0.01	0.00
3139	404	403	0.48	0.00	0.00	0.00	0.01	0.00
3140	399	403	1.20	0.00	0.00	0.00	0.01	0.00
3142	301	405	13.59	0.02	0.00	0.00	0.15	0.03
5000	385	501	7.22	0.01	0.00	0.00	0.08	0.01
5002	501	503	5.79	0.00	0.00	0.00	0.07	0.00
5004	503	505	7.14	0.00	0.00	0.00	0.08	0.01
5006	505	507	4.28	0.00	0.00	0.00	0.05	0.00
5008	507	509	2.86	0.00	0.00	0.00	0.03	0.00
5010	509	511	1.43	0.00	0.00	0.00	0.02	0.00
5012	505	513	1.43	0.00	0.00	0.00	0.02	0.00
5014	515	397	-15.63	0.02	0.00	0.00	0.18	0.04
5016	515	517	9.91	0.02	0.00	0.00	0.11	0.02
5018	517	519	1.43	0.00	0.00	0.00	0.02	0.00
5020	517	503	2.77	0.00	0.00	0.00	0.03	0.00
5022	515	521	4.28	0.00	0.00	0.00	0.05	0.00
5024	523	521	-1.43	0.00	0.00	0.00	0.02	0.00
5026	521	525	1.43	0.00	0.00	0.00	0.04	0.00
5028	517	527	4.28	0.00	0.00	0.00	0.05	0.01
030	529	527	-2.77	0.00	0.00	0.00	0.07	0.02
5032	529	531	1.43	0.00	0.00	0.00	0.04	0.00
5034	529	527	-0.09	0.00	0.00	0.00	0.01	0.00
5036	395	533	-249.16	0.07	0.00	0.00	0.40	0.06
5037	545	547	1.14	0.00	0.00	0.00	0.01	0.00

5038	533	535	-251.45	0.01	0.00	0.00	1.03	0.55
5042	535	537	6.85	0.00	0.00	0.00	0.31	0.25
5044-PU	537	539	5.43	0.00	145.81	0.00	0.25	0.16
5046	539	545	4.00	0.00	0.00	0.00	0.18	0.09
050	541	545	-1.43	0.00	0.00	0.00	0.06	0.01
5056-BN	535	0	-259.73	0.03	0.00	0.00	1.06	0.59
7000	357	358	18.84	0.00	0.00	0.00	0.21	0.05
7001	358	701	18.34	0.01	0.00	0.00	0.21	0.05
7002	701	703	14.63	0.01	0.00	0.00	0.09	0.01
7004	703	705	12.62	0.02	0.00	0.00	0.14	0.02
7006	707	705	-2.01	0.00	0.00	0.00	0.01	0.00
7008	705	709	8.61	0.00	0.00	0.00	0.10	0.01
7010	709	771	6.60	0.01	0.00	0.00	0.07	0.01
7012	711	713	2.89	0.00	0.00	0.00	0.03	0.00
7014	713	715	-3.81	0.00	0.00	0.00	0.04	0.00
7015	716	715	0.00	0.00	0.00	0.00	0.00	0.00
7016	715	717	-13.36	0.01	0.00	0.00	0.15	0.02
7018	717	719	-15.07	0.01	0.00	0.00	0.17	0.03
7020	719	721	-16.78	0.00	0.00	0.00	0.19	0.03
7022	721	723	-20.19	0.00	0.00	0.00	0.23	0.05
7026	723	727	-21.90	0.02	0.00	0.00	0.25	0.05
7028	727	729	-34.01	0.00	0.00	0.00	0.05	0.00
7030	731	729	-12.79	0.03	0.00	0.00	0.33	0.15
7032	729	733	-59.59	0.00	0.00	0.00	0.10	0.00
7033	356	727	5.82	0.01	0.00	0.00	0.07	0.00
7034	733	357	-71.68	0.00	0.00	0.00	0.11	0.01
7036	701	735	1.71	0.02	0.00	0.00	0.17	0.10
7038	727	737	16.21	0.01	0.00	0.00	0.18	0.03
7040	737	739	14.50	0.02	0.00	0.00	0.16	0.03
7042	739	773	12.79	0.01	0.00	0.00	0.15	0.02
044	741	743	4.25	0.00	0.00	0.00	0.05	0.00
7046	743	745	0.83	0.00	0.00	0.00	0.01	0.00
7048	745	747	1.71	0.00	0.00	0.00	0.02	0.00
7050	745	749	-2.58	0.00	0.00	0.00	0.03	0.00
7052	749	751	-4.29	0.00	0.00	0.00	0.05	0.00
7054	751	753	-6.00	0.00	0.00	0.00	0.07	0.00
7056	753	755	-7.71	0.00	0.00	0.00	0.09	0.01
7058	715	755	7.84	0.00	0.00	0.00	0.09	0.01
7060	755	757	-1.58	0.00	0.00	0.00	0.02	0.00
7061	713	714	4.99	0.00	0.00	0.00	0.06	0.00
7062	757	714	-4.99	0.00	0.00	0.00	0.06	0.00
7064	757	759	1.71	0.02	0.00	0.00	0.17	0.10
7066	721	761	1.71	0.00	0.00	0.00	0.02	0.00
7068	743	763	1.71	0.00	0.00	0.00	0.02	0.00
7070	741	767	5.13	0.00	0.00	0.00	0.06	0.00
7072	765	767	-1.71	0.00	0.00	0.00	0.04	0.00
7074	767	769	1.71	0.02	0.00	0.00	0.17	0.10
7078	711	771	-4.90	0.00	0.00	0.00	0.06	0.00
7080	741	773	-11.09	0.01	0.00	0.00	0.13	0.02

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
101-1		0.00	451.50	422.50	29.00	12.57
103-1		0.00	451.50	422.50	29.00	12.57

105-1	0.00	451.50	422.50	29.00	12.57
107-1	0.00	451.50	422.50	29.00	12.57
109-1	0.00	575.95	422.50	153.45	66.49
110-1	0.00	575.95	422.50	153.45	66.49
111-1	0.00	575.95	422.50	153.45	66.49
112-1	0.00	575.95	422.50	153.45	66.49
113-1	0.00	575.95	422.50	153.45	66.49
114-1 reducer	0.00	575.95	422.50	153.45	66.49
115-1	0.00	575.95	422.50	153.45	66.49
117-1	0.00	575.95	422.50	153.45	66.49
119-1	0.00	575.95	422.50	153.45	66.49
121-1	0.00	575.95	422.50	153.45	66.49
123-1	0.00	575.95	422.50	153.45	66.49
125-1	0.72	575.95	418.46	157.49	68.24
127-1	0.72	575.95	426.91	149.04	64.58
129-1	0.72	575.95	418.00	157.95	68.44
131-1	0.72	575.95	416.00	159.95	69.31
133-1	0.72	575.95	416.00	159.95	69.31
135-1	0.72	575.95	410.00	165.95	71.91
137-1	0.72	575.95	402.29	173.66	75.25
139-1	0.72	575.95	377.88	198.07	85.83
140-1	1.00	575.95	378.38	197.57	85.61
141-1	0.72	575.95	378.38	197.57	85.61
143-1	0.72	575.95	388.92	187.03	81.05
144-1	1.00	575.95	379.57	196.38	85.10
145-1	0.72	575.95	388.00	187.95	81.44
146-1	1.00	575.95	378.38	197.57	85.61
147-1	0.72	575.95	390.00	185.95	80.58
149-1	0.72	575.95	391.14	184.81	80.08
151-1	0.72	575.95	414.31	161.64	70.04
153-1	0.93	575.95	426.00	149.95	64.98
155-1	0.93	575.95	426.74	149.21	64.66
157-1	0.93	575.95	386.50	189.45	82.09
159-1	0.93	575.95	394.15	181.80	78.78
161-1	0.93	575.95	394.00	181.95	78.84
163-1	0.93	575.95	420.00	155.95	67.58
165-1	0.72	575.95	401.00	174.95	75.81
167-1	0.72	575.95	380.69	195.26	84.61
169-1	0.72	575.95	377.39	198.56	86.04
171-1	0.72	575.95	406.00	169.95	73.64
175-1	0.72	575.95	423.00	152.95	66.28
179-1	0.72	575.95	407.00	168.95	73.21
183-1	0.72	575.95	417.00	158.95	68.88
193-1	0.72	575.95	403.00	172.95	74.94
197-1	0.72	575.95	420.00	155.95	67.58
199-1	0.72	575.95	417.00	158.95	68.88
201-1	0.72	575.95	413.00	162.95	70.61
203-1	0.72	575.95	419.90	156.05	67.62
205-1	0.72	575.95	413.00	162.95	70.61
207-1	0.72	575.95	420.00	155.95	67.58
209-1	0.72	575.95	420.00	155.95	67.58
211-1	0.72	575.95	420.00	155.95	67.58
213-1	0.72	575.95	420.00	155.95	67.58
215-1	0.72	575.95	420.00	155.95	67.58
217-1	0.72	575.95	424.46	151.49	65.64
219-1	0.72	575.94	422.10	153.84	66.67
221-1	0.72	575.95	421.00	154.95	67.14
223-1	0.72	575.95	420.00	155.95	67.58
225-1	0.72	575.95	422.50	153.45	66.49
227-1	2.05	575.93	426.80	149.13	64.62

229-1	2.05	575.92	426.78	149.14	64.63
231-1 New subdiv.	7.27	575.90	438.20	137.70	59.67
233-1	2.05	575.90	438.15	137.75	59.69
235-1	2.05	575.89	438.26	137.63	59.64
237-1	2.05	575.89	438.26	137.63	59.64
238-1	2.05	575.89	436.00	139.89	60.62
301-1	1.46	575.98	426.78	149.20	64.65
303-1	1.46	576.00	419.90	156.10	67.64
305-1	1.46	576.01	419.90	156.11	67.65
307-1	1.46	576.02	415.90	160.12	69.38
309-1	1.46	576.02	419.80	156.22	67.69
311-1	1.46	575.98	428.65	147.33	63.84
313-1	1.46	575.98	433.20	142.78	61.87
314-1	1.00	575.98	431.00	144.98	62.82
315-1	1.46	575.95	413.00	162.95	70.61
317-1	1.46	575.96	420.00	155.96	67.58
319-1	1.46	576.00	427.00	149.00	64.57
321-1	1.46	576.01	426.80	149.21	64.66
323-1	1.46	576.01	425.00	151.01	65.44
325-1	1.46	576.02	420.00	156.02	67.61
327-1	1.46	576.00	415.00	161.00	69.77
329-1	1.46	575.96	426.85	149.11	64.6
331-1	1.46	575.98	431.41	144.57	62.6
333-1	1.46	576.01	420.40	155.61	67.43
335-1	1.46	576.03	426.96	149.07	64.6
337-1	1.46	576.03	423.46	152.57	66.1
339-1	1.46	575.97	419.74	156.23	67.70
341-1	1.46	575.98	424.00	151.98	65.8
343-1	1.46	576.00	424.40	151.60	65.6
345-1	1.46	576.01	416.35	159.66	69.1
347-1	1.46	575.95	419.79	156.16	67.67
349-1	1.46	575.94	420.00	155.94	67.5
351-1	1.46	575.94	419.00	156.94	68.0
353-1	1.46	575.94	419.89	156.05	67.62
355-1	1.46	575.94	419.89	156.05	67.6
356-1	1.00	575.94	416.00	159.94	69.3
357-1	1.46	575.94	403.80	172.14	74.59
358-1	0.50	575.94	403.80	172.14	74.59
359-1	1.46	576.02	426.89	149.13	64.
361-1	1.46	576.01	426.81	149.20	64.
362-1	0.50	576.00	426.81	149.19	64.65
363-1	1.46	575.99	419.79	156.20	67.
365-1	1.46	575.99	426.72	149.27	64.
369-1	1.46	575.99	420.00	155.99	67.6
371-1	1.46	575.99	426.72	149.27	64.
373-1	1.46	575.99	420.00	155.99	67.
375-1	1.46	575.98	420.00	155.98	67.5
377-1	1.46	575.96	420.70	155.26	67.2
381-1	1.46	576.07	409.80	166.27	72.
385-1	1.46	576.08	410.50	165.58	71.
387-1	1.46	576.08	408.38	167.70	72.6
389-1	1.46	576.11	420.00	156.11	67
391-1	1.46	576.14	415.26	160.88	69
393-1	0.00	576.21	428.00	148.21	64.2
394-1	0.00	576.21	428.00	148.21	64
395-1	1.68	576.23	424.00	152.23	65
397-1	1.46	576.11	420.00	156.11	67.6
399-1	1.68	576.23	424.00	152.23	65
401-1	1.68	576.23	433.85	142.38	61
403-1	1.68	576.23	428.80	147.43	63.

404-1		0.00	576.23	426.00	150.23	65.10
405-1		1.46	575.96	415.30	160.66	69.62
501-1		1.43	576.07	415.20	160.87	69.71
503-1		1.43	576.07	416.40	159.67	69.19
505-1		1.43	576.07	418.25	157.82	68.39
507-1		1.43	576.07	415.35	160.72	69.65
509-1		1.43	576.07	420.04	156.03	67.61
511-1		1.43	576.07	390.00	186.07	80.63
513-1		1.43	576.07	400.00	176.07	76.30
515-1		1.43	576.09	415.40	160.69	69.63
517-1		1.43	576.07	426.80	149.27	64.69
519-1		1.43	576.07	450.00	126.07	54.63
521-1		1.43	576.09	433.00	143.09	62.00
523-1		1.43	576.09	436.00	140.09	60.70
525-1		1.43	576.09	446.00	130.09	56.37
527-1		1.43	576.07	464.00	112.07	48.56
529-1		1.43	576.07	461.49	114.58	49.65
531-1		1.43	576.07	500.00	76.07	32.96
533-1	Area just be	2.28	576.30	542.73	33.57	14.55
535-1		1.43	576.30	547.33	28.97	12.56
537-1		1.43	576.30	547.33	28.97	12.55
539-1		1.43	722.12	547.33	174.79	75.74
541-1		1.43	722.11	500.00	222.11	96.25
545-1		1.43	722.11	547.33	174.78	75.74
547-1		1.14	722.11	560.00	162.11	70.25
701-1		2.01	575.93	415.00	160.93	69.73
703-1		2.01	575.92	415.18	160.74	69.65
705-1		2.01	575.90	410.92	164.98	71.49
707-1		2.01	575.90	403.00	172.90	74.92
709-1		2.01	575.90	415.18	160.72	69.64
711-1		2.01	575.89	411.00	164.89	71.45
713-1		1.71	575.89	415.13	160.76	69.66
714-1		0.00	575.89	416.53	159.36	69.06
715-1		1.71	575.89	415.19	160.70	69.64
716-1		0.00	575.89	413.77	162.12	70.25
717-1		1.71	575.89	416.00	159.89	69.29
719-1		1.71	575.90	415.20	160.70	69.64
721-1		1.71	575.90	419.00	156.90	67.99
723-1		1.71	575.91	419.00	156.91	67.99
727-1		1.71	575.93	420.00	155.93	67.57
729-1	Mobile homes	12.79	575.93	420.00	155.93	67.57
731-1	Mobile homes	12.79	575.90	420.00	155.90	67.56
733-1	Mobile homes	12.09	575.93	425.56	150.37	65.16
735-1		1.71	575.91	419.10	156.81	67.95
737-1		1.71	575.92	426.70	149.22	64.66
739-1		1.71	575.90	426.88	149.02	64.58
741-1		1.71	575.88	428.00	147.88	64.08
743-1		1.71	575.88	426.88	149.00	64.57
745-1		1.71	575.88	427.00	148.88	64.52
747-1		1.71	575.88	419.50	156.38	67.77
749-1		1.71	575.88	415.16	160.72	69.65
751-1		1.71	575.88	415.20	160.68	69.63
753-1		1.71	575.89	418.00	157.89	68.42
755-1		1.71	575.89	403.60	172.29	74.66
757-1		1.71	575.89	416.00	159.89	69.28
759-1		1.71	575.87	414.00	161.87	70.14
761-1		1.71	575.90	415.30	160.60	69.60
763-1		1.71	575.88	424.00	151.88	65.82
765-1		1.71	575.88	420.00	155.88	67.55
767-1		1.71	575.88	415.23	160.65	69.62

769-1	1.71	575.86	417.00	158.86	68.84
771-1	1.71	575.89	403.70	172.19	74.62
773-1	1.71	575.89	419.00	156.89	67.99
1000-1	0.00	576.05	417.00	159.05	68.92
1001-1	0.00	576.01	418.00	158.01	68.47

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM BOUNDARY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO BOUNDARY NODES

PIPE NUMBER	FLOWRATE (gpm)
1000	0.00
5056	259.73

NET SYSTEM INFLOW = 259.73
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 259.73

**** CYBERNET SIMULATION COMPLETED ****

DATE: 3/10/1998
TIME: 16:09:40

Cybernet Version: 2.18 SN: 1132180497 11-03-1998
Description: '97 ADD: PUMPS OFF, 20 PSI @ HYD & 0 PSI IN ZONE
Drawing: S:\S\C\3033.19\WATERMAP\W-STUDY

Fire Flow Summary.

JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
125	0.7	68.0	1	1000.7	2452.3	20.0	2.6	531
127	0.7	64.3	1	1000.7	2152.0	20.0	8.5	531
137	0.7	75.0	1	1000.7	2571.8	31.5	0.0	531
143	0.7	80.8	1	1000.7	2571.8	32.7	0.0	531
144	1.0	84.8	1	1001.0	2571.8	28.3	0.0	531
146	1.0	85.3	1	1001.0	2571.8	27.8	0.0	531
147	0.7	80.3	1	1000.7	2571.8	32.8	0.0	531
149	0.7	79.8	1	1000.7	2571.8	22.9	0.0	531
151	0.7	69.8	1	1000.7	2159.0	20.0	8.4	531
155	0.9	64.4	1	1000.9	1807.0	20.0	14.6	531
157	0.9	81.8	1	1000.9	2062.1	20.0	8.4	155
159	0.9	78.5	1	1000.9	1922.5	20.0	12.7	531
161	0.9	78.6	1	1000.9	1875.4	20.0	13.5	531
167	0.7	84.3	1	1000.7	1530.0	20.0	19.0	531
169	0.7	85.8	1	1000.7	1163.6	20.0	23.9	531
199	0.7	68.6	1	1000.7	2572.1	26.9	0.0	531
203	0.7	67.4	1	1000.7	2571.7	24.7	0.0	531
217	0.7	65.4	1	1000.7	2290.0	20.0	5.9	531
219	0.7	66.4	1	1000.7	2520.0	20.0	1.1	531
227	2.1	64.4	1	1002.1	1525.0	20.0	15.0	237
229	2.1	64.4	1	1002.1	1261.6	20.0	15.0	237
231	7.3	59.4	1	1007.3	926.6*	20.0	20.0	237
233	2.1	59.4	1	1002.1	764.4*	20.0	19.9	237
235	2.1	59.4	1	1002.1	668.8*	20.0	20.0	237
237	2.1	59.4	1	1002.1	658.4*	20.0	21.1	235
301	1.5	64.4	1	1001.5	2343.1	20.0	4.7	531
303	1.5	67.4	1	1001.5	2310.6	20.0	5.3	531
305	1.5	67.4	1	1001.5	2560.5	20.2	0.0	531
309	1.5	67.4	1	1001.5	2560.1	27.8	0.0	531
313	1.5	61.6	1	1001.5	2568.0	21.6	0.0	531
317	1.5	67.3	1	1001.5	2570.8	26.0	0.0	531
321	1.5	64.4	1	1001.5	2562.1	25.7	0.0	531
329	1.5	64.3	1	1001.5	1808.0	20.0	14.6	531
331	1.5	62.4	1	1001.5	2389.1	20.0	3.8	531
335	1.5	64.3	1	1001.5	2557.0	25.4	0.0	531
339	1.5	67.4	1	1001.5	2554.3	20.0	0.5	531
343	1.5	65.4	1	1001.5	2578.6	21.1	0.0	531
347	1.5	67.4	1	1001.5	2572.4	25.6	0.0	531
353	1.5	67.4	1	1001.5	2573.3	24.5	0.0	531
355	1.5	67.4	1	1001.5	2573.6	24.1	0.0	531
357	1.5	74.3	1	1001.5	2573.9	30.7	0.0	531

* Needed Fire Flow not attained.

JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT Number
359	1.5	64.4	1	1001.5	2313.5	20.0	6.7	531
361	1.5	64.4	1	1001.5	2287.0	20.0	6.8	531
363	1.5	67.4	1	1001.5	1920.8	20.0	13.1	531
365	1.5	64.4	1	1001.5	940.6*	20.0	26.5	531
371	1.5	64.4	1	1001.5	1860.7	20.0	14.0	531
387	1.5	72.4	1	1001.5	2548.5	36.8	0.0	531
391	1.5	69.4	1	1001.5	2393.0	20.0	5.8	531
393	0.0	64.0	1	1000.0	2784.0	20.0	0.1	531
405	1.5	69.4	1	1001.5	2181.6	20.0	7.9	531
501	1.4	69.4	1	1001.4	1558.6	26.3	0.0	531
507	1.4	69.4	1	1001.4	1228.1	20.0	6.5	531
515	1.4	69.4	1	1001.4	1693.3	27.8	0.0	531
517	1.4	64.4	1	1001.4	1232.9	31.7	0.0	531
529	1.4	49.4	1	1001.4	783.6*	20.0	3.3	531
703	2.0	69.4	1	1002.0	1784.8	20.0	15.0	531
709	2.0	69.4	1	1002.0	1461.4	20.0	20.0	531
713	1.7	69.4	1	1001.7	1704.1	20.0	16.3	531
715	1.7	69.4	1	1001.7	1772.0	20.0	15.2	531
719	1.7	69.4	1	1001.7	1863.5	20.0	13.7	531
733	12.1	64.9	1	1012.1	2574.0	20.3	0.0	531
737	1.7	64.4	1	1001.7	1823.9	20.0	14.4	531
739	1.7	64.3	1	1001.7	1402.8	20.0	20.8	531
743	1.7	64.3	1	1001.7	1273.8	20.0	21.2	763
747	1.7	67.5	1	1001.7	1185.8	20.0	23.6	531
749	1.7	69.4	1	1001.7	1393.2	20.0	18.9	745
751	1.7	69.4	1	1001.7	1494.4	20.0	19.5	531
755	1.7	74.4	1	1001.7	1817.1	20.0	14.5	531
761	1.7	69.3	1	1001.7	1385.6	20.0	21.0	531
763	1.7	65.6	1	1001.7	921.5*	20.0	26.6	531
767	1.7	69.4	1	1001.7	1184.1	20.0	17.9	765
771	1.7	74.4	1	1001.7	1567.2	20.0	18.4	531

Cybernet Version: 2.18 SN: 1132180497 11-03-1998
Description: '97 ADD: PUMPS OFF, 20 PSI @ HYD & 20 PSI IN ZONE
Drawing: S:\S\C\3033.19\WATERMAP\W-STUDY

Fire Flow Summary.

JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
125	0.7	68.0	1	1000.7	1459.2	48.2	20.0	531
127	0.7	64.3	1	1000.7	1459.1	41.6	20.0	531
137	0.7	75.0	1	1000.7	1459.1	58.2	20.0	531
143	0.7	80.8	1	1000.7	1459.1	62.4	20.0	531
144	1.0	84.8	1	1001.0	1459.1	63.5	20.0	531
146	1.0	85.3	1	1001.0	1459.1	63.7	20.0	531
147	0.7	80.3	1	1000.7	1459.1	62.2	20.0	531
149	0.7	79.8	1	1000.7	1459.1	58.3	20.0	531
151	0.7	69.8	1	1000.7	1459.1	44.5	20.0	531
155	0.9	64.4	1	1000.9	1459.1	33.8	20.0	531
157	0.9	81.8	1	1000.9	1459.1	48.2	20.0	531
159	0.9	78.5	1	1000.9	1459.1	42.5	20.0	531
161	0.9	78.6	1	1000.9	1459.1	41.0	20.0	531
167	0.7	84.3	1	1000.7	1459.0	25.2	20.0	531
169	0.7	85.8	1	1000.7	1163.6	20.0	23.9	531
199	0.7	68.6	1	1000.7	1459.2	52.5	20.0	531
203	0.7	67.4	1	1000.7	1459.0	50.9	20.0	531
217	0.7	65.4	1	1000.7	1459.3	44.4	20.0	531
219	0.7	66.4	1	1000.7	1459.3	48.0	20.0	531
227	2.1	64.4	1	1002.1	1424.8	25.0	20.0	237
229	2.1	64.4	1	1002.1	1179.0	25.0	20.0	237
231	7.3	59.4	1	1007.3	926.6*	20.0	20.0	237
233	2.1	59.4	1	1002.1	764.4*	20.0	19.9	237
235	2.1	59.4	1	1002.1	668.8*	20.0	20.0	237
237	2.1	59.4	1	1002.1	658.4*	20.0	21.1	235
301	1.5	64.4	1	1001.5	1455.1	44.8	20.0	531
303	1.5	67.4	1	1001.5	1453.3	46.1	20.0	531
305	1.5	67.4	1	1001.5	1452.4	49.5	20.0	531
309	1.5	67.4	1	1001.5	1452.2	52.2	20.0	531
313	1.5	61.6	1	1001.5	1456.9	46.1	20.0	531
317	1.5	67.3	1	1001.5	1458.5	51.3	20.0	531
321	1.5	64.4	1	1001.5	1453.5	49.4	20.0	531
329	1.5	64.3	1	1001.5	1458.9	33.9	20.0	531
331	1.5	62.4	1	1001.5	1458.9	44.1	20.0	531
335	1.5	64.3	1	1001.5	1450.3	49.4	20.0	531
339	1.5	67.4	1	1001.5	1462.4	49.1	20.0	531
343	1.5	65.4	1	1001.5	1463.2	48.5	20.0	531
347	1.5	67.4	1	1001.5	1459.4	51.2	20.0	531
353	1.5	67.4	1	1001.5	1459.9	50.8	20.0	531
355	1.5	67.4	1	1001.5	1460.1	50.7	20.0	531
357	1.5	74.3	1	1001.5	1460.3	57.5	20.0	531

* Needed Fire Flow not attained.

JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT Numbe
359	1.5	64.4	1	1001.5	1501.0	43.3	20.0	531
361	1.5	64.4	1	1001.5	1487.7	43.2	20.0	531
363	1.5	67.4	1	1001.5	1474.9	37.6	20.0	531
365	1.5	64.4	1	1001.5	940.6*	20.0	26.5	531
371	1.5	64.4	1	1001.5	1469.4	35.0	20.0	531
387	1.5	72.4	1	1001.5	1445.4	58.7	20.0	531
391	1.5	69.4	1	1001.5	1523.5	47.0	20.0	531
393	0.0	64.0	1	1000.0	1584.6	47.3	20.0	531
405	1.5	69.4	1	1001.5	1457.5	44.8	20.0	531
501	1.4	69.4	1	1001.4	897.4*	53.0	20.0	531
507	1.4	69.4	1	1001.4	806.1*	46.0	20.0	531
515	1.4	69.4	1	1001.4	972.6*	53.5	20.0	531
517	1.4	64.4	1	1001.4	715.3*	51.7	20.0	531
529	1.4	49.4	1	1001.4	487.0*	36.7	20.0	531
703	2.0	69.4	1	1002.0	1460.3	34.6	20.0	531
709	2.0	69.4	1	1002.0	1461.4	20.0	20.0	531
713	1.7	69.4	1	1001.7	1460.3	31.7	20.0	531
715	1.7	69.4	1	1001.7	1460.3	34.1	20.0	531
719	1.7	69.4	1	1001.7	1460.3	37.1	20.0	531
733	12.1	64.9	1	1012.1	1460.3	47.7	20.0	531
737	1.7	64.4	1	1001.7	1460.3	34.2	20.0	531
739	1.7	64.3	1	1001.7	1402.8	20.0	20.8	531
743	1.7	64.3	1	1001.7	1273.8	20.0	21.2	763
747	1.7	67.5	1	1001.7	1185.8	20.0	23.6	531
749	1.7	69.4	1	1001.7	1373.9	21.2	20.0	745
751	1.7	69.4	1	1001.7	1460.3	22.0	20.0	531
755	1.7	74.4	1	1001.7	1460.3	37.3	20.0	531
761	1.7	69.3	1	1001.7	1385.6	20.0	21.0	531
763	1.7	65.6	1	1001.7	921.5*	20.0	26.6	531
767	1.7	69.4	1	1001.7	1155.8	22.1	20.0	765
771	1.7	74.4	1	1001.7	1460.3	26.4	20.0	531

Cybernet Version: 2.18 SN: 1132180497 11-03-1998
Description: '97 ADD (PUMP OFF): PHASE 1 PIPE IMPROVEMENT EFFECTS 8, 10, 10
Drawing: S:\S\C\3033.19\WATERMAP\W-STUDY

*pipe 9086 inc. to 10" ø. (Between Hunter + Bolton Hill)

Fire Flow Summary.

JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
125	0.7	68.0	1	1000.7	1460.5	48.5	20.0	531
127	0.7	64.3	1	1000.7	1460.5	41.8	20.0	531
137	0.7	75.0	1	1000.7	1460.4	58.5	20.0	531
143	0.7	80.8	1	1000.7	1460.4	62.7	20.0	531
144	1.0	84.8	1	1001.0	1460.4	63.8	20.0	531
146	1.0	85.3	1	1001.0	1460.4	64.0	20.0	531
147	0.7	80.3	1	1000.7	1460.4	62.6	20.0	531
149	0.7	79.8	1	1000.7	1460.4	59.7	20.0	531
151	0.7	69.8	1	1000.7	1460.4	47.2	20.0	531
155	0.9	64.4	1	1000.9	1460.4	38.9	20.0	531
157	0.9	81.8	1	1000.9	1460.4	54.8	20.0	531
159	0.9	78.5	1	1000.9	1460.4	50.4	20.0	531
161	0.9	78.6	1	1000.9	1460.4	49.7	20.0	531
167	0.7	84.3	1	1000.7	1460.3	25.3	20.0	531
169	0.7	85.8	1	1000.7	1164.9	20.0	23.9	531
193	0.7	74.7	1	1000.7	1460.6	58.1	20.0	531
203	0.7	67.4	1	1000.7	1460.3	51.1	20.0	531
217	0.7	65.4	1	1000.7	1460.6	44.8	20.0	531
219	0.7	66.4	1	1000.7	1460.6	49.1	20.0	531
227	2.1	64.4	1	1002.1	1460.5	34.6	20.0	531
229	2.1	64.4	1	1002.1	1460.5	29.0	20.0	531
231	7.3	59.4	1	1007.3	1418.3	20.0	20.6	531
233	2.1	59.4	1	1002.1	1395.2	20.0	20.9	531
235	2.1	59.4	1	1002.1	1460.4	21.1	20.0	531
237	2.1	59.4	1	1002.1	1460.4	22.2	20.0	531
301	1.5	64.4	1	1001.5	1456.2	44.8	20.0	531
303	1.5	67.4	1	1001.5	1454.3	46.1	20.0	531
305	1.5	67.4	1	1001.5	1453.3	49.5	20.0	531
307	1.5	69.1	1	1001.5	1453.1	54.0	20.0	531
309	1.5	67.4	1	1001.5	1453.1	52.2	20.0	531
313	1.5	61.6	1	1001.5	1458.1	46.2	20.0	531
317	1.5	67.3	1	1001.5	1459.8	51.5	20.0	531
321	1.5	64.4	1	1001.5	1454.4	49.5	20.0	531
329	1.5	64.4	1	1001.5	1460.0	33.9	20.0	531
331	1.5	62.4	1	1001.5	1459.5	44.1	20.0	531
333	1.5	67.2	1	1001.5	1457.1	49.8	20.0	531
335	1.5	64.3	1	1001.5	1450.9	49.4	20.0	531
339	1.5	67.4	1	1001.5	1461.9	49.1	20.0	531
343	1.5	65.4	1	1001.5	1462.2	48.6	20.0	531
347	1.5	67.4	1	1001.5	1460.7	51.4	20.0	531
353	1.5	67.4	1	1001.5	1461.1	51.2	20.0	531

* Needed Fire Flow not attained.

JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JC N
355	1.5	67.4	1	1001.5	1461.2	51.1	20.0	3
358	0.5	74.3	1	1000.5	1461.3	56.2	20.0	3
359	1.5	64.4	1	1001.5	1498.3	43.9	20.0	53
362	0.5	64.4	1	1000.5	1476.4	41.5	20.0	3
363	1.5	67.4	1	1001.5	1468.4	44.7	20.0	3
365	1.5	64.4	1	1001.5	1461.9	45.5	20.0	53
371	1.5	64.4	1	1001.5	1466.3	38.2	20.0	3
387	1.5	72.4	1	1001.5	1445.8	58.7	20.0	3
391	1.5	69.4	1	1001.5	1523.7	47.0	20.0	3
393	0.0	64.0	1	1000.0	1584.5	47.3	20.0	53
399	1.7	65.7	1	1001.7	1628.6	52.3	20.0	3
403	1.7	63.6	1	1001.7	1628.6	32.6	20.0	3
405	1.5	69.4	1	1001.5	1458.7	44.9	20.0	53
501	1.4	69.4	1	1001.4	897.5*	53.0	20.0	3
507	1.4	69.4	1	1001.4	806.2*	46.0	20.0	3
515	1.4	69.4	1	1001.4	972.7*	53.5	20.0	53
517	1.4	64.4	1	1001.4	715.4*	51.7	20.0	53
529	1.4	49.4	1	1001.4	487.0*	36.7	20.0	3
703	2.0	69.4	1	1002.0	1461.0	40.9	20.0	3
709	2.0	69.4	1	1002.0	1460.7	45.9	20.0	53
714	0.0	68.8	1	1000.0	1461.1	34.5	20.0	3
716	0.0	70.0	1	1000.0	1461.1	31.8	20.0	3
719	1.7	69.4	1	1001.7	1461.2	38.9	20.0	53
733	12.1	64.9	1	1012.1	1461.4	48.2	20.0	3
737	1.7	64.4	1	1001.7	1461.3	34.8	20.0	3
739	1.7	64.3	1	1001.7	1418.8	20.0	20.6	3
743	1.7	64.3	1	1001.7	1293.2	20.0	21.2	76
747	1.7	67.5	1	1001.7	1203.5	20.0	23.4	3
749	1.7	69.4	1	1001.7	1404.6	21.2	20.0	4
751	1.7	69.4	1	1001.7	1461.2	24.5	20.0	53
755	1.7	74.4	1	1001.7	1461.1	40.7	20.0	3
761	1.7	69.3	1	1001.7	1409.8	20.0	20.7	3
763	1.7	65.6	1	1001.7	929.2*	20.0	26.5	53
767	1.7	69.4	1	1001.7	1168.7	22.1	20.0	76
771	1.7	74.4	1	1001.7	1460.9	37.9	20.0	3
1000	0.0	68.7	1	1000.0	1450.8	46.9	20.0	3
1001	0.0	68.2	1	1000.0	1456.5	49.0	20.0	53

Cybernet Version: 2.18 SN: 1132180497 13-03-1998
Description: 2010, ADD W/ PRV AND HIGH LEVEL SYSTEM
Drawing: S:\S\C\3033.19\WATERMAP\W-STUDY

Fire Flow Summary.

JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
125	0.9	67.7	1	1000.9	3131.7	20.0	22.6	123
127	0.9	64.0	1	1000.9	2620.2	20.0	25.0	175
137	0.9	74.7	1	1000.9	3321.0	35.1	20.0	2016
143	0.9	80.5	1	1000.9	3226.1	36.3	20.0	2016
144	1.3	84.6	1	1001.3	3226.1	27.4	20.0	2016
146	1.3	85.1	1	1001.3	3226.1	26.4	20.0	2016
147	0.9	80.0	1	1000.9	3116.6	39.7	20.0	2016
149	0.9	79.5	1	1000.9	2782.7	38.3	20.0	2016
151	0.9	69.5	1	1000.9	2529.0	27.9	20.0	2016
155	1.2	64.1	1	1001.2	2282.3	22.5	20.0	2016
157	1.2	81.5	1	1001.2	2174.0	40.1	20.0	2016
159	1.2	78.2	1	1001.2	2102.6	37.0	20.0	2016
161	1.2	78.3	1	1001.2	2057.7	37.2	20.0	2016
167	0.9	84.1	1	1000.9	1631.3	20.0	21.4	169
169	0.9	85.5	1	1000.9	1208.5	20.0	46.8	167
193	0.9	74.4	1	1000.9	3372.6	33.6	20.0	231
199	0.9	68.3	1	1000.9	3444.2	29.0	20.0	231
203	0.9	67.1	1	1000.9	3448.9	26.0	20.0	237
217	0.9	65.1	1	1000.9	2881.4	20.0	28.8	231
219	0.9	66.1	1	1000.9	3230.9	25.0	20.0	231
227	2.6	64.1	1	1002.6	2097.7	20.0	22.2	231
229	2.6	64.1	1	1002.6	1852.9	20.0	20.8	231
231	9.3	59.1	1	1009.3	1551.1	20.0	28.5	233
233	2.6	59.2	1	1002.6	1520.1	20.0	29.8	231
235	2.6	59.1	1	1002.6	1635.3	20.0	21.8	238
237	2.6	59.1	1	1002.6	1667.9	20.0	20.8	235
301	1.9	64.1	1	1001.9	2959.4	20.0	32.2	303
303	1.9	67.1	1	1001.9	2845.0	20.0	32.1	301
305	1.9	67.1	1	1001.9	3343.8	20.0	25.7	303
307	1.9	68.9	1	1001.9	3866.1	24.9	20.0	237
313	1.9	61.3	1	1001.9	3602.6	21.3	20.0	237
317	1.9	67.0	1	1001.9	3491.8	27.2	20.0	237
321	1.9	64.1	1	1001.9	3793.7	22.8	20.0	237
329	1.9	64.1	1	1001.9	2065.0	20.0	43.6	235
331	1.9	62.1	1	1001.9	3080.9	20.0	23.5	314
333	1.9	66.9	1	1001.9	3434.8	20.0	27.1	235
335	1.9	64.1	1	1001.9	3899.7	20.0	21.9	235
339	1.9	67.2	1	1001.9	3291.9	20.0	25.9	231
343	1.9	65.2	1	1001.9	3491.1	20.0	24.7	231
347	1.9	67.1	1	1001.9	3438.1	27.8	20.0	231
353	1.9	67.1	1	1001.9	3446.7	26.5	20.0	231

* Needed Fire Flow not attained.

JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT Number
355	1.9	67.1	1	1001.9	3450.0	26.0	20.0	231
358	0.6	74.1	1	1000.6	3390.0	25.3	20.0	735
359	1.9	64.1	1	1001.9	2900.6	20.0	28.5	361
362	0.6	64.1	1	1000.6	2606.3	20.0	32.9	361
363	1.9	67.2	1	1001.9	2714.2	20.0	22.8	369
365	1.9	64.1	1	1001.9	3070.6	20.0	27.7	231
371	1.9	64.1	1	1001.9	2321.6	20.0	28.2	373
387	1.9	72.2	1	1001.9	4398.9	26.7	20.0	235
391	1.9	69.2	1	1001.9	2892.5	20.0	42.8	235
393	0.0	63.8	1	1000.0	3667.6	20.0	35.2	235
399	2.2	65.5	1	1002.2	4703.3	24.3	20.0	401
403	2.2	63.4	1	1002.2	2245.8	20.0	32.4	404
405	1.9	69.1	1	1001.9	2598.3	20.0	36.1	237
501	1.8	69.2	1	1001.8	1221.6	22.1	20.0	509
507	1.8	69.1	1	1001.8	888.7*	22.0	20.0	509
515	1.8	145.0	1	1001.8	3502.0	20.0	20.0	516
517	1.8	140.0	1	1001.8	2259.0	30.0	20.0	519
529	1.8	125.0	1	1001.8	2020.8	20.0	29.5	527
703	2.6	69.1	1	1002.6	2309.3	20.0	32.6	735
709	2.6	69.1	1	1002.6	2690.3	20.0	31.8	231
714	0.0	68.5	1	1000.0	2002.3	20.0	22.4	757
716	0.0	69.7	1	1000.0	1883.5	20.0	29.4	715
719	2.2	69.1	1	1002.2	2198.8	20.0	23.4	721
733	15.5	64.6	1	1015.5	3450.0	21.6	20.0	231
737	2.2	64.1	1	1002.2	2113.4	20.0	24.3	739
739	2.2	64.0	1	1002.2	1536.1	20.0	27.8	773
743	2.2	64.0	1	1002.2	1380.8	20.0	21.2	763
747	2.2	67.2	1	1002.2	1268.8	20.0	26.7	745
749	2.2	69.1	1	1002.2	1517.5	20.6	20.0	745
751	2.2	69.1	1	1002.2	1675.7	20.0	23.9	745
755	2.2	74.1	1	1002.2	2046.8	24.7	20.0	753
761	2.2	69.1	1	1002.2	1512.3	20.0	43.2	721
763	2.2	65.3	1	1002.2	961.1*	20.0	40.8	743
767	2.2	69.1	1	1002.2	1228.7	22.1	20.0	765
771	2.2	74.1	1	1002.2	2036.4	20.0	30.3	711
1000	2.2	68.4	1	1002.2	2817.6	20.0	38.9	235
1001	2.2	68.0	1	1002.2	3142.7	20.0	32.4	235

Cybernet Version: 2.18 SN: 1132180497 11-03-1998
Description: 2020 ADD (PUMP OFF): PHASE 1 PIPING, FUTURE DEMAND
Drawing: S:\S\C\3033.19\WATERMAP\W-STUDY

No High-Level System.

Fire Flow Summary.

JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
125	1.5	66.7	1	1001.5	1181.8	50.0	20.0	531
127	1.5	63.1	1	1001.5	1181.7	44.2	20.0	531
137	1.5	73.7	1	1001.5	1181.7	59.0	20.0	531
143	1.5	79.5	1	1001.5	1181.7	63.7	20.0	531
144	2.1	83.6	1	1002.1	1181.7	65.7	20.0	531
146	2.1	84.1	1	1002.1	1181.7	66.0	20.0	531
147	1.5	79.0	1	1001.5	1181.7	63.5	20.0	531
149	1.5	78.5	1	1001.5	1181.7	61.3	20.0	531
151	1.5	68.5	1	1001.5	1181.7	49.5	20.0	531
155	2.0	63.1	1	1002.0	1181.7	42.1	20.0	531
157	2.0	80.5	1	1002.0	1181.7	58.5	20.0	531
159	2.0	77.2	1	1002.0	1181.7	54.4	20.0	531
161	2.0	77.3	1	1002.0	1181.7	54.0	20.0	531
167	1.5	83.1	1	1001.5	1181.7	39.5	20.0	531
169	1.5	84.5	1	1001.5	1122.5	20.0	20.8	531
193	1.5	73.4	1	1001.5	1181.9	58.6	20.0	531
199	1.5	67.3	1	1001.5	1181.8	53.0	20.0	531
203	1.5	66.1	1	1001.5	1181.7	51.5	20.0	531
217	1.5	64.1	1	1001.5	1181.9	46.6	20.0	531
219	1.5	65.1	1	1001.5	1181.9	49.8	20.0	531
227	4.3	63.1	1	1004.3	1181.8	39.1	20.0	531
229	4.3	63.1	1	1004.3	1181.8	35.3	20.0	531
231	15.3	58.1	1	1015.3	1181.8	26.0	20.0	531
233	4.3	58.2	1	1004.3	1181.8	25.2	20.0	531
235	4.3	58.1	1	1004.3	1181.7	28.3	20.0	531
237	4.3	58.1	1	1004.3	1181.7	29.0	20.0	531
301	3.1	63.2	1	1003.1	1178.3	46.5	20.0	531
303	3.1	66.2	1	1003.1	1176.6	48.4	20.0	531
305	3.1	66.2	1	1003.1	1175.5	50.8	20.0	531
307	3.1	67.9	1	1003.1	1175.0	54.4	20.0	531
313	3.1	60.4	1	1003.1	1179.8	46.5	20.0	531
317	3.1	66.1	1	1003.1	1181.2	51.8	20.0	531
321	3.1	63.2	1	1003.1	1176.8	49.8	20.0	531
329	3.1	63.1	1	1003.1	1181.4	39.0	20.0	531
331	3.1	61.1	1	1003.1	1181.0	45.3	20.0	531
333	3.1	66.0	1	1003.1	1179.4	50.9	20.0	531
335	3.1	63.2	1	1003.1	1173.3	49.9	20.0	531
339	3.1	66.2	1	1003.1	1183.0	50.4	20.0	531
343	3.1	64.2	1	1003.1	1183.3	49.4	20.0	531
347	3.1	66.1	1	1003.1	1181.9	51.8	20.0	531
353	3.1	66.1	1	1003.1	1182.3	51.5	20.0	531

* Needed Fire Flow not attained.

JCT No.	User 1 Demand (gpm)	User 1 Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT Number
355	3.1	66.1	1	1003.1	1182.4	51.5	20.0	531
358	1.1	73.1	1	1001.1	1182.4	57.1	20.0	531
359	3.1	63.2	1	1003.1	1209.6	46.1	20.0	531
362	1.1	63.2	1	1001.1	1192.9	44.4	20.0	531
363	3.1	66.2	1	1003.1	1188.6	47.3	20.0	531
365	3.1	63.1	1	1003.1	1182.9	46.7	20.0	531
371	3.1	63.2	1	1003.1	1186.2	41.9	20.0	531
387	3.1	71.3	1	1003.1	1169.1	59.0	20.0	531
391	3.1	68.4	1	1003.1	1232.8	50.4	20.0	531
393	0.0	63.0	1	1000.0	1295.2	48.7	20.0	531
399	3.5	64.8	1	1003.5	1338.0	52.7	20.0	531
403	3.5	62.7	1	1003.5	1338.0	38.4	20.0	531
405	3.1	68.1	1	1003.1	1180.4	48.1	20.0	531
501	3.0	68.3	1	1003.0	757.6*	54.1	20.0	531
507	3.0	68.3	1	1003.0	687.5*	48.6	20.0	531
515	3.0	68.3	1	1003.0	815.1*	54.5	20.0	531
517	3.0	63.3	1	1003.0	617.3*	51.7	20.0	531
529	3.0	48.3	1	1003.0	431.4*	36.7	20.0	531
703	4.2	68.1	1	1004.2	1182.2	45.2	20.0	531
709	4.2	68.1	1	1004.2	1182.0	48.5	20.0	531
714	0.0	67.5	1	1000.0	1182.3	40.1	20.0	531
716	0.0	68.7	1	1000.0	1182.3	38.7	20.0	531
719	3.6	68.1	1	1003.6	1182.4	43.5	20.0	531
733	25.4	63.6	1	1025.4	1182.5	48.7	20.0	531
737	3.6	63.1	1	1003.6	1182.5	39.2	20.0	531
739	3.6	63.0	1	1003.6	1182.4	27.2	20.0	531
743	3.6	63.0	1	1003.6	1182.4	21.2	20.0	531
747	3.6	66.2	1	1003.6	1128.7	20.0	20.7	531
749	3.6	68.1	1	1003.6	1182.4	28.6	20.0	531
751	3.6	68.1	1	1003.6	1182.3	33.3	20.0	531
755	3.6	73.1	1	1003.6	1182.3	46.1	20.0	531
761	3.6	68.0	1	1003.6	1182.4	28.4	20.0	531
763	3.6	64.2	1	1003.6	877.7*	20.0	24.0	531
767	3.6	68.0	1	1003.6	1096.0	22.1	20.0	765
771	3.6	73.1	1	1003.6	1182.1	44.4	20.0	531
1000	0.0	67.5	1	1000.0	1174.2	49.7	20.0	531
1001	0.0	67.0	1	1000.0	1178.9	50.7	20.0	531

```
+---------------------------------------------------+
|                MAXIMUM DIMENSIONS                  |
|                                                    |
|   Number of pipes .......................  250     |
|   Number of pumps .......................   62     |
|   Number junction nodes..................  250     |
|   Flow meters ...........................   62     |
|   Boundary nodes ........................   25     |
|   Variable storage tanks ................   62     |
|   Pressure switches .....................   62     |
|   Regulating Valves......................   62     |
|   Items for limited output ..............  250     |
|   limit for non-consecutive numbering ..20063      |
+---------------------------------------------------+
```

Cybernet version 2.18. SN: 1132180497-250

Extended Description:

U N I T S   S P E C I F I E D

```
   FLOWRATE ............ = gallons/minute
   HEAD (HGL) .......... = feet
   PRESSURE ............ = psig
```

O U T P U T   O P T I O N   D A T A

OUTPUT SELECTION: ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT

S Y S T E M   C O N F I G U R A T I O N

```
    NUMBER OF PIPES ....................(p) =  250
    NUMBER OF JUNCTION NODES ...........(j) =  205
    NUMBER OF PRIMARY LOOPS ............(l) =   41
    NUMBER OF BOUNDARY NODES ...........(f) =    5
    NUMBER OF SUPPLY ZONES .............(z) =    1
```

****
S I M U L A T I O N   R E S U L T S
****

The results are obtained after 16 trials with an accuracy = 0.00029
The regulating valves required 2 adjustments.

I M U L A T I O N   D E S C R I P T I O N

CyberNet Version 2.18. Copyright 1991,92 Haestad Methods Inc.
Run Description: 2020, ADD (PUMP OFF): ADJ. FUTURE DEMAND
Drawing: W-STUDY

P I P E L I N E   R E S U L T S

STATUS CODE: XX -CLOSED PIPE   BN -BOUNDARY NODE   PU -PUMP LINE
CV -CHECK VALVE   RV -REGULATING VALVE   TK -STORAGE TANK

PIPE NUMBER	NODE NOS. #1	#2	FLOWRATE (gpm)	HEAD LOSS (ft)	PUMP HEAD (ft)	MINOR LOSS (ft)	LINE VELO. (ft/s)	HL/ 1000 (ft/ft
1000-BN	101	0	0.00	0.00	0.00	0.00	0.00	0.00
1002	101	103	0.00	0.00	0.00	0.00	0.00	0.00
1004	103	105	0.00	0.00	0.00	0.00	0.00	0.00
1006	105	107	0.00	0.00	0.00	0.00	0.00	0.00
1008-XXPU	103	109						
1010-XXPU	105	111						
1012-XXPU	107	113						
1013	110	109	0.00	0.00	0.00	0.00	0.00	0.00
1014	115	110	0.00	0.00	0.00	0.00	0.00	0.00
1015	112	111	0.00	0.00	0.00	0.00	0.00	0.00
1016	117	112	0.00	0.00	0.00	0.00	0.00	0.00
1017	114	113	0.00	0.00	0.00	0.00	0.00	0.00
1018	119	114	0.00	0.00	0.00	0.00	0.00	0.00
1020	115	117	0.00	0.00	0.00	0.00	0.00	0.00
1022	117	119	0.00	0.00	0.00	0.00	0.00	0.00
1024	119	121	0.00	0.00	0.00	0.00	0.00	0.00
1026	123	121	4.67	0.00	0.00	0.00	0.03	0.00
1028	123	125	-4.67	0.00	0.00	0.00	0.03	0.00
1030	125	171	-5.39	0.00	0.00	0.00	0.03	0.00
1032	127	129	-8.99	0.00	0.00	0.00	0.06	0.00
1034	129	131	-9.71	0.00	0.00	0.00	0.06	0.01
1036	131	133	-11.84	0.00	0.00	0.00	0.08	0.01
1038	131	135	57.08	0.00	0.00	0.00	0.09	0.01
1040	135	137	56.36	0.00	0.00	0.00	0.09	0.00
1042	137	139	55.64	0.00	0.00	0.00	0.09	0.00
1043	140	139	-5.17	0.00	0.00	0.00	0.01	0.00
1044	141	140	-3.17	0.00	0.00	0.00	0.01	0.00
1045	140	144	1.00	0.00	0.00	0.00	0.01	0.00
1046	141	143	1.45	0.00	0.00	0.00	0.00	0.00
1047	141	146	1.00	0.00	0.00	0.00	0.01	0.00
1048	143	145	0.72	0.00	0.00	0.00	0.00	0.00
1050	139	147	49.75	0.00	0.00	0.00	0.14	0.01
1052	147	149	49.02	0.01	0.00	0.00	0.20	0.03
1054	149	151	48.30	0.02	0.00	0.00	0.20	0.04
1056	151	153	47.58	0.02	0.00	0.00	0.19	0.03
1058	153	155	45.71	0.00	0.00	0.00	0.19	0.02
1060	155	157	44.78	0.01	0.00	0.00	0.18	0.02
1062	157	159	43.85	0.01	0.00	0.00	0.18	0.02
1064	159	161	42.91	0.01	0.00	0.00	0.18	0.02
1066	153	163	0.93	0.00	0.00	0.00	0.00	0.00
1068	133	165	2.17	0.00	0.00	0.00	0.01	0.00
1070	165	167	1.45	0.00	0.00	0.00	0.02	0.00
1072	167	169	0.72	0.00	0.00	0.00	0.01	0.00
1074	127	171	8.27	0.00	0.00	0.00	0.05	0.00
1076	171	179	2.16	0.00	0.00	0.00	0.01	0.00
1082	175	179	-0.72	0.00	0.00	0.00	0.00	0.00
1084	179	183	0.72	0.00	0.00	0.00	0.00	0.00
1100	193	197	-44.54	0.00	0.00	0.00	0.09	0.00

1102	197	211	13.48	0.00	0.00	0.00	0.02	0.00
1104	199	201	19.07	0.00	0.00	0.00	0.03	0.00
1106	201	131	55.67	0.00	0.00	0.00	0.09	0.00
1108	133	203	-8.99	0.00	0.00	0.00	0.06	0.00
1110	203	205	-9.71	0.00	0.00	0.00	0.06	0.00
1112	205	315	-4.76	0.00	0.00	0.00	0.03	0.00
1114	207	209	0.11	0.00	0.00	0.00	0.00	0.00
1116	199	211	-19.79	0.00	0.00	0.00	0.03	0.00
1118	209	211	7.03	0.00	0.00	0.00	0.04	0.00
1120	209	213	-7.64	0.00	0.00	0.00	0.05	0.00
1122	213	215	4.30	0.00	0.00	0.00	0.03	0.00
1124	215	197	58.75	0.00	0.00	0.00	0.09	0.00
1126	215	217	15.68	0.01	0.00	0.00	0.10	0.01
1128	217	219	14.96	0.01	0.00	0.00	0.10	0.01
1130	219	221	-46.33	0.01	0.00	0.00	0.53	0.22
1132	221	193	-43.82	0.00	0.00	0.00	0.09	0.00
1134	221	223	-3.23	0.00	0.00	0.00	0.01	0.00
1136	223	225	-3.95	0.00	0.00	0.00	0.01	0.00
1138	225	121	-4.67	0.00	0.00	0.00	0.01	0.00
1140	219	227	24.42	0.03	0.00	0.00	0.16	0.02
1142	227	229	22.36	0.02	0.00	0.00	0.14	0.02
1144	229	231	18.96	0.02	0.00	0.00	0.22	0.06
1146	231	233	11.68	0.01	0.00	0.00	0.13	0.02
1148	233	235	-8.37	0.01	0.00	0.00	0.09	0.01
1150	235	238	-10.42	0.00	0.00	0.00	0.04	0.00
1152	238	237	32.07	0.01	0.00	0.00	0.13	0.01
3000	133	405	-5.74	0.00	0.00	0.00	0.07	0.00
3002	301	303	-11.64	0.01	0.00	0.00	0.13	0.01
3004	303	305	-13.10	0.01	0.00	0.00	0.15	0.02
3006	305	307	-14.57	0.00	0.00	0.00	0.09	0.01
3008	307	309	1.46	0.00	0.00	0.00	0.00	0.00
3010	205	311	-5.67	0.01	0.00	0.00	0.06	0.01
3012	311	301	-2.97	0.00	0.00	0.00	0.03	0.00
3014	311	313	-4.17	0.00	0.00	0.00	0.05	0.00
3016	207	315	3.46	0.00	0.00	0.00	0.02	0.00
3018	201	315	-37.33	0.00	0.00	0.00	0.11	0.01
3020	315	317	-40.09	0.00	0.00	0.00	0.11	0.01
3022	317	313	-41.56	0.01	0.00	0.00	0.12	0.01
3024	313	319	-44.97	0.01	0.00	0.00	0.13	0.01
3026	319	321	-46.30	0.00	0.00	0.00	0.13	0.01
3028	321	323	-47.77	0.00	0.00	0.00	0.14	0.01
3030	323	325	-50.70	0.00	0.00	0.00	0.14	0.02
3032	325	307	17.50	0.00	0.00	0.00	0.05	0.00
3034	323	327	1.46	0.01	0.00	0.00	0.15	0.10
3036	207	329	-4.29	0.00	0.00	0.00	0.05	0.00
3038	329	331	-5.75	0.01	0.00	0.00	0.07	0.01
3040	331	333	-7.25	0.01	0.00	0.00	0.08	0.01
3042	333	335	-13.34	0.01	0.00	0.00	0.15	0.03
3044	335	337	-3.61	0.00	0.00	0.00	0.04	0.00
3046	337	325	69.66	0.01	0.00	0.00	0.20	0.02
3048	333	319	0.13	0.00	0.00	0.00	0.01	0.00
3050	331	314	3.22	0.00	0.00	0.00	0.04	0.00
3051	313	314	-2.22	0.00	0.00	0.00	0.03	0.00
3052	213	339	-12.66	0.01	0.00	0.00	0.08	0.01
3054	339	341	-14.12	0.00	0.00	0.00	0.09	0.01
3056	341	343	-20.02	0.01	0.00	0.00	0.13	0.02
3058	343	345	-16.24	0.00	0.00	0.00	0.10	0.01
3060	345	333	-4.50	0.00	0.00	0.00	0.03	0.00
3062	341	331	3.19	0.00	0.00	0.00	0.04	0.00
3064	215	347	-70.84	0.00	0.00	0.00	0.11	0.01

3066	347	349	-72.31	0.00	0.00	0.00	0.12	0.01
3068	349	351	-73.77	0.00	0.00	0.00	0.12	0.01
3070	351	353	-75.24	0.00	0.00	0.00	0.12	0.01
3072	353	355	-76.70	0.00	0.00	0.00	0.12	0.01
3074	355	357	-75.52	0.00	0.00	0.00	0.12	0.01
3076	357	356	-14.06	0.00	0.00	0.00	0.16	0.04
3077	359	356	7.44	0.01	0.00	0.00	0.08	0.01
3078	359	361	17.39	0.01	0.00	0.00	0.11	0.01
3080	361	363	10.19	0.01	0.00	0.00	0.12	0.02
3082	363	365	4.11	0.00	0.00	0.00	0.05	0.00
3086	363	369	4.61	0.00	0.00	0.00	0.05	0.00
3088	369	371	3.15	0.00	0.00	0.00	0.04	0.00
3090	371	373	1.68	0.00	0.00	0.00	0.02	0.00
3092	373	375	0.22	0.00	0.00	0.00	0.00	0.00
3094	375	341	-1.24	0.00	0.00	0.00	0.01	0.00
3098	362	343	5.24	0.00	0.00	0.00	0.06	0.00
3099	361	362	5.74	0.00	0.00	0.00	0.07	0.01
3102	381	1000	15.21	0.01	0.00	0.00	0.17	0.03
3103	1000	1001	14.21	0.01	0.00	0.00	0.16	0.03
3104	381	335	11.19	0.02	0.00	0.00	0.13	0.02
3105	1001	345	13.21	0.00	0.00	0.00	0.15	0.02
3108	337	385	-74.74	0.02	0.00	0.00	0.21	0.02
3110	385	387	12.96	0.00	0.00	0.00	0.15	0.03
3112	387	381	27.86	0.00	0.00	0.00	0.32	0.11
3114	387	389	-16.37	0.01	0.00	0.00	0.19	0.04
3116	389	391	-15.41	0.01	0.00	0.00	0.17	0.04
3118	391	393	-16.87	0.03	0.00	0.00	0.19	0.04
3119	393	394	-16.87	0.00	0.00	0.00	0.19	0.04
3120	395	394	43.17	0.01	0.00	0.00	0.49	0.22
3122	395	397	101.62	0.05	0.00	0.00	0.29	0.04
3124	397	389	2.42	0.00	0.00	0.00	0.03	0.00
3126	397	385	97.73	0.01	0.00	0.00	0.28	0.04
3128	394	359	26.30	0.07	0.00	0.00	0.30	0.09
3134	395	399	16.68	0.00	0.00	0.00	0.05	0.00
3136	399	401	-0.05	0.00	0.00	0.00	0.00	0.00
3137	401	1500	20.28	0.03	0.00	0.00	0.23	0.05
3138	401	399	0.04	0.00	0.00	0.00	0.00	0.00
3139	1500	403	-13.40	0.01	0.00	0.00	0.15	0.03
3140	399	403	15.08	0.02	0.00	0.00	0.17	0.04
3142	301	405	7.20	0.01	0.00	0.00	0.08	0.01
5000	385	501	8.57	0.01	0.00	0.00	0.10	0.02
5002	501	503	7.14	0.00	0.00	0.00	0.08	0.01
5004	503	505	5.71	0.00	0.00	0.00	0.06	0.00
5006	505	507	4.28	0.00	0.00	0.00	0.05	0.00
5008	507	509	2.86	0.00	0.00	0.00	0.03	0.00
5010	509	511	1.43	0.00	0.00	0.00	0.02	0.00
5013	515	516	0.00	0.00	0.00	0.00	0.00	0.00
5014-XXRV	516	397						
5016	515	517	3.07	0.00	0.00	0.00	0.03	0.00
5018	517	519	1.43	0.00	0.00	0.00	0.02	0.00
5020-XX	517	503						
5022	515	521	-4.50	0.00	0.00	0.00	0.05	0.00
5024	523	521	7.35	0.00	0.00	0.00	0.08	0.01
5026	521	525	1.43	0.00	0.00	0.00	0.04	0.00
5028	517	527	0.21	0.00	0.00	0.00	0.00	0.00
5030	529	527	1.18	0.00	0.00	0.00	0.03	0.00
5032	529	531	-2.64	0.01	0.00	0.00	0.07	0.01
5034	529	527	0.04	0.00	0.00	0.00	0.00	0.00
5036	395	533	-163.15	0.31	0.00	0.00	0.67	0.25
5038	533	535	-165.43	0.00	0.00	0.00	0.68	0.26

5042	535	537	5.71	0.00	0.00	0.00	0.26	0.18
5044-PU	537	539	4.28	0.00	184.70	0.00	0.19	0.10
5046	539	545	2.86	0.00	0.00	0.00	0.13	0.05
5050	541	545	-1.43	0.00	0.00	0.00	0.06	0.01
5056-BN	535	0	-172.57	0.01	0.00	0.00	0.70	0.28
7000	357	358	17.67	0.00	0.00	0.00	0.20	0.04
7001	358	701	17.17	0.01	0.00	0.00	0.19	0.04
7002	701	703	15.17	0.01	0.00	0.00	0.10	0.01
7004	703	705	13.16	0.02	0.00	0.00	0.15	0.03
7006	707	705	34.14	0.01	0.00	0.00	0.14	0.01
7008	705	709	-9.41	0.00	0.00	0.00	0.11	0.01
7010	709	771	-11.41	0.01	0.00	0.00	0.13	0.02
7012	711	713	-15.12	0.01	0.00	0.00	0.17	0.03
7014	713	715	-9.32	0.00	0.00	0.00	0.11	0.01
7015	716	715	0.00	0.00	0.00	0.00	0.00	0.00
7016	715	717	-4.22	0.00	0.00	0.00	0.05	0.00
7018	717	719	-5.93	0.00	0.00	0.00	0.07	0.00
7020	719	721	-7.64	0.00	0.00	0.00	0.09	0.01
7022	721	723	-11.05	0.00	0.00	0.00	0.13	0.02
7026	723	727	-12.76	0.01	0.00	0.00	0.14	0.02
7028	727	729	118.26	0.00	0.00	0.00	0.19	0.01
7030	731	729	-12.79	0.03	0.00	0.00	0.33	0.15
7032	729	733	92.68	0.00	0.00	0.00	0.15	0.01
7033	356	727	-7.62	0.01	0.00	0.00	0.09	0.01
7034	733	357	80.59	0.00	0.00	0.00	0.13	0.01
7038	727	737	-32.06	0.04	0.00	0.00	0.36	0.11
7040	737	739	-33.77	0.10	0.00	0.00	0.38	0.12
7042	739	773	-35.47	0.07	0.00	0.00	0.40	0.13
7044	741	743	35.46	0.03	0.00	0.00	0.40	0.13
7046	743	745	26.28	0.04	0.00	0.00	0.30	0.08
7048	745	747	1.71	0.00	0.00	0.00	0.02	0.00
7050	745	749	22.86	0.02	0.00	0.00	0.26	0.06
7052	749	751	21.16	0.03	0.00	0.00	0.24	0.05
7054	751	753	19.45	0.01	0.00	0.00	0.22	0.04
7056	753	755	17.74	0.01	0.00	0.00	0.20	0.04
7058	715	755	-6.81	0.00	0.00	0.00	0.08	0.01
7060	755	757	9.22	0.00	0.00	0.00	0.10	0.01
7061	713	714	-7.51	0.00	0.00	0.00	0.09	0.01
7062	757	714	7.51	0.00	0.00	0.00	0.09	0.01
7066	721	761	1.71	0.00	0.00	0.00	0.02	0.00
7068	743	763	1.71	0.00	0.00	0.00	0.02	0.00
7070	741	767	3.42	0.00	0.00	0.00	0.04	0.00
7072	765	767	-1.71	0.00	0.00	0.00	0.04	0.00
7078	711	771	13.12	0.01	0.00	0.00	0.15	0.02
7080	741	773	-40.58	0.08	0.00	0.00	0.46	0.17
9030	523	2000	-8.78	0.00	0.00	0.00	0.02	0.00
9032	2001	2000	-2.61	0.00	0.00	0.00	0.02	0.00
9034	2001	2002	0.61	0.00	0.00	0.00	0.00	0.00
9036	2003	2002	1.39	0.00	0.00	0.00	0.01	0.00
9040	2020	2000	16.39	0.00	0.00	0.00	0.05	0.00
9042	2004	2005	5.39	0.00	0.00	0.00	0.03	0.00
9044	2005	2003	3.39	0.00	0.00	0.00	0.02	0.00
9046	2004	2006	-25.78	0.00	0.00	0.00	0.07	0.00
9048	531	2006	-4.07	0.00	0.00	0.00	0.03	0.00
9050 Bo Ser	2006	2007	-58.53	0.01	0.00	0.00	0.17	0.01
9052-BN	2007	0	-60.53	0.01	0.00	0.00	0.17	0.01
9054	2009	2006	-26.67	0.00	0.00	0.00	0.08	0.00
9060	2009	2010	24.67	0.00	0.00	0.00	0.07	0.00
9062	2011	2010	-21.53	0.00	0.00	0.00	0.06	0.00
9064-BN	0	1506	276.42	0.17	0.00	0.00	0.78	0.23

9066	773	1506	-77.77	0.04	0.00	0.00	0.22	0.02
9068	1506	1504	173.16	0.16	0.00	0.00	0.49	0.10
9070	401	1504	-22.05	0.00	0.00	0.00	0.06	0.00
9072	727	1502	-108.30	0.05	0.00	0.00	0.31	0.04
9074-BN	0	2011	11.47	0.03	0.00	0.00	0.13	0.02
9076	2015	237	-30.02	0.01	0.00	0.00	0.12	0.01
9078	2016	2015	-12.02	0.00	0.00	0.00	0.05	0.00
9080	2017	2016	5.98	0.00	0.00	0.00	0.02	0.00
9082	2018	2017	23.98	0.00	0.00	0.00	0.10	0.01
9084	161	2018	41.98	0.02	0.00	0.00	0.17	0.02
9086	219	707	36.15	0.01	0.00	0.00	0.15	0.01
9088	365	355	2.64	0.00	0.00	0.00	0.02	0.00
9090	2010	547	1.14	0.00	0.00	0.00	0.01	0.00
9092	1504	1502	125.61	0.03	0.00	0.00	0.36	0.05
9094	1500	1502	8.19	0.00	0.00	0.00	0.05	0.00
9096	2020	2004	-18.39	0.00	0.00	0.00	0.05	0.00
10000	705	2050	54.71	0.03	0.00	0.00	0.16	0.01
10002	2050	229	-1.36	0.00	0.00	0.00	0.00	0.00
10004	2050	2052	50.30	0.02	0.00	0.00	0.14	0.01
10006	2052	238	44.54	0.01	0.00	0.00	0.13	0.01
10008	743	2056	5.76	0.00	0.00	0.00	0.04	0.00
20000-XXCV	535	2009						

J U N C T I O N   N O D E   R E S U L T S

JUNCTION NUMBER	JUNCTION TITLE	EXTERNAL DEMAND (gpm)	HYDRAULIC GRADE (ft)	JUNCTION ELEVATION (ft)	PRESSURE HEAD (ft)	JUNCTION PRESSURE (psi)
101-1	Treatment Pl	0.00	451.50	422.50	29.00	12.57
103-1		0.00	451.50	422.50	29.00	12.57
105-1	Treatment Pl	0.00	451.50	422.50	29.00	12.57
107-1		0.00	451.50	422.50	29.00	12.57
109-1	Treatment Pl	0.00	575.89	422.50	153.39	66.47
110-1		0.00	575.89	422.50	153.39	66.47
111-1	Treatment Pl	0.00	575.89	422.50	153.39	66.47
112-1		0.00	575.89	422.50	153.39	66.47
113-1	Treatment Pl	0.00	575.89	422.50	153.39	66.47
114-1		0.00	575.89	422.50	153.39	66.47
115-1	Treatment Pl	0.00	575.89	422.50	153.39	66.47
117-1		0.00	575.89	422.50	153.39	66.47
119-1	Treatment Pl	0.00	575.89	422.50	153.39	66.47
121-1	E. Broadway	0.00	575.89	422.50	153.39	66.47
123-1		0.00	575.89	422.50	153.39	66.47
125-1		0.72	575.89	418.46	157.43	68.22
127-1		0.72	575.90	426.91	148.99	64.56
129-1	E. Broadway	0.72	575.90	418.00	157.90	68.42
131-1		0.72	575.90	416.00	159.90	69.29
133-1		0.72	575.90	416.00	159.90	69.29
135-1		0.72	575.90	410.00	165.90	71.89
137-1	Territorial	0.72	575.90	402.29	173.61	75.23
139-1	Territ/Jeans	0.72	575.89	377.88	198.01	85.81
140-1	Shopping Cen	1.00	575.89	378.38	197.51	85.59
141-1		0.72	575.89	378.38	197.51	85.59
143-1		0.72	575.89	388.92	186.97	81.02
144-1		1.00	575.89	379.57	196.32	85.07
145-1		0.72	575.89	388.00	187.89	81.42
146-1	Shopping Cen	1.00	575.89	378.38	197.51	85.59

147-1	Jeans Road	0.72	575.89	390.00	185.89	80.55
149-1		0.72	575.87	391.14	184.73	80.05
151-1		0.72	575.86	414.31	161.55	70.00
153-1		0.93	575.84	426.00	149.84	64.93
155-1		0.93	575.84	426.74	149.10	64.61
157-1		0.93	575.83	386.50	189.33	82.04
159-1		0.93	575.82	394.15	181.67	78.72
161-1	Jeans Road	0.93	575.81	394.00	181.81	78.79
163-1	End Hope Ln.	0.93	575.84	420.00	155.84	67.53
165-1	Old Highway	0.72	575.90	401.00	174.90	75.79
167-1		0.72	575.90	380.69	195.21	84.59
169-1	Old Highway	0.72	575.90	377.39	198.51	86.02
171-1	E. Broadway	0.72	575.89	406.00	169.89	73.62
175-1		0.72	575.89	423.00	152.89	66.25
179-1		0.72	575.89	407.00	168.89	73.19
183-1	E. Broadway	0.72	575.89	417.00	158.89	68.85
193-1	Hunter 14-in	0.72	575.90	403.00	172.90	74.92
197-1	Hunter 14-in	0.72	575.90	420.00	155.90	67.56
199-1	Territ. 16,	0.72	575.90	417.00	158.90	68.86
201-1	Territ./Dunh	0.72	575.90	413.00	162.90	70.59
203-1		0.72	575.90	419.90	156.00	67.60
205-1	Territ./Dunh	0.72	575.90	413.00	162.90	70.59
207-1	McCutcheon/T	0.72	575.90	420.00	155.90	67.56
209-1	Hunter/McCut	0.72	575.90	420.00	155.90	67.56
211-1		0.72	575.90	420.00	155.90	67.56
213-1		0.72	575.90	420.00	155.90	67.56
215-1	Hunter/McCut	0.72	575.90	420.00	155.90	67.56
217-1	Hunter Road	0.72	575.89	424.46	151.43	65.62
219-1		0.72	575.88	422.10	153.78	66.64
221-1		0.72	575.89	421.00	154.89	67.12
223-1		0.72	575.89	420.00	155.89	67.55
225-1		0.72	575.89	422.50	153.39	66.47
227-1		2.05	575.86	426.80	149.06	64.59
229-1		2.05	575.84	426.78	149.06	64.59
231-1	New Subdivis	7.27	575.82	438.20	137.62	59.64
233-1		20.05	575.81	438.15	137.66	59.65
235-1		2.05	575.81	438.26	137.55	59.61
237-1	Huston Rd. @	2.05	575.81	438.26	137.55	59.60
238-1	Hunter Road/	2.05	575.81	436.00	139.81	60.59
301-1	City Center	1.46	575.91	426.78	149.13	64.62
303-1		1.46	575.91	419.90	156.01	67.61
305-1		1.46	575.92	419.90	156.02	67.61
307-1		1.46	575.92	415.90	160.02	69.34
309-1		1.46	575.92	419.80	156.12	67.65
311-1		1.46	575.91	428.65	147.26	63.81
313-1		1.46	575.91	433.20	142.71	61.84
314-1		1.00	575.91	431.00	144.91	62.79
315-1		1.46	575.90	413.00	162.90	70.59
317-1		1.46	575.90	420.00	155.90	67.56
319-1		1.46	575.92	427.00	148.92	64.53
321-1		1.46	575.92	426.80	149.12	64.62
323-1		1.46	575.92	425.00	150.92	65.40
325-1		1.46	575.92	420.00	155.92	67.57
327-1		1.46	575.91	415.00	160.91	69.73
329-1		1.46	575.90	426.85	149.05	64.59
331-1		1.46	575.91	431.41	144.50	62.62
333-1		1.46	575.92	420.40	155.52	67.39
335-1		1.46	575.93	426.96	148.97	64.55
337-1		1.46	575.93	423.46	152.47	66.07
339-1		1.46	575.91	419.74	156.17	67.67

341-1	1.46	575.91	424.00	151.91	65.83
343-1	1.46	575.91	424.40	151.51	65.66
345-1	1.46	575.92	416.35	159.57	69.15
347-1	1.46	575.90	419.79	156.11	67.65
349-1	1.46	575.90	420.00	155.90	67.56
351-1	1.46	575.90	419.00	156.90	67.99
353-1	1.46	575.90	419.89	156.01	67.61
355-1	1.46	575.91	419.89	156.02	67.61
356-1	1.00	575.91	416.00	159.91	69.29
357-1	1.46	575.91	403.80	172.11	74.58
358-1	0.50	575.91	403.80	172.11	74.58
359-1	1.46	575.92	426.89	149.03	64.58
361-1	1.46	575.92	426.81	149.11	64.61
362-1	0.50	575.92	426.81	149.11	64.61
363-1	1.46	575.91	419.79	156.12	67.65
365-1	1.46	575.91	426.72	149.19	64.65
369-1	1.46	575.91	420.00	155.91	67.56
371-1	1.46	575.91	426.72	149.19	64.65
373-1	1.46	575.91	420.00	155.91	67.56
375-1	1.46	575.91	420.00	155.91	67.56
381-1	1.46	575.94	409.80	166.14	72.00
385-1	1.46	575.95	410.50	165.45	71.69
387-1	1.46	575.95	408.38	167.57	72.61
389-1	1.46	575.96	420.00	155.96	67.58
391-1	1.46	575.97	415.26	160.71	69.64
393-1	0.00	576.00	428.00	148.00	64.13
394-1	0.00	576.00	428.00	148.00	64.13
395-1	1.68	576.00	424.00	152.00	65.87
397-1	1.46	575.96	420.00	155.96	67.58
399-1	1.68	576.00	424.00	152.00	65.87
401-1	1.68	576.00	433.85	142.15	61.60
403-1	1.68	575.98	428.80	147.18	63.78
405-1 City Center	1.46	575.90	415.30	160.60	69.59
501-1 Bolton Hill	1.43	575.94	415.20	160.74	69.65
503-1	1.43	575.93	416.40	159.53	69.13
505-1	1.43	575.93	418.25	157.68	68.33
507-1	1.43	575.93	415.35	160.58	69.59
509-1	1.43	575.93	420.04	155.89	67.55
511-1	1.43	575.93	390.00	185.93	80.57
515-1	1.43	749.98	415.40	334.58	144.98
516-1	0.00	749.98	415.40	334.58	144.98
517-1	1.43	749.97	426.80	323.17	140.04
519-1	1.43	749.97	450.00	299.97	129.99
521-1	1.43	749.98	433.00	316.98	137.36
523-1	1.43	749.98	436.00	313.98	136.06
525-1	1.43	749.98	446.00	303.98	131.72
527-1	1.43	749.97	464.00	285.97	123.92
529-1	1.43	749.97	461.49	288.48	125.01
531-1 10th St. @ e	1.43	749.98	500.00	249.98	108.32
533-1 0.5 MG RESER	2.28	576.31	542.73	33.58	14.55
535-1 @ RES	1.43	576.32	547.33	28.99	12.56
537-1 @ RES	1.43	576.32	547.33	28.99	12.56
539-1 @ RES	1.43	761.01	547.33	213.68	92.60
541-1 @ RES	1.43	761.01	500.00	261.01	113.11
545-1 @ 0.5 MG RES	1.43	761.01	547.33	213.68	92.60
547-1 South & abov	1.14	749.98	560.00	189.98	82.32
701-1 Bolton Hill	2.01	575.90	415.00	160.90	69.72
703-1	2.01	575.89	415.18	160.71	69.64
705-1 Bolton Hill	2.01	575.87	410.92	164.95	71.48
707-1	2.01	575.87	403.00	172.87	74.91

709-1	Ponderosa, @	2.01	575.87	415.18	160.69	69.63
711-1	Oak Island	2.01	575.90	411.00	164.90	71.45
713-1		1.71	575.90	415.13	160.77	69.67
714-1		0.00	575.90	416.53	159.37	69.06
715-1		1.71	575.91	415.19	160.72	69.64
716-1		0.00	575.91	413.77	162.14	70.26
717-1		1.71	575.91	416.00	159.91	69.29
719-1		1.71	575.91	415.20	160.71	69.64
721-1		1.71	575.91	419.00	156.91	67.99
723-1		1.71	575.91	419.00	156.91	67.99
727-1	Oak Island A	1.71	575.92	420.00	155.92	67.56
729-1	Mobile homes	12.79	575.92	420.00	155.92	67.56
731-1	Mobile homes	12.79	575.89	420.00	155.89	67.55
733-1	Mobile homes	12.09	575.91	425.56	150.35	65.15
737-1		1.71	575.96	426.70	149.26	64.68
739-1		1.71	576.06	426.88	149.18	64.64
741-1		1.71	576.05	428.00	148.05	64.15
743-1		1.71	576.02	426.88	149.14	64.63
745-1		1.71	575.98	427.00	148.98	64.56
747-1		1.71	575.98	419.50	156.48	67.81
749-1		1.71	575.96	415.16	160.80	69.68
751-1		1.71	575.93	415.20	160.73	69.65
753-1		1.71	575.92	418.00	157.92	68.43
755-1		1.71	575.91	403.60	172.31	74.67
757-1		1.71	575.90	416.00	159.90	69.29
761-1		1.71	575.91	415.30	160.61	69.60
763-1		1.71	576.02	424.00	152.02	65.88
765-1		1.71	576.04	420.00	156.04	67.62
767-1		1.71	576.05	415.23	160.82	69.69
771-1		1.71	575.88	403.70	172.18	74.61
773-1	Oak Island	1.71	576.12	419.00	157.12	68.09
1000-1	7th & Sertic	1.00	575.93	417.00	158.93	68.87
1001-1	Sertic	1.00	575.92	418.00	157.92	68.43
1500-1		25.50	575.97	426.00	149.97	64.99
1502-1		25.50	575.97	426.00	149.97	64.99
1504-1		25.50	576.00	435.00	141.00	61.10
1506-1		25.50	576.16	450.00	126.16	54.67
2000-1	Sherwood For	5.00	749.98	433.00	316.98	137.36
2001-1		2.00	749.98	444.50	305.48	132.37
2002-1		2.00	749.98	444.50	305.48	132.37
2003-1		2.00	749.98	456.00	293.98	127.39
2004-1		2.00	749.98	471.00	278.98	120.89
2005-1		2.00	749.98	458.00	291.98	126.52
2006-1	Sherwood For	2.00	749.98	570.00	179.98	77.99
2007-1	Half way to	2.00	749.99	600.00	149.99	65.00
2009-1		2.00	749.98	542.00	207.98	90.12
2010-1		2.00	749.98	550.00	199.98	86.66
2011-1		33.00	749.97	520.00	229.97	99.65
2015-1	Huston/Jeans	18.00	575.79	438.00	137.79	59.71
2016-1		18.00	575.79	438.00	137.79	59.71
2017-1		18.00	575.79	386.00	189.79	82.24
2018-1	Huston/Jean	18.00	575.80	376.00	199.80	86.58
2020-1	OLD PRV LOCA	2.00	749.98	450.00	299.98	129.99
2050-1		5.76	575.84	427.00	148.84	64.50
2052-1		5.76	575.82	427.00	148.82	64.49
2056-1		5.76	576.02	427.00	149.02	64.57

R E G U L A T I N G   V A L V E   R E P O R T

VALVE TYPE	POSITION NODE	CONTROLLED PIPE	VALVE SETTING (ft or gpm)	VALVE STATUS	UPSTREAM GRADE (ft)	DOWNSTREAM GRADE (ft)	THROUGH FLOW (gpm)
PRV-1	516	5014	574.99	CLOSED	749.98	575.96	0.00

S U M M A R Y   O F   I N F L O W S   A N D   O U T F L O W S

(+) INFLOWS INTO THE SYSTEM FROM BOUNDARY NODES
(-) OUTFLOWS FROM THE SYSTEM INTO BOUNDARY NODES

PIPE NUMBER	FLOWRATE (gpm)
1000	0.00
5056	172.57
9052	60.53
9064	276.42
9074	11.47

NET SYSTEM INFLOW = 520.99
NET SYSTEM OUTFLOW = 0.00
NET SYSTEM DEMAND = 520.99

**** CYBERNET SIMULATION COMPLETED ****

DATE: 3/16/1998
TIME: 15:05:11

ybernet Version: 2.18 SN: 1132180497 17-03-1998
Description: 2020, ADD W/ ADJUSTED FUTURE DEMAND
Drawing: S:\S\C\3033.19\WATERMAP\W-STUDY

ire Flow Summary.

JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT No.
125	0.7	68.2	1	1000.7	4657.6	20.0	27.3	123
127	0.7	64.6	1	1000.7	3493.6	20.0	27.3	175
137	0.7	75.2	1	1000.7	6000.0	37.8	27.2	2016
143	0.7	81.0	1	1000.7	6000.0	24.0	24.2	155
144	1.0	85.1	1	1001.0	4796.8	20.0	35.9	2016
146	1.0	85.6	1	1001.0	4691.9	20.0	36.8	2016
147	0.7	80.6	1	1000.7	5875.5	31.6	20.0	155
149	0.7	80.1	1	1000.7	4738.1	30.6	20.0	155
151	0.7	70.0	1	1000.7	4062.1	22.1	20.0	155
155	0.9	64.6	1	1000.9	3492.4	20.0	21.2	153
157	0.9	82.0	1	1000.9	3633.1	30.5	20.0	155
159	0.9	78.7	1	1000.9	3728.7	22.5	20.0	2016
161	0.9	78.8	1	1000.9	3630.8	23.9	20.0	2016
167	0.7	84.6	1	1000.7	1758.5	20.0	21.4	169
169	0.7	86.0	1	1000.7	1264.6	20.0	49.3	167
193	0.7	74.9	1	1000.7	6000.0	38.2	28.0	231
199	0.7	68.9	1	1000.7	6000.0	39.3	30.8	2016
203	0.7	67.6	1	1000.7	6000.0	32.4	30.8	2016
217	0.7	65.6	1	1000.7	4107.5	20.0	42.4	231
219	0.7	66.6	1	1000.7	5943.5	22.3	20.0	231
227	2.1	64.6	1	1002.1	3412.1	20.0	37.6	231
229	2.1	64.6	1	1002.1	4037.7	22.6	20.0	231
231	7.3	59.6	1	1007.3	2194.7	20.0	33.4	233
233	20.1	59.7	1	1020.1	2125.1	20.0	35.3	231
235	2.1	59.6	1	1002.1	3340.0	20.0	25.2	233
237	2.1	59.6	1	1002.1	3355.3	20.0	24.8	2015
301	1.5	64.6	1	1001.5	3982.0	20.0	37.7	303
303	1.5	67.6	1	1001.5	3593.8	20.0	40.9	301
305	1.5	67.6	1	1001.5	4607.0	20.0	30.8	303
307	1.5	69.3	1	1001.5	6000.0	28.8	27.1	309
313	1.5	61.8	1	1001.5	6000.0	29.1	31.8	311
317	1.5	67.6	1	1001.5	6000.0	35.1	31.8	2016
321	1.5	64.6	1	1001.5	6000.0	29.5	29.9	319
329	1.5	64.6	1	1001.5	2420.9	20.0	53.2	1506
331	1.5	62.6	1	1001.5	4426.1	20.0	26.9	314
333	1.5	67.4	1	1001.5	4799.8	20.0	38.1	345
335	1.5	64.6	1	1001.5	6000.0	21.5	37.6	237
339	1.5	67.7	1	1001.5	4773.4	20.0	35.4	341
343	1.5	65.7	1	1001.5	5210.8	20.0	32.9	345
353	1.5	67.6	1	1001.5	6000.0	38.9	32.4	235
355	1.5	67.6	1	1001.5	6000.0	39.3	32.8	235

* Needed Fire Flow not attained.

JCT No.	Avg. Day Demand (gpm)	Avg. Day Pressure (psi)	Zone No.	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	@Residual Pressure (psi)	Min. Zone Pressure (psi)	@JCT Number
358	0.5	74.6	1	1000.5	6000.0	21.8	20.7	701
359	1.5	64.6	1	1001.5	3674.0	20.0	34.1	361
362	0.5	64.6	1	1000.5	3212.5	20.0	38.8	361
363	1.5	67.7	1	1001.5	3434.2	20.0	24.4	369
365	1.5	64.6	1	1001.5	4725.3	20.0	42.3	235
371	1.5	64.6	1	1001.5	2796.0	20.0	30.3	373
387	1.5	72.6	1	1001.5	6000.0	36.6	37.0	381
391	1.5	69.6	1	1001.5	3314.4	20.0	52.5	1506
393	0.0	64.1	1	1000.0	4700.1	20.0	45.1	394
399	1.7	65.9	1	1001.7	6000.0	43.0	44.2	237
403	1.7	63.8	1	1001.7	3133.2	20.0	52.4	1506
405	1.5	69.6	1	1001.5	3234.2	20.0	50.1	2016
501	1.4	69.7	1	1001.4	1274.4	22.1	20.0	509
507	1.4	69.6	1	1001.4	914.9*	22.0	20.0	509
515	1.4	145.0	1	1001.4	3565.5	20.0	20.0	516
517	1.4	140.0	1	1001.4	2280.5	30.0	20.0	519
529	1.4	125.0	1	1001.4	2037.4	20.0	29.6	527
703	2.0	69.6	1	1002.0	2861.2	20.0	41.2	701
709	2.0	69.6	1	1002.0	3929.0	20.0	36.9	231
714	0.0	69.1	1	1000.0	2533.7	20.0	23.8	757
716	0.0	70.3	1	1000.0	2308.1	20.0	34.0	715
719	1.7	69.6	1	1001.7	2824.3	20.0	25.9	721
733	12.1	65.2	1	1012.1	6000.0	37.2	34.4	235
737	1.7	64.7	1	1001.7	3168.9	20.0	44.2	739
739	1.7	64.6	1	1001.7	2818.0	20.0	48.9	737
743	1.7	64.6	1	1001.7	2266.5	20.0	19.9	2056
747	1.7	67.8	1	1001.7	1650.8	20.0	32.9	745
749	1.7	69.7	1	1001.7	2054.5	20.0	26.8	745
751	1.7	69.7	1	1001.7	2157.3	20.0	32.5	749
755	1.7	74.7	1	1001.7	2732.5	22.3	20.0	753
761	1.7	69.6	1	1001.7	1704.7	20.0	49.4	721
763	1.7	65.9	1	1001.7	1179.4	20.0	50.9	2056
767	1.7	69.7	1	1001.7	1802.8	22.1	20.0	765
771	1.7	74.6	1	1001.7	2449.7	20.0	36.5	711
1000	1.0	68.9	1	1001.0	3352.3	20.0	49.5	1001
1001	1.0	68.4	1	1001.0	4039.1	20.0	40.6	1000

APPENDIX D
DRINKING WATER ANALYSIS

Analysis of
• Drinking Water
• Waste Water
• Industrial Chemicals
• Solid Waste
• Bacteriology

Analytical Laboratory & Consultants, Inc.
361 West Fifth Ave.
Eugene, OR 97401
Oregon Certified Lab #16
(541) 485-8404

Lab Report No.: 76834
Client P.O.:
Date Received: 3/27/97 1505

Mar. 97

REPORT OF ANALYSIS OF DRINKING WATER FOR INORGANIC CHEMICALS PHASE II & V

RECEIVED APR 17 1997 CITY OF VENETA

Attention: Frank Wright
System: City of Veneta
Address: PO Box 458
Veneta,OR 97487
PWS ID#: 4100920
Sampled at: Nelson Family Market
Date Collected: 3/27/97

Bill to:
Address:
Source ID: Well #4
Sampled by: Kyle Schauer
Time Collected: 1400

Sample Composition: Treated / Distribution / Single

CONTAMINANT	CODE	METHOD	MCL mg/l	ANALYSIS mg/l	MDL mg/l	ANALYST/DATE
Antimony	1074	SM 3113 B	0.006	ND	0.0030	RW/JW 3/30/97
Arsenic	1005	SM 3113 B	0.05	ND	0.0050	RW/JW 3/29/97
Barium ✓	1010	SM 3113 B	2	0.0130	0.0100	RW/RF 3/30/97
Beryllium	1075	SM 3113 B	0.004	ND	0.0001	RW/JW 4/2/97
Cadmium	1015	SM 3113 B	0.005	ND	0.0001	RW/JW 4/1/97
Chromium	1020	SM 3113 B	0.1	ND	0.0010	RW/RF 3/28/97
Cyanide ✓	1024	SM 4500-CN F	0.2	ND @ 0.05	0.02	JH/JW 4/9/97
Fluoride	1025	SM 4500-F C	4.0	ND	0.5	JH/JW 4/2/97
Lead	1030	SM 3113 B	0.015	ND	0.0020	RW/JW 3/30/97
Mercury	1035	SM 3112 B	0.002	ND	0.0004	RW/RF 4/1/97
Nickel	1036	SM 3113 B	0.1	ND	0.0025	RW/JW 3/29/97
Nitrate	1040	SM 4500-NO_3 D	10	ND	0.4	JH/JW 3/28/97
Nitrite	1041	SM 4500-NO_3 E	1.0	ND	0.1	JH/GZ 3/28/97
Selenium	1045	SM 3113 B	0.05	ND	0.0050	RW/RF 3/31/97
Sodium ✓	1052	SM 3111 B		19.6	1.0	RW/RF 4/9/97
Sulfate ✓	1055	SM 4500-SO_4 E		5.2	1.0	JH/GZ 4/3/97
Thallium	1085	EPA 200.9	0.002	ND	0.0010	RW/RF 3/31/97

4/17/97 Copies to: Frank, Kyle, Engineer, V.O.C. File
Original filed in History-Location file
Miscellaneous - Various sites

ND means "None Detected"

APPROVED [signature] DATE 4/11/97

D-1

76834.WPS

Analysis of
• Drinking Water
• Waste Water
• Industrial Chemicals
• Solid Waste
• Bacteriology

Analytical Laboratory & Consultants, Inc.
361 West Fifth Ave.
Eugene, OR 97401
Oregon Certified Lab #16
(541) 485-8404

Lab Report No.: 76835
Client P.O.:
Date Received: 3/27/97 1505

REPORT OF ANALYSIS OF DRINKING WATER
VOLATILE ORGANIC CHEMICALS EPA 502.2

RECEIVED APR 17 1997 CITY OF VENETA

Attention: Frank Wright
System: City of Veneta
Address: PO Box 458
Veneta, OR 97487
PWS ID #: 4100920
Sampled at: Nelson Family Market
Date Collected: 3/27/97

Bill to:
Address:
Source ID: Well #4
Sampled by: Kyle Schauer
Time Collected: 1400

Sample Composition: Treated / Distribution / Single

CONTAMINANT	CODE	METHOD	MCL mg/l	ANALYSIS mg/l	MDL mg/l	ANALYST/DATE	
1,1-Dichloroethylene	2977	502.2	0.007	ND	0.0005	FW	4/8/97
1,1,1-Trichloroethane	2981	502.2	0.2	ND	0.0005	FW	4/8/97
1,1,2-Trichloroethane	2985	502.2	0.005	ND	0.0005	FW	4/8/97
2-Dichloroethane	2980	502.2	0.005	ND	0.0005	FW	4/8/97
1,2-Dichloropropane	2983	502.2	0.005	ND	0.0005	FW	4/8/97
1,2,4-Trichlorobenzene	2378	502.2	0.07	ND	0.0005	FW	4/8/97
Benzene	2990	502.2	0.005	ND	0.0005	FW	4/8/97
Carbon Tetrachloride	2982	502.2	0.005	ND	0.0005	FW	4/8/97
Cis-1,2-Dichloroethylene	2380	502.2	0.07	ND	0.0005	FW	4/8/97
Dichloromethane	2964	502.2	0.005	ND	0.0005	FW	4/8/97
Ethylbenzene	2992	502.2	0.7	ND	0.0005	FW	4/8/97
Monochlorobenzene	2989	502.2	0.1	ND	0.0005	FW	4/8/97
O-Dichlorobenzene	2968	502.2	0.6	ND	0.0005	FW	4/8/97
P-Dichlorobenzene	2969	502.2	0.075	ND	0.0005	FW	4/8/97
Styrene	2996	502.2	0.1	ND	0.0005	FW	4/8/97
Tetrachloroethylene ✓	2987	502.2	0.005	0.0017	0.0005	FW	4/8/97
Toluene	2991	502.2	1.0	ND	0.0005	FW	4/8/97
Total Xylenes	2955	502.2	10.0	ND	0.0005	FW	4/8/97
Trans-1,2-Dichloroethylene	2979	502.2	0.1	ND	0.0005	FW	4/8/97
Trichloroethylene	2984	502.2	0.005	ND	0.0005	FW	4/8/97
.nyl Chloride	2976	502.2	0.002	ND	0.0005	FW	4/8/97

D-2

ND means "Not Detected"

4/17/97 copies to Frank-Kyle, Engineers V.O.C. File
Original filed in History-Location file ~~Miscellaneous~~ Various.

Analysis of
- Drinking Water
- Waste Water
- Industrial Chemicals
- Solid Waste
- Bacteriology

Analytical Laboratory & Consultants, Inc.
361 West Fifth Ave.
Eugene, OR 97401
Oregon Certified Lab #16
(541) 485-8404

Lab Report No.: 76835-TB
Client P.O.:
Date Received: 3/27/97 1505

REPORT OF ANALYSIS OF DRINKING WATER
VOLATILE ORGANIC CHEMICALS EPA 502.2

RECEIVED APR 17 1997 CITY OF VENETA

Attention Frank Wright
System City of Veneta
Address PO Box 458
Veneta, OR 97487
PWS ID # 4100920
Sampled at Nelson Family Mkt.
Date Collected 3/27/97
Sample Composition: Treated / Distribution / Single

Bill to
Address
Source ID Travel Blank for 76835
Sampled by
Time Collected

CONTAMINANT	CODE	METHOD	MCL mg/l	ANALYSIS mg/l	MDL mg/l	ANALYST/DATE
1,1-Dichloroethylene	2977	502.2	0.007	ND	0.0005	FW 4/8/97
1,1,1-Trichloroethane	2981	502.2	0.2	ND	0.0005	FW 4/8/97
1,1,2-Trichloroethane	2985	502.2	0.005	ND	0.0005	FW 4/8/97
1,2-Dichloroethane	2980	502.2	0.005	ND	0.0005	FW 4/8/97
1,2-Dichloropropane	2983	502.2	0.005	ND	0.0005	FW 4/8/97
1,2,4-Trichlorobenzene	2378	502.2	0.07	ND	0.0005	FW 4/8/97
Benzene	2990	502.2	0.005	ND	0.0005	FW 4/8/97
Carbon Tetrachloride	2982	502.2	0.005	ND	0.0005	FW 4/8/97
Cis-1,2-Dichloroethylene	2380	502.2	0.07	ND	0.0005	FW 4/8/97
Dichloromethane	2964	502.2	0.005	ND	0.0005	FW 4/8/97
Ethylbenzene	2992	502.2	0.7	ND	0.0005	FW 4/8/97
Monochlorobenzene	2989	502.2	0.1	ND	0.0005	FW 4/8/97
O-Dichlorobenzene	2968	502.2	0.6	ND	0.0005	FW 4/8/97
P-Dichlorobenzene	2969	502.2	0.075	ND	0.0005	FW 4/8/97
Styrene	2996	502.2	0.1	ND	0.0005	FW 4/8/97
Tetrachloroethylene	2987	502.2	0.005	ND	0.0005	FW 4/8/97
Toluene	2991	502.2	1.0	ND	0.0005	FW 4/8/97
Total Xylenes	2955	502.2	10.0	ND	0.0005	FW 4/8/97
Trans-1,2-Dichloroethylene	2979	502.2	0.1	ND	0.0005	FW 4/8/97
Trichloroethylene	2984	502.2	0.005	ND	0.0005	FW 4/8/97
Vinyl Chloride	2976	502.2	0.002	ND	0.0005	FW 4/8/97

D-3
ND means "Not Detected"

4/17/97 copies to: Frank - Kyle, Engineers V.O.C. File
Original filed in History - Location file Miscellaneous - Various site

Analytical Laboratory & Consultants, Inc.

Lab Report No 76835

TAKEN from; Nelson Family MRKT

DATE

Unregulated VOCs

RECEIVED APR 17 1997 CITY OF VENETA

CONTAMINANT	CODE	METHOD	MCL mg/l	ANALYSIS mg/l	MDL mg/l	ANALYST	DATE
1,1-Dichloroethane	2978	502.2		ND	0.0005	FW	4/8/97
1,1-Dichloropropene	2410	502.2		ND	0.0005	FW	4/8/97
1,1,1,2-Tetrachloroethane	2986	502.2		ND	0.0005	FW	4/8/97
1,1,2,2-Tetrachloroethane	2988	502.2		ND	0.0005	FW	4/8/97
1,2,3-Trichloropropane	2414	502.2		ND	0.0005	FW	4/8/97
1,3-Dichloropropane	2412	502.2		ND	0.0005	FW	4/8/97
1,3-Dichloropropene	2413	502.2		ND	0.0005	FW	4/8/97
2,2-Dichloropropane	2416	502.2		ND	0.0005	FW	4/8/97
Bromobenzene	2993	502.2		ND	0.0005	FW	4/8/97
Bromodichloromethane ✓	2943	502.2		0.0007	0.0005	FW	4/8/97
Bromoform	2942	502.2		ND	0.0005	FW	4/8/97
Bromomethane	2214	502.2		ND	0.0005	FW	4/8/97
Chloroethane	2216	502.2		ND	0.0005	FW	4/8/97
Chloroform	2941	502.2		ND	0.0005	FW	4/8/97
Chloromethane	2210	502.2		ND	0.0005	FW	4/8/97
Dibromochloromethane	2944	502.2		ND	0.0005	FW	4/8/97
Dibromomethane	2408	502.2		ND	0.0005	FW	4/8/97
M-Dichlorobenzene	2967	502.2		ND	0.0005	FW	4/8/97
O-Chlorotoluene	2965	502.2		ND	0.0005	FW	4/8/97
P-Chlorotoluene	2966	502.2		ND	0.0005	FW	4/8/97
Dichlorodifluoromethane	2212	502.2		ND	0.0005	FW	4/8/97
Trichlorofluoromethane	2218	502.2		ND	0.0005	FW	4/8/97
Bromochloromethane	2430	502.2		ND	0.0005	FW	4/8/97
Isopropylbenzene	2994	502.2		ND	0.0005	FW	4/8/97
n-Propylbenzene	2998	502.2		ND	0.0005	FW	4/8/97
1,3,5-Trimethylbenzene	2424	502.2		ND	0.0005	FW	4/8/97
tert-Butylbenzene	2426	502.2		ND	0.0005	FW	4/8/97
1,2,4-Trimethylbenzene	2418	502.2		ND	0.0005	FW	4/8/97
sec-Butylbenzene	2428	502.2		ND	0.0005	FW	4/8/97
p-Isopropyltoluene	2030	502.2		ND	0.0005	FW	4/8/97
n-Butylbenzene	2422	502.2		ND	0.0005	FW	4/8/97
Naphthalene	2248	502.2		ND	0.0005	FW	4/8/97
Hexachlorobutadiene	2246	502.2		ND	0.0005	FW	4/8/97
2,3-Trichlorobenzene	2420	502.2		ND	0.0005	FW	4/8/97

 4/17/97 copies to Mark Kyle, Engineer, TCC File

ND means "Not Detected"

Original filed in History-Location file Miscellaneous various

APPROVED [signature] DATE 4/10/97

D-4

76835.WPS

Analytical Laboratory & Consultants, Inc. Lab Report No 76835-TB

Unregulated VOCs

CONTAMINANT	CODE	METHOD	MCL mg/l	ANALYSIS mg/l	MDL mg/l	ANALYST/DATE	
1,1-Dichloroethane	2978	502.2		ND	0.0005	FW	4/8/97
1,1-Dichloropropene	2410	502.2		ND	0.0005	FW	4/8/97
1,1,1,2-Tetrachloroethane	2986	502.2		ND	0.0005	FW	4/8/97
1,1,2,2-Tetrachloroethane	2988	502.2		ND	0.0005	FW	4/8/97
1,2,3-Trichloropropane	2414	502.2		ND	0.0005	FW	4/8/97
1,3-Dichloropropane	2412	502.2		ND	0.0005	FW	4/8/97
1,3-Dichloropropene	2413	502.2		ND	0.0005	FW	4/8/97
2,2-Dichloropropane	2416	502.2		ND	0.0005	FW	4/8/97
Bromobenzene	2993	502.2		ND	0.0005	FW	4/8/97
Bromodichloromethane	2943	502.2		ND	0.0005	FW	4/8/97
Bromoform	2942	502.2		ND	0.0005	FW	4/8/97
Bromomethane	2214	502.2		ND	0.0005	FW	4/8/97
Chloroethane	2216	502.2		ND	0.0005	FW	4/8/97
Chloroform	2941	502.2		ND	0.0005	FW	4/8/97
Chloromethane	2210	502.2		ND	0.0005	FW	4/8/97
Dibromochloromethane	2944	502.2		ND	0.0005	FW	4/8/97
Dibromomethane	2408	502.2		ND	0.0005	FW	4/8/97
M-Dichlorobenzene	2967	502.2		ND	0.0005	FW	4/8/97
O-Chlorotoluene	2965	502.2		ND	0.0005	FW	4/8/97
P-Chlorotoluene	2966	502.2		ND	0.0005	FW	4/8/97
Dichlorodifluoromethane	2212	502.2		ND	0.0005	FW	4/8/97
Trichlorofluoromethane	2218	502.2		ND	0.0005	FW	4/8/97
Bromochloromethane	2430	502.2		ND	0.0005	FW	4/8/97
Isopropylbenzene	2994	502.2		ND	0.0005	FW	4/8/97
n-Propylbenzene	2998	502.2		ND	0.0005	FW	4/8/97
1,3,5-Trimethylbenzene	2424	502.2		ND	0.0005	FW	4/8/97
tert-Butylbenzene	2426	502.2		ND	0.0005	FW	4/8/97
1,2,4-Trimethylbenzene	2418	502.2		ND	0.0005	FW	4/8/97
sec-Butylbenzene	2428	502.2		ND	0.0005	FW	4/8/97
p-Isopropyltoluene	2030	502.2		ND	0.0005	FW	4/8/97
n-Butylbenzene	2422	502.2		ND	0.0005	FW	4/8/97
Naphthalene	2248	502.2		ND	0.0005	FW	4/8/97
Hexachlorobutadiene	2246	502.2		ND	0.0005	FW	4/8/97
,2,3-Trichlorobenzene	2420	502.2		ND	0.0005	FW	4/8/97

RECEIVED APR 17 1997 CITY OF VENETA

 4/17/97 Copies to Frank Tyle, Engineer, V.O.C. File

ND means "Not Detected"

Original Filed in History-Location File Miscellaneous VAR1043 Site

APPROVED [signature] DATE 4/11/97

D-5

78835TB.WPS

Analysis of
- Drinking Water
- Waste Water
- Industrial Chemicals
- Solid Waste
- Bacteriology

Analytical Laboratory & Consultants, Inc.
361 West Fifth Ave.
Eugene, OR 97401
Oregon Certified Lab #16
(541) 485-8404

Lab Report No.: 76836
Client P.O.:
Date Received: 3/27/97 1505

REPORT OF ANALYSIS OF DRINKING WATER FOR SECONDARY CONTAMINANTS

RECEIVED APR 17 1997 CITY OF VENETA

Attention: Frank Wright
System: City of Veneta
Address: PO Box 458
Veneta, OR 97487
Bill to:
Address:
PWS ID#: 4100920
Source ID: Well #4
Sampled at: Nelson Family Market
Sampled by: Kyle Schaver
Date Collected: 3/27/97
Time Collected: 1400
Sample Composition: Treated / Distribution / Single

PARAMETER	METHOD	SECONDARY MCL	DETECTION LEVEL	RESULTS	UNITS
Color	SM 2120 C	15	1	2	C.U.
Corrosivity	Langlier's	non-corrosive	--	-1.4	
Anionic Surfactants, MBAS	SM 5540 C	0.5	0.05	ND	mg/l
pH	SM 4500-H B	6.5-8.5	--	7.2	
Hardness (as $CaCO_3$)	SM 2340 C	250	1	67	mg/l
Odor	SM 2150 B	3	1	1	T.O.N.
Total Solids	SM 2540 B	500	10	180	mg/l
Aluminum	SM 3113 B	0.05-0.2	0.0020	ND	mg/l
Chloride	SM 4500-Cl C	250	1	26	mg/l
Copper	SM 3111 B	1	0.050	ND	mg/l
Fluoride	SM 4500-F C	2.0	0.5	ND	mg/l
Iron	SM 3111 B	0.3	0.050	ND	mg/l
Manganese	SM 3111 B	0.05	0.020	ND	mg/l
Silver	SM 3113 B	0.1	0.0050	ND	mg/l
Sulfate	SM 4500-SO_4 E	250	1	5	mg/l
Zinc	SM 3111 B	5	0.050	ND	mg/l
Total Dissolved Solids	SM 2540 C	500	10	178	mg/l
Total Alkalinity (as $CaCO_3$)	SM 2320 B	--	1	70	mg/l
Calcium Hardness (as $CaCO_3$)	SM 3111 D	--	1	45	mg/l

4/17/97 copies to Frank - Kyle, Engineer, V.O.C. File
original filed in History - Location file ~~Miscellaneous~~ VARIOUS Sites

ND means "None Detected"

APPROVED [signature] DATE 4/14/97

D-6

76836.WPS

RESULTS OF MARCH 1997 CHEMICAL ANALYSIS OF DRINKING WATER INORGANIC CHEMICAL WELL 4			
CONTAMINANT	**MCL (mg/l)**	**MDL (mg/l) (minimum detectable level)**	**RESULT OF ANALYSIS (mg/l)**
Barium	2	0.01	0.0130
Cyanide	0.2	0.02	0.05
Sodium*	--	1.0	19.6
Sulfate*	--	1.0	5.2
VOLATILE ORGANIC CHEMICALS ANALYSIS OF DRINKING WATER			
Tetrachloroethylene	0.005	0.0005	0.0017
Bromodichloromethane *	--	0.0005	0.0007
SECONDARY CONTAMINANTS ANALYSIS OF DRINKING WATER			
	SECONDARY MCL	**DETECTION LEVEL**	**RESULTS (units)**
Color	15	1	2 C.U.
Corrosivity	non-corrosive	--	-1.4
pH	6.5-8.5	--	7.2
Hardness	250	1	67 mg/L
Odor	3	1	1-T.O.N
Total solids	500	10	180 mg/L
Chloride	250	1	26 mg/L
Sulfate	250	1	5 mg/L
Total dissolved solids	500	10	178 mg/L
Total alkalinity	--	1	70 mg/L
Calcium hardness	--	1	45 mg/L

* *unregulated*

APPENDIX E
VENETA URBAN RENEWAL AGENCY

3033.19

A Boundary Description
of
Veneta Economic Development District

City of Veneta
Lane County
Oregon

Beginning at a point South 89°56' West, 717.44 feet from the Southeast corner of the Harriet Glass Donation Land Claim No. 51, Notification No. 5467, Township 17 South, Range 5 West of the Willamette Meridian; thence South 0°40'05" East 60.00 feet more or less to the Southerly margin of County Road No. 847 (Jeans Road); thence North 89°56' East along the Southerly margin of County Road No. 847 (Jeans Road) 92.0 feet more or less to a point being South 0°07' West 274.5 feet from a point South 89°51' West 2137.3 feet from the Northeast corner of Section 31, Township 17 South of Range 5 West of the Willamette Meridian; thence South 0°07' West 1076.6 feet to a point on the Southerly right-of-way line of the Coos Bay Branch of the Southern Pacific Railroad; thence North 89°56' West along the Southerly right-of-way line of the Coos Bay Branch of the Southern Pacific Railroad 1414.50 feet to the Northeast corner of a 1.24 acre parcel of land deeded from the Archdiacese of Portland in Oregon to the City of Veneta; thence South 0°19' West 1289.88 feet to a point on the Northerly right-of-way of County Road #408 (Hunter Road) being South 89°20' East 2026.5 feet and North 0°19' East 20.0 feet from the Quarter Corner on the West line of Section 31, Township 17 South, Range 5 West of the Willamette Meridian; thence North 89°20' West 30.00 feet; thence North 0°19' East 376.90 feet; thence North 89°20' East 439.0 feet; thence South 0°19' West 23.07 feet; thence North 89°21' West 469.0 feet to a point North 0°19' East 373.83 feet and South 89°20' East 1088.5 feet from the Quarter Corner on the West line of Section 31, Township 17 South, Range 5 West of the Willamette Meridian; thence North 0°19' East 955.37 feet to the Southerly right-of-way line of the Coos Bay Branch of the Southern Pacific Railroad; thence South 89°51'30" East 1063.00 more or less along the Southerly right-of-way line of the Coos Bay Branch of the Southern

Pacific Railroad to a point on the Easterly right-of-way of Oregon State Highway No. 200 (Territorial Highway); thence Southerly along the Easterly right-of-way of Oregon State Highway No. 200 (Territoria-l Highway) 1323.80 feet more or less to a point on the Southerly right-of-way of County Road No. 408 (Hunter Road); thence East along the Southerly right-of-way of County Road No. 408 (Hunter Road) 120.0 feet more or less to a point being East 134.00 feet and South 20.00 feet from the Northwest corner of the Southwest quarter of Section 31, Township 17 South, Range 5 West of the Willamette Meridian; thence South 100.00 feet; thence East 196.00 feet to a point East 330.00 feet and South 120.00 feet of the Northwest corner of the Southwest Quarter of Section 31, Township 17 South, Range 5 West of the Willamette Meridian; thence South 606.00 feet to a point on the North line of Lot 13, Dalton's Poultry Farm, as platted and recorded in Book 10, page 26, Lane County Oregon Plat Records, in Lane County, Oregon; thence East 390.00 feet more or less to the Northeasterly corner of said Lot 13, Dalton's Poultry Farm; thence South 280.00 feet to the Southeasterly corner of said Lot 13, Dalton's Poultry Farm; thence West 465.5 feet to a point 261.00 feet East of the Southwest corner of said Lot 13, Dalton's Poultry Farm; thence South 325.00 feet to a point on the Northerly line of Lot 15, of said Dalton's Poultry Farm; thence East 80.00 feet to the Northeasterly corner of said Lot 15, Dalton's Poultry Farm; thence South 233.00 feet to the Southeasterly corner of said Lot 15, Dalton's Poultry Farm; thence Westerly along the South line of said Lot 15, Dalton's Poultry Farm 362.40 feet more or less to a point on the Easterly right-of-way of Oregon State Highway No. 200 (Territorial Highway); thence Northerly along the Easterly right-of-way of Oregon State Highway No. 200 (Territorial Highway) 910.00 feet more or less to a point being East of a point on the East line of Section 36, Township 17 South, Range 6 West of the Willamette Meridian that is 668.25 feet South of the East one-quarter section corner of said Section 36; thence West 749.00 feet more or less to a point 500.00 feet West of a point on the Westerly right-of-way of Oregon State Highway No. 200 (Territorial Highway) and said point being West of a point on the

East line of Section 36, Township 17 South, Range 6 West of the Willamette Meridian that is 668.25 feet South of the East one-quarter Section corner of said Section 36; thence North 222.75 feet; thence West 42.00 feet; thence North 445.5 feet to a point on the South right-of-way of Hunter Avenue, said point being 536.00 feet West of the Northweast corner of the Southeast one-quarter of Section 36, Township 17 South, Range 6 West of the Willamette Meridian, in Lane County, Oregon and on the Southerly line of the Plat of Veneta as platted and recorded in Book 7, Page 4, Lane County Plat Records, in Lane County, Oregon; thence North $89^{0}48'$ West 1083.05 feet to the Initial Point of the First Addition to Veneta as platted and recorded in Book 7, Page 31, Lane County Plat Records, in Lane County, Oregon; thence North $89^{0}48'$ West 20.00 feet; thence North 20.00 feet; thence East 346.00 feet along the center line of Hunter Avenue as recorded in said First Addition to Veneta to a point on the West right-of-way of Eighth Street; thence North along the West right-of-way of Eighth Street 404.00 feet to the Southeast corner of Lot B as recorded in said plat of First Addition to Veneta; thence West 318.8 feet along the South line of said Lot B; thence North 401.90 feet along the Westerly line to the most Northwesterly corner of said Lot B; thence North $3^{0}30'$ East 770.00 feet more or less to a point where the Southeasterly right-of-way line of that transmission line easement granted Pacific Power and Light Company, by instrument recorded November 28, 1955, Reception No. 71571, Lane County Oregon Deed Records, intersects with the Northerly right-of-way line of the relocated Florence-Eugene Highway as described in that deed to the State of Oregon, recorded June 28, 1971, Reception No. 52569, Lane County, Oregon Records; thence North $39^{0}19'08''$ East 720.18 feet along the Southeasterly right-of-way line of said easement granted to Pacific Power and Light company; thence North $12^{0}31'11''$ East 89.55 feet; thence North $78^{0}31'45''$ East 257.28 feet to the intersection with the 377.0 foot contour line of Fern Ridge Reservoir and U.S.C.E. Monument M-153; thence continuing along said contour North $78^{0}31'45''$ East 469.65 to U.S.C.E. Monument N-153; thence along said contour line South $59^{0}37'30''$ East 516.00 feet to U.S.C.E. Monument 0-153;

thence along said contour line North 59°15' East 1064.05 feet to U.S.C.E. Monument Q-153; thence along said contour line North 71°58' East 1060.00 feet to U.S.C.E. Monument R-153; thence along said contour North 61°01' East 668.30 feet to U.S.C.E. Monument S-153; thence along said contour North 85°16' East 505.10 feet to U.S.C.E. Monument T-153; thence along said contour North 65° 23' East 539.70 feet to U.S.C.E. Monument U-153; thence along said contour South 54°59' East 244.90 feet to U.S.C.E. Monument V-153; thence along said contour North 21°46' East 186.0 feet to U.S.C.E. Monument W-153; thence along said contour South 88°59' East 244.6 feet to U.S.C.E. Monument X-153; thence along said contour North 55°20' East 213.14 feet to a point North 0°40'05" West and South 89°56' West 717.42 feet from the Southeast corner of the Harriet Glass Donation Land Claim No. 51, Township 17 South, Range 5 West of the Willamette Meridian; thence South 0°40'05" East 1541.98 feet to Point of Beginning, in Veneta, Lane County, Oregon.

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VENETA URBAN RENEWAL AGENCY
FINANCIAL STATEMENT/BILLS PAYABLE
FOR THE PERIOD JULY 1 TO SEPTEMBER 30, 1998

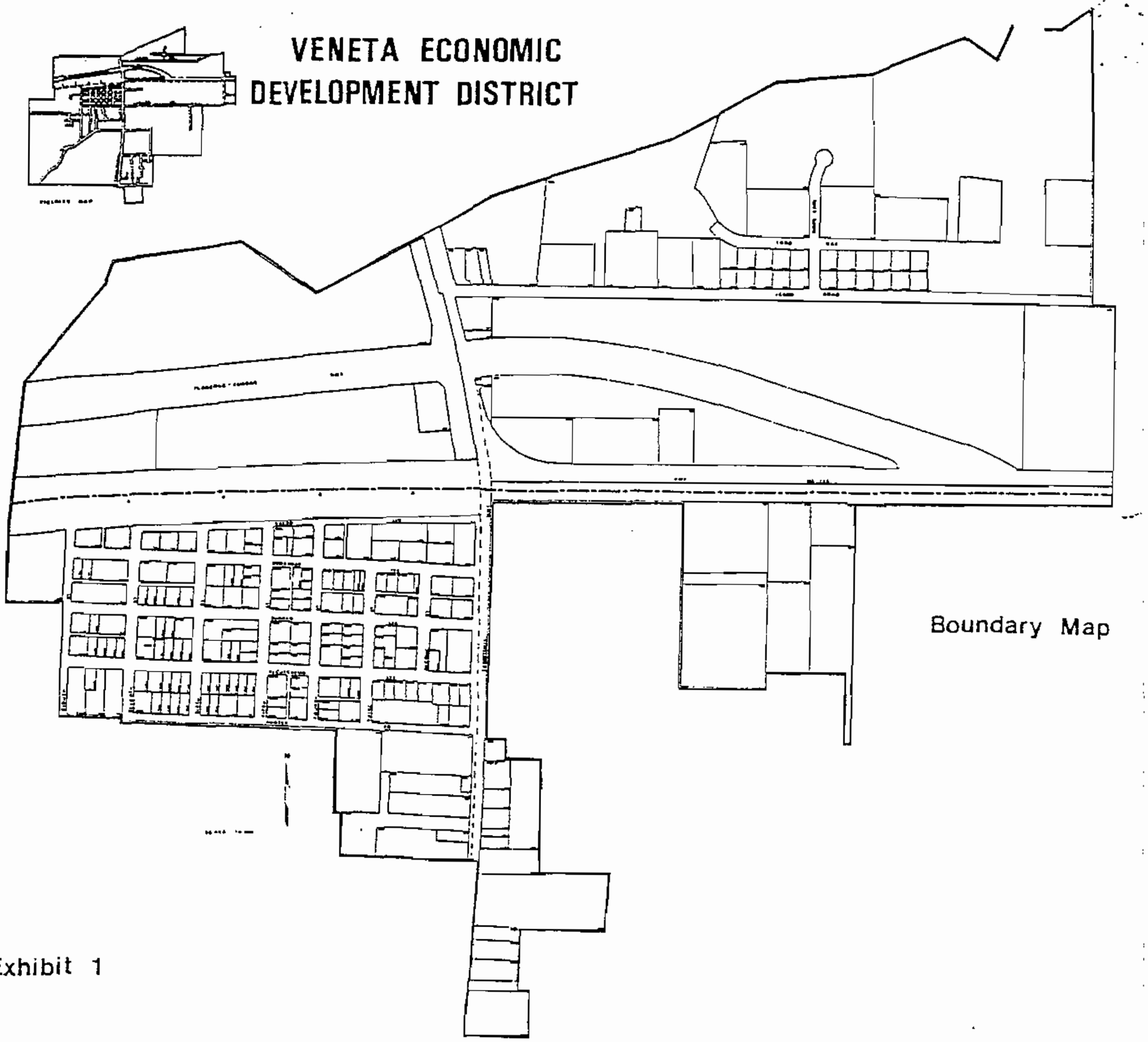
BEGINNING BALANCE -	**July 1, 1998**		**$ 1,132,666.55**
REVENUES:			
	Property Taxes - Current		
	Property Taxes - Prior	**1,084.02**	
	Interest from Lane County	**64.42**	
	Interest from LGIP/Savings	**6,188.13**	
	Short Term Loan	**-**	
	Loan Proceeds (Bond)	**-**	
TOTAL REVENUE			**7,336.57**
Available Resources:			**$ 1,140,003.12**
EXPENDITURES:			
	KeyBank Nat'l	**300,063.75**	
	Spencer&Kupper	**5,000.00**	
	SHJPW	**2,532.60**	
	West Lane News	**556.10**	
TOTAL EXPENSES			**(308,152.45)**
ENDING BALANCE -	**September 30, 1998**		**$ 831,850.67**

BILLS PAID/PAYABLE:

Speer Hoyt Jones Poppe Wolfe	**$ -**
West Lane News	**-**
Preston Ellis & Gates	**1,995.46**

AGENCY FUNDS:

General Fund	**$ 19,457.93**
Debt Service Fund	**812,392.74**
TOTAL:	**$ 831,850.67**



Boundary Map

Exhibit 1

APPENDIX F
WATER CONSERVATION AND CURTAILMENT

APPENDIX F

WATER CONSERVATION APPROACHES/POLICIES

Oregon water conservation rules require water purveyors to consider the cost effectiveness of water conservation and to develop a plan for water curtailment should conditions require a significant reduction in water use.

Elements of a water conservation plan should include a description of conservation measures currently implemented by the water supplier and installation of water meters. At a minimum, the city is required to provide a detailed description and implementing schedule for the following conservation measures:

- An annual water audit of the system.
- A system-wide leak repair or line replacement program to reduce system leakage to 15 percent, and if further reduction of system leakage is found to be feasible and appropriate, to reduce system leakage to 10 percent.
- A meter testing and maintenance program.
- A public education program on efficient water use.

The city prepares annual water audits of the water system and monthly production reports. Water production reports contain information on total water production at the water treatment plant and metered water service measurements are submitted monthly to the city engineer for review. Over the past four years, overall leakage has decreased to a low of 6 percent. This decrease is attributed to diligent system repair by city staff.

Along with the audits, a regularly scheduled meter testing and maintenance program has been in place for the last five years. Since 1993, 193 meters or 22 percent of the meters in Veneta have been replaced. Additionally, all leaking services replaced since 1993 have been made with more reliable (copper) materials. Regular meter reading and inspection is the city's most viable option for keeping leakage in check.

Since an additional water source is needed by the city, the cost and feasibility of implementing additional conservation measures should be evaluated. Conservation measures which may require examination are listed below:

- System-wide leak repair program or line replacement to reduce system leakage to less than ten percent.
- Low water use landscaping (xeriscaping) and/or efficient lawn and garden irrigation programs.
- Incentive programs which encourage conservation.

- Retrofitting/replacement of existing inefficient water fixtures.
- Rate structures which support and encourage water conservation.
- Water reuse opportunities.

Finally, the city is required to give a description of new conservation measures to be implemented during the next five years to improve water use efficiency within its jurisdiction.

Following is a discussion of conservation techniques available to the city. Each is reviewed based upon how Veneta currently reacts to the requirements.

Conservation Techniques

Detection and Elimination of Leaks: The key to maintaining an ongoing, effective leak detection program is to maintain a constant vigil on water accounting. Current data indicates the city's unaccounted water is between 6 and 8 percent which reflects excellent performance in leak detection and elimination.

Public works staff currently record total water production and total water delivered through system meters monthly. Since the entire community is metered there are few opportunities for water to leave the system. Still, more accurate assessment of the following systems operation and equipment will provide better monitoring:

- Hydrant flushing - flow used for hydrant flushing, fire training and other incidental uses relative to hydrant operation is only estimated.
- Construction water - although the city requires that all water used for construction be metered, there are occasions when unmetered water is used.
- Possible errors in the well master meters.
- Cumulative errors in individual customer meters.

Low Water Use Landscaping: The city currently does not have a program to encourage low water use landscaping. However, the city completed construction of a new city administrative building in 1997 which included native shrubs and ground cover. These plants should use less water than imported species. The planning commission has generally encouraged native plants and low water use landscaping, but no policies are in place. Similarly, no programs exist to encourage or reward conservation.

Retrofitting or replacement of existing inefficient water using fixtures can range from replacement of seals and fittings to changing out high flush toilets. Since much of the city's development occurred in the 1960's and 1970's, it is suspected that low flush toilets are an exception; however, low flush units were installed in the 1997 construction of the new city Administration building.

Efficient water use in existing facilities is not currently employed. The filter backwash system is set to operate on a timed schedule rather than based upon system headloss. Using a timed schedule causes the backwash cycle to be initiated before the filter is fully loaded and can lead to use of excessive backwash water. The backwash water is currently discharged to an open drain. There exist opportunities for reuse of a portion of the backwash water if the facility is designed for reuse.

Policy Options

Selection of specific measures for a water conservation program should be tailored to the community's needs and an assessment made of those measure which are appropriate and feasible. The success of the selected measures and the policies used to implement them will depend on public acceptability, effectiveness in reducing water usage, and financial feasibility. Three different policy options are available for a community to implement all or part of the above measures: educational, regulatory, and incentive. Each of these policy options are discussed below.

Educational policies are used to inform consumers of potential conservation measures and influence their water consumption behavior. The Water Resources Department of Oregon has various consumer informational pamphlets available regarding water leak detection, low-flow plumbing fixtures, and landscaping and irrigation tips. Educational policies are considered to be highly acceptable to the public and relatively inexpensive to implement. The cost of these policies are typically modest, and there is flexibility regarding how much and when to spend money on the program. However, educational policies are of limited effectiveness when used alone, except in the case of a temporary drought.

Incentive policies are used to provide rewards and penalties to influence water users. These incentives may be either positive or negative. Positive incentives reward water users for taking conservation-related actions while negative incentives penalize water users who do the opposite. Examples of incentive policies are conservation pricing, such as inverted block rates (i.e., the price per gallon increases as water use increases) and financial incentives for retrofitting old, inefficient water fixtures. The city currently uses a flat rate water structure. It is commonly believed in the water service industry that a flat rate structure does not support or encourage water conservation.

The public acceptability and financial attractiveness of incentive policies varies. Positive incentives, although highly acceptable with the public, may be quite costly if substantial effort is required to achieve a significant behavioral response. In contrast, a negative incentives policy, though unacceptable to the public, may be financially more attractive.

Regulatory policies either require water users to take stipulated conservation actions, or forbid other actions which are thought detrimental to water conservation. Such policies limit an individual's freedom more severely than do educational or incentive policies, because, theoretically, the individual does not have the option of noncompliance. These policies include rationing, watering restrictions, landscaping regulations and prohibitions on water waste. Rationing is when services are limited in use or allocation. Restrictions are when specific uses (such as lawn watering) are prohibited. An example of a new regulatory policy is the state plumbing code requirement for the installation of ultra low flow toilets (1.6 gallons per flush) in all new building construction as of July 1, 1993.

Public acceptability of regulatory policies will vary depending upon the policies adopted. Some measures such as water rationing are not popular with the public while water restrictions and water waste prohibitions have high acceptability. There is also considerable variation in the costs of enforcing several regulatory policies. Water rationing is the least expensive to implement since water use can be metered and compared. Overuse can be detected and penalized through fines and, if necessary, interruption of service. In contrast, watering restrictions and waste prohibitions require continual monitoring during the watering season. Effective enforcement of these restrictions and prohibitions could be costly.

Water Curtailment

Water curtailment refers to the management of water resources during periods of a water supply emergency. A curtailment plan must describe the frequency and magnitude of past supply deficiencies within the past ten years and current capacity limitations. A curtailment plan list should provide the following:

- A list of three or more levels/conditions of alert for potential shortage or water service difficulty.
- Curtailment actions for each level/alert based on local conditions.
- A list of specific stand-by water use curtailment actions for each level/stage of alert ranging from public notice of a potential alert to loss of service at the critical alert stage.
- Stand-by rules or regulations necessary for enforcement of the curtailment actions, usage, population served, connections to other municipal supply systems, and a map of the water system and service area.

The last time that Veneta experienced a water supply shortage was in 1992 and the city responded by requiring lawn watering every other day. The scheduled watering program was monitored by public works staff but, by and large, was accepted by the community without extensive enforcement action required. Records are not available in regard to the success in terms of peak demand reduction. The city has retained their resolution which provides the council with the authority to declare a water emergency and to enforce an odd-even water regime. The city needs to have in place a multiple level staging plan which provides for various levels of water source reduction and measures for reduction in demand. A curtailment plan is provided in Section 6.

Long-Range Supply Plan

The city is required to develop a long-range supply plan for meeting the future water demand of its residents. The following information and evaluation is required by this plan.

- An estimate of the water supplier's long-range water demand projections for 10 and 20 years.
- A comparison of the projected water needs and the size and reliability of water rights, permits or other current water supply contracts held by the water supplier.
- If the future demand projections indicate an additional water source will be required within the next twenty years, potential new sources must be evaluated and ranked based on cost, availability, reliability, and likely environmental impacts.

The overall objective of the long-range supply study is to develop a municipal water system program which will best serve the present and future water supply needs of the city.

where is? section 4
4.8

APPENDIX G
OHD DRINKING WATER QUALITY STANDARDS
& CITY OF VENETA WATER QUALITY ANALYSIS

APPENDIX G

Water Quality Regulations

National drinking water regulations were established in 1974 with the signing of the Safe Drinking Water Act (SDWA). This act and subsequent regulations were the first to apply to all public water systems in the United States. The Environmental Protection Agency (EPA) was authorized to set standards and implement the Act. With the enactment of the Oregon Drinking Water Quality Act, the State of Oregon accepted primary enforcement responsibility for drinking water regulations within the state. The SDWA and associated regulations have been amended a number of times.

One of the main elements of the drinking water regulations is the establishment of maximum contaminant levels (MCLs) for inorganic, organic, microbiological and radionuclide contaminants and turbidity. An MCL is the maximum allowable level of a contaminant in water delivered to the users of a public water system. Concentrations above the MCL for a contaminant are considered violations and regulations require the water supplier to perform immediate corrective action and notify the public of such violations. Specific information on the regulations concerning public water systems may be found in the Oregon Administrative Rules (OAR), Chapter 333, Division 61. Secondary MCLs are recommended performance levels.

Responsibilities. As a water supplier, the city is responsible for taking all reasonable precautions to ensure that:

- Water delivered to users does not exceed MCL.
- The water system facilities are free of public health hazards.
- Water system operation and maintenance is performed as required by state regulations.

Tasks. Specific tasks of a water supplier include the following:

- Routinely collect and submit water samples for laboratory analyses at the frequencies prescribed in the state regulations.
- Take immediate corrective actions when MCL levels are exceeded and report as prescribed in the state regulations.
- Report water analyses results to the Health Division within the time periods specified in the state regulations.
- Provide public notice of MCL violations - notify all customers of the system, as well as the general public in the service area, when MCL levels have been exceeded.

- Provide public notice of monitoring violations and variances. Notify all customers served by the system when any of the following are evident:

  - Reporting requirements are not met.
  - Public health hazards are found to exist in the system.
  - Operation of the system is subject to a permit or a variance.

- Maintain monitoring and operating records and have the records available for review when the system is inspected.

- Maintain a minimum 20 psi at all service connections at all times.

- Maintain records of customer complaints relating to water quality and maintain records and reports on actions undertaken.

- Conduct an active cross-connection program for systematically identifying and controlling cross connections between water and sewer lines.

- Submit engineered plans, prepared by an Oregon registered professional engineer to the Health Division, for review and approval before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from this requirement.

- Comply with water personnel certification rules - ensure the persons responsible for the production, treatment and distribution of drinking water are certified by the state.

Oregon Drinking Water News
PIPELINE
Drinking Water Program, Oregon Health Division

Vol. 13, Issue 5 • Special Edition, Fall 1998

OREGON DRINKING WATER QUALITY STANDARDS

(Including the 1996 Safe Drinking Water Act Amendments)

Fall, 1998

G-3

YOU GOT OUR NUMBER!

Contract counties are responsible for all community water systems with groundwater sources serving less than 3,300 people as well as all nontransient noncommunity and transient noncomunnity water systems. Operators and managers of these systems should call their county health department first for assistance with drinking water issues.
State staff are responsible for all community water systems using surface water sources and those community systems serving 3,300 or more people. In those counties without a local health department contact please call the state program at (503) 731-4317.

Contract Counties
The Drinking Water Program contracts with the following counties to perform much of the program work at the local level.

Baker/Malheur	Ray Huff/Susan Fuller	(541) 473-5186
		Email: envhealth@malheurco.org
Benton	Bob Wilson/Ron Smith	(541) 757-6841
		Email: ronald.e.smith@co.benton.or.us
Clackamas	Jim Buckley/Steve Dahl	(503) 655-8384
		Email: jamesb@co.clackamas.or.us
		Email: steved@co.clackamas.or.us
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Coos	Frances Smith	(541) 756-2020
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Crook	Russell Hanson/Ann McSheery	(541) 447-8155
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Curry	Mike Meszaros	(541) 247-5501
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State Program
Technical staff members are frequently in the field assisting water systems. Each day, however, one staff member serves as *phone duty person* in the Portland office and is available to answer questions at (503) 731-4317. Please make use of this person unless you feel you must speak with a specific staff member.

Another option is to contact a staff person's voice mail directly. To do this, call our auto-attendant number (503) 731-4821 and when directed by the recording, dial the person's extension listed below.

Web site	www.ohd.hr.state.or.us/cehs/dwp
General Inquiries	(503) 731-4317
Portland office fax	(503) 731-4077
Voice mail	(503) 731-4821 + ext.

Drinking Water Administration: (503) 731-4010	
Dave Leland, Program Manager	ext. 757
Diane Weis	ext. 751
Technical Services: (503) 731-4317	
Western Region	
Tom Charbonneau, Manager	ext. 749
Scott Curry	ext. 739
Carrie Gentry	ext. 742
Bonnie Waybright	ext. 752
Eastern Region	
Pendleton office fax	(541) 276-4778
Gary Burnett, Manager (Pendleton)	(541) 276-8006
Leslie Bensching (Pendleton)	(541) 276-8006
John Potts (Corvallis)	(541) 757-4281
Kari Salis (Portland)	ext. 764
Bart Stepp (Pendleton)	(541) 276-8006
Monitoring and Compliance: (503) 731-4381	
Mary Alvey, Manager	ext. 748
Cheri Law	ext. 747
Roberta Lindgren	ext. 741
Patrick Meyer	ext. 753
Mike Patterson	ext. 746
Georgine Proctor	ext. 761
Brian Rigwood	ext. 743
Nancy Stellmach	ext. 760
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Chris Hughes, Manager	ext. 750
Jeff Frederick (Springfield)	(541) 726-2594
Mike Grimm	ext. 765
Dennis Nelson (Springfield)	(541) 726-2587
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Tom Pattee (Springfield)	(541) 726-2588
Dave Phelps	ext. 759
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Dr. Irene Ronning, Coordinator **(503) 229-5505**

OREGON DRINKING WATER QUALITY STANDARDS

(Including the 1996 Safe Drinking Water Act Amendments)

This summary provides a broad overview of current and future drinking water quality standards which public water systems in Oregon must meet through the year 2005. It is organized in two major sections - Section I: Current Standards, and Section II. Future Standards. This summary is for reference only, and is not a substitute for the actual statutes and regulations that govern public water supply in Oregon. Future standards described here are still under development at the national level, and are subject to change.

Types of Drinking Water Contaminants

The sources of drinking water, both tap and bottled water, include rivers, lakes, ponds, reservoirs, springs,and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals, and in some cases radioactive materials, and can pick up substances resulting from the presence of animals or from human activities.

Drinking water contaminants are any substances present in drinking water that could adversely affect human health. Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. They can be grouped into the following general categories:

- Microbial Contaminants - such as viruses and bacteria which can come from sewage treatment plants, septic systems, agricultural and livestock operations, and wildlife.
- Inorganic Chemicals - such as salts or metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming. Includes lead and copper leached into the water from household plumbing and fixtures.
- Organic Chemicals - Pesticides and herbicides which may come from a variety of sources, such as agriculture, urban stormwater runoff, and residential uses. Also includes synthetic and volatile chemicals which are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic system.
- Radiologic Contaminants - which can be naturally-occurring or result from oil and gas production and mining operations.

Every drinking water system is vulnerable to microbial or chemical contaminants of one type or another from a variety of sources. Disease-causing microorganisms (bacteria, viruses, protozoans) can be present in surface water (lakes and streams) or from groundwater (wells or springs) from human or animal feces. Microorganisms can also enter the water system through pipe breaks or cross connections. Organic chemicals (industrial solvents, pesticides) are mainly man-made and can enter drinking water supplies as a consequence of chemical production, storage, use, or disposal in the water source area. Inorganic chemicals can be introduced by human activities (nitrate from fertilizer) but more often result from natural occurrence in rocks, soils, and mineral deposits (radon, arsenic). Drinking water treatment which is essential to remove microbes and chemicals can also add or form contaminants in drinking water, such as disinfectant chemicals themselves, byproducts of disinfectants with other materials in the water, and treatment chemicals used in filtering water. Finally, water storage tanks, pipes, and household plumbing that are in direct contact with water can contribute contaminants from either the material used in the tanks and pipes or from internal coatings used to protect the materials from contact with the water (lead and copper, organics).

Drinking Water Standards and Health Protection

In order to ensure that tap water is safe to drink, national regulations set by the US Environmental Protection Agency limit the amount of certain contaminants in water provided by public water systems. Other national regulations set by the Food and Drug Administration, establish limits for contaminants in bottled water which must provide the same level of protection of public health. Drinking water quality standards are established to protect human health by limiting the exposure of people to drinking water contaminants. There are now national drinking water quality standards for 79 different contaminants. These standards may be in several forms:

- Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health, allowing for a margin of safety. All regulated contaminants have an MCLG.
- Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water, set a close to the MCLG as feasible using the best available treatment technology. Most MCLs are expressed in concentration units called "milligrams per liter" (mg/L), which for drinking water is the

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same as "parts per million", or ppm. MCLs can be expressed in a variety of other measurement units.

- Treatment Technique (TT) - A required process intended to reduce the level of a contaminant in drinking water. For any contaminant that can not be detected or measured effectively in water, the standard may be a treatment technique requirement, which means that all water systems at risk of the contaminant are required to provide continuous water treatment to remove the contaminant at all times.
- Action Level (AL) - The concentration of a contaminant, which when exceeded, triggers treatment or other requirement which a water system must follow.

Public water systems and bottled water producers must sample water for contaminants routinely to ensure that standards are met, and report the results of that sampling to the regulatory agency. Sampling frequencies vary by the type of drinking water contaminant. Contaminants that are associated with immediate health impacts, like bacteria and nitrates, must be sampled often, such as every month, quarter, or year. Contaminants associated with health effects that could develop from very long-term exposures, like arsenic, are tested less frequently, such as every 3 or 4 years.

Some people may be more vulnerable to contaminants than the general population. Immune-compromised persons, such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice from their health care providers. USEPA and Centers for Disease Control and Prevention (CDC) guidelines on appropriate measures to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the national Safe Drinking Water Hotline (800-426-4791).

Drinking Water Regulatory Program

A brief overview of the public drinking water regulatory program is useful. The first national drinking water standards, called the National Interim Primary Drinking Water Regulations (NIPDWR), were adopted on December 24, 1975, by the US Environmental Protection Agency (USEPA) under the 1974 Safe Drinking Water Act. By 1986, drinking water quality standards were in place for 23 different contaminants. The 1986 Safe Drinking Water Act mandated USEPA to set standards for 83 contaminants within 3 years, and 25 more contaminants every three years thereafter. Today, there are national standards for 79 contaminants.

In Oregon, public drinking water systems are subject to the Oregon Drinking Water Quality Act (ORS 448 - Water Systems). The primary purpose of the 1981Oregon Act is to "assure all Oregonians safe drinking water." According to the Oregon Act, safe drinking water means water which is sufficiently free from biological, chemical, radiological, or physical impurities such that individuals will not be exposed to disease or harmful physiological effects." Under the Oregon Act,the Health Division has broad authority to set water quality standards necessary to protect public health through insuring safe drinking water within a public water system. To accomplish this, the Division is directed under the Act to require regular water sampling by water suppliers. These samples must be analyzed in laboratories approved by the Division, and the results of laboratory tests on those samples must be reported by the water supplier to the Division. The Division must investigate water systems that fail to submit samples,or whose sample results indicate levels of contaminants that are above maximum allowable levels. Water suppliers who fail to sample the water or report the results, or whose water contains contaminants in excess of allowable levels must take corrective action and notify water users.

Since 1986, the Division has exercised primary responsibility for administering the federal Safe Drinking Water Act in Oregon, an arrangement called Primacy. The Health Division adopts and enforces standards that are no less stringent than the federal standards, and in return, the USEPA gives the Division the regulatory responsibility for public drinking water systems and partial financial support for the Oregon program operation.

In practice, the Oregon drinking water standards match the national standards established under the Safe Drinking Water Act by the USEPA. This is because setting maximum levels for drinking water contaminants to protect human health involves considerable development of health effects information and other scientific research that is best carried out at the national level. The Health Division concentrates its efforts on implementing the national standards at Oregon public water systems.

Oregon Public Water Systems

Today, there are 2,719 public water systems in Oregon subject to regulation under the federal Safe Drinking Water Act. They serve 25 or more people at least 60 days per year. Of these, 889 are community water systems, which means the systems serve at least 15 connections used by year-round residents. These systems perform the most frequent water sampling for the greatest number of contaminants, because the people served have the most ongoing exposure to the drinking water. **Community water systems** in Oregon serve a total of about 2.7 million people and range in size from 15-home subdivisions and mobile home parks up to and including the City of Portland. **Nontransient noncommunity water systems** serve nonresidential populations consisting of the same people every day, such as a school or workplace with its own independent water supply system. There are 340 of these in Oregon. **Transient noncommunity water systems** serve transient populations. Examples are campgrounds, parks, or restaurants with their own independent water supply systems, and there are 1,490 of these in Oregon.

Oregon public water systems get their water either from wells or springs (called groundwater) or from rivers, lakes, or streams (called surface water). Of the 2,719 public water systems in Oregon, 2,472 get their water exclusively from groundwater. 247 water systems get their water in whole or in part from surface water supplies. Generally speaking, surface water requires much more treatment and processing to ensure safety for drinking than does groundwater.

There are many small water systems in Oregon. Almost 87% of the public water systems in Oregon serve 500 or fewer people each.

An additional 900 very small systems, serving 10-24 people each, are subject only to the Oregon Act. About 500,000 Oregonians get their drinking water from individual home wells, which are not subject to either state or federal public water system standards.

Measuring Progress

The Oregon Safe Drinking Water Benchmark, stated below, is intended to measure progress of public water suppliers toward meeting safe drinking water standards in Oregon:

"The percentage of Oregonians served by public drinking water systems that meet all health-based standards continuously during the year"

Meeting all health-based standards at all times during the year is an important indicator of drinking water safety. The benchmark includes the following health-based standards, listed from highest to lowest health risk:

- *E. Coli* (or fecal coliform) bacteria maximum level
- Surface water treatment technique performance levels (filtration and disinfection)
- Nitrate/Nitrite maximum levels
- Chemical/Radiological maximum levels
- Lead action level
- Total coliform bacteria maximum level
- Copper action level

Included in the benchmark are about 1,300 public water systems that serve the majority of the state's population, including all community systems, all nontransient noncommunity systems, and the larger transient noncommunity systems (serving over 500 people per day).

The Oregon benchmark goal is to reach 95% by 2005. Results for the last four years are 1994-49%, 1995-50%, 1996-56%, 1997-89%. Note that progress toward the benchmark goal is likely to be affected by revisions to existing standards and establishment of standards for additional contaminants that are scheduled for the coming years, described in Section II.

For More Information

The chart on page 1 lists both state and county drinking water staff members, along with their telephone numbers. County staffs are responsible for community water systems serving fewer than 3,300 people and using groundwater sources as well as all nontransient noncommunity and transient noncommunity systems. Operators of those systems should contact their county health department directly for assistance on drinking water issues.

State staff are responsible for all community water systems serving more than 3,300 people and all smaller community systems that use surface water sources. In counties without drinking water programs, state staff are responsible for all public water systems. State staff also serve as a technical resource for county drinking water programs as needed.

Also, visit the Oregon Drinking Water Web Page (http://www.ohd.hr.state.or.us/cehs/dwp) for drinking water information and publications. In addition, you can contact the national Safe Drinking Water Hotline at 800-426-4791.

I. Current Standards

There are now drinking water quality standards in Oregon for 84 contaminants. These standards are summarized in this Section.

Microbial Contaminants - Coliform Bacteria

Purpose: Coliform bacteria is the primary measure of the microbial quality of drinking water. They are used as indicators of the possible presence of pathogenic, or disease-causing, microorganisms. Routine samples collected by Oregon public water suppliers are analyzed for total coliform bacteria. Samples that show the presence of total coliforms are further examined for fecal coliforms or *E. coli.*, which are more specific indicators of fecal contamination.

Health effects: Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, bacteria may be present. Coliforms present in more samples than allowed is a warning of potential problems. Fecal coliforms and *E. Coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term health effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely compromised immune systems.

Application: All public water systems must regularly test for coliform bacteria from locations in the distribution system, identified in a coliform sampling plan.

Monitoring: All community systems, and noncommunity systems using surface water sources or serving over 1,000 people, must sample monthly:

Population	Number of Monthly Samples
up to 1,000	1
1,001-2,500	2
2,501-3,300	3
3,301-4,100	4
4,101-4,900	5
>4,900	see rules

All other systems must test for coliform bacteria once per calendar quarter.

Compliance: All coliform sample results are reported as "coliform absent" (negative) or "coliform present" (positive). A set of 3-4 repeat samples is required for each positive coliform sample (so that a total of at least five samples is collected during the month). Repeat sampling continues until the maximum contaminant level is exceeded or a set of repeat samples with negative results is obtained. Small systems (fewer than 40 samples/month) are allowed no more than one positive sample per month. larger systems are allowed no more than 5% positive samples in any month. Confirmed presence of fecal coliform or *E. coli* is considered an acute health risk and requires immediate notification of the public.

Water Treatment/control measures: Disinfection processes for source waters, such as chlorination, ozonation, and ultraviolet light. Other control measures include maintaining a disinfectant residual in the distribution system, protection of the source water area, proper well construction, maintaining distribution system pressure, and cross connection control.

Rule history:
Federal rule - 6/29/89
Oregon rule - 1/1/91

Microbial Contaminants - Surface Water Treatment

Purpose: Control pathogenic microorganisms and indicators in surface water sources, including *Giardia lamblia,* enteric viruses, heterotrophic plate count bacteria (HPC) and *Legionella.* Control level of particulate matter from soil runoff (turbidity).

Health effects: Inadequately treated water from surface water supplies may contain sufficient numbers of disease-producing organisms to cause illness. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches. Turbidity has no health effects. However, turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease-causing organisms.

Application: All public water systems using surface water sources, and all public water systems using groundwater sources determined by the Division to be under the direct influence of surface water.

Compliance: Water systems must provide a total level of treatment to remove/inactivate 99.9% (3-log) of *Giardia lamblia,* and to remove/inactivate 99.99% (4-log) of viruses, as follows:
Filtration plus disinfection treatment meeting performance standards, or
Disinfection treatment plus meet criteria to remain unfiltered, or
Disinfection plus natural filtration plus wellhead/ source water protection.

Filtration performance standards:
Continuous turbidity recording, report results every four hours
95% of turbidity readings less than 0.5 ntu (1 ntu for alternative technologies)
All turbidity readings less than 5 ntu
Minimum 2-log removal/inactivation, based on comprehensive performance evaluation

Disinfection performance standards:
Daily calculation of CxT (disinfectant concentration x time) at highest flow
CxT sufficient to meet needed removal/inactivation levels
Continuous 0.2 mg/L disinfectant residual at entry point
Minimum detectable disinfectant residual in 95% of distribution system samples

Implementation dates:
12/91 Unfiltered systems meet requirements to remain unfiltered
6/93 Filtration or alternate water source in place. Filtered systems meet performance requirements
6/94 State determines which community groundwater systems are under direct influence of surface water
12/95 Surface-influenced community systems meet treatment performance requirements
6/99 State determines which noncommunity groundwater systems are under direct influence of surface water
12/01 Surface-influenced noncommunity systems meet treatment performance requirements

Rule history:
Federal rule - 6/29/89
Oregon rule - 1/1/91

Microbial Contaminants - Disinfection By-products

Purpose: Trihalomethanes are organic contaminants that are called disinfection byproducts, because they result from disinfectants (chlorine used to kill harmful microbes in the drinking water) reacting with natural organic matter in the source water. Total Trihalomethanes (TTHMs) represents the sum of four by-products; chloroform, bromoform, dichlorobromomethane, and dibromochloromethane. The challenge is to maintain adequate levels of disinfection to kill microorganisms while at the same time minimizing the levels of TTHMs produced.

Table 1 - Microbial Contaminants

Contaminant	MCL, mg/L	Health Effects	Source of Drinking Water Contamination
Giardia lamblia	TT[1]	Gastrointestinal disease	Human and animal fecal wastes
Legionella	TT	Legionnaire's disease	Natural waters, can grow in water heating systems
Heterotrophic plate count (HPC)	TT	Indicates water quality, effectiveness of disinfection treatment	Naturally occurring bacteria
Total coliforms	<5% positive[2]	General indicator of pathogens	Environmental bacteria
Fecal coliforms and E. Coli	Confirmed presence	More specific indicator of pathogens	Human and animal fecal wastes
Turbidity	TT	Interferes with disinfection, indicator of filtration treatment efficiency	Particulate matter from soil runoff
Viruses	TT	Gastrointestinal disease	Human and animal fecal wastes
Trihalomethanes (total)	0.10	Liver, kidney, central nervous system effects, possible cancer	Drinking water chlorination by-product

[1] Treatment technique, filtration plus disinfection, or equivalent
[2] No more than 1 positive sample per month for systems collecting <40 samples per month

Health Effects: Some people who drink water containing TTHMs in excess of the MCL over many years could experience problems with their liver, kidneys, or central nervous systems, and may have an increased risk of getting cancer.

Application: TTHM requirements apply to community systems serving over 10,000 people and applying a disinfectant to the drinking water.

Monitoring: TTHMs must be monitored throughout the distribution system at frequencies varying from quarterly to once per year.

Compliance: Compliance is determined on meeting the maximum level for TTHMs over a running 12-month average of the sample results.

Water treatment/control measures: TTHMs can be reduced by moving the point of chlorine application from prior to filtration to after filtration, where many of the natural organic compounds in the water have been reduced. Alternative disinfectants such as chlorine combined with ammonia or ozone disinfection are available.

Rule history:
Federal rule - 11/29/79
Oregon rule - 9/24/82

Lead and Copper

Purpose: Set treatment technique requirements to control lead and copper in drinking water at the customer tap. Although lead and copper are naturally present in geologic deposits, they are rarely present in Oregon at significant levels in surface water or groundwater sources. They are primarily from corrosion of plumbing and plumbing fixtures in homes and buildings. Lead comes from lead solder and brass fixtures, and copper comes from copper tubing and brass fixtures.

Health effects:

Lead: Infants and young children are typically more vulnerable to lead in drinking water than the general population. Infants and children who drink water containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure.

Copper: Copper is an essential nutrient, but some people who drink water containing copper in excess of the action level over a relatively short period of time could experience gastrointestinal distress. Some people who drink water containing copper in excess of the action level over many years could suffer liver or kidney damage. People with Wilson's Disease should consult their personal doctor.

Application: All community and nontransient noncommunity systems

Monitoring: Samples are collected from "high-risk" homes; those with lead-soldered plumbing built prior to the July 1985 prohibition of lead solder in Oregon. One-liter samples of standing water (first draw after 6 hours of non-use) are collected at homes identified in the water system sampling plan. The number of samples required for initial and subsequent monitoring is summarized below:

Water System Population	Initial Sample Sites	Reduced Sample Sites
>100,000	100	50
10,001-100,000	60	30
3,301-10,000	40	20
501-3,300	20	10
101-500	10	5
<101	5	5

Two rounds of initial sampling were required during 1992-94, collected at six-month intervals. Subsequent annual sampling from the reduced number of sites is required after demonstration that lead and copper action levels are met. After three rounds of annual sampling, samples are required every three years. Water systems practicing corrosion control treatment must also monitor for water quality parameters (such as pH, temperature, alkalinity) and comply with target levels as specified by the Division.

Compliance: In each sampling round, 90% of samples from homes must have lead levels less than or equal to 0.015 mg/L, and copper levels less than or equal to 1.3 mg/L.

Water Treatment/Control Measures: Water systems that can not meet these levels must either implement a corrosion control program or develop alternate sources of water by January, 1998. If levels are not met even after treatment installation and optimization, then continuing public education efforts are required. It is possible that lead levels in a particular home may be higher than at other homes in the community as a result of the materials used in that home's plumbing. People who are concerned about elevated lead levels can arrange to test their water and if the results are high, can flush taps for 30 seconds to 2 minutes before using tap water, especially after periods of non-use.

Rule History:
Federal rule - 6/7/91
State rule - 12/7/92
Technical corrections to federal rule - 6/30/94

Inorganic Contaminants

Purpose: Control levels of fifteen metals and minerals in drinking water, both naturally-occurring and resulting from agricultural or industrial use. Inorganic contaminants most often come from the source of water supply, but can also enter water from contact with materials used for pipes and storage tanks. See Table 2.

Health effects: For most inorganic contaminants, health concerns are related to long-term or even lifetime exposures (see Table 2). Nitrate and nitrite, however,can seriously affect infants in short-term exposures by interfering with the transfer of oxygen from the lungs to the bloodstream. Infants below the age of six months who drink water containing nitrate or nitrite in excess of the MCLs could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome. USEPA is reviewing the drinking water standard for arsenic because of special concerns that it may not be stringent enough. Arsenic is a naturally-occurring mineral known to cause cancer in humans at high concentrations.

Application: All public water systems. The exception is the asbestos standard which applies to community and nontransient noncommunity systems.

Monitoring: Nitrate - community and nontransient noncommunity systems must sample quarterly for surface water sources and annually for groundwater sources. All noncommunity and state-regulated water systems must sample annually. Asbestos - community and nontransient noncommunity systems with asbestos-cement water pipes or with water sources in geologic asbestos deposit areas must sample every nine years. All other inorganics - community and nontransient noncommunity systems must sample surface water sources annually and groundwater sources every three years. All transient noncommunity and state-regulated water systems must sample once.

Compliance: Water systems must meet the established maximum contaminant levels (Table 2). Systems that can not meet one or more MCLs must either install water treatment systems or develop alternate sources of water.

Water Treatment: A variety of water treatment processes are available for reducing levels of specific inorganic contaminants in drinking water, including ion exchange and reverse osmosis.

Rule history:

Federal rules - 12/24/75 (NIPDWR), 1/30/91 and 7/1/91 (Phase II), and 7/19/92 (Phase V)

State rule - 9/24/82 (arsenic), 12/7/92 (Phase II), and 1/14/92 (Phase V)

Table 2 - Inorganic Contaminants

Contaminant	MCL, mg/L (or as noted)	Potential Health Effects	Sources of Drinking Water Contamination
Antimony	0.006	Blood cholesterol increases, blood sugar decreases	Discharge from petroleum refineries, fire retardants, ceramics, electronics, solder
Arsenic	0.05	Skin damage, circulatory system effects, increased cancer risk	Erosion of natural deposits of volcanic rocks, runoff from orchards, runoff from glass and electronics production wastes
Asbestos	7 million fibers per liter (>10 um fiber size)	Benign intestinal polyps	Erosion of natural geologic deposits, decay of asbestos-cement water pipes
Barium	2	Increase in blood pressure	Discharge of drilling wastes, discharge from metal refineries, erosion of natural deposits
Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories, discharge from electrical, aerospace, and defense industries
Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes, erosion of natural deposits, discharge from metal refineries, runoff from waste batteries and paints
Chromium (total)	0.1	Allergic dermatitis	Discharge from steel and pulp mills, erosion of natural deposits
Cyanide	0.2	Thyroid, nervous system damage	Discharge from steel/metal factories, discharge from plastic and fertilizer factories
Fluoride	4.0[1]	Bone disease, mottled teeth	Erosion of natural deposits, discharge from fertilizer and aluminum industries, drinking water additive promoting strong teeth
Mercury (total inorganic)	0.002	Kidney damage	Erosion of natural deposits, discharges from refineries and factories, runoff from landfills, runoff from cropland
Nickel	None[2]	Heart and liver damage	Electroplating, stainless steel, alloys
Nitrate (as N)	10	Methemoglobinemia ("blue baby syndrome") in infants below the age of six months	Runoff from fertilizer use, leaching from septic tank/ drain fields, erosion of natural deposits
Nitrite	1	Methemoglobinemia ("blue baby syndrome") in infants below the age of six months	Runoff from fertilizer use, leaching from septic tank/ drain fields, erosion of natural deposits (rapidly converted to nitrate)
Selenium	0.05	An essential nutrient, excessive levels associated with hair and nail loss, numbness in fingers and toes, circulatory problems	Discharge from petroleum and metal refineries, erosion of natural deposits, discharge from mines
Thallium	0.002	Hair loss, blood changes, and kidney, liver, intestinal effects	Leaching from ore processing sites, discharge from electronics, drugs, and glass factories

[1]Note: a secondary standard for fluoride is set a 2.0 mg/L to control tooth discoloration

[2]Federal standard withdrawn 2/23/95 Monitoring is required

Organic Chemicals

Purpose: Control levels of 53 different organic contaminants (see Table 3). Organic contaminants are most often associated with industrial or agricultural activities that affect sources of drinking water supply. Major types of organic contaminants include industrial and commercial solvents and chemicals, and pesticides used in agriculture and landscaping. Organic contaminants can also enter drinking water from materials in contact with the water such as pipes and internal paints and coatings.

Health effects: For organic contaminants, health concerns are related to long-term or even lifetime exposures to low levels of contaminant (see Table 3).

Table 3 - Organic Contaminants

Contaminant	MCL, mg/L	Potential Health Effects	Sources of Drinking Water Contamination
Acrylamide	TT[1]	Central nervous system effects, increased risk of cancer	Polymers used in water and sewage treatment
Alachlor	0.002	Eye, liver, kidney, spleen effects, increased risk of cancer	Runoff from herbicides used on row crops
Atrazine	0.003	Cardiovascular and reproductive effects	Runoff from herbicides used on row crops
Benzene	0.005	Decreased blood platelets, increased risk of cancer	Discharge from factories, leaching from landfills and gas storage tanks
Benzo(a)-pyrene (Polyaromatic hydrocarbons)	0.0002	Reproductive difficulties and increased risk of cancer	Leaching from linings of water storage tanks and water pipes
Carbofuran	0.04	Blood, nervous system and reproductive system effects	Leaching of soil fumigant used on rice and alfalfa
Carbon tetrachloride	0.005	Liver effects and increased risk of cancer	Discharge from chemical plants and other industrial activities
Chlordane	0.002	Blood and nervous system effects, increased risk of cancer	Residue of banned termiticide
Chloro-benzene	0.1	Kidney and liver effects	Discharge from chemical and agricultural chemical factories
2,4-D	0.07	Liver, adrenal gland, and kidney damage	Runoff from herbicides used on row crops
Dalapon	0.2	Kidney effects	Runoff from herbicides used on rights of way
1,2 Dibromo-3-chloropropane (DBCP)	0.0002	Reproductive difficulties and increased risk of cancer	Runoff from soil fumigant used on soybeans, cotton, pineapples, orchards
o-Dichloro-benzene	0.6	Liver, kidney, circulatory system damage	Discharge from industrial chemical factories
p-Dichloro-benzene	0.075	Liver, kidney, spleen damage, blood effects	Discharge from industrial chemical factories
1,2-Di-chloroethane	0.005	Increased risk of cancer	Discharge from industrial chemical factories
1,1-Di-chloro-ethylene	0.007	Liver damage	Discharge from industrial chemical factories
cis 1,2-Dichloro-ethylene	0.07	Immune system problems	Discharge from industrial chemical factories
trans 1,2-Dichloro-ethylene	0.1	Liver damage and immune system problems	Discharge from industrial chemical factories
Dichloro-methane	0.005	Liver damage and increased risk of cancer	Discharge from pharmaceutical and chemical factories
1,2-Di-chloropro-pane	0.005	Increased risk of cancer	Discharge from industrial chemical factories
Di(2-ethyl-hexyl) adipate	0.4	General toxic and reproductive effects	Discharge from chemical factories
Di(2-ethyl-hexyl) phathalate	0.006	Liver effects, reproductive difficulties, increased risk of cancer	Discharge from chemical and rubber factories
Dinoseb	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables
Dioxin (2,3,7,8-TCDD)	3×10^{-8}	Reproductive difficulties and increased risk of cancer	Emissions from waste incineration and other combustion, discharge from chemical factories
Diquat	0.02	Cataracts	Runoff from herbicide use
Endothall	0.1	Stomach, intestine effects	Runoff from herbicide use
Endrin	0.002	Nervous system effects	Residue of banned insecticide
Epichloro-hydrin	TT[1]	Stomach effects and increased risk of cancer	Discharge from industrial chemical factories, impurity in some water treatment chemicals
Ethyl-benzene	0.7	Liver, kidney damage	Discharge from petroleum refineries
Ethylene dibromide	0.00005	Stomach, kidney, reproductive system effects, and increased risk of cancer	Discharge from petroleum refineries
Glyphosate	0.7	Kidney, reproductive system effects	Runoff from herbicide use
Heptachlor	0.0004	Liver damage, increased risk of cancer	Residue of banned termiticide
Heptachlor epoxide	0.0002	Liver damage, increased risk of cancer	Breakdown of heptachlor
Hexachloro-benzene	0.001	Liver, kidney, reproductive system effects, and increased risk of cancer	Discharge from metal refineries and agricultural chemical factories
Hexachloro-cyclopenta-diene	0.05	Kidney damage	Discharge from chemical factories
Lindane	0.0002	Liver, kidney effects, increased risk of cancer	Runoff/leaching from insecticide used on lumber, gardens, cattle; restricted in 1983
Methoxy-chlor	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetable, alfalfa, livestock

Contaminant	MCL, mg/L	Potential Health Effects	Sources of Drinking Water Contamination
Oxamyl (Vydate)	0.2	Nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, tomatoes
Pentachloro-phenol	0.001	Liver and kidney effects, increased risk of cancer	Discharge from wood preserving operations
Picloram	0.5	Liver damage	Herbicide runoff
Polychlorinated biphenyls (PCBs)	0.0005	Skin, thymus gland, reproductive system nervous system effects, immune deficiencies, increased risk of cancer	Runoff from landfills, discharge of waste chemicals
Simazene	0.004	Blood effects	Herbicide runoff
Styrene	0.1	Liver, kidney, blood effects	Discharge from rubber and plastic factories, leaching from landfills
Tetrachloro-ethylene	0.005	Liver damage and increased risk of cancer	Leaching from PVC pipes, discharge from factories and dry cleaning
Toluene	1	Liver, kidney, nervous system effects	Discharge from petroleum refineries
Toxaphene	0.003	Kidney, liver, nervous system effects, increased cancer risk	Runoff/leaching from insecticide used on cattle, cotton, canceled in 1982
2,4,5-TP (Silvex)	0.05	Liver damage	Residue of banned herbicide, canceled in 1983
1,2,4-Trichloro-benzene	0.07	Adrenal gland changes	Discharge from textile finishing factories
1,1,1-Trichloro-ethane	0.2	Liver, nervous system, circulatory system effects	Discharge from metal degreasing sites and other factories
1,1,2-Trichloro-ethane	0.005	Kidney, liver, immune system damage	Discharge from industrial chemical factories
Trichloro-ethylene	0.005	Liver damage and increased risk of cancer	Discharge from metal degreasing sites and other factories
Vinyl chloride	0.002	Increased risk of cancer	Leaching from PVC pipe, discharge from plastics factories
Xylenes (total)	10	Nervous system damage	Discharge from petroleum factories, discharge from chemical factories

[1]Treatment technique requirement (limit dosage of polymer treatment chemicals)

Application: Community and nontransient noncommunity water systems.

Monitoring: One test for each contaminant from each water source is required during every 3-year compliance period, beginning in the 1993-95 period. The exceptions are dioxin and acrylamide/ epichlorohydrin. Only those systems determined by the Division to be at risk of contamination must monitor for dioxin. Water systems using polymers containing acrylamide or epichlorohydrin in their water treatment processes must keep their dosages below specified levels.

Compliance: Water systems must meet the established maximum contaminant levels (Table 3). Systems that can not meet one or more MCLs must either install or modify water treatment systems or develop alternate sources of water.

Water Treatment: A variety of water treatment processes are available for reducing levels of specific organic contaminants in drinking water, including activated carbon and aeration.

Rule history:
- Federal rules - 1/30/91 and 7/1/91(Phase II); and 7/19/92 (Phase V)
- State rule - 12/7/92 (Phase II) and 1/14/92 (Phase V)

Radiologic Contaminants

Purpose: Limit exposure to six radioactive contaminants in drinking water (see Table 4). These contaminants are both natural and man-made.

Health effects: Primarily increased cancer risk from long-term exposure.

Application: All community water systems.

Monitoring: One sample from each source for gross alpha every four years. Only communities serving over 100,000 people or with sources potentially impacted by man-made radiation sources designated by the Division must sample for other radiologic contaminants.

Compliance: Community water systems that can not meet MCLs must install treatment or develop alternate water sources.

Water treatment: Variety of treatment processes will reduce radiologic contaminants, including ion exchange and reverse osmosis.

Rule history:
- Federal rule - 7/9/76
- State rule - 9/24/82

Table 4 - Radiologic Contaminants

Contaminant	MCL, pCi/L (picocuries per liter), unless otherwise noted	Potential health effects	Sources of Drinking Water Contamination
Gross alpha	15	Cancer	Erosion of natural deposits
Gross beta[1]	50	Cancer	Decay of natural and man-made deposits
Iodine-131[2]	3	Cancer	Power production
Radium 226+228[3]	5	Cancer	Erosion of natural deposits
Strontium 90[2]	8	Cancer	Power and weapons production
Tritium[2]	20,000	Cancer	Power and weapons production

[1]Sampling required only if designated by the Division - Gross beta + photon emitters not to exceed 4 millirems per year
[2]Sampling required only if designated by the Division
[3]Sampling only if gross alpha result exceeds 5 pCi/L

Review and Update of Current Standards

USEPA is required to review existing drinking water standards by the year 2000. It is likely that 5-6 standards will undergo detailed review and possible revision.

II. Future Standards

New and revised drinking water quality standards are mandated under the federal 1996 Safe Drinking Water Act. These include:

- Disinfectants/Disinfection by-products
- Enhanced surface water treatment
- Radon/Radionuclides
- Arsenic
- Groundwater
- Next five contaminants

The Health Division, under the Primacy Agreement with USEPA, will have up to two years to adopt each federal rule after it is finalized. This Section is intended to summarize and preview these standards, currently under development by USEPA and not yet final.

Microbial Standards - Disinfectants/Disinfection By-products, Enhanced Surface Water Treatment, Groundwater Disinfection

Purpose: Increase protection of people from disease-producing (pathogenic) organisms in water supplies while at the same time limiting the exposure of people to chemical disinfectants and various chemical by-products of disinfection treatment present as a result of disinfection treatment practices.

The primary additional organism of concern in surface water supplies is *Cryptosporidium.* 100% of surface water supplies are considered at some risk of containing microorganisms at any given time.

Human enteric viruses from human fecal matter is of concern in groundwater supplies. Available data suggests that 8-10% of public wells may be at risk of virus contamination, so requirements will focus on identification of at-risk wells and either reducing the risk or providing adequate levels of disinfection treatment to kill viruses.

Finally, disinfection treatment used to kill microorganisms in drinking water can react with naturally occurring organic and inorganic matter in water to form disinfection by-products. The challenge is to apply levels of disinfection treatment needed to kill microorganisms while limiting the levels of disinfection by-products produced.

Occurrence data in US public water systems is currently lacking, therefore, larger utilities are now collecting microbiological and disinfection by-product data under the Information Collection Rule (ICR). ICR data will be complete, validated, and available by January, 2000, and will be used to design future microbial drinking water standards. Therefore, the new microbial standards will be introduced in stages, with early stages focusing on improvements in health protection that can be achieved by optimizing existing water system facilities without major capital costs, and final stages requiring major capital investments if public health needs are demonstrated by the ICR data. The regulatory stages are summarized below:

Stage 1 Disinfectants/Disinfection By-products (Stage 1 D/DBP) - Reduced MCLs and new MCLs

Interim Enhanced Surface Water Treatment (IESWTR) - Increased filtration and disinfection performance standards for large systems (serving over 10,000 people)

Filter Backwash Recycling Rule (FBR) - Regulation of filter backwash recycling to limit accumulation of microorganisms

Groundwater Rule (GWR) - New disinfection treatment performance standards or alternative practices for all systems with groundwater at risk of virus contamination

Long-term Stage 1 Enhanced Surface Water Treatment (LT1ESWTR)- Increased filtration and disinfection performance standards for smaller systems

Stage 2 Disinfectants/Disinfection By-products (Stage 2 D/DBP)- Further reduced MCLs and new MCLs

Long-term Stage 2 Enhanced Surface Water Treatment (LT2ESWTR) - Further increased filtration and disinfection performance standards for all systems

Revisions to current coliform bacteria standards - If needed

Health effects: See Table 5.

Table 5 - Future Microbial Contaminants, Disinfectant Residuals, and Disinfection By-products

Contaminant	MCL, mg/L	Potential Health Effects	Source of Drinking Water Contamination
Bromate	0.010	Cancer	Drinking water ozonation by-product
Bromodichloromethane	(see total trihalomethanes (TTHMs)	Cancer: liver, kidney, and reproductive effects	Drinking water chlorination by-product
Bromoform	(see TTHMs)	Cancer, nervous system, liver and kidney effects	Drinking water chlorination by-product
Chloral hydrate	TT	Liver effects	Drinking water chlorination by-product
Chloramines (residual total chlorine)	4 (as CL_2)		Drinking water chlorination residual
Chlorine (residual free chlorine)	4 (as CL_2)		Drinking water chlorination residual
Chlorine dioxide	0.8 (as CLO_2)		Drinking water residual from disinfection using chlorine dioxide
Chlorite	1.0	Oxidative effects to red blood cells	By-product of disinfection using chlorine dioxide
Chloroform	(see TTHMs)	Cancer: liver, kidney, reproductive effects	Drinking water chlorination by-product
Cryptosporidium	TT (filtration)	Severe gastrointestinal illness, especially for people with compromised immune systems	Fecal matter from humans and animals, especially cattle
Dichlorobromomethane	(see TTHMs)	Nervous system, liver, kidney, reproductive effects	Drinking water chlorination by-product
Dichloroacetic acid	(see HAA5)	Cancer: reproductive, developmental effects	Drinking water chlorination by-products
Haloacetic acids (HAA5)[1]	0.060 (Stage 1) 0.030 (Stage 2)	Cancer and other effects	Drinking water chlorination by-products
Trichloroacetic acid	(see HAA5)	Liver, kidney, spleen developmental effects	Drinking water chlorination by-product

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Contaminant	MCL, ms/L	Potential Health Effects	Source of Drinking Water Contamination
Total Trihalo-methanes (TTHMs)	0.10 (current) 0.080 (Stage 1) 0.040 (Stage 2)	Cancer and other effects	Drinking water chlorination by-products
Viruses	TT (disinfection)	Severe gastro-intestinal illness	Human fecal matter

[1] Sum of the concentrations of mono-, di-, and trichloroacetic acids and mono- and dibromoacetic acids

Application: Microbial standards apply to all public water systems using groundwater or surface water sources of supply. D/DBP standards apply to community and nontransient noncommunity systems that apply disinfectants.

Monitoring: Monitoring is likely to be required both for pathogenic organisms and for disinfectants and disinfection by-products. Monitoring of treatment processes is also likely.

Compliance: Compliance is demonstrated by either meeting the MCLs or meeting treatment technique requirements or best management practices for applicable contaminants. See Table 5.

Federal regulation dates:
- Information collection rule - 5/14/96
- Notice of data availability - 11/3/97
- Final Stage 1 D/DBP and IESWTR - 11/98
- Final Filter Backwash Recycling Rule - 8/00
- Final LT1ESWTR and GWR - 11/00
- Final Stage 2 D/DBP, LT2ESWTR - 5/02
- Coliform bacteria rule revision - 2002 or later

Arsenic

Purpose: Revise existing standard for arsenic based on health effects research suggesting that arsenic may present an internal organ cancer risk at low levels of exposure. EPA has finalized a comprehensive arsenic health research plan to reduce uncertainties in assessing health risks of arsenic, but the results are not expected to be available before the scheduled adoption of the new standard.

Health effects: Current standard of 0.050 mg/L is based on health effects including skin thickening and possible skin cancer. Revised standard to take into account risk of internal organ cancer.

Application: Community and nontransient noncommunity systems, surface water and groundwater sources.

Monitoring: To be determined in rule.

Compliance: Based on meeting revised Maximum Contaminant Level. EPA suggests a health target level of 0.002 mg/L for discussion of the revised MCL. National annual costs of meeting a range of possible MCLs are: 0.0005 mg/L, $120B; 0.002 mg/L, $4.2B; 0.010 mg/L, $710M; 0.020 mg/L, $330M; 0.050 mg/L, $120M. Many utilities provide water with arsenic levels greater than 0.002 mg/L.

Federal regulation dates:
- EPA proposed rule - January, 2000
- EPA final rule - January, 2001

Radionuclides

Purpose: Set new standards for radon and uranium. The radon MCL is to be based on a revised risk assessment by the National Academy of Sciences. Finalize standards for currently regulated contaminants, including radium-226, radium-228, alpha emitters, and beta and photon emitters.

Health effects: Primarily cancer for all contaminants. Radon is a radioactive gas which is naturally-occurring in some groundwater. It poses a health risk when the gas is released from water into air, as occurs during showering, bathing, or washing clothes or dishes. Radon in drinking water is a relatively small part of the total radon in air. Other sources are radon gas from soil which enters homes through foundations, and radon inhaled directly while smoking cigarettes. Radon which is inhaled has been linked to lung cancer, however, it is not clear what level of radon in drinking water contributes to this effect. People concerned about radon in their homes can have their homes tested to determine total exposure level. For information on how to conduct home tests, contact Radiation Protection Services at (503) 731-4272.

Application: Community and nontransient noncommunity systems, surface water and groundwater sources.

Monitoring: To be determined in rule.

Compliance: Based primarily on meeting MCLs. Existing MCLs for radium-226 and 228 are unlikely to be raised, as was earlier expected, from 5 pCi/L to 20 pCi/L. Uranium MCL proposed in 1991 at 0.02 mg/L. Radon MCL proposed in 1991 at 300 pCi/L. A multi-media approach to radon regulation is under discussion, in which an Alternative MCL could be set by states with effective indoor air radon reduction programs in place and operating. The Alternative MCL would be in the range of 3,000-4,000 pCi/L. Oregon radon data from 65 deep community wells collected in 1983 showed 23 with radon greater than 300 pCi/L. Cost data from 1990 suggests the following national annual costs of various alternate radon MCLs: 200 pCi/l, $3.3B; 300 pCi/L, $2.5B; 1,000 pCi/L,$816M; 4,000 pCi/L, $178M.

Regulation dates (Contaminants other than radon):
- EPA proposed rule - 7/18/91
- EPA final rule - November, 2000

Regulation dates (Radon):
- NAS studies complete - June, 1998
- EPA draft rule - December, 1998
- Guidelines for multi-media programs - August, 1999
- EPA final rule - August, 2000

Drinking Water Contaminant Candidate List (DWCCL)

Purpose. Identify chemical and microbiological contaminants known or anticipated to occur in public water systems, for possible future regulation. The first DWCCL was published in February, 1998. In Tables 6 and 7, the list is broken into two groups. The first group includes twenty contaminants that are priorities for regulation, and will be the source for regulatory decisions in 2001. The second group includes forty additional contaminants which require further research on health, treatment, and/or analytical methods, or need further occurrence data collection. For each contaminant, its classification is shown along with the Chemical Abstract System Number (CASN), if applicable, for use in locating additional information on the contaminant. The list must be updated every five years.

In addition, the tables indicate the contaminants on the DWCCL for which EPA Health Advisories have been published. These advisories contain known information on health risks, and specify ranges of concentrations that are acceptable for drinking over different lengths of time. Advisories are generally used to evaluate specific contaminant exposures at specific sites, such as chemical spills.

Table 6 - Contaminant Candidate List - Regulatory Determination Priorities (20)

Contaminant	Classification	Chemical Abstract Number	Health Advisory Published
Acanthamoeba	microbiological	————	
1,1,2,2-tetrachloroethane	organic	630-20-6	
1,1-dichloroethane	organic	75-34-3	
1,2,4-trimethylbenzene	organic	95-63-6	
1,3-dichloropropene	pesticide	542-75-6	
2,2-dichloropropane	organic	594-20-7	
Aldrin	pesticide	309-00-2	X
Boron	inorganic	7440-42-8	
Bromobenzene	organic	108-86-1	
Dieldrin	pesticide	60-57-1	X
Hexachlorobutadiene	organic	87-68-3	
p-Isopropyltoluene	organic	99-87-6	
Manganese	inorganic	7439-96-5	
Metolachlor	pesticide	51218-45-2	
Metribuzin	pesticide	21087-64-9	
Naphthalene	organic	91-20-3	
Organotins	organic	————	
Triazines & degradation products (including Cyanazine, Atrazindesethyl)	pesticide	————	
Sulfate	inorganic	————	
Vanadium	inorganic	7440-62-2	

Table 7 - Contaminant Candidate List - Research and Occurrence Priorities (40)

Contaminant	Classification	Chemical Abstract Number	Health Advisory Published
Adenoviruses	microbiological	————	
Aeromonas hydrophilia	microbiological	————	
Cyanobacteria (Blue-green algae) and their toxins	microbiological	————	
Caliciviruses	microbiological	————	
Coxsackieviruses	microbiological	————	
Echoviruses	microbiological	————	
Helicobacter pylon	microbiological	————	
Microsporidia	microbiological	————	
1,1-dichloropropene	organic	563-58-6	
1,2-diphenylhydrazine	organic	122-66-7	
1,3-dichloropropane	organic	142-28-9	
2,4,6-trichlorophenol	organic	88-06-2	
2,4-dichlorophenol	organic	120-83-2	
2,4-dinitrophenol	organic	51-28-5	
2,4-dinitrotoluene	organic	121-14-2	
2,6-dinitrotoluene	organic	606-20-2	
2-methyl-phenol	organic	95-48-7	
Alachlor ESA	pesticide	————	
Aluminum	inorganic	7429-90-5	
Acetochlor	pesticide	34256-82-1	
DCPA (Dacthal) monoacid & degradates	pesticide	887-54-7	
DCPA (Dacthal) di-acid degradates	pesticide	2136-79-0	
DDE	pesticide	72-55-9	
Diazinon	pesticide	333-41-5	X
Disulfoton	pesticide	298-04-4	X
Diuron	pesticide	330-54-1	X
EPTC (s-Ethyl-dipropylthiocarbonate)	pesticide	759-94-4	
Fonofos	pesticide	944-22-9	X
Linuron	pesticide	330-55-2	
Methyl bromide	organic	74-83-9	
Molinate	pesticide	2212-67-1	
Mycobacterium avium intercellulare (MAC)	microbiological	————	
MTBE	organic	1634-04-4	X
Nitrobenzene	organic	98-95-3	
Perchlorate	inorganic	————	
Prometon	pesticide	1610-18-0	
RDX	organic	121-82-4	X
Sodium	inorganic	7440-23-5	
Terbacil	pesticide	5902-51-2	X
Terbufos	pesticide	13071-79-9	X

Monitoring: To support identification of contaminants, the EPA must establish the National Contaminant Occurrence Database (NCOD) by August, 1999. Monitoring and reporting may be required for public water systems for up to 30 unregulated contaminants for inclusion in the database.

Regulating contaminants: EPA must publish a decision on whether or not to regulate at least five contaminants (including sulfate) from the DWCCL by August, 2001, and from each updated DWCCL every five years. For any contaminants from the first DWCCL for which a decision is made to regulate, the final rule is due by February, 2005, with compliance required by water systems by February, 2008.

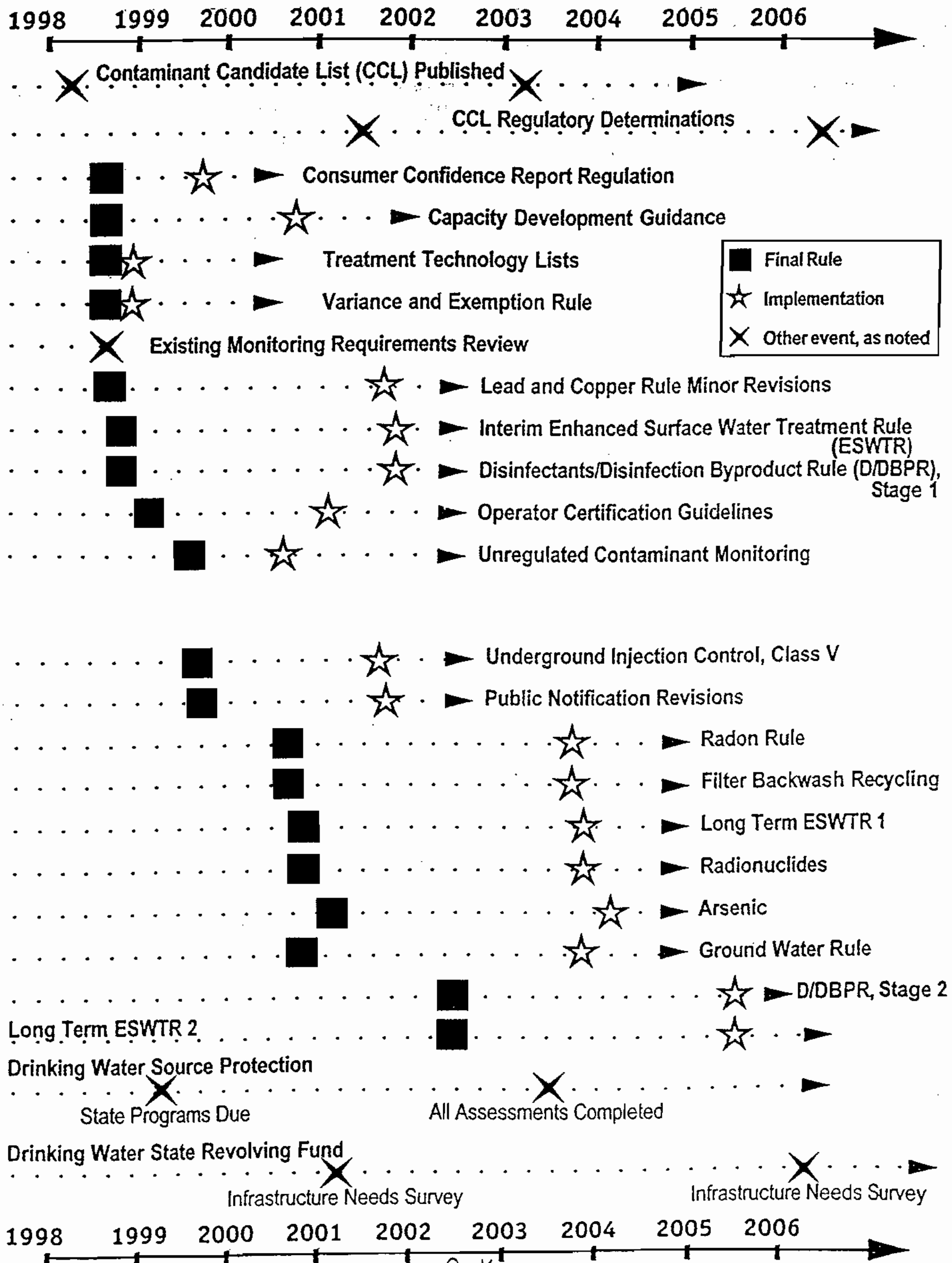
Safe Drinking Water Act Timeline

The chart on page 13 shows a simplified implementation timeline for major provisions of the 1996 Safe Drinking Water Act, prepared and published by the USEPA [1]. These will take effect from now until 2005 and beyond. These provisions include the new drinking water standards described above as well as many new program initiatives such as consumer confidence reports, technical/financial/managerial capacity development, operator certification, drinking water source protection, and the drinking water state revolving loan fund. Watch for information on these program initiatives in future regular editions of the PIPELINE.

Other useful sources of information include:
Journal American Water Works Association (and related publications)
Rural Water Magazine, National Rural Water Association (and related publications)
USEPA, AWWA, and other organization web pages (access through Oregon Drinking Water web page)

[1] "Safe Drinking Water Is In Our Hands - Existing Standards and Future Priorities" EPA 815-F-98-007 (June, 1998)

Timeline of SDWA Activities



APPENDIX H
GRANT AND LOAN PROGRAMS

APPENDIX H

H1.0 GRANT AND LOAN PROGRAMS

Many communities are unable to finance major utility improvement projects without some form of funding assistance, such as low interest loans or grants. For particularly needy communities, two or more outside funding sources may be packaged together. This type of financing can occasionally reduce the local funding responsibility to an acceptable level.

A brief description of the major federal and state funding programs which are typically used to assist qualifying communities in the financing of public works improvement programs, is given below. Each of the government assistance programs has specific prerequisites and requirements. These assistance programs promote such goals as aiding economic development, benefiting areas of low to moderate income families, and providing for specific community improvement projects. Each program has unique requirements; therefore, not all communities or projects may qualify for each.

H1.1 Oregon Community Development (OCD) Block Grant Program

The Community Development Block Grant (CDBG) program is a federal program administered by the Oregon Economic Development Department (OEDD) for non-metropolitan cities and counties. Urban cities and counties are not included in the state's program because they receive Community Development Block Grant funds directly from the U.S. Department of Housing and Urban Development. The preparation of this master plan was funded in part using CDBG funds.

The national objective of the block grant program is the development of viable urban communities, by providing decent housing and a suitable living environment and expanding economic opportunities, principally for persons of low and moderate income.

The Regional Development Division of the OEDD operates the state's CDBG program to support the agency's mission--More and Better Jobs for Oregonians--through assistance for a variety of activities that benefit low and moderate income persons.

The Oregon program also supports the state's strategic plan, known as "Oregon Shines," by improving the standard of living and quality of life for Oregonians, promoting a diverse and growing economy, and helping to strengthen local leadership and the capacity to solve problems at community and regional levels. Specific objectives for rural Oregon include:

- Improving the availability and adequacy of public infrastructure and facilities.

- Conserving the existing housing supply and improving housing conditions.

- Increasing the supply of housing affordable to low and moderate income persons--particularly those with the lowest incomes.

- Increasing access to public facilities providing services to families and individuals with disabilities or critical needs.

The funds available in the program vary from year to year depending on congressional allocations and funds which roll over from previous programs.

Description

Oregon's CDBG Public Works funds are targeted to support public water and sewer systems because they are the basic infrastructure necessary for the health and economic well-being of every community, and they are the most difficult to finance because of the high expense to citizens. Federal laws, the Clean Water Act and Safe Drinking Water Act, in particular, are requiring municipalities to make expensive improvements in existing systems to comply with national standards. There are few sources of outside funds that communities can use to pay for such projects.

The OEDD is committed to helping Oregon's communities make the necessary improvements in their water and sewer systems by providing state and federal funds according to financial need.

Grant assistance must be used in areas which are primarily residential. Projects must be needed first and foremost to solve problems faced by current residents. Project components that are primarily for building capacity in a system must be paid for with local and/or other funding sources.

Funds Available

The amount of funds made available is dictated by federal Congress in budget appropriations. There is considerable competition for these funds, and generally it helps a community's position to ensure that the grant application is fully and properly completed and that all documentation is provided. It is anticipated that the fiscal year 2000 allocation from Congress will be less than the approximate $5,200,000 which was available for water and sewer projects in 1998.

Grants will be made for each of three phases necessary to complete improvement projects. Phase 1 consists of planning and preliminary engineering; Phase 2 consists of final engineering, financial feasibility, and environmental review; and Phase 3 consists of project construction. The maximum amount available for a single project is $750,000.

Applications for projects are accepted year around.

Project Priority

Applications are generally funded in the order they are received. However OEDD reserves the right to fund projects out of order for these reasons:

A. To coordinate funding efforts with other funding agencies to ensure that other funding commitments are not lost.

B. Some application reviews take longer than others because additional information is needed from the regulatory authority, other funding sources, the applicant and/or other state and local agencies. While this information is being gathered, other eligible applications may receive grant awards.

C. If the applications received exceed the funds available, OEDD will use its best judgement to fund qualified projects that are ready to proceed.

Eligible Activities

Eligible activities include the construction, improvement or expansion of publicly-owned water and sewer projects critically needed for the benefit of current residents. The project cost can include construction costs, equipment, the acquisition of real property or permanent easements, preliminary planning and preliminary and final engineering, surveying, architectural and other support activities, contingencies, payment of special assessments to recover non-Community Development Block Grant costs of a water or sewer project for properties occupied by low and moderate income persons, and administrative costs associated with federal requirements.

H1.2 Rural Water and Waste Disposal Loans and Grants

Rural Utility Service (RUS) has the authority to make loans and grants to public bodies and non-profit corporations in rural areas to construct or improve essential community facilities. Grants are also available to applicants who meet the median household income (MHI) requirements. While applicants must have a population less than 10,000 to be eligible for water system financing, priority is given to public entities in areas with less than 5,500 people to restore a deteriorating water supply, or to improve, enlarge or modify a water facility.

Borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.

- Have legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.

- Be financially sound and able to manage the facility effectively.
- Have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance and to retire the indebtedness and maintain a reserve.

The term generally applied on municipal loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority nor the useful life of the improvement or facility to be financed. Interest rates are set periodically and are based on current market yields for municipal obligations. The following information provides a general summary of loan conditions.

Market Rate. The market rate is paid by those applicants whose median household income (MHI) in the service area is more than the $27,756 which is the Oregon non-metropolitan MHI. The market rate is below 6 percent.

Intermediate Rate. The intermediate rate is paid by those applicants whose MHI of the service area is less than $27,756. The current interest rate for qualified applicants is in the range of 4.75 percent.

Poverty Line Rate. The lowest rate is paid by those applicants whose MHI of the service area is below $22,205 (80 percent of the non-metropolitan MHI) and the project is needed to meet the regulatory agency health and sanitary standards. The poverty rate is currently 4.500 percent.

Maximum grant amounts, based on MHI, are provided in Table H-1. The grants are calculated on the basis of eligible costs which do not include the costs attributable to reserve capacity. In addition, grant funds cannot be used to reduce total user costs below that of comparable communities funded by RUS.

TABLE H-1

MAXIMUM RUS GRANT FUNDS BASED ON MEDIAN HOUSEHOLD INCOME (MHI)

Median Household Income (MHI)	Maximum Grant
<$22,205	75%
$22,205 to $27,756	55%
>$27,756	0%

Eligibility for the RUS grants and loans are based on census data and population studies. The MHI for households in the city of Veneta has been established in a special census in 1993. That census determined that 51.4 percent of the city population has a low/moderate income level.

Other restrictions and requirements are associated with the RUS loans and grants. If the city becomes eligible for grant assistance, the grant will apply only to eligible project costs. Additionally, grant funds are only available after the city has incurred long-term debt resulting in an annual debt service obligation equal to ½ percent of the MHI. To receive a RUS loan, the city must secure bonding authority, usually in the form of general obligation or revenue bonds. In addition, the RUS funds are limited by an annual funding allocation by Congress. This funding allocation has been steadily falling. 1999 fund allocations are anticipated to supply only about 30 percent of the need.

H1.3 Safe Drinking Water Revolving Loan Fund (SDWRLF)

The SDWRLF was created by Congress in 1996 to establish loan financing to construct and improve local public drinking water systems. The fund is intended to assist community and non-profit non-community drinking water systems. Funds can be used to plan, design and construct drinking water facilities needed to correct non-compliance with current or future drinking water standards.

The Oregon Health Division (OHD), the Oregon Economic Development Department (OEDD) and the Department of Environmental Quality (DEQ) have established a partnership to carry out the SDWRLF. The Safe Drinking Water Act and the SDWRLF are administered by the OHD and OEDD, respectively.

Project Eligibility

Program eligibility is limited to projects necessary to ensure that water systems comply with applicable requirements and to further public health protection goals of drinking water quality standards administered by OHD.

Applicants may apply for any phase or combination of phases in a single application. An application may include one or more elements of a water system (i.e., supply, storage, treatment, transmission and metering)

Applicants with 300 or more service connections are eligible for final design and construction only if they maintain a current master plan that evaluates the needs of the water system for at least a twenty-year period, and include the eight major elements that are outlined in the Administrative Rule.

Eligible Applicants and Activities

The activities which are eligible for funding include the planning and preliminary engineering, design and specifications, and construction of improvements to drinking water systems.

Activities which are ineligible are listed below:

- Dams or rehabilitation of dams.
- Purchase of water rights, except if the water rights are owned by a system that is being purchased through a consolidation.
- Reservoirs, except for finished water reservoirs and those reservoirs that are part of the treatment process.
- Laboratory fees for monitoring.
- Projects for the improvement of fire protection.
- Projects for systems in significant noncompliance, unless funding will ensure compliance.
- Administrative costs.
- Costs incurred prior to official award of funds by OEDD.
- Purchase of equipment, such as motor vehicles, not directly appurtenant to the project.
- Purchase of off-site property for the project-related purposes such as wetland mitigation or other uses not directly related to the project.
- Operation and maintenance expenses.
- Improvements made to any part of a system that is or will be owned and operated by an ineligible water system.
- Projects primarily intended to supply or attract future growth.

Capacity Analysis (Financial, Managerial and Technical Review)

The state will review the overall financial, managerial, and technical capacity of the applicant to maintain compliance with the Safe Drinking Water Act.

If a system does not have the technical, managerial, and/or financial capacity to ensure compliance, or is in significant noncompliance, the system may receive assistance only if: The assistance will ensure compliance and the owner or operator of the system agrees to undertake appropriate changes that will ensure the system has the technical, managerial and financial capacity to meet and maintain compliance with the Safe Drinking Water Act.

Capacity review will take place shortly after the final application is submitted to OEDD.

Project Priority List and Intended Use Plan

A drinking water system that responds with project and financial need information in a "Letter of Interest" will have its project rated, via a point system, using the criteria in this rule. OHD has received its 1998 estimated appropriations and has available $11,530,785 in funds for the SRF program. A total of 38 eligible projects are listed by OHD with a total amount request of $61,723,140. Veneta's project is listed as project number 35. Veneta's low priority is because of the relative low health risk (Veneta's iron and manganese problems do not constitute an immediate health threat). Veneta could update its letter of interest and likely receive some additional rating points from OHD in next year's allocation due to additional deficiencies identified. However, OHD funds for Veneta's project will still not be available for over five years.

H1.4 Economic Development Administration (EDA) Public Works Grant Program

The EDA Public Works Grant Program, administered by the U. S. Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. To be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs which might be created if the proposed project were completed. Communities which can demonstrate the existing system is at capacity (i.e., moratorium on new connections) have a greater chance of being awarded this type of grant. EDA grants usually represent 50 to 80 percent of the project cost; therefore, some type of local funding is required.

H1.5 Oregon Water Development Loan Fund

This program is administered by the Oregon Water Resources Department. The Water Development Loan Fund (WDLF) provides long-term loan financing to fund water supply projects which will be used for drinking water, fish protection and watershed enhancement, and the drainage or irrigation of agricultural lands. Eligible applicants include special districts, cities, and counties.

Funds to finance a water development project are obtained by the issuance of self-liquidating bonds. The State Treasurer is authorized to sell bonds in an mount equal to 1½ percent of the true cash value of Oregon property to fund the program. The bonds are repaid by those benefiting from the project at no cost to the Oregon taxpayer.

Loans are available to construct, repair, improve, expand or otherwise modify community water systems, to acquire a water supply or water right, or acquire rights-of-way, easements and relocation of roads and utilities necessary for project construction.

WDLF financing can be used in conjunction with funds from other agencies or the applicant. The loan will be secured with a first lien on real property or a covenant to the state for water user charges. Maximum term of a loan is 30 years.

H1.6 Small Scale Energy Loan Program (SELP)

The SELP program is administered by the Oregon Department of Energy and provides loans for projects which can demonstrate savings in energy costs or energy conservation. There are no grants available and interest rate on loans is in the range of 8 percent.

H2.0 LOCAL FUNDING SOURCES

The amount and type of local funding obligations for water system improvements will depend, in part, on the amount of grant funding anticipated and the requirements of potential loan funding. Local revenue sources for capital expenditures include:

- Various types of bonds.
- Water service charges.
- Sinking fund.
- Connection and user fees.
- System development charges.
- Urban Renewal funds.
- Ad valorem taxes.

Local revenue sources for operating costs are generally limited to water service charges. The following sections identify those local funding sources and financing mechanisms which are most common and appropriate for the improvements identified in this study.

H2.1 General Obligation Bonds

General obligation (G.O.) bonds are backed by the full faith and credit of the issuer. For payment of the principal and interest on the bond, the issuer may levy ad valorem general property taxes. Such taxes are not needed if revenue from assessments, user charges or some other source is sufficient to cover debt service.

The Oregon Revised Statues limit the maximum term for general obligation bonds to 40 years for cities. If in the event the Rural Development Administration purchased the bonds, the realistic term for which general obligation bonds should be issued is 15 to 20 years.

Financing of water system improvements by general obligation bonds is usually accomplished by the following procedure:

1. Determination of the capital costs required for the improvement.

2. An election authorizing the sale of general obligation bonds.

3. Following voter approval, the bonds are offered for sale.

4. The revenue from the bond sale is used to pay the capital costs associated with the projects.

From a fund raising viewpoint, general obligation bonds are preferable to revenue bonds in matters of simplicity and cost of issuance. Since the bonds are secured by the power to tax, these bonds usually command a lower interest rate than other types of bonds. General obligation bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, their tax exempt status and their general acceptance.

These bonds can be revenue-supported wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the obligated bonds is eliminated. Such revenue-supported general obligation bonds have most of the advantages of revenue bonds, but also maintain the lower interest rate and ready marketability.

Other advantages of general obligation bonds over other types of bonds are as follows:

- The laws authorizing general obligation bonds are less restrictive than those governing other types of bonds.

- By the levying of taxes, the debt is repaid by all property benefitted and not just the system users.

- Taxes paid in the retirement of these bonds are IRS deductible.

- General obligation bonds offer the flexibility to retire the bonds by tax levy and/or user charge revenue.

General obligation bonds are normally associated with the financing of facilities which benefit an entire community and must be approved by a majority vote.

The disadvantage of general obligation bonds is that debt is often added to the debt ratios of the underlying municipality or city, thereby restricting the flexibility of the municipality or city to issue debt for other purposes. Furthermore, general obligation bond authorizations must be approved by a majority vote and often necessitate extensive public information programs with associated expenses.

H2.2 Revenue Bonds

With the trend to shift away from ad valorem property taxes and toward a greater reliance on user fees, revenue bonds are becoming a frequently used option for long-term debt. Revenue bonds are payable solely from charges made for the services provided. These bonds cannot be paid from tax levies or special assessments; their security is the borrower's promise to operate the system in a manner which will provide sufficient net revenue to meet the debt service and other obligations of the bond issue.

Many communities prefer revenue bonding over general obligation bonding because it ensures no tax will be levied. In addition, debt obligation will be limited to system users since repayment is derived from user fees. Another advantage of revenue bonds is they do not count against a municipality's direct debt, but instead are considered "overlapping debt." This feature can be a crucial advantage for a municipality near its debt limit or for the rating agencies, which closely consider the amount of direct debt when assigning credit ratings. Revenue bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or without the geographical boundaries of the issuer.

Successful issuance of revenue bonds depends on bond market evaluation of the dependability of the revenue pledged. Recent legislation has eliminated the requirement that the revenues pledged to bond payment have a direct relationship to the services financed by revenue bonds. Revenue bonds may be paid with all or any portion of revenues derived by a public body or any other legally available monies. In addition, if additional security to finance revenue bonds was needed, a public body may mortgage grant security and interests in facilities, projects, utilities or systems owned or operated by a public body.

There exist no legal limitations on the amount of revenue bonds to be issued, but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods and effectiveness for billing and collecting, rate structures, provision for rate increases as needed to meet debt service requirements, historic track record in obtaining rate increases adequacy of reserve funds provided in the bond documents, supporting covenants to protect projected revenues and the degree to which forecasts of net revenues are considered sound and economical.

Municipalities may elect to issue revenue bonds for revenue producing facilities without a vote of the electorate (ORS 288.805 - 288.945). Certain notice and posting requirements must be met and a 60 day waiting period is mandatory. A petition signed by 5 percent of the municipality's registered voters will cause the issue to be referred to an election.

H2.3 Improvement Bonds (Bancroft Bonds)

Improvement bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing which is less than full-fledged general obligation or revenue bonds but is quite useful, especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not occurring to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the direct or indirect benefits, among the benefitted property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the city sells Bancroft improvement bonds to finance the construction and the assessment is paid over 20 years in 40 semi-annual installments with interest. Cities are limited to improvement bonds not exceeding three percent of true cash value.

With Bancroft bond financing, an improvement city is formed, the boundaries are established and the benefitted properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or a front-foot (facing the improvement) basis. Property owners are then given an opportunity to protest the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a preassessment program based on the estimated total costs must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is the property to be assessed must have a true cash value at least equal to 50 percent of the total assessments to be levied. As a result, a substantial cash payment is usually required by owners of undeveloped property. In addition, the development of an assessment city is very cumbersome and expensive when facilities for an entire community are contemplated. General obligation bonds can be issued in lieu of improvement bonds and are usually more favorable.

H2.4 Capital Construction (Sinking) Fund

Sinking funds are often established by budget for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from system development charges or serial levies. Veneta does not have a sinking fund with sufficient reserves to fund a project of the magnitude described in this plan.

H2.5 Connection and User Fees

Previously, most cities charged connection fees to cover the cost of connecting new development to water systems. However, based on recent legislation, connection fees can no longer be programmed to cover a portion of capital improvement costs.
User fees can be used to retire general obligation bonds and are commonly the sole source of revenue to retire revenue bonds and to finance operation and maintenance. User fees represent monthly charges of all residences, businesses and other users who are connected to the water system. These fees are established by resolution and can be modified, as needed, to account for increased or decreased operating and maintenance costs. The monthly charges are usually based on the class of user (e.g., single family dwelling, multiple family dwelling, schools, etc.) and the water demand through a user's connection.

H2.6 System Development Charges and Assessment

A system development charge (SDC) is a fee collected as each piece of property is developed. The charge is used to finance the necessary capital improvements and municipal services required by the development. Such a fee can be used to recover only the capital costs of infrastructure. Operating, maintenance and replacement costs cannot be financed through system development charges.

The Oregon Systems Development Charges Act was passed by the 1989 Legislature (HB 3224) and governs the requirements for systems development charges effective July 1, 1991. Two types of charges are permitted under this act: 1) improvement fees and 2) reimbursement fees. SDCs collected before construction are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDCs are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, the city may provide some improvements or services which directly benefit a particular development. The city may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.

Under the Oregon Systems Development Charges Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan must also be prepared which lists the capital improvements which may be funded with improvement fee revenues and the estimated cost and timing of each improvement. Thus, revenue from the collection of SDCs can be used only to finance specific items listed in a capital improvement plan. In addition, SDCs cannot be assessed on portions of the project paid for with any grant funding program.

H2.7 Ad Valorem Taxes

Ad valorem property taxes are often used as a revenue source for utility improvements. Property taxes may be levied on real estate, personal property or both. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions.

A marked advantage of these taxes is the simplicity of the system. It requires no monitoring program for developing charges, additional accounting and billing work is minimal and default on payments is rare. In addition, ad valorem taxation provides a means of financing which reaches all property owners who benefit from a water system, whether a property is developed or not. The construction costs for the project are shared proportionally among all property owners based on the assessed value of each property.

Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits.

H2.8 Urban Renewal

Veneta's existing Urban Renewal Agency encompasses about 354 acres and includes most of the downtown core area, the public works facilities and much of the area north of Highway 126 within the urban growth boundary. Community leadership has examined the possibility of using the taxing authority of the Urban Renewal Agency to fund, in part the requirements for water system infrastructure improvements. The Urban Renewal Agency has a current payment capacity of $269,000 per year. With a ten year pay back period at 5.5 percent the Urban Renewal Agency could borrow up to two million dollars.

Regulations governing the use of Urban Renew Funds require that the funds be expended within the Agency boundary and that the agency can not be increased in size by more than one percent. It may be necessary to extend the Urban Renewal Agency boundary to include a narrow corridor and the new reservoir development area in order to optimize the use of the agency funds.