Introduction:

Part Three of a projected four part study of municipal drinking water in urban Clackamas County deals with the major water providers of west Clackamas County, Lake Oswego, West Linn, South Fork Water Board, Wilsonville and smaller providers as a group. Parts One and Two described the metropolitan area, water problems in general, and the Clackamas River Basin with its municipal water providers up to the municipal intakes. The purpose of the study is to inform League of Women Voters of Clackamas County members and to develop local positions for testimony on local water issues.

Part III Summary:

West Clackamas County presently has ample, quality drinking water. Facilities for major purveyors have been considerably upgraded in recent years. Facilities are well run with relatively small, trained staffs. System redundancy (lots of back-up capability), routine maintenance, ample storage facilities and tielines for emergencies are regarded as necessary to maintain constant water supplies. However there are some important concerns.

- The first concern is the question of sufficient water supplies, particularly in the area served by the Clackamas River during the summer low water volume/peak consumer demand. Further, Clackamas River water providers are too dependent on the other Clackamas River water providers for emergency backup. In a prolonged emergency, all providers would suffer. While water is usually plentiful at that time in the Bull Run and Willamette River systems, the efficient allocation, transmission and storage of water throughout the metropolitan area needs to be improved.
- Second, determining water quality and maintaining safe, drinkable water, both in fact and in the public eye, will become increasingly difficult as the "soup" of pollutants thickens and the need to test for ever more minute quantities and exotic, mostly unknown recombinations of pollutants, becomes urgent.
- Third, there is the need for conservation in the widest sense, both of basin habitat and of water itself.
- Fourth, the political will must exist to generate the large capital sums need to pay for on-going maintenance, and improvements on a regional and sub-regional scale.

Table 1 **SYSTEM DESCRIPTION**

	Lake Oswego	South Fork Water Board (SFWB) West Linn & Oregon City (co-owners)	West Linn	Wilsonville
Present population (For projected population see p. 5, Water Consumption Chart)	37,750	Bulk water provider to West Linn & Oregon City, wholesales to Clackamas River Water-South (CRW-S)	23,400	15,590
Function of water system	Produces and distributes drinking water	Bulk producer only	Distributes drinking water only	Produces and distributes drinking water
Water consumption present & projected	See accompanying chart			
Governance	City	IGA 50% West Linn-50%Oregon City	City	City
Organizational Structure	City Council, City Manager, Engineering Dept, WTP & Maintenance staffs	Appointed Board Advisory Board Manager WTP staff, Oregon City office staff	City Council, City Manager, Public Works system & maintenance staffs	City Council Public Works System maintenance staff which runs WTP under contract by US Filter Corporation
State registered & generally compliant with water quality testing, reporting, planning, consumer reporting requirements	ID#4100457 Yes	ID #4100591 Yes	ID#4100944 Yes	ID#4100954 Yes
Water quality presently meets or exceeds current Safe Drinking Water Act and Oregon Health Division requirements	Yes	Yes	Yes	Yes
Water Rights	Clackamas River 32.3mgd senior 3.8mgd junior 40.1mgd Total	Clackamas River 42.6 senior usable 9.1 senior, non-useable 51.7 mgd Total	none	Willamette River 20mgd 1974 junior water right
Available Water volume (see Appendix B)	Municipal water rights as a % of flow Clackamas River Average flow 1,000 mgd Minimum flow 290 mgd High flow = 8.785% Low flow = 31%			Peak volume intake less than 1% of volume at minimum flows

Table 2 System Description

	Lake Oswego	South Fork Water Board	West Linn	Wilsonville
Raw water quality	Very good, #1 problem is turbidity, 30+ minor source discharges within 30 miles of river mouth			About 20 major sources of discharge upstream of intake facility (see pgs. 7-8)
Raw water intake capacity-filtered/screened	Yes 32 mgd	Yes 43 mgd	N/A	Yes 120 mgd
Improvements needed	No	No	N/A	N/A
Raw Water Transmission	Approx. 13 mgd	22 mgd	N/A	N/A
Intake facility capacity (pumps) Sufficient capacity Current Buildout	14.7 mgd Yes No	28 mgd Yes Currently yes	N/A N/A	N/A Yes Yes
Water Treatment Plant Current capacity Sufficient capacity @ buildout	16 mgd needs 10 mgd at buildout	20 mgd, except in high turbidity periods when disinfection capacity. may be limited to 12 mgd	N/A	10 mgd, abundant additional capacity, all pipes sized to 70 mgd.
Finished Water Transmission Lines	50 miles, (7 3/4 mile main line from WTP) flows too fast @peak times	Division St. pumping capacity is firm at 17 mgd to Oregon City and West Linn	13 mgd, from Oregon City across I-205 bridge, upgraded in 1990's	N/A
Distribution System	210 miles, mostly ductile iron (see Glossary)	N/A	112 miles, about 46% not ductile iron, over 1/2 laid before mid-1980's	81 miles, 77 of them ductile iron
Pressure zones	19, divided into sub-zones	N/A	6 zones, 19 sub-zones	3 zones
Pump stations	13	1	3, upgraded in the 80's & 90's	2 (WTP & one booster pump)
Pressure reducing stations	25	0	17	3
Systems Control & Data Acquisition (SCADA)	Yes, updated	Yes, updated	Yes, updated	Yes, updated
Hookups	11,000 (85% residential, 15% other)	3, West Linn, Oregon City and Clackamas River Water-South	9582 (96% residential and 4% other)	4000 (3500 single and multi-family, 500 other)

Table 3 System Description

	Lake Oswego	South Fork WB	West Linn	Wilsonville
Storage				
# of reservoirs	17	None except for clearwell and 1.6mg in process	6 (4 small, aging, oldest within a few years of 100)	4
General condition	Good, mostly inground	N/A	variable	excellent
Total capacity	27 mgd	N/A	6mgd (5.5 useable)	10.7 mgd (7.95mg storage+2.7mg in treatment plant)
Storage Volume of Finished Water				
Equalization/peaking	3 mgd	N/A	1.0 mgd	1.7mg (est.)
Fire	11.3 mgd	N/A	1.63 mgd	.72 mg
Emergency	12.4 mgd	N/A	3.24 mgd	Pump if needed
Sufficient now	Yes	N/A	No (1.0 mgd deficit)	Yes
At buildout	No (especially if Stafford is included)	More clearwell capacity	No	Yes
Interties Portland Tigard West Linn Tualatin	1 mgd 1 mgd 5.4 mgd .3 mgd only West Linn immediately available	Indirectly from Lake Oswego, possibly some from CRW	Lake Oswego 5.4 mgd	Tualatin, 2 mgd emergency only, currently inactive
Immediately Available for emergencies	12.4 mg stored, .2mg well, up to 5.4mgd from West Linn if it can be spared or if Clackamas River is available	Clearwell and water being processed	5.4 mgd from Lake Oswego if it is available, possibly some from Oregon City's Mt. View reservoir, stored water	Wells, or pump more river water, use stored water
Main Problems	Several parts of the system are at peak or near capacity at peak use times. No cheap way to expand Vulnerable to a shutdown of the Clackamas River because three other interties need work to be operative	Needs to resolve issues with only major customer (CRW) Needs to upgrade plant treatment capacity during high turbidity times Finish renovation program/upgrade	50% of the distribution pipes need replacing Reservoirs need major upgrades in near future Parts of system at or near peak day capacity No community agreement on storage needs Parts of the system vulnerable to slides and seismic activity Vulnerable to shutdown of Clackamas River also	Not enough customers for Willamette River treated water due to concerns about treated water quality Cost of water is high despite contributions by TVWD and Or. Dept. of Corrections

WATER CONSUMPTION

	Lake Oswego					West Linn			Wilsonvillle			
	1999	2020		Buildout		1998	2015	2020 Buildout	1999-2000		2015	2020 Buildout
									Actual use[A]	Free use		
Population	37,750		w/s		w/s	23,400	28,000	38,000	14,365	14,365	20-22,000	25-28,000
Peak Daily Demand (mgd)	12.4					6.54	4.0	5.34	4.8	6.8		
Average Daily Demand (mgd)	6.2	17.1	20-24	19	26	2.91	9.8	12.73	2.51	3.4		20.2[B]

Notes

Lake Oswego: w/s means with Stafford area included
Wilsonville: [A] Actual means conservation measures were in effect
Free use means no conservation measures in effect

[B] Annual estimated increase for industry is 10% and includes 2 large industrial users at 2 mgd, Special use is 9.6%

WATER CONSUMPTION BY CUSTOMER CLASS

CUSTOMER CLASS	PERCENT OF TOTAL CONSUMPTION		
	Lake Oswego	West Linn	Wilsonville
Single Family	71	89	28
Multi-family & Apartments	14	9	22
Commercial	9	5	50
Irrigation	4	1	
Public Facilities	2	5	
Total	**100%**	**100%**	**100%**
Water unaccounted for as a % of <u>total production</u>	Less than 15%	Less than 15%	Less than 15%

Note: 40-60% of residential consumption can be devoted to outside use.
15% water unaccounted for is the industry maximum standard

Lake Oswego Water Master Plan 6/1/97 – 5/31/99, pg. 3-6
Section 3 – Water Demand Projections
Final Report – Table 3-4

West Linn interview 3/03
Wilsonville interview 2/03

Treatment Process - Lake Oswego and South Fork Water Board

Source:
The water source is the Clackamas River basin covering about 936 square miles. Much of the volume originates as snow melt. The lower river water is very soft and often of low temperature. During the summer the water is normally clear and warmer. During storms in the watershed and during the winter rains, turbidity may increase. Periods of high turbidity seldom last more than a week.

Turbidity is the main problem in treating the river water. Increased turbidity can slow down the processing time needed to clear and disinfect the water and thus reduce treatment plant output or even close the plants for a few days.

Other pollution exists. There are 30 plus pollution points within the last 30 miles of the river. However raw water quality is generally considered to be very good. (See LWVCC Drinking Water Study Part II, 2002)

Treatment

See Treatment Chart that follows on page 7.

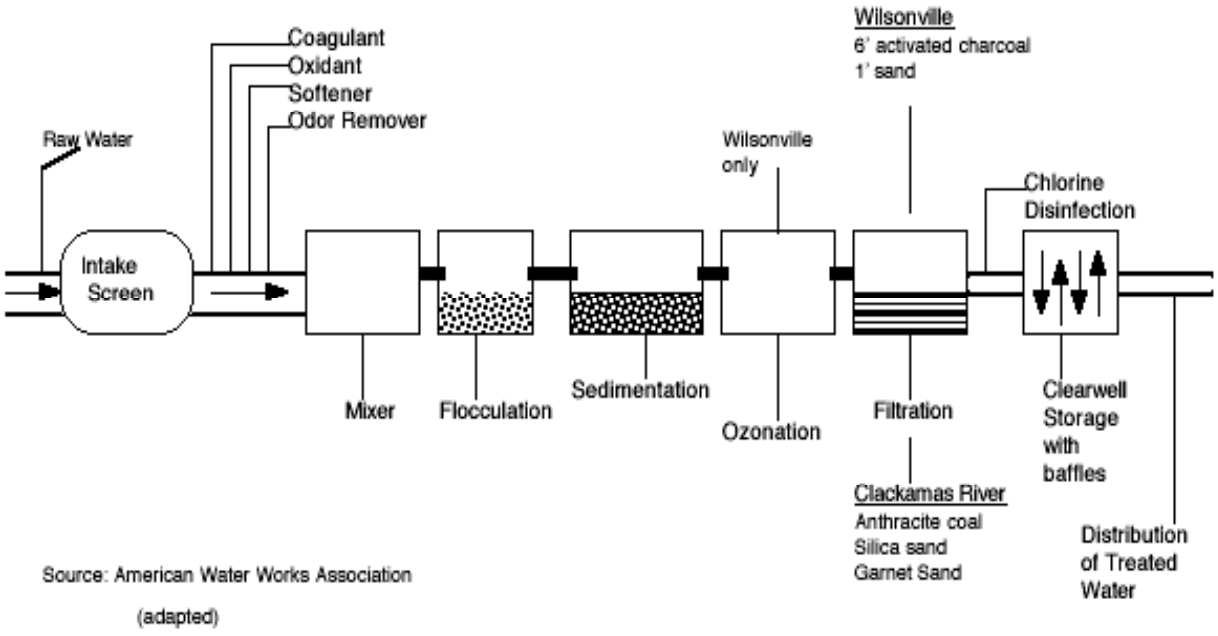
The treatment process begins when the raw water is collected by intakes and pumped to the plants. For South Fork Water Board the water flows by gravity through traveling screens where debris is removed and then is pumped up 70 feet to the treatment plant. For Lake Oswego, the raw river water is pumped under the river to the treatment plant in the Robinwood District of West Linn.

As the water enters the plant coagulants are added to help settle the water and remove small particles. Sand and alum help the suspended smaller particles to combine into larger, heavier floc particles that are easier to remove by settling out. This process is called flocculation.

In the settling tank or contact basins, the larger floc particles drop to the bottom. The addition of sand speeds the process. Filtration is the next step. Before the water actually enters the filters, chemicals are added which make the remaining floc particles cling to the filter material as the water passes through. The filter layers are composed of anthracite coal, silica sand and garnet sand in that order (lightest to heaviest in weight). The filter media expands and mixes together when the water flow is reversed for backwash and the collected sediments and floc are washed away into settling ponds. After the shakeup of backwash, the media return to their original order because of their different relative weights.

The clearwell collects the filtered water and chlorine is added to help disinfect the water. Once the pH and chlorine levels are adjusted to assure optimum levels when the water leaves the plant. The clearwell contains large internal walls (baffles) to keep the water moving in the clearwell long enough for the chlorine to complete the disinfection process. The treated water is then pumped to treated water storage reservoirs or on to consumers. The whole process is monitored and controlled by computer systems called SCADA (Supervisory Control and Data Acquisition).

WATER TREATMENT PROCESS



Wilsonville

Source

Wilsonville's present main water source is the Willamette River. The water source is primarily snowmelt and seasonal rains. Its water volume is controlled by a series of dams operated by the US Army Corps of Engineers. The dams' primary purpose is flood control. Other purposes include environmental concerns like keeping the flow sufficient for pollution flushing, and habitat and wildlife maintenance.

Water volume appears to be sufficient now. Wilsonville's current consumption takes less than 1% of the water available in the river during the low-flow season. However, if the climate warms, water providers along the Willamette may face the same problems of insufficient dedicated water storage. With its reserve wells, Wilsonville has some protection.

In comparison to the raw waters from the Bull Run, Clackamas and Tualatin/Trask systems, raw water quality is poor. Agricultural pesticides and herbicides, treated (and occasionally untreated) sewage and other point and non-point pollutants are found. The 35-mile stretch of river in which the treatment plant is located is known as the Newberg Pool. Scientific investigations in parts of the Pool have detected over-high percentages of deformation in small fish. Dredging in the Pool several miles upstream from the treatment plant has raised concerns in some people about bottom layer pollutants being stirred up and moving downstream.

Although the treated water passes its tests under current standards, many people remain concerned about what may remain that currently cannot be identified and /or tested for, e.g. chemical recombinations formed from the broken down chemical components of pollutants. They are also

concerned that standards keep evolving and that what is acceptable today will be found harmful tomorrow.

Several types of contaminants are found in the Willamette River. 70 to 80 percent of pollution enters the river via non-point sources, particularly man-made chemicals used in agriculture. Most of the chemical runoff enters the river during the rainy season. As of 2000, EPA had standards for 29 of the 300 active agricultural chemicals now used in Oregon, according to Tap Gap. Another contaminant source is point-source pollution (under DEQ permits) from 19 major and several hundred minor sources plus many relatively unregulated small general sources, all upriver from the Newberg Pool.

The major point sources include eleven municipal sewage treatment plants and seven industries. These industries include pulp and paper mills, plus other types of industry. Dioxins and heavy metals are also found in the Willamette. Nationwide studies are focusing on pharmaceuticals and personal care pollutants that are emitted from sewage treatment plants and other sources, and their endocrine system disruption of hormone processes in both humans and animals. Various other studies may be significant for the Willamette and the Newberg Pool. There are no standards and almost no studies of the impacts of combinations of pollutants or long-term exposure.

A number of Willamette River studies have focused on problems in the Newberg Pool, now the source of water for the Willamette Water Treatment Plant. Currently, an Oregon State University study is finding an overall percentage of about 48% skeletal fish deformities in a large study of northern pikeminnows in the Newberg Pool. Detailed investigations of about 145 of these fish have shown the presence of parasites but no clear causal factor has been found yet.

Willamette River Water Treatment

The treatment process is similar but more elaborate than for Clackamas River water. Between the steps of sedimentation and filtration, the process of ozonation has been added. Ozone, a form of oxygen, is injected through the water to break down organic chemicals that add taste and odor to the water, help to remove further organics materials and kill bacteria and other organisms. This is where E-coli, giardia and cryptosporidium are killed. The ozone is an unstable compound that bubbles to the surface in enclosed tanks and dissipates as harmless oxygen.

The media used in filtration are somewhat different too. Here six feet of activated charcoal resembling coarsely ground coffee and one foot of sand are the media. Backwashing is used to remove the sediments here as well. Plans are to replace the charcoal every two years.

Climate Change and Implications for Storage

Scientists now agree that the earth appears to be in a warming phase, though they are still uncertain about how much warming to expect. Studies by Portland Water Bureau forecast a warming trend of about 1.5 ° C for the decade beginning 2020 and about 2.0° C for the decade beginning 2040. Though it is likely that the total amount of water that falls will not change appreciably, this warmer weather will mean that water that is now stored as snowpack during cold, wet seasons (and therefore available for use during the warmer drier months) will no longer have as much storage capacity and streamflow fluctuations will be greater than now. Summer flows will be decreased at the same time that higher temperatures are likely to create increased demand for water.

These climate changes are very likely to have an impact on local drinking water systems, particularly those like the Clackamas River, where summer water supply is dependent on snowmelt for filling streams and replenishing underground springs, and the Willamette River where the water behind the dams is replenished by melting snowpacks. The Bull Run watershed is also likely to become a more rain-driven system, experiencing lower late-spring and summer flows than now. Since the Tualatin/Trask system is already about 99% rain-dependent, it is not likely to experience the same changes. Most water providers will need to take measures to increase conservation, particularly in the summer, and to increase storage in reservoirs or aquifers.

On the Clackamas River there does not seem to be scope for large additional raw water storage. Increasing storage at Timothy Lake has been rejected as a possibility by Portland General Electric (PGE). In an April 2003 scoping document for Clackamas basin hydroelectric projects, the Federal Energy Regulatory Commission (FERC) says that the average water yield in the upper Clackamas basin is "essentially captured by the current design and operation of Timothy Reservoir." Thus Aquifer Storage and Recovery (ASR) for treated water may become necessary in the future. Although Clackamas River Water (CRW) has been experimenting with an ASR well, ASR in the Clackamas Basin is still in the development stages.

Meeting the Costs

The cost of water infrastructure is high. There are four methods of financing capital costs.

- The first method is the sale of bonds backed by income, or general obligation bonds, which are backed by the full faith and credit of the governments' taxing authority.

- The second financing method is the system development charge (SDC). These charges are permitted by Oregon law and can be used for capital costs only. The formula for computing SDC's is very restrictive. Only new construction or enhancement of an existing system can use this money.

- The third source of financing is tax revenue. It is used less for capital construction than the first two methods since tax revenue tends to be the main source of general fund (unrestricted) money.

- The final source of income to finance a system is income from sales. Many water providers use water sales as an enterprise fund. That means that water sales pay for the costs of providing water to customers. Sales can be either bulk/wholesale or direct to customers.

The following charts show relative charges and costs for providers in West Clackamas County.

SYSTEMS DEVELOPMENT CHARGES (as of 6/03)				
Meter size	Lake Oswego	West Linn	Future West Linn Urban Area	Wilsonville[1]
5/8”	2041	2279	3105	4012
3/4”	2041	3419	4657	5967
1”	3400	5699	7763	10,036
1.5”	6802	11,399	15,526	14,622
2”	13,604	18,238	24,841	30,002
3”	32,649	36,476	49,683	60,921
4”	57,136	56,995	77,630	101,184
6”	125,156	113,990	155,260	201,630
8”	217,662	182,384	248,416	322,577
10”	340,098	284,976	388,151	574,883
Multi-family	n/a	1,611	2,195	n/a

[1] Includes meter fee

Notes:
5/8” and 3/4” meters are the most common residential meter size, although large houses with many plumbing fixtures are beginning to frequently use 1” meters

Other fees for new meters may include dig-in fee, tap fee and drop-in fee, which will add hundreds of dollars more to the charges.

Dig in fee – charge for digging around water main to place meter and water connections
Tap fee – charge for connecting meter to water main
Drop-in fee – charge for placing meter in box and connecting to house pipes

MONTHLY RESIDENTIAL WATER RATES

One unit = 100 cubic feet (or cf) = 748 gallons At $.83 per unit, 1 penny buys 9 gallons

	Population served	Base costs plus charges per 100 cf (or "unit")	Five Units	Seven Units	Ten Units	14 Units	18 Units
Lake Oswego	35,750 (as of 1/1/2003)	12.71 base cost. Plus $.83 per unit	$16.86	$18.52	$21.01	$24.33	$27.65
West Linn, via South Fork Water Board*	23,430 (as of 7/1/2002)	Base including 700cf= $11.39. $1.30 per each additional unit	$11.39	$11.39	$15.29	$20.49	$25.69
Wilsonville	15,590 (as of 7/1/2002)	Base including 400cf= $17.66. $3.29 each per next 6 units. $4.99 per unit above that.	$20.95	$27.53	$37.40	$57.36	$77.32
Rivergrove	3,700	$8.06 base cost. Every unit costs $1.34	$14.76	$17.44	$21.46	$26.82	$32.18

(as of 7/03)

*Wholesale cost to West Linn = $.55 per 100 cf

Note:
Lake Oswego's "Master Fees and Charges" describes "average" residential use for one year as 120 units, or (748 X 120 = 89,760 gallons per year)

WEST CLACKAMAS PROVIDERS

LAKE OSWEGO

Summary:

1. Lake Oswego has a well-run municipal water system that meets current needs.

2. There are points of strain in the system. Even now, peak demands must draw on stored water. At times water must be pumped through large transmission lines faster than is recommended to satisfy demand. Other parts of the system will reach capacity within a few years.

3. Although future population growth will be moderate unless part of the Stafford Triangle is served, growing demand will make capital improvements necessary.

4. There is limited untreated water storage on the Clackamas River for municipal purposes. The river flow is largely dependent on snowmelt and thus vulnerable to global warming.

Background

The City of Lake Oswego serves a population of about 38,000 as well as several small wholesale customers located within or adjacent to the City's Urban Services Boundary (USB). Lake Oswego's original municipal water supply came from wells. Later, as Lake Oswego grew, extra water was piped from Portland down Highway 43. In the mid-1960's groundwater quality became a problem. Since 1967-1968, Lake Oswego has used the Clackamas River as its water source, keeping one well on Iron Mountain Boulevard for emergencies.

Population boomed in Lake Oswego in the 1950's, averaging almost 17% growth per year. Growth has slowed steadily since then. In the 1990's the City averaged less than 1.5% annually. Lake Oswego and its Urban Service Areas (USA) are thus approaching what is called buildout or the population assumed when the area is completely developed according to current zoning and land use regulations. In 2020, the population is projected to be 45,000. Buildout within the USB is projected to be 47,500-50,000.

However, Metro has identified the Stafford Triangle, adjacent to the USB as a possible area of future growth. The 2001 Lake Oswego Master Plan treats 1200 acres of the 2,000 acres of the Triangle separately within the plan in terms of population and cost projections. An additional population of 4,800 to 14,400 could be served in the Stafford area by 2020, which also could be buildout.

Total buildout for the current USA and Stafford would therefore be from 52,300-64,400.

Water Demand

The term "demand" refers to all the water requirements of a water system including domestic, commercial, municipal, industrial, irrigation, institutional uses as well as unbilled, unmetered, and unaccounted-for water. Losses are generally attributed to unmetered use, leaks, and inaccurate meters. Acceptable maximum water loss standard for the industry is 15%.

Lake Oswego maintains wholesale water contracts with eight water districts and cities, including Tigard and Portland. Water consumption by wholesale customers is recorded monthly and therefore daily use records are not incorporated into Lake Oswego statistics. However, most of the ultimate customers are residential. (See Small Water Districts p. 25) Five out of the eight wholesale users, Glenmorrie, Skylands, Alto Park (Portland), Hidalgo (Portland) and Arrowwood (Portland), as a group, consume less than one per cent of production. Rivergrove has an emergency agreement that is rarely used. The Lake Grove Water District operates under a surplus supply agreement. It has consistently purchased 0.2 to 0.3 mgd annually. Tigard's annual demand has dropped from a five-year high of 4.5 mgd to nothing.

Evaluation of the Current System

Lake Oswego

Distribution System Water Quality

As a public water supply system, Lake Oswego is required by the Oregon Health Division to monitor and report results for over 100 regulated and unregulated inorganic and organic compounds Routine samples of finished water have been analyzed for various pesticides, all of which were "below detection limits" Test results indicate that all regulated compounds have been "below detection limits". (See Chart 5-3)

TABLE 5-3.

COMMUNITY WATER SYSTEM MONITORING REQUIREMENTS

Parameter	Frequency
Inorganics	Yearly
Turbidity	Every 4 hours
Nitrate	Quarterly
Synthetic Organics (SOC)	Every 3 Years
Unregulated SOC	Every 3 Years
Volatile Organic	Every 3 Years
Unregulated VOC	Every 3 Years
Trihalomethane	Quarterly
Radiological	Every 4 Years
Lead and Copper Rule	Yearly

Lake Oswego Water Master Plan, page 5-7
Section 5 – Existing System Description
Final Report 2001

VOC is volatile organic compounds SOC is synthetic organic compounds Both are defined in the Glossary on pages 33-34

Table 5.3 shows the required testing and time periods for that testing. Only 10% of pesticides are currently covered by testing. Water quality reports are done for all municipal water providers. Each household in a provider's area receives a copy of the water quality report. Copies of the same information are also available online at the Oregon Health Division's website.

The Distribution System

Lake Oswego's water system has complexities caused by topography and distance. Raw water is pumped from the Clackamas River, 10 miles away, then piped under the Willamette River to a treatment plant located nearly eight miles from most of the service area. As a result, the distribution system has 19 pressure zones with additional sub-zones to deal with the topography and land uses. Elevation varies from 30 – 1000' above sea level. There is a total storage capacity of 27 million gallons in 17 storage reservoirs (five of them dating from before 1970). All but two are buried which reduces the visual impact and the threats from earthquake and terrorist attacks.

Storage capacity is important because stored water serves three major purposes.

- First, it can be used to smooth out the peaks and valleys of fluctuating demand, so that finished water production can also be more level. This means that capital investment in the system can be held down until peak demand outgrows the ability of parts of the system to deliver. Equalization or peaking storage should equal 25% of an average peak demand day-currently about 3 mg.
- Second, storage for fire fighting (Average Peak Demand or APD) should, as a whole, equal the ability to pump 3,000 gallons a minute for four hours (720,000 gallons) on location at 20 psi (pounds per square inch). This is a state requirement. There are upward variations in requirements based on the size, use and complexity of a specific site or sub-zone. Current total fire-fighting requirement is 11.3 mg.
- Third, there is storage for emergencies. The state recommends storing at least one average day's demand (ADD). Currently the City has about 12.4 mg or about 2 average day's supply (which may be less than demand on one peak day).

While overall numbers may be good, the zones and sub-zones will all have different requirements, which means that local improvements may be necessary. As buildout approaches the capacity of the system will have to increase.

Conservation

The City conducts numerous programs encouraging water conservation in terms of education and reporting. The city plumbing code requires low flow fixtures for new construction and retrofits. It has an aggressive leak detection and mains rehabilitation program. (However leakage while less than the acceptable 15%, is still relatively high at 13.4%) The City spends about $500,000 a year to replace and upgrade waterlines. It has not implemented inclined or inverted block rates that encourage conservation by charging incrementally higher rates for greater water use above a certain amount. Nor does it have any dual metering in place for large users of outside water. It does, however, meter water used for public purposes, like parks and fire fighting. According to city

figures, if residents reduced summertime usage by 10% the city would save one million gallons per day. This equals the volume of a swimming pool 267' long x 50' wide x 10' deep.

Lake Oswego - Problems and Prospects

The 2001 master plan rates the various components of the water supply system as being in good order subject to ongoing maintenance and replacements.

One problem is growth and the peak day supply. The current peak day demand is about 12.4 mgd, with some days significantly higher. The peak day demand is projected to increase to 20-24 mgd by 2020 and could reach 26 mgd if Stafford is developed. Major wholesale water sales are not included in these projections. The capacity of various major parts of the water system is already stretched during periods of peak demand Thus far shortfalls in production can be made up by using treated water from the reservoirs, because the shortages are only for short periods.

- The raw water intake: The firm capacity of the intake facility is estimated to be 14.7 mgd with some reserves. It is estimated that demand will overtake capacity by about 2009. The actual intake itself was expanded and fitted with EPA approved fish screens with enough area to divert up to 32 mgd in 2002.

- The raw water treatment pipe under the Willamette River can comfortably transport about 13 mgd. In 2020 and at buildout, water would have to be pumped through faster than is recommended in order to provide enough water. This would put extra strain on the intake and pumps and could cause failure.

- The water treatment plant now has a capacity of 16 mgd. Built in 1967, expanded in 1980 and upgraded in the late 1990's to comply with new drinking water standards (at a cost of about 5 million dollars), the plant has to stretch production at times to meet peak demand.

- Finished water pumping equipment could have a capacity of about 20 mgd but there would be little backup available for repairs and servicing. Lake Oswego is already exceeding the firm capacity of the finished water transmission line that has a capacity of only 10 mgd if the standard water flow speed criterion is met.

The second problem is that of emergency supply. Lake Oswego has four intertie locations plus one small well (0.2 mgd). The original pipeline from Portland along Highway 43 could provide 1 mgd. An intertie with Tigard at SE Bonita and SW Bangy Road could provide about 1 mgd. They are termed operational but would need renovation before they could actually be used. A small intertie between Lake Oswego and Tualatin exists, but its elevation precludes receiving water under most conditions. The main (and only immediately useable) intertie is the one between Lake Oswego and West Linn/SFWB at Robinwood, with a design capacity of 5.4 mgd.

Thus the current emergency water supply is 5.6 mgd or just under one average day's supply. Upgrades have been completed and a new Intergovernmental Agreement (IGA) approved replacing the original 1984 IGA. Projections suggest that an emergency intertie capacity of 12-13 mgd) would meet future average day demands.

Third is the problem of growth. Moderate growth to buildout will require system expansion as various parts of the system reach capacity. If part of the Stafford Triangle is added, the demand for water and the capital costs of providing it will increase. (Fig. ES-1 and ES-2 Projected Peak Day Demand with Stafford vs. Peak Supply Capacity) A partial solution to the costs might be a cooperative venture. Montgomery Watson Harza prepared a supply evaluation matrix (Figure ES-4) and a summary of costs for 10 mgd of additional water from five possible sources for the 2001 master plan (ES-5). Estimates varied from 18.3 million dollars to 30.1 million dollars. Because of the lack of surplus water at peak times, large wholesale contracts would not be possible either. A shared capital and operating cost program with a customer might be possible. Tigard, a previous wholesale customer, has declined such an arrangement.

Figure ES-1
Projected Peak Day Demand vs. Firm Supply Capacity (USB + wholesale demands)

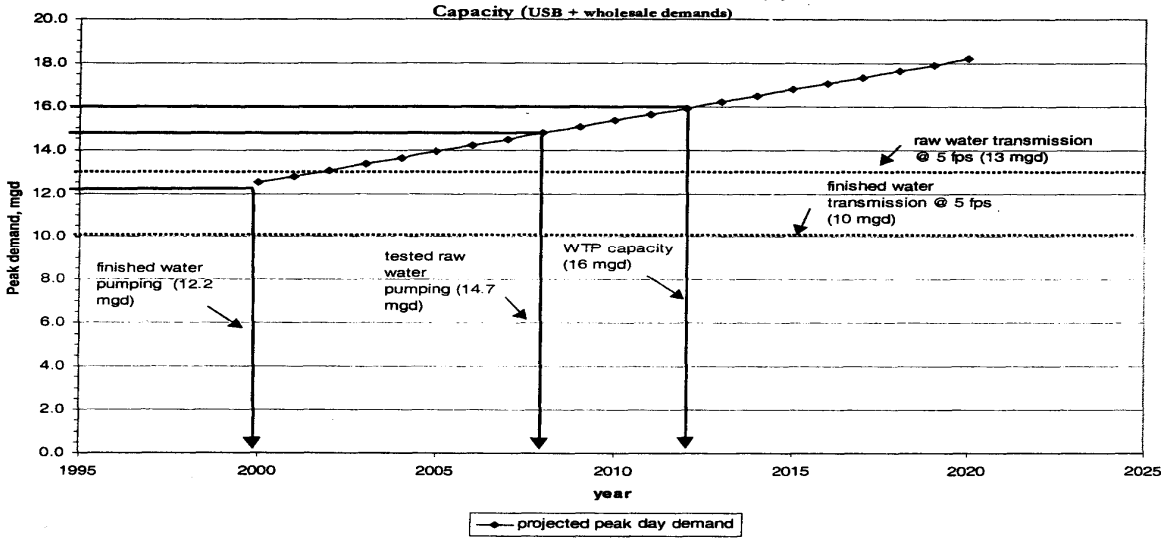


TABLE ES-2
CITY OF LAKE OSWEGO
PROJECTED DEMANDS WITHIN THE USB

	2020	BUILDOUT
Population	45,000	50,000
Peak Day Per Capita Consumption (gpcd)	380	380
Average Day Per Capita (gpcd)	180	180
Peak Daily Demand (mgd)	17.1	19.0
Average Daily Demand (mgd)	8.1	9.0

TABLE ES-4 SUPPLY EVALUATION MATRIX					
CRITERION	Expand Existing LO WTP	Joint LO/SFWB Expansion	Willamette WTP	City of Portland	Joint Expansion with Other Clackamas Basin Providers
Certainty of supply	H	H	H	M	M
Water quality	H	H	H	H	H
Reliability	H	H	H	H	H
Ease of implementation	H	M	M	M	M
Consistency with regional planning	H	H	M	H	H
Compatibility with existing facilities	H	H	L	H	M
Ability to isolate Stafford costs	M	M	H	M	M
Ownership/agreements	H	M	M	L	M

Ability to meet criteria:
H = high M = medium L = low

Note: comments below are from Clackamas County League of Women Voters

Certainty of supply: may be affected by global warming
Water quality: may be affected by improved testing for pollutants and future fluctuations in flow caused by global warming
Reliability: short-term disruptions in supply, such as power outages, storms, contamination or natural events
This matrix was done before the Wilsonville water treatment plant came online

Table ES-5

SUMMARY OF COSTS FOR 10 MGD OF ADDITIONAL SUPPLY

($ millions) as of 2000

COST	SOURCE OPTIONS				
	Lake Oswego WTP	**SFWB**	**SFWB with Tigard**	**Willamette WTP**	**Portland Wholesale**
Capital	23.5	18.4	14.5	15.7	3.1
20 Year O & M	6.6	3.7	3.4	6.6	15.2
Total	**30.1**	**22.1**	**17.9**	**22.3**	**18.3**

O&M = Operation & Maintenance Costs
Preceding four charts from Lake Oswego Master Plan, Executive Summary, 2001

SOUTH FORK WATER BOARD (SFWB)

Summary:

1. SFWB governance is an IGA with two equal participants, West Linn and Oregon City. Equal participation has in the past and may in the future result in stalemate when goals and philosophies of growth differ. Without some means of resolving issues, such as rates and production capacity, SFWB's financial stability and its ability to serve its stakeholders can be impaired.

2. SFWB decided in its 1999 Master Plan that only one major wholesale customer, Clackamas River Water-South (CRW-S) fits into the long-term picture. However, there is currently no contract with CRW and negotiations have stalled. Also there is the possibility that CRW may by-pass SFWB and serve CRW-S directly. The loss of 20 to 30 percent of its revenue might precipitate a major recalculation of rates and operating costs.

3. SFWB is in better shape now after several years of fiscal and physical renovation, than it was previously. Improvements to clearwell (disinfection) capacity are needed to smooth out production lows during periods of turbidity. Some upgrades are needed to comply with new state and federal mandates too.

4. With two cities to serve, estimates of population changes and the timing of buildout may be difficult to determine. Ample water rights exist, though system expansion would be necessary to fully use all of these rights.

5. SFWB has very limited treated water storage, leaving it to Oregon City and West Linn to develop storage for their separate needs. This simplifies operations and reduces costs, but may need to be modified in the future.

6. SFWB's only emergency backups are other Clackamas water providers. If an incident shuts down the Clackamas River for a long time, only limited help would be available.

Background

The South Fork Water Board has been supplying water to Oregon City and West Linn since 1915 from the Clackamas River Basin.

The SFWB system is based on five water rights on the Clackamas River system that were originally held by Oregon City. They are the most senior municipal rights on the river system except for a small intervening right held by Gladstone. They all predate major instream rights held by the Oregon Water Resources Division. Presently the SFWB has the right to withdraw up to 42.6 mgd at its intake. The SFWB has applied to the ORWD for alternate points of diversion for three older rights on the South Fork and Memaloose Creek. If these applications were to be approved, the total actual maximum withdrawal rate at the intake based on all five rights during low flow periods would be 51.71 mgd. (See Appendix A)

Structure

In 1915, when the SFWB was organized, West Linn had a one-third share in the project. In 1996, an inter-governmental agreement (IGA) was signed between Oregon City and West Linn making them equal partners, with equal Board representation of three members each. Councilors and commissioners are appointed by the respective mayors. Chairmanship rotates between the two cities

on alternate years. There are two advisory committees. The technical advisory committee consists of the two city managers and their staff. The citizen's advisory committee meets once a month and is comprised of neighborhood association representatives, interested citizens appointed by the city councils and an industry representative. The Oregon City Finance Department handles accounting, funds handling and payroll/benefits for SFWB. The even voting split between the two partners has been obvious on occasions where philosophies on urban growth and spending money have differed.

The treatment plant was built in the late 1950's, upgraded extensively in the mid-1970's and again in the 1990's. In 1994 SFWB sold bonds to pay for the construction of a new raw water intake, transmission line installation and upgrades to the Division Street Pump Station where the lines to Oregon City and West Linn divide.

A Master Plan was done in 1997. It is currently being revised and should be done in 2003. Some of the needs set out in the 1997 Plan have not yet been met. These include replacing the raw water transmission line, expanding the raw water pump station, and replacing part of the main transmission pipeline. Questions about plant storage needs and a 10 mgd plant expansion remain to be addressed in the plan update.

Demand and Demand Projections

Since 1991, the total average annual demand supplied by the SFWB system to all of its customers has ranged from 6.6 to 8.5 mgd. The maximum monthly demand has ranged from 9.3 to 13 mgd over this period and the peak day demand was 18.34 mgd. The current peak day supply capacity of the SFWB is about 20 mgd.

Water demand projections in the 1997 master plan estimated 2015 peak day water demand as high as 36.7 mgd, if CRW-S remains a customer or 21.7 mgd for just West Linn and Oregon City. Revised population estimates coming after the 2000 census figures became available, a more restrained attitude towards growth in Oregon City and the continued desire in West Linn to have growth pay for itself probably makes this demand projection higher than it will be in the newly revised 2003 plan. With 42.6 mgd available now from its water rights now and 51.7 mgd potentially available, there is surplus water available for some time to come. (However the treatment plant would need expansion as peak day demand reached roughly 20 mgd). Expansion could be delayed by imposing conservation measures along the lines of Wilsonville and/or imposing a building moratorium. Obviously an intermediate step would be to stop selling water to CRW to serve CRW-S.

Wholesale Water Rates

Currently, water rates for Oregon City and West Linn are about the same. Oregon City is normally a somewhat higher volume consumer (54%) than West Linn (46%) if considered as 100% users. Rates have not changed much since 1996. However, SFWB has one major wholesale customer, serving the southern district of Clackamas River Water, CRW- South, or the Clairmont area of Oregon City. In the last three years CRW has provided about 20% of SFWB's annual revenue of about $2.9 to $3 million. The rate charged CRW is somewhat higher than that charged to Oregon City and West Linn. Usually it is governed by a contract. However, there is currently no contract and SFWB is supplying water as needed at a much higher rate. Contract negotiations have been protracted. If CRW decided to seek water supplies for Clairmont elsewhere, causing SFWB a 20% revenue drop, West Linn and Oregon City water consumers might be facing a change in rates.

Emergency Backup

Emergency back up water supply relies on other Clackamas River water providers, that is, CRW and Lake Oswego, and the treated water stored at the plant and in Oregon City and West Linn.

WEST LINN

Summary

1. West Linn lacks a substantial commercial and industrial base to share the costs of utilities.

2. West Linn's primarily residential ratepayers feel the cost pressures of providing service, and are reluctant to systematically adjust rates or pass levies. The costs of providing for urban growth are a particular sore point.

3. Over half the distribution system is old and/or made of out-dated materials and should be replaced.

4. The question of what constitutes adequate treated water storage needs to be resolved. In addition, its largest and oldest reservoir despite multiple renovations, will need replacement in the not so distant future.

5. Given improvement, the system can be made to serve build-out.

6. West Linn has good ties now with Lake Oswego for emergencies, but does not have, (along with Oregon City and SFWB) a sizeable alternative to Clackamas River water. Emergency storage is barely sufficient in parts of West Linn

7. Major parts of West Linn's system are vulnerable to mudslides and, to a lesser extent, earthquakes.

The Distribution System

West Linn's distribution system, like Lake Oswego's, faces topographical challenges. The finished water transmission pipe runs downhill in Oregon City through a mudslide zone, across a bridge to the main pumping and storage area, and to Bolton Reservoir which has lost part of its capacity due to changes made necessary by past mudslides. Both the I-205 bridge and main transmission pipe have received seismic upgrades. However, the pipe is more vulnerable than one underground. Then water must be distributed and stored in an uphill area as well as the flatter areas surrounding the uplands. Like Lake Oswego each of the resulting zones and sub-zones have have its own peaking and pressure requirements as well as requirements for fire flow and emergency storage. The state of a zone may be quite different than the overall view. Population growth is concentrated in the areas most difficult or distant to reach.

Emergency Water Supplies

The intertie with Lake Oswego's Robinwood water treatment plant was built in 1984. An intergovernmental agreement (IGA) to operate and maintain an intertie designed to provide 5.4 mgd to West Linn. In July 2003, West Linn, Lake Oswego and SFWB signed a new IGA which

recognizes recent upgrades in the intertie pump station so that now West Linn can rely solely on Lake Oswego water when the 24" transmission line is shut down for repairs. Lake Oswego, South Fork Water Board and West Linn shared the costs in proportion to benefits received. The intertie new consists of an 18 inch diameter transportation pipe and two pumps. The largest pump can process 3.6 mgd by itself or somewhat more than the average day demand.

Emergency use is defined as system failure or an event affecting water quality, which is a threat to customer health and safety. Emergency use specifically excludes low water pressure or low volume at peak use when the system is functioning normally.

The quantity to be supplied is limited to the maximum feasible as long as supplying water is not detrimental to suppliers' own water system. No resale of water (wholesaling) is permitted without prior written agreement.

If the intertie is to be used for more than two weeks, both city councils must approve. For less than two weeks, staff must give written approval.

The intertie now consists of an 18 inch diameter transmission pipe and two pumps. The largest pump can process 3.6 mgd by itself, or somewhat more than the average day demand.

The useable stored water capacity of 5.5 mgd exceeds the overall fire use requirement of 3.5 mgd. However, fire flow requirements are broken down by zones based on land use and based on using only a fraction of the water demanded on a peak use day. An examination of the current master plan shows that West Linn probably has areas where the emergency water supply is less than, or barely reaches, one average day's demand once peaking and fire storage are subtracted.

Problems

Despite considerable improvements to the system in the 1990's, as the result of the voters approving a capital levy, a number of problems remain.

- The first problem is the reservoirs - size, age, and location. The treated water reservoirs are not completely underground which is the safest place. The six reservoirs except the oldest, Bolton Reservoir, are above ground. Bolton Reservoir (1913) which is in the ground, is the largest. It is located in an area of landslides. It holds 2.5 million gallons, of which only 2 million is accessible because of the location of the current intake/outtake pipe. An earlier connection had to be abandoned because of a mudslide, leaving half a million gallons of the reservoirs' original capacity unreachable. Over the years, Bolton has been repaired, relined and covered, but it does not have the fuller protection that more modern completely buried storage tanks possess. Its remaining useful life is about 20 years. The single tower reservoir, Rosemont, with a capacity of 0.4 million gallons is the most exposed. Four of the storage facilities hold less than one million gallons, which is considered the smallest efficient size today. Three of the four are on top of the hill. Four of the reservoirs were built prior to 1975, including the three largest.
- Second, much of West Linn's distribution system is old or constructed of outdated materials. (See Table 2, pg. 3) 57% of the system was installed prior to 1980, about 18% before 1970.
- Third, there is debate within the community about growth and the costs of growth i.e. how to distribute the costs of growth. Costs fall heavily on the residents. (See table pg. 10) Voters have proved to be reluctant to approve rate increases and levies for capital improvements. This reluctance is reflected in the views of the city council.

- Fourth, and directly related to distributing the costs of growth, is the question of system capacity. What infrastructure is necessary to supply present and potential needs without encouraging costly development? Does excess water storage capacity encourage urban growth? What is excess capacity? The present city council seems to want to look at the big picture outlined in the water master plan, especially at the storage recommendations and at any other proposals that might cause rate increases, before proposing rate changes. For example, the 1999 master plan recommended a five-year capital maintenance program costing about $4.75 million dollars to be funded by the current customers. At that time it would have represented a total of about $678 per household or $136 a year ($11 a month) averaged over 5 years. Some of the recommendations were not carried out, particularly those related to storage. Meanwhile West Linn has grown.
- The fifth problem is the emergency water supply. Given the shortage of stored water the importance of emergency tielines increases. While the emergency tieline with Lake Oswego can meet requirements for an average use day in West Linn, there are limits as to the volume that can be transferred during peak use days which would tend to be the same for both cities. West Linn would suffer if the Clackamas River could not be used as a water source for an extended time, i.e. longer than several days. Lake Oswego would be hard put to supply its own hookups with enough emergency water through its ties to Tigard and Portland. According to the 1999 master plan, the facilities vulnerable to the 100 year seismic event are the Willamette River crossing, and two of the smaller reservoirs. The reservoirs could be out of service for several weeks and the crossing could be out of use for months. Lake Oswego's main transmission line is underground and thus less likely to be damaged in an earthquake, but the intakes are close together and could suffer simultaneous damage. The feasibility of various regional transmission plans hinges on funding the capital costs to maintain and upgrade parts of the Bull Run system and to install key major pipelines elsewhere in the metropolitan area. Estimates for any major phase rapidly reach hundreds of millions of dollars, whatever the plan. Expanding alternate large volume water sources outside of the Clackamas River for Lake Oswego and West Linn or SFWB seems a distant possibility at present.

WILSONVILLE

Summary

Wilsonville provides a different chapter among West Clackamas County water providers.

1. Its source is the Willamette River, not the Clackamas River.

2. Its ties lie with Tualatin Valley Water District. In 1975 TVWD granted 20 mgd of its unused 150 mgd Willamette River water rights to Wilsonville. Since then TVWD has continued to get its water from the Bull Run and Tualatin/Trask systems. While not using its remaining 130 mgd Willamette River water rights, funding excess capacity in the Wilsonville water treatment plant has been sufficient to satisfy the Oregon Water Rights Division as to intent to use for purposes of retention.

3. Unlike the public's general satisfaction with Clackamas River water quality, there is unease over the water quality of the Willamette River, both before and after treatment, among a large segment of actual and potential users. This uncertainty has prevailed over the desires of various city councils to

acquire water rights from Tualatin Valley Water District in exchange for using treated Willamette River water and the TVWD Board itself.

4. Wilsonville has ample water for build-out and emergency purposes. Most of its distribution system does not need modernization.

5. The water treatment plant itself is currently under the contract management of a large US corporation owned by a French holding company. However, ultimate control and responsibility for the system remains with the City of Wilsonville.

6. Before the new water treatment plant opened, Wilsonville had to deal with a long-term water shortage. This led to the use of conservation measures in pricing and metering that other West Clackamas County providers have not been forced to institute, although some constraints have been relaxed now.

7. Due to lack of wholesale customers, Wilsonville's water rates are high, although about one-half of the capital costs were borne by others.

History of the Water Treatment Plant

In the early 1990's, Wilsonville had to deal with a prolonged water shortage as the water table of the Troutdale Aquifer which supplies water to Wilsonville's wells, dropped and volume became insufficient to deal with expanding demand. Shortages, especially during the summer peak use period, led to the adoption of strong conservation measures. These include restrictions on outside watering, separate metering (and pricing) for outside use, and inverted block pricing for both inside and outside use, that is, the cost increases as the volume used increases.

In January 1998 a moratorium was declared on new construction. Once the moratorium was declared, under State law Wilsonville had two years to find a solution to its water needs. In September 1999, Wilsonville's voters approved a $25,000,000 revenue bond issue to fund its share of the construction of a Willamette River water treatment plant.

Financing Treatment Plant Capacity

Tualatin Valley Water District (TVWD) and Wilsonville are closely tied together with respect to Willamette River water rights. In 1975 Tualatin Valley Water District applied for 150 mgd of Willamette River water tights in order to secure ownership of its own water at some future time. Shortly thereafter, Tualatin Valley Water District transferred about 20 mgd of its unperfected rights to Wilsonville.

By about 1994, the City of Tigard also entered into testing and promoting the use of Willamette River water with the help of Montgomery Watson, the engineering firm that eventually built the plant. Towards the end of the 1990's Tualatin Valley Water District formed a coalition of water providers called the Willamette Water Supply Agency (WWSA). The original members were TVWD, Tigard, Tualatin, Sherwood, Canby, Clackamas River Water (CRW) and Gladstone. These members were promised water rights contributed by Tualatin Valley Water District in exchange for using water from the expanded version of the treatment plant. Wilsonville was not a coalition member because it already had its own water rights. The yearly budget was about $160,000 with Tualatin Valley Water District providing about one-half the budget.

Most of the city councils voted in favor of using treated Willamette River water in their systems. The momentum was such that a detailed alternative plan for the southwest suburbs to join together in buying and transmitting water from the Bull Run system was largely ignored by the city councils when it was proposed in 1998. The councils' concerns were centered around the opportunity to own their own water rights.

Controversy Over Using Treated Willamette River Water

Citizen opposition to using treated Willamette River Water quickly developed. This opposition shaped the final capacity of the treatment plant as well as its potential customer base. Citizen groups opposing the use of treated Willamette River water quickly formed in Wilsonville and Tigard, followed by Tualatin and Sherwood and eventually within the Tualatin Valley Water District. Two initiative petitions reversed revenue bond measures that aimed at providing funding for water distribution systems and for Wilsonville plant capacity. Four additional initiative petitions brought about city charter amendments requiring citizen approval before treated Willamette River water could be added into local municipal water. Another initiative petition requesting a similar ordinance for TVWD eventually resulted in the TVWD commissioners approving the ordinance themselves. Portland City commissioners also have passed resolutions forbidding entry of treated Willamette River water into the Bull Run system.

The ultimate purity of drinking water processed from the treatment plant was a motivating concern for the public, but not the only one. As time went on, opponents raised questions about the accuracy of some of the information provided by some of the interested parties regarding the quality of water testing at various levels and the costs of the system. There were further questions about whether there had been full compliance with various regulations and due process on the part of all concerned. In the spring of 2003, TVWD hired Environmental Standards of Valley Forge, Pennsylvania to determine whether appropriate testing of Willamette River water was conducted, and whether state and federal standards were strictly followed, so that the proper treatment process was selected for the plant.

The Outcome

Wilsonville wound up paying for roughly one-half the total cost of about 47 million dollars for the new treatment plant and related improvements. That is, Wilsonville paid for 20 mgd of capacity at a cost of about 23.5 million dollars while the Oregon Department of Corrections contributed 6.4 million dollars towards the costs of providing water for the new prison and Tualatin Valley Water Distract paid 17 million dollars for excess capacity in the plant and the water intake with a view to eventually using some of its 130 mgd rights for Willamette River water. This investment also satisfied OWRD requirements that TVWD show some concrete interest in developing its Willamette water rights.

Mostly as a result of citizen activism, there are presently no wholesale customers for treated Willamette River water. No large distribution system connects or is proposed to connect Wilsonville to the rest of the metropolitan area distribution system, particularly to the southwest areas of Clackamas County (which includes the Stafford Triangle) and southeast Washington County, which are geographically and in terms of potential population growth, the nearest potential customers. TVWD is receiving neither interest on its 17.5 million dollar investment nor water. A smaller Willamette Water Supply Agency is looking at other options for a mission.

The Treatment Plant Today

Questions of Water Quality

Wilsonville's water source continues to be a source of controversy. On April 29, 2002, Wilsonville's new water treatment plant, located less than a mile west of the I-5 bridge, began operations. According to the 2002 Annual Water Quality Report the treatment facility is "over-designed" in the sense that drinking water standards could often be met without using all the steps in the extensive treatment that the plant uses at all times.

The 2002 Report states that prior to bringing the facility on-line, an independent lab analyzed the quality of the finished product and determined that the water easily met and surpassed current drinking water standards.

The water is tested frequently by an independent laboratory used by numerous other local water districts and has easily met current drinking water standards. US Filter, the plant operator, also has a corporate lab that performs tests nationwide. There is continual computerized monitoring of the treatment process using SCADA (supervisory control and data acquisition) as there is at SFWD and Lake Oswego.

In addition the plant has redundant, or back-up, components for all these processes as well as an emergency generator and 2.7 million gallons of storage for treated water (about one average day's supply). Of the four pumps currently in use, three have a capacity of 7.5 mgd, while the fourth has a capacity of 4 mgd. That is, only one pump could supply current demand most of the time.

Plant Operation and Contract Management

The plant is under the supervision of the Director of Public Works. However, US Filter Corporation has a five-year contract with the city to operate the plant. The plant manager reports directly to the both the Director of Public Works and to US Filter. The contract may be cancelled without cause at any time by the city, after giving due notice. The contract has three parts dealing with operating costs.

- Fixed costs. For example this includes salaries for employees, office expense, and insurance.
- Capped costs. Other costs have a set maximum. Any savings are shared. Overages are the responsibility of US Filter. Laboratory monitoring is the biggest cost in this area.
- Pass-through costs. These are paid directly by the city. They are variable and basically outside of the control of the plant operators, the largest being chemical and electricity costs.

The plant has been operating for too short a period to determine whether it is operating at a return on its true economic cost. It is certainly, operating way under current capacity. Currently it is the ratepayers of Wilsonville who benefit because the water rates do not reflect nearly one-half the cost of the new plant. TVWD is receiving no return on its substantial investment except for having demonstrated to the OWRD its interest in its water rights.

Distribution System

Being a relatively new and growing town, most of Wilsonville's transmission and distribution system has been built within the last 30 years, meaning that there is little to be upgraded. There are four reservoirs totaling 7.95 million gallons in storage in addition to the 2.7 million gallons stored within the plant or a total of nearly 10.7 million gallons.

Emergency Supplies/Storage

Meanwhile Wilsonville has plenty of water for present and immediate future. In addition, the eight wells that served Wilsonville for water until the new treatment plant opened can provide enough backup water for emergencies. The water table is gradually rising in the wells now they are no longer being used as Wilsonville's water source, but it will be years, if ever, before the level is completely restored. Meanwhile they are classified as groundwater limited by the OWRD. Aquifer Storage and Recovery (ASR) may be a possibility, but it has not been decided whether it would be better to go to ASR or just increase plant production. Currently, at the lowest river flow, intake is less than one percent of the river's water volume.

SMALL WATER DISTRICTS

Summary

1. Increasing governmental regulation and increased costs make their future prospects doubtful.
2. Some small districts especially in rural areas will continue since few other options exist. In more urban areas, they most likely will be absorbed by cities or possibly other larger water or multi-service districts.

Small water districts provide drinking water to approximately 9000 people in West Clackamas County. Those small districts vary in size and cost efficiency. Their future is clouded and many questions need answering. This section addresses those districts and their current situations. The following table provides basic information about the small districts in the study area.

District	Population	Hookups	Location	Water Source	Governance	Interties
Glenmorrie Water Cooperative	325	130	Glenmorrie area off Hwy 43 south of Lake Oswego	Well and Lake Oswego as needed to supplement	Board elected by members of co-op association	Lake Oswego
Lake Grove WD	3300	1100	Unincorporated Lake Grove mixed with some western Lake Oswego	Portland and Lake Oswego as needed to supplement	Board elected by public vote	Lake Oswego and Portland
Palatine Hill WD (mostly serves Multnomah Co.)	1500 (500 in Clackamas County)	550	Riverdale area straddling the Multnomah and Clackamas County lines	Portland	Board elected by public vote	
Rivergrove WD	3720	1240	South of Jean Road to Tualatin River, east to Lake Oswego city limit, west to 65th Ave.	Two wells	Board elected by public vote	Tualatin and Lake Oswego
Skylands Water Co.	210	90	Off Cherry Drive between Lake Oswego and West Linn	Well and Lake Oswego as needed to supplement	Private water company	Lake Oswego
Southwood Park WD	900	297	Upper NW corner of Clackamas County	Well, backed up by Tigard Water District	Board elected by public vote	None known

As the preceding chart shows, three districts each have populations of less than 1000 people. This makes meeting state and federal mandates for drinking water expensive. System construction and maintenance, the cost of required testing and staff costs are large burdens for relatively few paying customers. None of these districts has any commercial or industrial users, only residential users to bear the cost. None of the three has any quantity of water storage available. All have small reservoirs and depend on other providers to supply any extra water they may need.

Upgrades of infrastructure are few and usually the result of state mandates. Glenmorrie and Skylands don't want new customers since this would mean additional growth in those neighborhoods and the neighborhoods are not anxious to accommodate growth. Southwood Park is completely surrounded by other municipalities and can't grow. Limited opportunities for infill exist, so the district is likely as large as it will get. Glenmorrie and Skylands share a part-time staff person who owns a full-service company serving small water districts. He also works for Lake Grove Water District. Southwood Park is serviced by Tigard Water District.

The larger water districts are in slightly better shape both financially and administratively. Rivergrove and Lake Grove Water Districts both have systems development charges (SDC's) to fund infrastructure improvements. Each has a long-term capital plan for upgrades and replacement of their systems. Indeed all of Lake Grove's pipes are ductile iron, a situation that no other city of any size in this area can match. Lake Grove has a new 1,000,000 gallon in-ground concrete reservoir. Lake Grove has paid cash for all improvements and has no debt. Lake Grove Water District has one full-time office person and one part-time field person.

Rivergrove Water District has three reservoirs totaling 1,850,000 gallons. While Rivergrove's system needs some upgrades, it has no debt. Rivergrove has two full-time and three part-time employees. One is full-time field, one is half-time field, one is half-time administrative and halftime field and the two part-time employees are office staff. Interties with Lake Oswego and Tualatin exist for emergency use, so adequate water is currently available. If large amounts of infill occur in Rivergrove, an additional well will be needed soon. Modifications to the distribution system could eliminate the need to build additional storage. Storage is expensive at $1.00/gallon of storage plus engineering and permit costs. Few reservoirs are built with less than 1,000,000 gallons capacity.

Meeting state and federal requirements are costly for larger small districts as well. They stand a better chance of long-term survival since their resources are greater. Rivergrove has a small number of multi-family residential complexes, commercial, educational and public facilities. Lake Grove serves the Kruse Way office area and has a substantial number of commercial users and business in Lake Grove. This gives them a substantial customer base no other small district in the area has.

STUDIES I, II and III

Summary

Currently, municipal water providers provide west Clackamas County consumers with ample quality drinking water. The major facilities are well run and maintained by relatively small, trained staffs.

There are present and future areas of concern, however.

- First is the matter of water supply.

The Bull Run System has enough high quality water to supply the entire metropolitan area. It is dependent on rainfall, not snow melt, which is increasingly important at a time of global warming. Missing are large pieces of the infrastructure which would store, filter, treat and transmit water to new regional consumers and increase the flow to areas which are already customers as demand increases. The City of Portland, the owner of the Bull Run system, and the other present and potential users do not agree as yet on what is needed, what the costs would be or how the costs would be allocated to create a regional system. All agree that great sums of money would be involved. Financing, control and ownership are the outstanding issues. Currently, the system can provide moderate back-up water supply to LO. It is the major supplier to the Lake Grove Water District and indirectly (via Tigard) to Southwood Park Water District at the top of Mountain Park.

The Clackamas River Basin which supplies water to Lake Oswego and West Linn is partly dependent on snow melt and therefore its flow is more vulnerable when the snow pack is down. For most of the year the water volume is ample and the quality is good. However, peak demand and low water volume coincide from mid-summer until the fall rains come. There is many-sided debate as to just how much water the Clackamas River can supply without serious damage to the natural habitat and fauna during this period.

Aquatic life has already suffered in some low water seasons. With the exception of Estacada's water intake, all the municipal intakes are close together near the river's confluence with the Willamette River. Thus, the providers will all face the same difficulties, if there are water quality or volume problems. If all peak season permit holders used their current rights completely, the summer water volume would not consistently be sufficient. However, Lake Oswego and SWFB are not currently equipped to pump, treat, and distribute their maximum water allocation.

Water storage facilities on the Clackamas River itself are limited and are primarily used to store water for electricity generation. Increasing the height of the dam at Timothy Lake, PGE's major storage area, has been discussed as a storage option for municipal water. ASR remains a possibility if suitable locations can be found, but there have only been a few attempts to do so thus far.

Furthermore, the Lake Oswego and SWFB intakes remove a sizeable volume of water from the Clackamas Basin almost entirely. Most of the run-off ultimately drains into the Willamette River and thus is not recycled for the benefit of the basin. Those concerned with the health of the Basin are very aware of this fact, particularly when the subject of big municipal water rights comes up.

The Willamette River is the third major source for municipal drinking water. The problems of partial dependence on snowmelt and low season flow/peak season demand are somewhat mitigated by a number of federal dams. The main purpose of the dams is not the provision of municipal water. Moreover, agricultural, industrial and urban pollution are always a concern. While the river has more than enough year around water for Wilsonville and Wilsonville could sell large volumes to other west side metropolitan water suppliers from its new water treatment plant, nobody wants to buy. TVWD has invested millions in the treatment plant, without a return so far, except to ensure that sufficient excess capacity has been built into the plant to provide for future needs, if consumer resistance ever fades.

Finally, groundwater from wells provides a source for west Clackamas County water providers. Wilsonville's wells, its primary source until 2002 when its new treatment plant on the Willamette opened, now provide emergency backup. Lake Oswego has one backup well. Smaller water providers like Rivergrove may use wells as a primary source. The major difficulties are the prevention and detection of pollution and maintaining use that does not threaten the water table. The water table can also be affected adversely by changes outside the control of the provider. Thus wells do not seem to be a source capable of meeting a large increase in future demand.

- A second concern is the allocation of water from the Clackamas River system.

PGE holds the most senior large volume rights on the river, but the water used for electricity generation is returned to the river and thus is available for other users. PGE also holds the right to store water at Timothy Lake where only a modest volume is allocated to maintaining stream flows during the low flow season. PGE rights most impinge on municipal rights at Memaloose Creek where Oregon City (SFWB) rights might periodically interfere with PGE rights and thus are not currently exercised. Lake Oswego and Oregon City (used by SFWB) water rights are very large and very senior and thus not directly threatened by other users and their current water rights and rights applications. This is unlikely to happen due to opposition by PGE, those with environmental/habitat concerns and to the experts' estimation that the watershed does not generate the necessary extra water volume.

The real difficulty is the relatively huge size of the municipal rights combined with their seniority. It is unlikely that Lake Oswego and SFWB could ever fully use their rights, even at projected "build-out". Thus, a portion of the rights will remain forever uncertificated (unperfected) and vulnerable to the extension process which the OWRD has just begun to tighten up for municipal right holders. More junior rights holders, particularly those concerned with recreational and instream flows, feel threatened by "excessive" municipal rights and would like some official adjustment of rights to reflect more modern concerns. Meantime, unused water is available for other rights holders. Controversy continues. Can an allocation system designed to distribute an infinite resource be adapted to a very finite world? How should adaptations be structured? Should the whole system be scrapped and one where the public good plays more importance be constructed? How should current holders be compensated for their losses? Who should participate and control the process? Meanwhile, it remains almost impossible to put a price on municipal rights and municipal rights holders remain exceedingly reluctant to give up any rights, even those that will probably never be used. Questions of how to transfer rights among holders also remain difficult.

- A third concern is maintaining drinkable water in fact and in public perception.

Wilsonville's treatment plant is new and loaded with safeguards and redundancies. Lake Oswego and SFWB treatment plants have both been greatly improved in the past five years. Wilsonville's distribution system is relatively new (30 years old or less); Lake Oswego's has been renovated for the most part; West Linn's system has been improved but over one-half of its pipes need replacing. Peak periods of turbidity can challenge both SFWB and Lake Oswego plants at present. Lake Oswego, SFWB and West Linn all face major improvements to deal with projected buildout.

The greater general challenge is detecting and containing pollutants as urban and industrial areas generating pollutants grow within the watersheds and agricultural chemicals continue to infiltrate ground water and surface run-off. Pollution prevention is infinitely more efficient than efforts to remove contaminants. It is becoming apparent that even minute quantities of certain contaminants can have negative effects. The ability to detect pollutants is limited. It is not even possible, today, to identify, let alone test for, all the possible chemical combinations and re-combinations in the pollution soup. But it has been discovered that billionths and trillionths of certain chemicals and their combinations can produce distortions in the aquatic environment.

The proposed urban growth in the lower Clackamas basin, means that prevention of contamination becomes an urgent priority. Wilsonville is an example of what happens when a very modern treatment plant meets the perception of a sizeable segment of potential users, that no current treatment can satisfactorily deal with the unknowns of the pollution soup in the raw water.

- The fourth concern is conservation - both of basin environment and of water itself.

West Clackamas County water providers, as a whole, are very aware of wastage within their systems. The major providers are proud of the fact that their wastage and unmetered uses are lower than OWRD guidelines permit. Consumer education efforts are spotty, with the exception of the mandated annual water quality reports distributed to customers. There is awareness of the need for consumer conservation education, but time and money is generally short. SFWB has funds and a dedicated staff person for public education and out-reach. However, Wilsonville is probably the best example of conservation efforts in west Clackamas County. Due to its years of water shortage and the fact the distribution system is relatively new, consumer conservation measures could be instituted with inside/outside dual meters installed as a matter of course so that different rates could be assigned for outside use and inverted block pricing was instituted. Past conservation needs and the current efforts to educate consumers about the capabilities of its treatment plant have caused Wilsonville to be continually aware of the need for public outreach. Smaller water districts have limited time and money to devote to conservation. The very smallest may not even have the funds to maintain their systems or to hire more than one part-time employee. Slightly larger systems can afford system maintenance, to monitor operations via SCADA and have one or more full-time employees, but funds are still too tight for more than the basics.

- Finally, there is the ongoing need to fund operations and infrastructure renovations and improvements.

Consumers who often are also voters fail to recognize that while raw water may be free, drinking water delivery may be increasingly expensive. This ignorance is often reflected in those selected to oversee water matters. Rates and SDC's need to be reviewed often and revised if necessary.

Major improvements require large capital sums. To obtain funds, not only must projects be planned thoroughly, but the public must be educated so the bond levies will be approved. Improvements to the SFWB, Lake Oswego and Wilsonville water delivery systems resulted from levies passed in the 1990's, but as peak demand increases further upgrades may become necessary for Lake Oswego and SFWB within a few years. In Lake Oswego and Wilsonville water rates and SDC's are frequently reviewed and adjusted as needed. SFWB has only one wholesale customer. If that customer goes elsewhere, then both West Linn and Oregon City may have to increase their water rates. West Linn also had the funds to make critical improvements as the result of a successful levy in the 1990's. However, a lot remains to be renovated and operating funds remain chronically short, as for years, city councils have been reluctant to regularly increase water rates in annual increments. While SDC's are regularly reviewed and costs assessed according to geographic areas to be served, even the highest SDC's fail to recover the true costs of serving West Linn's new expansion areas.

The feasibility of various regional transmission plans hinge on the capital costs of maintaining and upgrading parts of the Bull Run system and of installing key major pipelines elsewhere in the metropolitan area. Estimates for any major phase rapidly reach hundreds of millions of dollars.

Consensus Statements

Preamble:

The LWVCC believes that the availability of high quality drinking water is essential for the health and safety of consumers. It further believes that water policy decisions should be based on the principle that water belongs to the public and should be managed for its benefit. In keeping with this philosophy, the LWVCC supports the following statements:

1. The LWVCC feels that the process used by the US Environmental Protection Agency (EPA) in accordance with the Safe Water Drinking Act and the Oregon Health Division of the Department of Human Resources and by the Oregon Water Resources Department provides a sound approach towards ensuring sufficient water and high standards for drinking water systems. Processes should be monitored vigorously to guarantee compliance with laws. In addition WCC municipal drinking water providers should acknowledge that drinking water standards evolve over time and that it is necessary to exceed standards wherever possible in an effort to eliminate undesirable elements from water supplies.

2. Municipal water providers should maintain sole possession of sufficient water rights to adequately serve maximum estimated future needs. They should support state efforts to review and improve existing methods of allocating water including unperfected municipal water rights, now that water is viewed as a limited resource and the public interest is viewed as an interested party in the allocation process.

3. Regional water providers should continue to plan for regional municipal water needs, but the development and operation of water systems should remain under local jurisdiction. Cooperative long-term planning by the metropolitan region's water providers should help to assure a continuous, sufficient supply of highest available quality drinking water.

4. WCC water providers should actively promote reduction of in-system water wastage, including leaks and unmetered use. They should actively promote conservation by an appropriate mix of education, conservation credits, pricing, and dual metering systems.

5. WCC water providers should continue to participate in groups like the Clackamas River Basin Council that are trying to maintain and improve the Clackamas watershed and to maintain the high water quality of the Clackamas River. Similarly, where appropriate, water providers should participate in bodies trying to maintain and improve Willamette River water quality and the quality of groundwater. These concerns should include controls to protect watersheds from man-made and natural features that could adversely affect water quality and quantity such as excessive timber harvest, agricultural chemical pollution, over-development, polluted urban and industrial run-off, and contamination of underground aquifers.

6. Expenditures for short-term capital improvements are necessary increments to a well-prepared master plan.

7. Municipal water providers' master plans should be updated on a timely basis. There should be ample time for public input.

8. The governing bodies of municipal water providers should recognize that treatment and delivery of drinking water involve considerable operating and capital expense. Rates and SDC's should reflect these costs and should be reviewed frequently. A sizeable reserve fund is very desirable.

9. Water storage: The LWVCC support ASR as a cost-effective, low-visibility environmentally safe means of storing treated water where it is technically feasible. Before increasing the capability to store surface water by creating reservoirs or increasing dam heights, the LWVCC supports careful examination of regional needs, relative costs, environmental impact and the concerns of surrounding property owners, with attention paid to maintaining due process and to obtaining maximum public input.

10. Emergency water supplies: The LWVCC supports the provision for a minimum one day back-up water supply or more if so recommended by the state. It supports the development of substantial emergency water supply sources from outside the normal intake area, particularly for those with intakes on the Clackamas River.

11. Out of basin water sales: The LWVCC does not support increasing sales of water outside of the Clackamas Basin other than the historic sales to west Clackamas County rights holders, if summer and early fall water levels would be threatened especially in the lower reaches of the Clackamas River.