

RESOLUTION NO. 1266

A RESOLUTION ACCEPTING THE TROUTDALE SEWAGE TREATMENT PLANT ALTERNATIVES STUDY

WHEREAS, the City engaged the services of a consultant to examine the capacity of the existing sewage treatment plant and was advised that improvements costing approximately eight million dollars would be needed in the near future; and

WHEREAS, the Council wanted to consider other alternatives before expending such a large sum of money on the plant at its current site; and

WHEREAS, the U.S. Army Corps of Engineers had a program entitled "Partners for Environmental Progress" in which assistance was provided to local jurisdictions on a cost-sharing basis; and

WHEREAS, the City applied for and was accepted into that program for the purpose of conducting a Market Feasibility Study for the sewage treatment plant; and

WHEREAS, the City by Resolution No. 1173 adopted on May 23, 1995, entered into an Agreement with the U.S. Army Corps of Engineers to conduct the Study; and

WHEREAS, the study has been completed and a Draft Report was provided to the Council on April 23, 1996; and

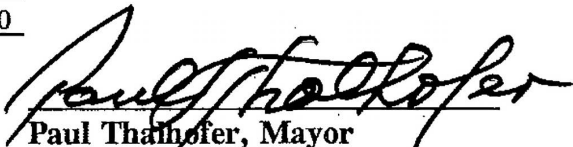
WHEREAS, minor changes were made to the Draft Report, and the report was reviewed and approved by the U.S. Army Corps of Engineers through its chain of command; and

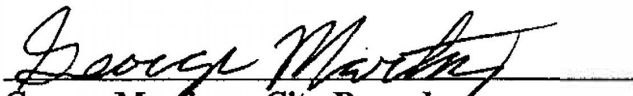
WHEREAS, the approved document has now been presented to the City as a Final Report dated May, 1996.

NOW THEREFORE BE IT RESOLVED BY THE COUNCIL OF THE CITY OF TROUTDALE

That the City accepts the "Troutdale Sewage Treatment Plant Alternatives Study Final Report" dated May, 1996.

YEAS: 7
NAYS: 0
ABSTAINED: 0


Paul Thalhofer, Mayor
Dated: 7-29-96

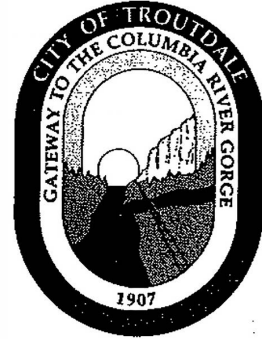

George Martinez, City Recorder
Adopted: July 23, 1996
C:PWJUL96

*Partners for Environmental Progress
Program*



**US Army Corps
of Engineers**

Portland District



City of Troutdale, OR

**Troutdale Sewage Treatment Plant
Alternatives Study**

Final Report

May 1996

Executive Summary

Authority

This Market Feasibility Study of options for sewage treatment for the City of Troutdale is a cost-sharing partnership between the U.S. Army Corps of Engineers and the City of Troutdale, authorized for the Corps by the House Report accompanying P.L. 101-514 and authorized for the City by Resolution No. 1173. The roles and responsibilities of each party were described in an Intergovernmental Agreement dated May 23, 1995.

Background

The City of Troutdale currently has a City owned and operated sewage treatment plant that exceeds its design capacity for BOD and is approaching its hydraulic design capacity for total flow. Following a 1994 study performed for the City by CH2M Hill, it became apparent that significant capital improvements would be needed. Rather than simply upgrading the existing plant at its current location in the downtown business area, the City Council asked to have a variety of options considered for feasibility and relative cost.

Alternatives

General

This study examined four possible alternatives, addressing improvements needed, order-of-magnitude cost estimates, siting, land acquisition, and other related issues. Capital costs are presented in the figure below. Each is summarized below.

Alternative 1: Improvements to Troutdale's Existing Plant

Improvements to Troutdale's existing treatment plant are a viable alternative to meet the long term waste water treatment needs of the City. The capital costs to accomplish these improvements are estimated at approximately \$8.1 million, and preliminary indications are that the improvements could be made within the existing plant property. This alternative, although the least-cost option among the four options considered, would not eliminate the odor and aesthetic concerns associated with the current plant's siting, although those concerns might be mitigated to some extent at an additional cost.

Alternative 2: Construct New Troutdale Plant

Construction of a new sewage treatment plant for Troutdale is a viable alternative to meet the long term waste water treatment needs of the City. A preferred location for such a plant would be a ten-acre site along the west bank of the Sandy River slightly north of the Portland Troutdale Airport. The capital costs to accomplish this alternative, including conveyance costs and land acquisition, are estimated at approximately \$18.4 million for discharge to the Sandy River or \$16.4 million for discharge to the Columbia River; however, the latter figure does not include any land acquisition costs or environmental clean-up that may be required to construct the 5,500-foot outfall from the plant to the Columbia. This alternative would relocate the plant from the downtown area but would not necessarily result in the closure or relocation of the adjacent private treatment facility operated by Waste Water Management, Inc. This alternative would also require demolition and cleanup work at the present treatment plant site at an estimated cost of \$595,000, which could be offset by an estimated sale price of the land and salvage value of the equipment of \$1,109,000 if the City Council should decide to sell the property.

Alternative 3: Utilize City of Gresham Treatment Plant

Discontinuance of the City's treatment plant and utilization of an expanded Gresham plant is a viable alternative to meet the long term waste water treatment needs of the City. The City of Gresham has indicated a willingness to consider such an arrangement subject to agreement concerning a number of issues such as DEQ regulation, permits, pretreatment, operations and staffing, level of treatment, and cost of service. The capital costs to accomplish this alternative, including conveyance costs and purchase of capacity from the City of Gresham, are estimated at approximately \$25.7 million. This capital cost, which is approximately 40 percent greater than the cost to construct a new plant with discharge to the Sandy River, is not offset by lesser treatment costs. Using Gresham's current rate resolution, annual Operation and Maintenance reimbursement costs to Gresham for Troutdale's current average flow of approximately 1.27 million gallons per day would be about \$830,000. This compares to an estimated \$395,000 for O&M costs at Troutdale's existing plant. This alternative would eliminate the City's treatment plant from the downtown area but would not necessarily result in the closure or relocation of the adjacent private treatment facility operated by Waste Water Management, Inc. This alternative would also require demolition and cleanup work at the present treatment plant site at an estimated cost of \$595,000, which could be offset by an estimated sale price of the land and salvage value of the equipment of \$1,109,000 if the City Council should decide to sell the property.

Alternative 4: Construct New Regional Treatment Plant for Troutdale, Fairview, and Wood Village

Construction of a new sewage treatment plant for Troutdale, Fairview, and Wood Village is a viable alternative to meet the long term waste water treatment needs of the City. A preferred location for such a plant would be a thirty-one acre (including wetlands mitigation) site west of Sundial Road south of the Troutdale Electrical Substation. The capital costs to accomplish this alternative, including conveyance costs, land acquisition, and wetland mitigation, is estimated at approximately \$24.3 million. However, that preferred site may not be available from the owner, Reynolds Metals. Using the less-preferred (for this alternative) site mentioned in section 4.5.4 would increase the cost to \$26.1 million due to additional conveyance requirements. The increase in costs for this option in comparison to the construction of a Troutdale-only plant would appear to be justified only if the other participants shared in the costs for the additional capacity. However, informal discussions with staff members from Fairview and Wood Village indicate that, since they have already purchased needed capacity from Gresham, they would not be able to purchase capacity from Troutdale unless they were to receive a refund from Gresham. An informal check with Gresham staff reveals that some refund might be possible but would involve negotiations beyond the scope of this study. This alternative would relocate the plant from the downtown area but would not necessarily result in the closure or relocation of the adjacent private treatment facility operated by Waste Water Management, Inc. This alternative would also require demolition and cleanup work at the present treatment plant site at an estimated cost of \$595,000, which could be offset by an estimated sale price of the land and salvage value of the equipment of \$1,109,000 if the City Council should decide to sell the property.

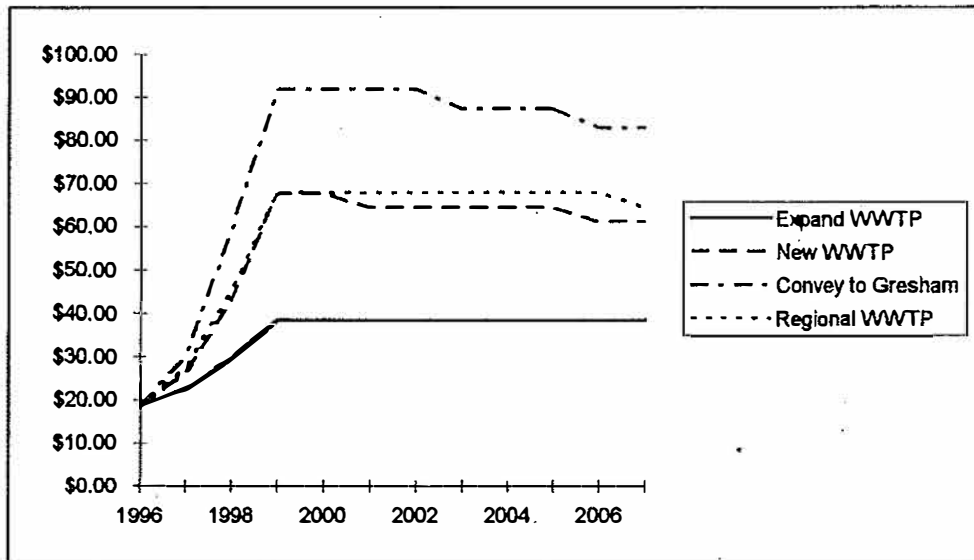
Alternative Capital Cost Estimates

Alternative	Description	Estimated Capital Cost (million \$)
1	Improve Troutdale's Existing Plant	8.1
2	Construct New Troutdale Plant	16.4 to 18.4
3	Utilize Gresham Plant	25.7
4	Construct Tri-City Plant	24.3 to 26.1

Financial Analysis

Based on a set of assumptions about economic conditions and financing, the impact of each alternative on user fees was determined. The current sewer rate is \$18.75 per month. In Alternative 1 the rate would increase each year to 1999 where it would level off at \$38 per month. In Alternative 2, the second least costly Alternative, the rate would increase and level off at about \$61 per month. Alternative 3, the most costly option, would drive sewer rates to \$83 per month. The sewer rate for Alternative 4 would be about \$64 per month by 2007. These are shown in the next figure.

Predicted Sewer Rates for Each Alternative



A variety of financing options were considered. Only Alternative 1 appears to qualify for any funding assistance, and then only from the Oregon Economic Development Department. This assistance can be secured by a revenue bond or a general obligation bond. The high cost of the other Alternatives would make them difficult to qualify for any assistance. For these alternatives it would be advisable to consider only general obligation bonds.

Private Operation

One aspect of the study was to study the possibility of private vs. public operation of the treatment plant. While such privatization is feasible, determining the cost of private operation is problematic without compiling a definite scope of work and either placing estimates on each task or submitting the work for public bidding - either approach being beyond the scope of this study. A preliminary check of other privately-operated plants would seem to indicate that Troutdale might be able to contract out the treatment part of Troutdale's sewer operation at a cost less than \$400,000. However, this estimate does not address some of the concerns associated with private operation as mentioned in Section 5.4.2. It also should be remembered that even if treatment operations were contracted out, Troutdale would still need personnel and equipment for operation, maintenance, and repair of nearly 41 miles of sewer mains and pump stations.

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1. Introduction

1.1 General

This report describes the Market Feasibility Study in which various options for the City of Troutdale's sewage treatment plant have been investigated. The study is conducted under the Partners for Environmental Progress program of the U.S. Army Corps of Engineers. The report has been jointly prepared by the City of Troutdale Public Works Department and the Portland District Corps of Engineers.

1.2 Study Authority

The authority for conducting this study is drawn from the House Report accompanying the Fiscal Year 1991 Appropriations Act (Public Law No. 101-514). This act provided the Congressional intent for the Corps of Engineers to conduct jointly financed studies in partnership with eligible non-Federal partners, including local governments and other public entities. Funding for the FY 1995 program was provided by the Energy and Water Development Appropriations Act for Fiscal Year 1995. The Partners for Environmental Progress (PEP) Program provides the mechanism for conducting these joint market feasibility studies.

1.3 Study Purpose and Scope

Troutdale, a municipal corporation in the State of Oregon with a population of about 11,500, is located in the northwest portion of the state, immediately south of the Columbia River and about 15 miles east of the City of Portland. The City-owned-and-operated sewage treatment plant is located in the downtown business portion of the City adjacent to a recently-constructed Factory Outlet Mall. Originally constructed in 1969, the plant has been upgraded over the years and now has a capacity of 1.6 million gallons per day.

This study is designed to address several concerns that the City has about the treatment plant. A plant capacity study has shown that the City's 6 percent annual growth rate over the past 5 years will probably continue and the plant will require an additional \$8.1 million of improvements in the near future. The City is interested in determining the feasibility of constructing a new facility in a more remote location away from the business area before expending such a large sum.

In addition, high operating expenses and a large debt payment have resulted in the City having one of the highest sewer rates in the area. The City is interested in evaluating privatization as a means of reducing sewer rates or slowing the growth of sewer rates.

Finally, the City discharges its wastewater to the nearby Sandy River under a permit issued by the Oregon Department of Environmental Quality. In an 18 month period in 1993 to

1994, the City failed to meet one or more permit requirements and had to place limits on the amount of pollutants some of the industrial users may discharge to the plant. The City is interested in a prompt feasibility study that will allow it to make the necessary decisions concerning future location and operation of the plant.

The scope of study includes the following:

- Analyze the costs and other relevant factors for four options: (a) improvements to the existing plant; (b) construction of a new plant away from the business area; (c) join with the cities of Fairview and Wood Village who already use the City of Gresham's privately-operated plant and utilize that facility; and (d) construct a new plant to be utilized with Fairview and Wood Village.
- Analyze the costs and other relevant factors for municipal vs. private operation for each option, recognizing that private operation is the only alternative for option "c".
- Propose applicable financing alternatives.
- Conduct public involvement meeting.
- Report on findings and recommendations for further action.

2. Description of the Study Area

2.1 Location

The City of Troutdale, Oregon is located in Multnomah County, Oregon in the northwestern region of the state. It is about 17 miles to the east of the city center of Portland. Gresham, Oregon lies generally to the south and west of Troutdale. The smaller incorporated communities of Fairview and Wood Village are to the west of Troutdale. See Figure 1 for a vicinity map.

2.2 Physical Profile

As of 1990 Troutdale encompassed a land area of 5.0 square miles. Gresham is considerably larger with 22 square miles; and Fairview and Wood Village have 3.2 and 0.8 square miles respectively according to 1990 Census data.

The Sandy River runs along or near the eastern boundary of Troutdale and is the receiving stream for municipal sewage discharge. The Columbia River flows east to west to the north of the study area and may be a candidate for sewage discharge. The principal highway in the area, Interstate 84, runs along the north part of the study area, generally paralleling the Columbia River, and connects Portland with points east. A main trunk of the Union Pacific Railroad generally parallels I-84. Troutdale is near sea level with the Troutdale airport elevation at 35 feet with elevations increasing to the south.

2.3 Land Use

Figure 2 presents a map of land use in the City of Troutdale. Residential zoning accounts for 55 percent of the land area in the city. A considerable amount of unbuilt residential property remains which should allow population to more than double in the next 25 years (see Figure 4 below.)

Of particular interest for this study is the location of the existing treatment plant which is in industrial zoned property. The treatment plant property abuts commercial property in the downtown business district and is adjacent to a retail mall development. There is interest in moving the plant away from the commercial district to avoid complaints about odor and in the interest of visual esthetics.

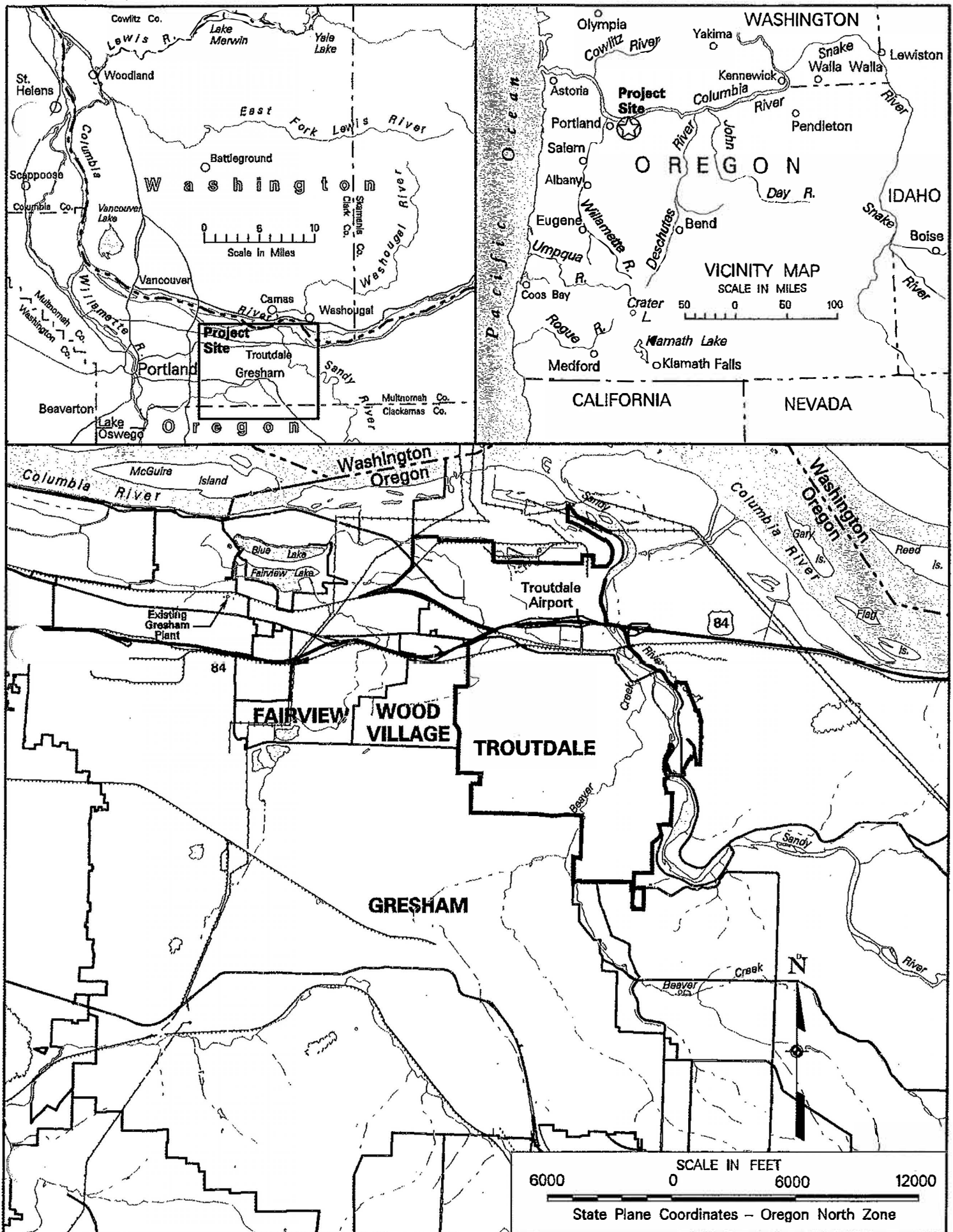
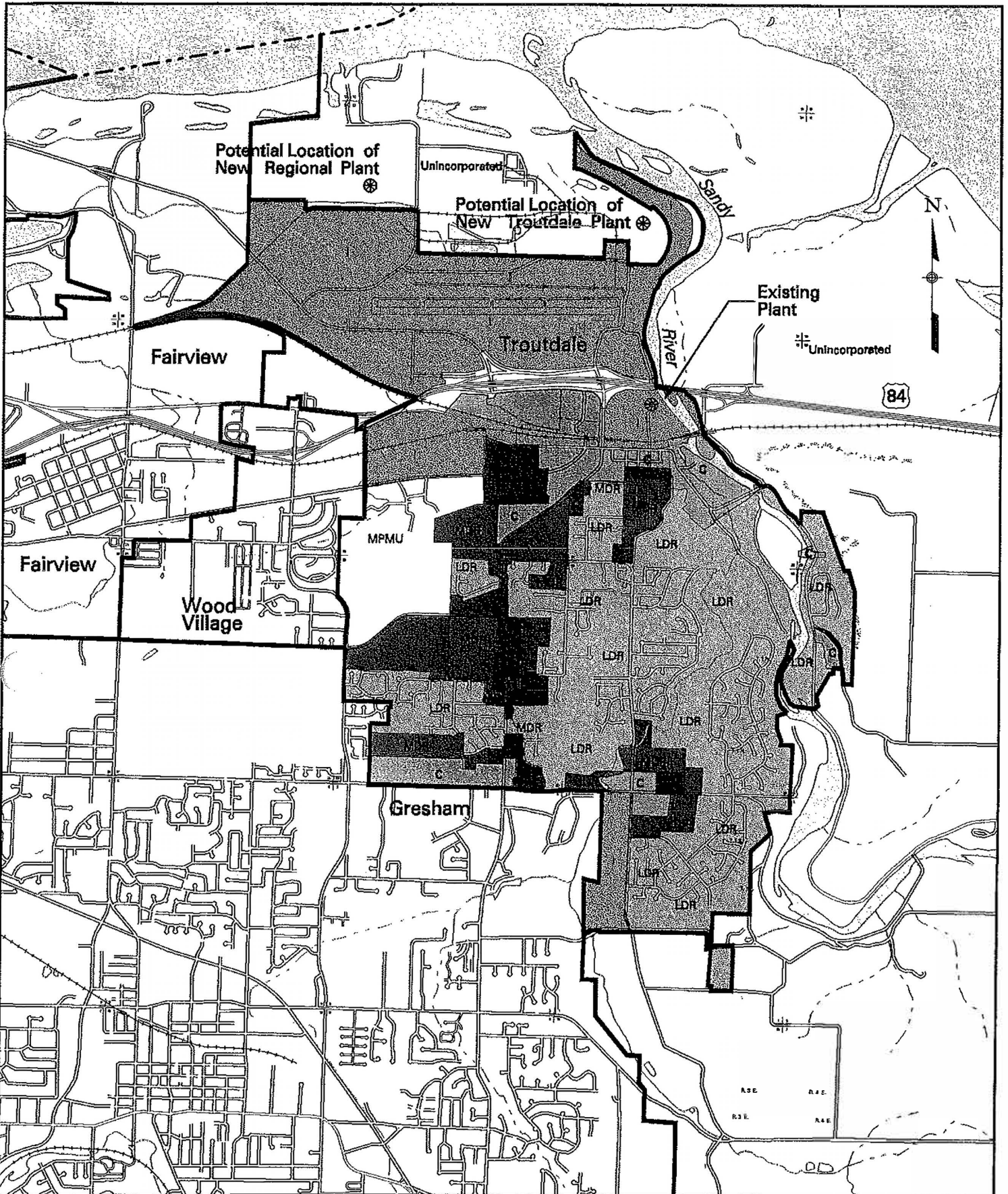


FIGURE 1
 CITY OF TROUTDALE'S SEWAGE TREATMENT PLANT
 Market Feasibility Study - Vicinity Map



3000 0 3000 6000
 SCALE IN FEET
 State Plane Coordinates - Oregon North Zone

LEGEND

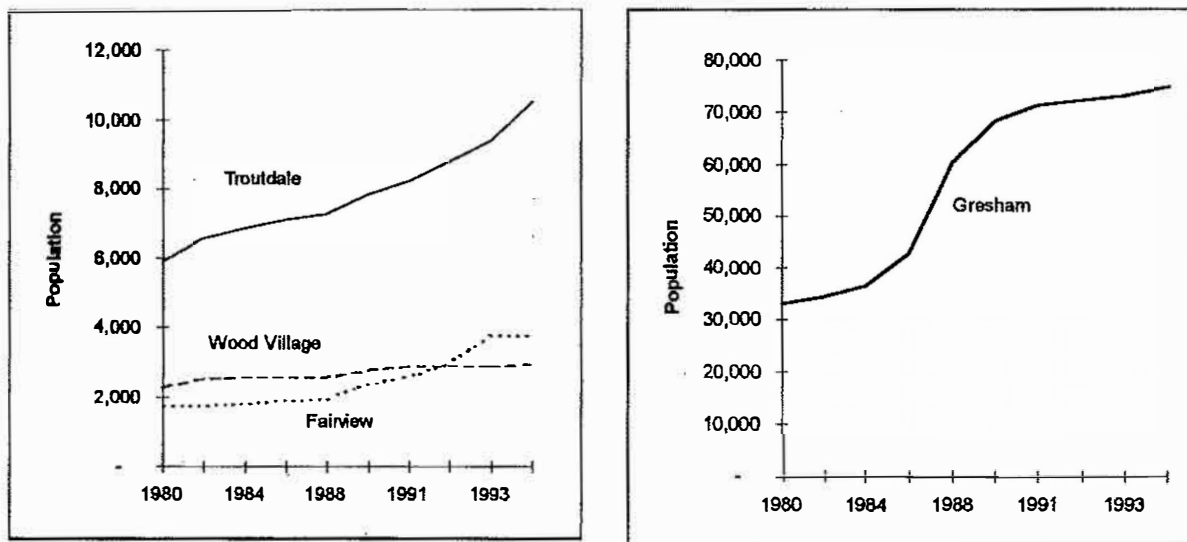
1232 ac.	LDR	Low Density Residential
282 ac.	MDR	Medium Density Residential
181 ac.	HDR	High Density Residential
197 ac.	MPMU	Master Planned
281 ac.	C	Commercial
936 ac.		Industrial

FIGURE 2
CITY OF TROUTDALE'S SEWAGE TREATMENT PLANT
Market Feasibility Study - Zoning Designations

2.4 Population and Housing

Sewage flows and loads are closely tied to population and number of households. Troutdale's population as of July 1, 1994 is estimated to have been 10,495 and is growing rapidly, having increased 34 percent since 1990. Fairview has also experienced fast recent growth with a 1994 population of 3,740. Gresham, the largest community with a 1994 population of 74,625, had tremendous growth in the 1980's due to in-migration and annexations. Wood Village has been fairly stable at 2,950 as of 1994. Figure 3 illustrates these trends.

Figure 3: Local Area Population Trends



The City of Troutdale has estimated the "Buildout" population to be approximately 25,000 by the year 2021.

Figure 4: City of Troutdale Population Projection

Year	Projected Population
1990 (Census)	7,852
1995	11,400
2000	13,300
2010	18,400
2020	24,400

Source: City of Troutdale Public Works Department

As of 1990, households in Troutdale numbered 2,443 with 3.1 persons per household. Household information is presented in Figure 5.

Figure 5: 1990 Census Household Data

	Persons in Households	Households	Persons per Household
Troutdale	7,623	2,443	3.12
Fairview	2,307	893	2.58
Wood Village	2,750	1,076	2.56
Gresham	67,475	25,705	2.62
Total	80,155	30,117	

Source: 1990 Census for Population and Housing, Summary Population and Housing Characteristics, Oregon, 1990 CPH-1-39, Table 5.

The number of households is normally tracked by the number of residential sewer accounts. Although the City does not keep separate sewer accounts, it does have water accounts which should closely, if not exactly, match the number of sewer accounts. The following table presents 1995 water user account data. The number of residential water accounts underestimates households since some multi-family developments may represent only one account in the City's records.

Figure 6: Troutdale Water User Count, June 1995

Class	Number of Water Accounts
Residential	3,187
Commercial/Industrial	112
Agricultural	10

Source: City of Troutdale, Public Works Department.

Housing in Troutdale is dominated by single family structures which accounted for 88 percent of all housing units in 1990. Multi-family housing and manufactured housing accounts for much larger shares in the other local area communities as indicated in Figure 7.

Figure 7: Troutdale and Study Area Housing Characteristics, 1990

Units in Structure	Troutdale	Fairview	Gresham	Wood Village
Single Family	2,210	532	16,498	465
% of total	88%	58%	61%	41%
Multi-Family	274	209	9,150	264
% of total	11%	23%	34%	24%
Mobile Home	25	181	1330	393
% of total	1%	20%	5%	35%
Total	2,509	922	26,978	1,122

Source: 1990 Census for Population and Housing, Summary Population and Housing Characteristics, Oregon, 1990 CPH-1-39, Table 8.

2.5 Employment, Industry and Income

According to 1990 Census data, the dominant employment categories for Troutdale residents are Wholesale and Retail Trade and Services which together accounted for 60 percent of private sector employment.¹ Manufacturing comprised 16 percent of total private employment.

Many Troutdale residents commute to Portland for their jobs. Census data for 1990 indicate that 55 percent of employed Troutdale residents work in Portland; another 18 percent work in Gresham.²

Here are a few of the firms in Troutdale of interest with respect to both local employment and to the City's sewage treatment plant:

Columbia Gorge Factory Outlet Stores. There are approximately 42 stores in this large retail facility with seasonal employment reaching about 200. This mall is of interest not only as an employer but also because it is directly adjacent to the city's sewage treatment plant (STP). Management has no expansion plans because there is no land available.

Waste Water Management. This company has only 4 employees and is regulated by a waste water discharge permit. The company accepts waste water from septage haulers carrying domestic and commercial waste. This firm is also located adjacent to the existing city STP.

¹ Based on Census Tract, Block Numbering Area 103.02 which covers much of Troutdale. Census of Population and Housing, Census Tract/BNA, 1990 CPH-3-266 A, Table 18.

² Census of Population and Housing, Census Tract/BNA, 1990 CPH-3-266 A, Table 17.

McMenamins Edgefield Complex. This facility includes restaurants, lodging facilities, brewery and winery, a seasonal beer garden, and catering. High season employment reaches about 175. The brewery produces about 400 to 500 barrels of beer a month and discharges about 2,000 gallons per day to the STP. The brewery is also regulated by a waste water discharge permit.

Burns Brothers Travel Stop. Total employment is 143 at this large travel stop which services truckers and recreational vehicles. On site is a deli, restaurant, motel, store, lounge, fueling station, and truck wash. Daily discharge is estimated at 40,000 to 50,000 gallons. Pollutants of concern are oil and grease, BOD and TSS.

City per capita income, according to 1990 Census data, is just slightly below the County level and about the same as for the state as a whole. Household income, however, is considerably above the County and state level because Troutdale has a relatively large persons per household ratio. Figure 8 summarizes available income estimates for the local study area, Multnomah County and the state. Bureau of Economic Analysis income estimates for the county and state are provided for comparison purposes.

Figure 8: Income Estimates for Study Area, Multnomah County and Oregon

Location	Census 1989 Per Capita Income Estimate	Census 1989 Median Household Income Estimate	BEA 1989 Per Capita Income Estimate	BEA 1993 Per Capita Income Estimate
Multnomah County	14,462	26,928	18,111	22,629
Troutdale	13,332	38,993		
Fairview	12,789	27,308		
Gresham	13,526	31,833		
Wood Village	13,291	28,560		
Oregon	13,418	27,250	16,258	19,437

Sources: 1990 Census of Population and Housing, Summary social, Economic and Housing Characteristics Oregon, 1990 CPH-5-39. Survey of Current Business, April 1992 and April 1995. Note the difference between the Census 1989 per capita income estimates and the 1989 Bureau of Economic Analysis' estimates for the County and State.

3. Problem Statement

This section provides a brief summary of the existing sewage treatment plant, design capacity, historical and future flows and loads, and remaining capacity. This section explains the problem the City of Troutdale faces with regard to its sewage treatment plant. Information from this section is derived from the City of Troutdale Sewage Treatment Plant (STP) Capacity and Local Limits Study, prepared by CH2M HILL in January, 1995.

3.1 Description Of The Current System

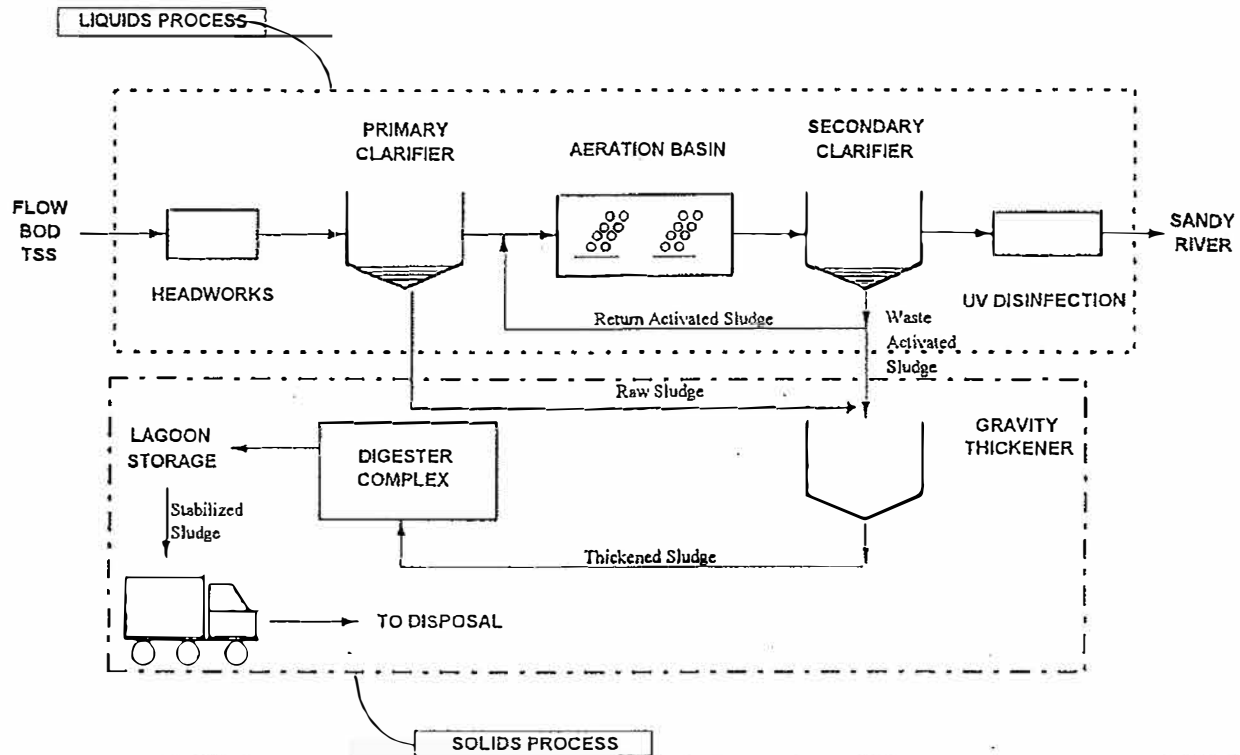
The Troutdale STP is an activated sludge system constructed in 1969 and received major upgrades in 1979 and 1993 and a minor upgrade in 1985. In 1979 an aeration basin, secondary clarifier, and chlorine contact basin were added. In 1985 additional headworks facilities were constructed. In 1993 two new anaerobic digesters went on line. The Troutdale STP switched from chlorine disinfection to ultra-violet (UV) disinfection of its effluent in December of 1994. The Troutdale STP is designed for an average flow of 1.6 million gallons per day (mgd) and a peak flow of 3.0 mgd.

Influent to the Publicly Owned Treatment Works (POTW) flows through headworks removal facilities before discharging to the primary clarifier. The primary clarifier effluent is mixed with the return-activated sludge before being pumped to the aeration basin, where it is aerated to promote biological degradation of organic wastes. Waste-activated sludge from the secondary clarifier is conveyed to a gravity thickener and then to one of two anaerobic digesters for stabilization.

Stabilized sludge is held in a sludge storage lagoon until it is transferred and applied to local agricultural land in accordance with the STP's sludge management plan. Sludge is currently land applied at a total of 11 sites in Corbett, Sandy, and Troutdale. The total combined acreage of land available for sludge application on these 11 sites is 230 acres. The application rate is based on an agronomic loading rate. Based on the nitrogen loading the application rate changes every three months due to quarterly EPA mandated bio-solids testing. In addition to nitrogen, the actual solids concentration is a limiting factor. The present application rate is 20,000 gal/ac/year at a concentration of two percent. The treatment plant has agreements with both DEQ and the site owners. No expiration dates exist for any of the sites. An agreement at a site would most likely expire if ownership changes hands or the site life is reached. The site life is based on cumulative loading rates of metals over a period of years. Currently zinc would be the limiting factor for these sites with an average site life of 700 years.

Effluent from the aeration basin is discharged to a secondary clarifier, then to a Parshall flume. A UV disinfection system has recently been constructed to replace chlorine disinfection as a means of eliminating residual chlorine concentrations in the STP's effluent. After the disinfection process, the effluent is discharged to the Sandy River. On the next page Figure 9 outlines the entire treatment process.

Figure 9: Process Flow Schematic For Troutdale's STP



- Headworks:** What it is: Facility where waste water enters the treatment plant.
What it does: Removes grit and large suspended solids and rags.
- Primary Clarifier:** What it is: An in-ground concrete tank about 40' in diameter and 12' deep.
What it does: Removes smaller suspended solids and BOD by settling about 1-2 hours.
- Aeration Basin:** What it is: Tank that allows contact between hungry bacteria and settled waste water. Bacteria require large amounts of air.
What it does: Allows incoming organic matter to be oxidized by bacteria.
- Secondary Clarifier:** What it is: An in-ground circular tank about 60' in diameter and 13' deep.
What it does: Removes suspended solids and BOD.
- UV Disinfection:** What it is: A series of in-stream ultra violet lamps, similar to fluorescent lamps, that treated waste water flows through.
What it does: Destroys disease-causing micro-organisms.
- Gravity Thickener:** What it is: A concrete circular in-ground tank 20' in diameter and 14' deep.
What it does: Reduces liquid content of sludge by about 50%.
- Digester Complex:** What it is: Two 45' diameter concrete tanks 28' deep.
What it does: A two-stage system that biologically breaks down sludge and renders it stable.
- Lagoon Storage:** What it is: One acre x 14' deep lined lagoon with 6' of sludge and a 7' water cap.
What it does: Stores stable sludge until it is convenient to haul it away.

Figure 10: Design Capacity Of Troutdale's STP For Each Process Component

Process	Capacity
Headworks	7 mgd
Primary Clarifier	1,273 gallons/day/square foot
Aeration Basin	52 lb of BOD/1,000 cubic feet/day
Secondary Clarifier	690 gallons/day/square foot
UV Disinfection	5 mgd
Gravity Thickener	6 gallons/square foot/hour
Digester Complex	20 days detention
Lagoon Storage	1,000,000 gallons sludge (plus water cap)

3.2 Sewage Flows And Loads

3.2.1 Flows

In 1993, the last full year of data available from CH2M HILL's study, Troutdale's STP experienced the following flows:

- Dry weather (May through October) average daily flow - 1.03 mgd
- Dry weather maximum month daily flow - 1.16 mgd
- Dry weather maximum day flow - 1.90 mgd
- Wet weather (November through April) average daily flow - 1.17 mgd
- Wet weather maximum month daily flow - 1.34 mgd
- Wet weather maximum day flow - 1.95 mgd

During February 1994, the plant recorded flows in excess of 3.0 mgd for a period of 12 hours during a 5-year return frequency rain event. The exact flow rate that occurred is unknown because the strip chart recorder on the Parshall flume reads a maximum of 3.0 mgd. In general, flows to the plant have not exceeded the design flow of 1.6 mgd for extended periods.

3.2.2 Loads

In 1993, the last full year of data available from CH2M HILL's study, Troutdale's STP experienced the following average BOD and TSS pounds per day loadings:

- Dry weather average influent BOD - 3,507
- Wet weather average influent BOD - 3,400

- Dry weather average influent TSS - 2,576
- Wet weather average influent TSS - 2,851

During the last two years, influent BOD concentrations have shown a dramatic increase over previous years. Three major industries have contributed to this increase: Burns Brothers Travel Stop, McMenam's Edgefield Brewery and Winery, and Waste Water Management, Inc. These historical values of BOD concentration are in the higher end of the expected range for raw domestic waste water (source: Waste Water Engineering, Metcalf and Eddy). Typical values for domestic waste water are 110 mg/L BOD for weak domestic waste water, 220 mg/L BOD for medium strength, and 400 mg/L for strong domestic untreated waste water.

The design loading of the aeration basin is 52 pounds of BOD per 1,000 cubic feet of volume (assuming 30% BOD removal across the primary clarifier). Using average influent BOD values (377 mg/L) and flows (1.10 mgd) from 1993, the current loading of the aeration basin is 67 pounds of BOD per 1,000 cubic feet of volume. The aeration basin is routinely operating at loads above its design capacity, particularly in the last two years.

3.3 Projected Flows And Loads

3.3.1 Factors Affecting Flow And Loading to Troutdale's STP

As mentioned earlier the aeration basin is routinely operating at loads above its design capacity, particularly in the last two years. For the past several years Troutdale has been experiencing significant commercial and residential development. The City's population has risen an average of 4.1 percent per year from 1986 to 1994. From 1992 to 1994 average BOD loadings to Troutdale's STP increased by 45 percent. During those same two years Troutdale's population increased approximately 20 percent.

3.3.2 Wastewater Flow Projections

Flow projections were based on the following conditions:

Annual Average Daily Flow (AADF): Average of daily flows (domestic plus industrial) in a one year period.

Dry Weather Average Daily Flow (DWADF): Average of daily flows (domestic plus industrial) in a 6-month period (May 1 through October 31).

Wet Weather Average Daily Flow (WWADF): Average of daily flows (domestic plus industrial) in a 6-month period (November 1 through April 30).

Dry Weather Maximum Month Average Daily Flow (DWMMADF): 30-day moving average daily flow in a 6-month period (May 1 through October 31).

Wet Weather Maximum Month Average Daily Flow (WWMMADF): 30-day moving average daily flow in a 6-month period (November 1 through April 30).

Dry Weather Maximum Daily Flow (DW MDF): Maximum average daily flow in a 6-month period (May 1 through October 31).

Wet Weather Maximum Daily Flow (WW MDF): Maximum average daily flow in a 6-month period (November 1 through April 30).

Peak Instantaneous Flow (PIF): Diurnal peak flow on the peak daily average flow.

Flow projections are presented in Figure 11. Projections were made on the basis of population equivalents (PE) for each season. According to historical treatment plant data, a per capita loading of 107 (dry weather) and 122 (wet weather) gal/capita/day (gpcd) are used to determine projected monthly average daily flows. These loadings include I/I contributions.

The projected dry weather maximum month average daily flow and dry weather maximum daily flow at buildout are 3.01 and 4.07 million gallons per day (mgd), respectively. As an example, the dry weather maximum month average daily flow at buildout is calculated as follows:

$$\begin{aligned} \text{DWMMADF (year 2021)} &= \text{Annual Average Daily Flow (AADF year 2021)} \times \text{Peaking Factor} \\ &= 2.79 \text{ mgd} \times 1.08 = 3.01 \text{ mgd} \end{aligned}$$

Note. The AADF for year 2021 is found in Figure 11.

During February of 1994 Troutdale's STP recorded flows in excess of 3.0 MGD. These high flows occurred for a period of 12 hours during a 5-year return frequency rain event. The exact flow is unknown, since the strip chart recorder on the Parshall flume only reads up to a maximum of 3.0 mgd. According to the Department of Environmental Quality's (DEQ) guidelines for making flow projections, the flow rate which corresponds to this 5-year storm is the current wet weather maximum daily flow (WW MDF). The peak instantaneous flow (PIF) can be estimated by multiplying a peaking factor to the WW MDF. No treatment plant data is available to estimate a peak instantaneous flow peaking factor. Therefore, a textbook peaking factor value of 1.5 times the WW MDF will be used to estimate the PIF. The projected PIF to the treatment plant at buildout is calculated as follows:

$$\begin{aligned} \text{PIF (year 2021)} &= \text{WW MDF (year 2021)} \times \text{Peaking Factor} \\ &= 5.35 \text{ mgd} \times 1.5 = 8.03 \text{ mgd} \end{aligned}$$

3.3.3 Wastewater Loading Projections

Dry and wet weather wasteload projections were based on two parameters: Biochemical Oxygen Demand (BOD), and Total Suspended Solids (TSS). Figure 12 and Figure 13 present these projections for BOD and TSS, respectively. At year 2021, dry weather maximum month average daily flow BOD and TSS loadings are 9,230 and 10,150 pounds per day (lb/day), respectively. Dry weather maximum daily flow BOD and TSS loadings are estimated at 15,600 and 18,778 lb/day, respectively.

Figure 11: Flow Projections (MGD)

Year	Population	AA DF	DWADF	WWADF	DWMMADF	WWMMADF	DWMDF	WWMDF	PIF*
1995	11400	1.27	1.22	1.39	1.37	1.59	1.86	2.44	3.66
2000	13300	1.48	1.42	1.62	1.60	1.85	2.16	2.85	4.27
2005	15800	1.76	1.69	1.93	1.90	2.20	2.57	3.38	5.07
2010	18400	2.05	1.97	2.24	2.21	2.56	2.99	3.94	5.91
2015	21400	2.39	2.29	2.61	2.58	2.98	3.48	4.58	6.87
2020	24400	2.72	2.61	2.98	2.94	3.40	3.97	5.22	7.83
2021	25000	2.79	2.68	3.05	3.01	3.48	4.07	5.35	8.03

ABBREVIATIONS:

AA DF - Annual Average Daily Flow

DWADF - Dry Weather Average Daily Flow

WWADF - Wet Weather Average Daily Flow

DWMMADF - Dry Weather Maximum Month Average Daily Flow

WWMMADF - Wet Weather Maximum Month Average Daily Flow

DWMDF - Dry Weather Maximum Daily Flow

WWMDF - Wet Weather Maximum Daily Flow

PIF - Peak Instantaneous Flow *Estimated as 1.5 x WWMDF

Figure 12: BOD Loading Projections (LB/DAY)

Year	Population	AA DF	DWADF	WWADF	DWMMADF	WWMMADF	DWMDF	WWMDF
1995	11400	2,964	3,260	3,349	4,209	4,298	7,114	8,744
2000	13300	3,458	3,804	3,908	4,910	5,014	8,299	10,201
2005	15800	4,108	4,519	4,642	5,833	5,957	9,859	12,119
2010	18400	4,784	5,262	5,406	6,793	6,937	11,482	14,113
2015	21400	5,564	6,120	6,287	7,901	8,068	13,354	16,414
2020	24400	6,344	6,978	7,169	9,008	9,199	15,226	18,715
2021	25000	6,500	7,150	7,345	9,230	9,425	15,600	19,175

Figure 13: TSS Loading Projections (LB/DAY)

Year	Population	AA DF	DWADF	WWADF	DWMMADF	WWMMADF	DW MDF	WW MDF
1995	11400	3,306	3,703	3,637	4,628	5,488	8,563	10,513
2000	13300	3,857	4,320	4,243	5,400	6,403	9,990	12,265
2005	15800	4,582	5,132	5,040	6,415	7,606	11,867	14,571
2010	18400	5,336	5,976	5,870	7,470	8,858	13,820	16,968
2015	21400	6,206	6,951	6,827	8,688	10,302	16,074	19,735
2020	24400	7,076	7,925	7,784	9,906	11,746	18,327	22,502
2021	25000	7,250	8,120	7,975	10,150	12,035	18,778	23,055

3.4 Remaining Capacity Of Troutdale's STP

3.4.1 Basis for Design Criteria

Figure 14 presents original design criteria for each unit process, and compares these criteria with actual operating data. According to the 1993 operating data in Figure 14 the original design criteria has been exceeded for plant influent and the aeration basin.

3.4.2 Remaining Capacity of Existing Units

The estimated remaining capacity of existing facilities, based on comparing projected future flows and loadings with current performance, is presented in Figure 15. The limiting design parameter is also presented for each process. Note in Figure 15 that the aeration basin is currently operating above capacity and in the next 5 to 6 years the primary clarifier and influent screw pump will have reached their respective capacities.

3.4.3 Other Considerations

New or expanded treatment works are required to meet minimum standards for mechanical, electrical, fluid systems, and component reliability in accordance with the Environmental Protection Agency's (EPA) policy. This is to ensure that the treatment facilities will operate effectively on a day-to-day basis and that capabilities are provided for satisfactory operation during power failures, flooding, peak loads, equipment failures, and maintenance shutdowns. These reliability and redundancy standards are important to ensure that unacceptable degradation of the receiving water will not occur as a result of the interrupted operation of specific treatment operation or processes. In that regard, standards have been established for three classes of wastewater treatment works.

The most stringent reliability standards, Class I, are applied to facilities which discharge to waters that are used for drinking water intake, shellfish, or water contact sports, or which are located in a dense residential area. For the purpose of this analysis, it is assumed that continued use of the existing treatment plant site will require future expansions or

upgrades to meet Class I requirements. Requirements for Class I applicable to the processes used at the Troutdale WWTP are summarized in Figure 16.

Figure 14: Original Design Criteria and 1993 Loadings

Unit Process	Original Design Criteria	1993 Operating Data
Plant Influent Design Flow (DWMMADF) BOD Load (DWMMADF) TSS Load (DWMMADF)	1.6 mgd 2,700 lb/day 2,400 lb/day	1.2 mgd 3,920 lb/day 3,010 lb/day
Head Works Mechanical screen capacity (PIF) Grit removal capacity (PIF)	7mgd 7mgd	>3 mgd >3 mgd
Primary Clarifier Surface overflow rate (DWMMADF)	1,270 gpd/SqFt	960 gpd/SqFt
Influent Screw Pump Capacity	4.5 mgd	>3 mgd
Aeration Basin BOD loading HRT	52 lb/1,000 CuFt-day 4.1 hours	76 lb/1,000 CuFt-day 5.4 hours
Secondary Clarifier Surface overflow rate Solids loading	690 gpd/SqFt 14 lb/SqFt-day	424 gal/day/SqFt 11 lb/SqFt-day
Gravity Sludge Thickener Solids loading rate Hydraulic loading rate	0.2 lb/SqFt-hr 6 gal/SqFt-hr	See Note
Anaerobic Digesters Hydraulic detention time	20 days	See Note
UV Disinfection Maximum flow Transmittance TSS Dose	(1994 Design) 5 mgd 50% 30 mg/L 32,000 mws/cm2	

Note: Some processes do not present operating data because they came on line in 1993.

Figure 15: Estimated Remaining Capacity of Unit Processes

Unit Process	Year at Capacity	Limiting Design Parameter
Headworks	2016	Flow
Primary Clarifier	2000	Overflow Rate
Influent Screw Pump	2001	Flow
Secondary Treatment (Aeration Basin and Secondary Clarifier)	Currently Above Capacity (a)	Organic and Solids Loading
UV Disinfection	2005	Flow
Digester Complex (b)	2013	Sludge Production

(a) Although the system is currently above capacity, the plant is in compliance with its NPDES permit.

(b) Based on design by Gibbs and Olson

Figure 16: Reliability and Redundancy Requirements Class I

Plant Component	Requirement	Status of Existing Facilities
Mechanical Bar Screens	Provide backup screen with either manual or mechanical cleaning (manual cleaning only two screens).	Meets Criteria.
Grit Removal	Minimum of two.	Criteria not met.
Primary Sedimentation	Pass 50% of design flow capacity with largest unit out of service.	Criteria not met.
Aeration Basin	Provide a minimum of two equal-volume basins. No backup basin required.	Criteria not met.
Aeration Equipment	Provide the design oxygen transfer capacity with largest unit out of service. Provide a minimum of two.	Criteria not met. Design oxygen transfer can not be met with one brush aerator out of service.
Secondary Sedimentation	Pass 75% of design flow capacity with the largest unit out of service.	Criteria not met.
Disinfection	Pass 50% of the design flow with largest unit out of service.	Meets criteria.
Electrical Power	Provide two separate and independent sources of electrical power, either from two separate utility substations or from a single substation and a generator.	In the event of a commercial power failure all essential equipment can be operated by the existing on site stand-by generator.

3.4.4 Conclusion

In recent years the City of Troutdale's STP has experienced a dramatic increase in organics and solids loading due to residential and commercial development. Troutdale's STP received a major upgrade to its solids handling capacity in 1993; however, the last major upgrade to handle organics loading was done in 1979. The aeration basin is currently receiving BOD loading at levels well in excess of its original design criteria while other components of Troutdale's STP will soon be at their original design capacities. By the year 2021 Troutdale's population is projected to reach 25,000. Troutdale needs additional sewage treatment capacity to adequately treat its waste water in the years to come. The next section examines the options for achieving additional capacity.

4. Sewage Treatment Plant Alternatives

This section explains the four alternatives for meeting the City's wastewater treatment needs. Those alternatives are as follows:

1. Improvements to the existing plant.
2. Construction of a new plant away from the business area.
3. Utilize the City of Gresham's privately-operated plant along with the cities of Fairview and Wood Village.
4. Construct a new plant to be jointly used with Fairview and Wood Village.

In addition to these capital intensive, long term alternatives which are the focus of this study, a couple of short term improvements are first considered in Section 4.1 below. These improvements are generally applicable to all alternatives.

4.1 Short Term Improvements Applicable To All Four Alternatives

There appears to be evidence of industrial waste discharges to the treatment plant in excess of reasonable local limits. These highly concentrated, unscheduled discharges appear to be overloading the secondary treatment process and causing process upsets. Strict regulation of the City's permitted significant industrial users should improve the treatment plant's performance. City staff will continue to identify other significant industrial users, monitor their discharge, and determine if a waste water discharge permit must be issued on a case by case basis.

In its Sewage Treatment Plant (STP) Capacity and Local Limits Study for the City of Troutdale, CH2M HILL recommended two types of short term improvements. These short term improvements are low capital cost projects that can enhance plant performance (mainly BOD removal) and allow time for implementation of the selected long term improvement alternative. CH2M HILL's recommended short term improvements were as follows:

- Reduce the organic loading from significant industrial users before they discharge to the treatment plant (source reduction) by applying stringent enforcement of industrial pretreatment standards. The City currently regulates the discharge of two significant industrial users through separate discharge permits: Waste Water Management and Edgefield Brewery.
- Reduce the organic loading at the treatment plant with the use of a coagulant to enhance BOD and TSS removal from the primary clarifier and reduce organic loadings to the secondary treatment system.

Regardless of which alternative is chosen to meet the City's waste water treatment needs until buildout, City staff will continue to implement the first short term improvement, the City's industrial pretreatment program. This program is ongoing and will continue

indefinitely. The second measure, utilizing a coagulant, would be implemented only in the event the pretreatment program failed to effectively reduce loading to Troutdale's STP and if coagulant use proves effective in field tests. It is assumed that these combined measures would defer the need for major capital improvements for approximately three to five years.

As part of field testing of coagulants, alum jar tests were performed on raw waste water. The tests were intended to simulate the addition of alum to enhance removal of BOD in the primary clarifier and a corresponding reduction in organic loading to the secondary system. The dose required to achieve good floc formation and produce a clear supernatant was in excess of 150 mg/L.

Further alum testing was performed on December 19-20, 1994. Two 55 gallon drums of alum were added to influent waste water in the primary clarifier during a 48 hour period. Influent to Troutdale's STP (before the addition of alum) and primary clarifier effluent (after the addition of alum) were then tested for TSS, Total Chemical Oxygen Demand (TCOD), and Soluble Chemical Oxygen Demand (SCOD). Figure 17 below shows the reduction achieved after the addition of alum.

Figure 17: Primary Clarifier Alum Testing For Troutdale's STP

Date	Primary Clarifier Influent Before Alum			Primary Clarifier Effluent After Alum		
	TSS	TCOD	SCOD	TSS	TCOD	SCOD
12/19/94	308	630	230	96	310	150
12/20/94	208	890	180	96	420	98

Note. All results are expressed in mg/L.

Use of alum will result in chemical costs to the City of approximately \$200 per day; however, it will reduce the potential for violating permit standards and associated fines imposed by the State. The additional chemical sludge generated can be handled by the existing digesters. A coagulant such as alum would only be used in the event that source reduction measures as part of the City's pretreatment program failed.

4.2 Alternative 1: Improvements to Troutdale's Existing Plant

4.2.1 Description of Expansion of Troutdale's Existing STP

To meet the long term needs for waste water treatment through the year 2021, the existing plant will require significant modifications. The outdated and overloaded primary and

secondary processes will require replacement and upgrade to meet the current design criteria and reliability/redundancy requirements.

To identify primary and secondary process requirements through the design year of 2021, the flow and load projections presented in Chapter 2 for that year were used in conjunction with a process spreadsheet model prepared by CH2M HILL. The spreadsheet model allowed for preliminary process sizing for a conventional activated sludge process. The long term improvements to Troutdale's STP recommended by CH2M HILL are as follows:

Required unit processes for modernization of the primary and secondary treatment systems:

- Primary clarifiers: (2) @ 40-ft. diameter
- Two aeration basins: 1.13 million gallons total
- Secondary clarifiers: (2) @ 65-ft. diameter

Additional support facilities would be required to accommodate replacement of the primary and secondary processes, including:

- A new sludge pump station
- A new blower building
- A new administration/laboratory building

In addition to upgrading the primary and secondary treatment processes, the other processes at the plant would need to be expanded as they reach capacity. These include:

- Headworks (new bar screen by 2016)
- Influent pumping (new screw pump by 2001)
- UV Disinfection (additional capacity required by 2005)
- Digester Complex (additional capacity required by 2013)

Long term improvements to Troutdale's existing STP are considered a viable alternative to meet waste water treatment needs for the City through the year 2021.

4.2.2 Costs

The costs associated with long term improvements to Troutdale's existing STP are summarized in Figure 18 below.

Figure 18: CH2M HILL's Construction Cost Estimates, January, 1995

Description	Construction Cost	Contingency	Upgrade Totals
Long Term Improvements Summary.			
1. Add two new primary clarifiers.	\$1,210,000	\$240,000	\$1,450,000
2. Add two new secondary clarifiers.	1,965,000	395,000	2,360,000
3. New sludge pump station.	750,000	150,000	900,000
4. Add two new aeration basins.	1,495,000	300,000	1,795,000
5. New blower building.	200,000	50,000	250,000
6. Add new influent bar screen to existing headworks.	60,000	15,000	75,000
7. Add an additional screw pump.	120,000	30,000	150,000
8. Expand the UV disinfection system.	415,000	85,000	500,000
9. New administration/laboratory building.	225,000	45,000	270,000
10. Additional Digester Capacity	300,000	60,000	360,000
Total Long Term Plant Upgrades Construction Costs	\$6,740,000	\$1,370,000	\$8,110,000

4.2.3 Implementation Of Alternative 1

If alternative one is selected for Troutdale's STP, implementation would begin in fiscal year 1996-1997 with new facilities being brought on line in fiscal year 1998-1999.

4.3 Alternative 2 - Construct New Troutdale Plant

This section describes the alternative of constructing a new wastewater treatment plant for the city of Troutdale in a new location away from the central city. Among issues discussed are the type and size and potential locations for a new facility, the cost of the proposed plant and other relevant factors which may affect this alternative.

4.3.1 Type and Size of New Plant

As described in Chapter 3, the existing Troutdale plant is a 1.6 MGD conventional activated sludge system with anaerobic digesters and UV disinfection. The plant is operating at capacity, managing relatively high solids loading. Design Criteria for the new plant are flows and loads projected at the city of Troutdale buildout year (2021) and taken from the Capacity and Local Limits Study prepared for the City of Troutdale by CH2M-Hill, January 1995. These flows were discussed in Chapter 3 and are reproduced in Figure 19. Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) loadings from this study assume there is no pretreatment which change the strength of wastewater.

Figure 19: Troutdale Flow and Loading Projections (Year 2021)

Flow Condition	Flow (MGD)	BOD (lb/day)	TSS (lb/day)
Dry Weather Average Daily Flow (DWADF)	2.68	7,150	8,120
Wet Weather Average Daily Flow (WWADF)	3.05	7,345	7,975
Dry Weather Maximum Month Average Daily Flow (DWMMAADF)	3.01	9,230	10,150
Dry Weather Maximum Daily Flow (DWMDF)	4.07	15,600	18,778
Peak Instantaneous Flow (PIF)	8.03	-----	-----

Flows and average solids loading over the last ten years were used to provide raw sewage characteristics for the proposed new plant. Solids loads of 373 mg/L BOD₅ and 418 mg/L TSS were used. These loads are 75% of the average loadings over the last ten years at Troutdale, assuming some marginal pretreatment lowers loadings from industrial customers. Both values are in the high range for domestic wastewater. This is a conservative design to get the largest probable size requirements for process tanks and equipment. Pretreatment of industrial discharges is recommended here and in the 1995 Capacity and Local Limits Study to reduce these loads and increase the life of any existing or new facility.

Factors affecting the type of plant considered for this study include cost, feasibility, wastewater conditions, and permit requirements. A conventional activated sludge plant was chosen because of the ability to handle continued heavy solids loading, flexibility of operation, familiarity for operating staff, odor management and relatively low land area

requirement. Compared to other types of treatment plants, this plant can be constructed cost-effectively, and meet variable permit requirements.

Design criteria used for the preliminary design are the treatment standards in the state of Oregon for discharge into the Sandy River as described in OAR 340-41-482. These are as shown in Figure 20.

Figure 20: Treatment Plant Design Effluent Criteria

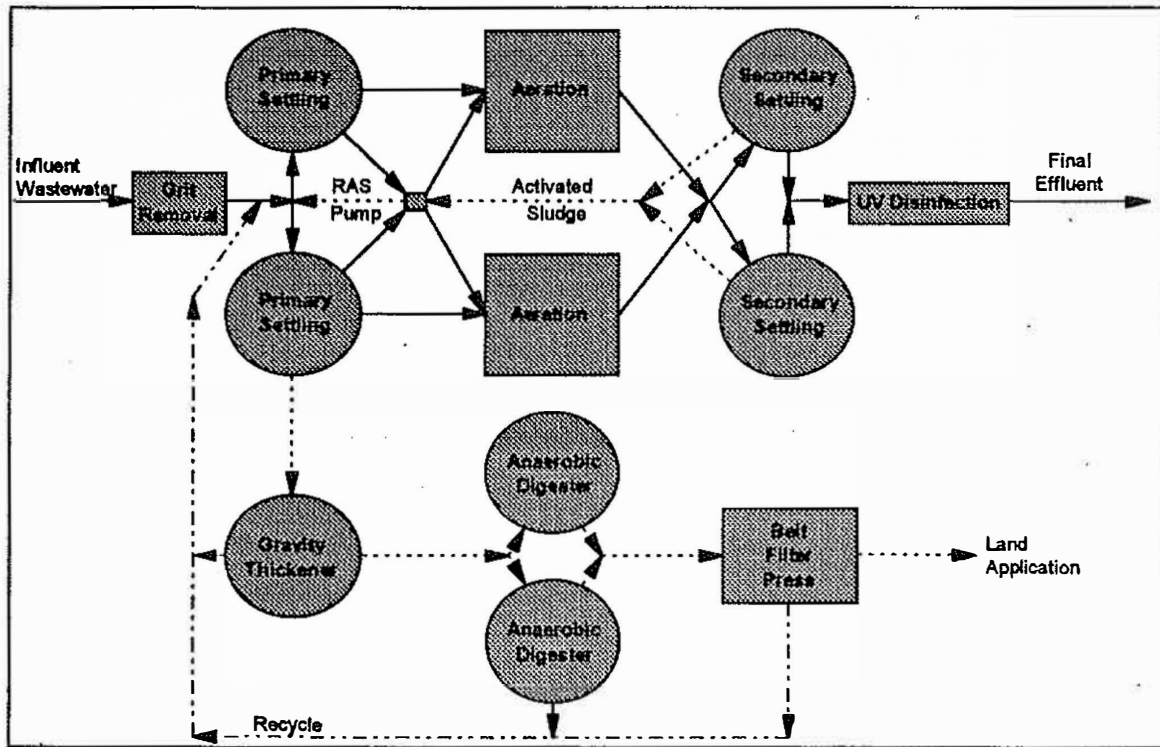
Parameter	Effluent Criteria
BOD ₅ (June 1 - October 31)	10 mg/L Monthly average
TSS (June 1 - October 31)	10 mg/L monthly average
BOD ₅ (November 1 - May 31)	30 mg/L Monthly average
TSS (November 1 - May 31)	30 mg/L monthly average
Disinfection	Equivalent to 1 ppm Cl for 60 minutes
Dissolved Oxygen	95%
Temperature	58.5°F maximum
pH	6.5 to 8.5
Bacteria	33 per 100 ml

The plant processes are shown in the process flow diagram in Figure 21. Each process is described in more detail in this section with specific process design criteria. A preliminary design was done for a new facility to provide sizes of new facility components to meet discharge and redundancy and reliability requirements. Solids balance was checked. A hydraulic profile was not calculated, but if an additional lift station is necessary, it will fit within the cost range provided.

Bar Screen. The Bar Screen which removes rags, plastics and other screenable material which could clog pumps and other processes is designed for the Peak Instantaneous Flow (PIF) (8.03 MGD) and minimum flow to maintain velocity. Two screens with 5/8 inch openings are recommended for this and provide required redundancy. A mechanical bar screen has ease of operation and cleaning and fits within the flow channel with minimum head loss. The screening facility includes flow measurement, screening and automatic mechanical cleaning with screenings dewatering.

Grit Chamber. Grit chambers remove grit, sand, and other inorganic particles which are abrasive to pumps and process equipment in the plant. Two parallel spiral flow grit chambers were included in this design because of the relatively inexpensive construction and low maintenance. The primary design criteria for grit removal is peak flow. With three minute retention times at 8.03 MGD, two rectangular chambers, each with a volume of 1120 ft³ are required. To meet optimum dimensions for a grit removal facility each covered tank is 30 feet long, 7.5 feet wide and 5 feet deep with a collection trough, mechanical accretion apparatus, and grit pump. Dewatering and disposal as solid waste is concurrent with the screenings.

Figure 21: Process Diagram, New Troutdale Plant



Primary Clarifier. The primary clarifier design criteria include the PIF and minimum flow to provide minimum and maximum allowed retention times (1.5 to 2.2 hours) for settling solids. Two circular clarifiers each with 276,000 gallon capacity provide required redundancy and retention times. Each tank is 60 feet in diameter and 15 feet deep. Equipment includes chemical flocculation addition, circular mechanical sludge and scum scrapers, with pumps to provide adequate primary treatment. Clarified water discharges over weirs to the aeration basins. Settled solids and scum are pumped to the sludge digester complex for thickening and treatment.

Aeration Basin. Two aeration basins capable of being subdivided into smaller tanks are designed for maximum and minimum flows to provide appropriate retention times. A diffused air aeration system with submerged dome diffusers consists of air blowers, mains, and header pipes for air distribution. The design criteria for the system are the discharge BOD assuming return sludge of 8,000 mg/L volatile suspended solids, 3,500 mg/L mixed liquor volatile suspended solids, and 10 days mean cell residence time. At the maximum day loading, 2 one million gallon tanks are required to provide adequate treatment, and design dry weather capacity can be met with one tank out of service. Tanks are two parallel 100 feet long by 90 feet wide, 15 feet deep rectangular tanks with overflow weirs to the secondary clarifiers. Baffles or permanent tank walls can separate the tanks into four tanks if necessary to meet flow conditions.

Secondary Clarifier. Design criteria for the secondary clarifier include the overflow rate at peak flow, solids discharge limits and underflow rates. Two 130 feet diameter 10 feet deep circular clarifiers provide an average overflow rate of 115 gal/ft²day, and a peak rate of 250 gal/ft²day. Design flows can be accommodated with one clarifier out of service. Equipment includes chemical circular mechanical sludge scrapers with pumps to provide adequate treatment. Sludge is returned to solids treatment and clarified water discharges over weirs to the disinfection facilities.

Disinfection. UV disinfection equipment currently used at the Troutdale WWTP can be salvaged and used at a new facility with some upgrading and increased capacity. A contact basin is required for maximum flows at the disinfection facility.

Effluent Pump Station and Outfall. A pump station designed for maximum flows is required to pump effluent over the levee protecting the proposed treatment plant site and into the Sandy River. A 24 inch diameter outfall with diffuser located on the inside of a bend in the Sandy River will be required.

Anaerobic Digesters. Digesters and return and waste sludge pumping facilities similar to the existing plant are required for the new facility. The digesters receive sludge from primary and secondary clarifiers, and stabilize the sludge for land application. Sludge is pumped from the secondary clarifier underflow to the aeration basin or digesters to remove excess sludge and maintain populations of microbes in treatment processes. Pumps also remove excess sludge from the digesters to the storage lagoon or truck loading station.

Solids Thickening and Storage. Solids handling at the existing facility includes storage of sludge for land application. A large solids load from industrial discharges increases the amount of solids for handling. Gravity thickening and belt filter presses were not designed for this facility. Some thickening and storage will be required. Based on BOD wastage rates of 3800 lb/d from treatment calculations, 2300 gal/d sludge thickened to 20% solids will be generated. Since year round land application will not be possible, a lagoon with at least 1,000,000 gallon storage capacity is required. A lagoon of this size is shown in Figure 22. Pretreatment requirements would also lower solids production and sludge disposal needs.

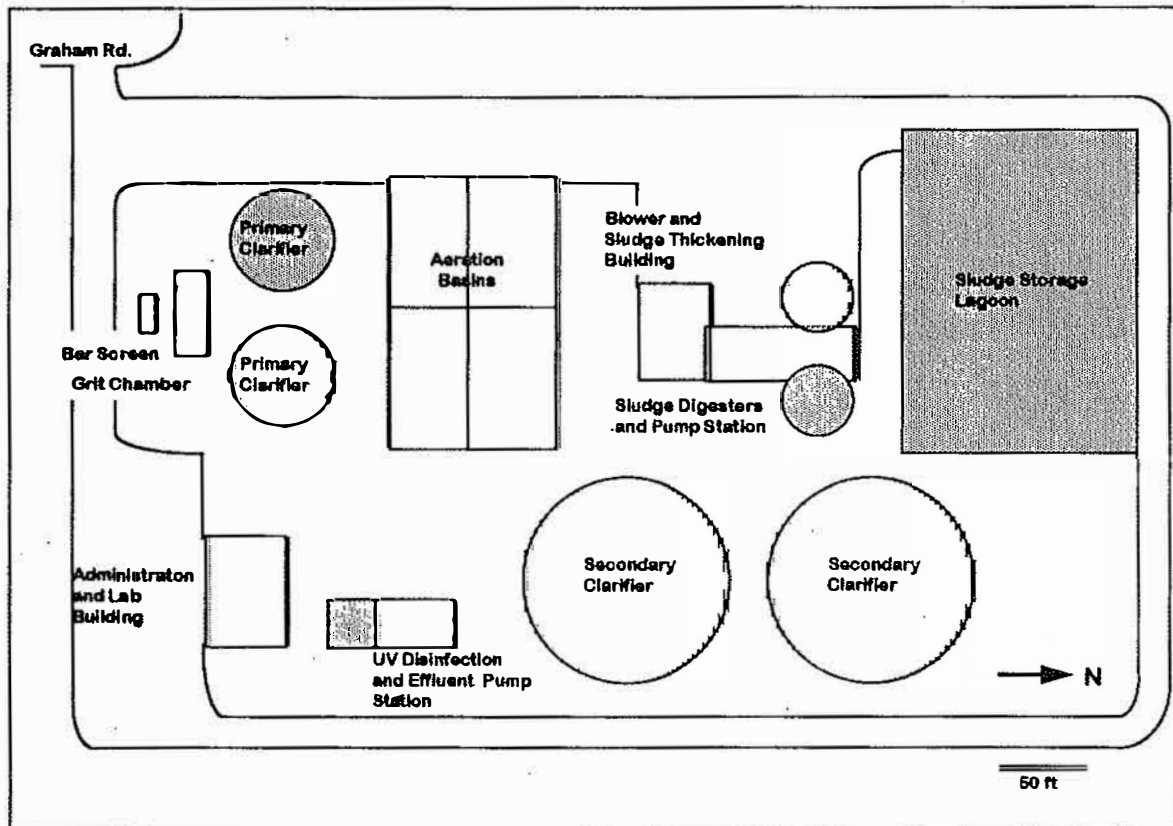
4.3.2 Proposed Site

The proposed plant arrangement can fit on a minimum ten acre site. Criteria for picking the location include:

- available land which is constructible
- near the Sandy River
- away from the central city
- convey the sewage from the current location at a minimum cost

- compatible with adjacent land uses without rezoning.

Figure 22: Proposed Troutdale Treatment Plant Layout



The most advantageous site is the southern 10 acre portion of the 69.9 acre lot 400 northeast of the Troutdale airport and east of Reynolds Metals, west of the Sandy River off Graham Road. The site is currently undeveloped grazing land owned by Reynolds Metals outside city limits. At 30 feet above mean sea level, it is approximately 10 feet lower in elevation than the existing treatment plant and is within the Sandy Drainage District's levee system, and protected against a 500 year flood event. According to the National Wetlands Inventory, it is constructible upland with no wetlands. A Level I site assessment was not performed for the site, but a discussion with the USEPA Superfund remedial project manager and examination of regulatory records indicates that although the aluminum plant is undergoing investigation and cleanup of contamination from plant operations, the selected portion of lot 400 is probably unaffected by contamination from the aluminum plant operations. Lot 400 is outside the city limits. The city could partition the lot if acceptable to the current owner, annex and zone the site for this use. A cost of \$350,000 is estimated for acquisition of this 10 acre parcel.

Conveyance System. Facilities required to convey sewage from the existing treatment plant to the new facility are designed for maximum hour flows without surcharge, or 8.03

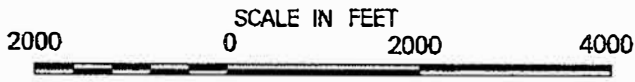
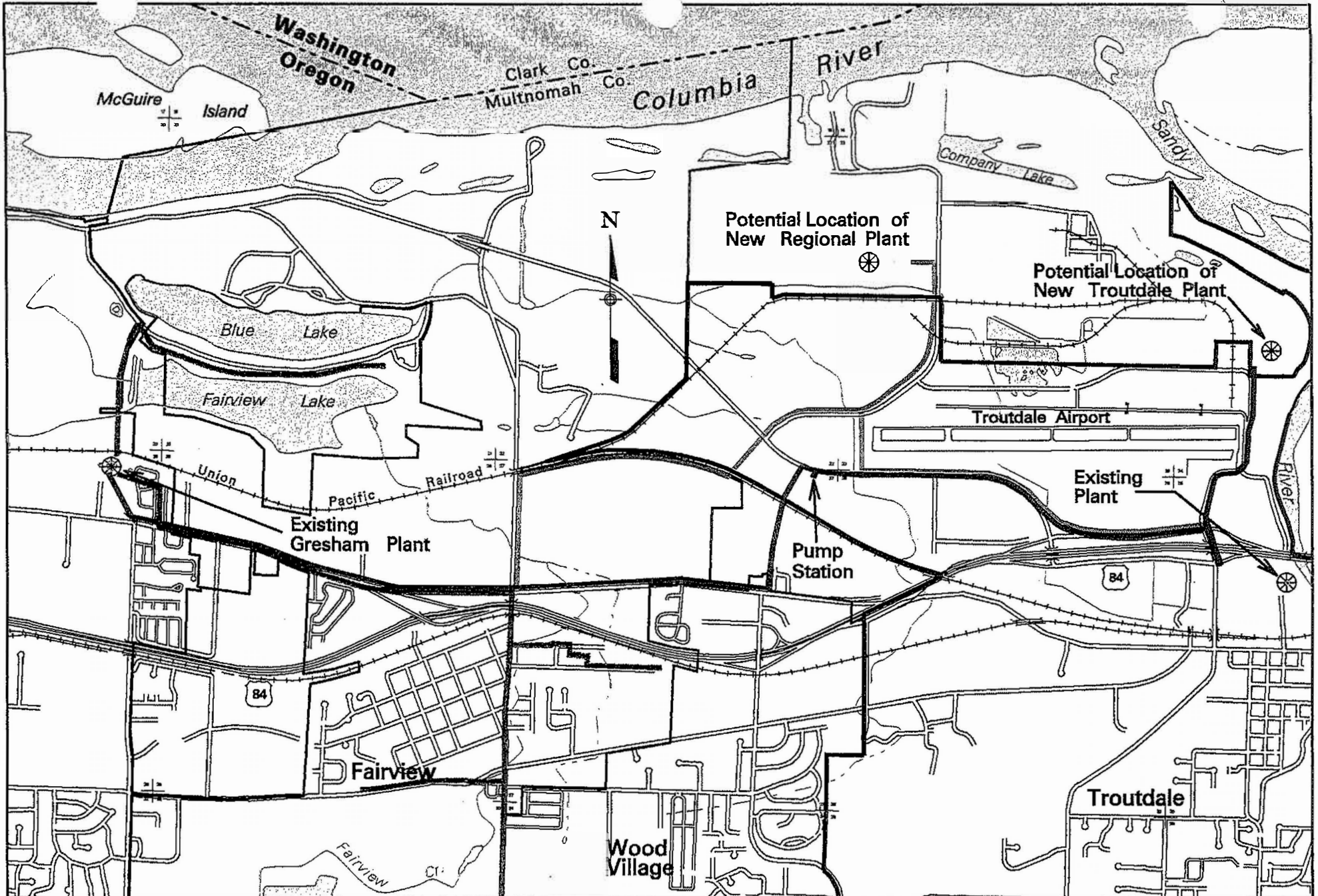
MGD. Although sewage in the Troutdale airport basin is pumped up to the existing plant, no modifications of these facilities to provide gravity flow to the new facility are considered. Facilities required include a diversion structure at the existing plant, a 24 inch gravity concrete sewer line, a bypass structure upstream of the new plant headworks and a bypass diversion structure upstream of the new effluent pump station wet well. The sewer line can be constructed almost exclusively in existing roadway rights of way. The proposed alignment is indicated on Figure 23.

4.3.3 Costs

One of the purposes of this report is to provide an order of magnitude cost estimate for a variety of alternatives so the city of Troutdale may determine a best possible course of action for its future wastewater treatment needs. Given the number of alternatives to consider within the limited budget, it was not feasible to provide a detailed cost estimate for the construction of a new wastewater treatment facility and appurtenant features. In order to provide the city with reasonable cost estimates for potential future capital expenditures, a simple method to determine costs was needed.

We employed a method using actual historical costs of new wastewater treatment plant construction to calculate future costs for plants of several sizes. Using data from a variety of municipalities in Oregon who have built new activated sludge treatment plants in the last fifteen years, and applying inflation factors to calculate present worth, we calculated a range of construction costs per million gallons per day of treatment capacity. Construction costs were adjusted to present worth using the U.S. Army Corps of Engineers Civil Works Construction Cost Index System (CWCCIS). A feature category of "Permanent Operating Equipment" was given to the wastewater treatment plant for estimating a cost index.

We conducted a survey of fourteen municipalities in Oregon who have constructed new activated sludge facilities in the last fifteen years. Each city was asked to provide the following information: design flows (Average Dry Weather Flow), the construction cost and the year the construction contract was awarded, specific stringent discharge design criteria such as 10/10 BOD and TSS, low nitrogen or phosphorus, or other criteria which would have an effect on cost, and the type of the facility. Of the respondents, several plants were either upgrades of existing facilities, were facultative sludge lagoons, or had other significant circumstances which affected costs. Because of these circumstances, some respondents were excluded from the reported results. The results of the survey are summarized in Figure 24. Footnotes indicate significant rationale for variances in construction costs.



- Alternative 4 Proposed Sewer Line
- Alternative 3 Proposed Sewer Line
- Alternative 2 Proposed Sewer Line
- Existing Fairview Sewer Lines

**CITY OF TROUTDALE'S SEWAGE TREATMENT PLANT
Market Feasibility Study – Proposed Sewer Line Routes
FIGURE 23**

Produced by GIS, Survey and Mapping Section

Figure 24: Construction Costs for Wastewater Treatment Facilities in Oregon

Municipality	Plant Size (MGD)	Construction Cost (\$Million)	Year Built	Cost Adjustment Factor	1995 Cost (\$Million)	Cost per MGD Capacity * (\$Mill)
Bandon ⁽¹⁾	0.5	3.3	1992	1.12	3.7	7.4
Coos Bay #1	1.5	5.6	1987	1.27	7.1	4.7
Coos Bay #2 ⁽²⁾	1	3.2	1990	1.15	3.7	3.7
Metropolitan ⁽³⁾ Wastewater Management Commission	49.0	105	1979	1.64	172.1	3.5
Stayton ⁽⁴⁾	1.9	7.8	1995	1.00	7.8	4.1
Oakridge	0.5	2.6	1993	1.09	2.8	5.7
Tri-City Service District ⁽⁵⁾	5.3	23.0	1983	1.36	31.2	5.9
Average Cost						5.0

* 1995 Dollars

(1) Extra costs related to upgrade of existing facility while in operation, including demolition and tight site conditions

(2) Upgrade of existing plant, only partially new, owner estimates 85% of new construction cost

(3) Lower cost reflects economy of scale for large system

(4) Sequential Batch Reactor design

(5) Discharge to Willamette drives cost slightly higher

Based on this information, the average cost per million gallons per day capacity is approximately \$5.0 million. This cost will vary depending on a variety of factors, but for a plant of this capacity and complexity, this value is fairly accurate. Most of these facilities have 20/20 discharge requirements during low flows which are similar to requirements if discharge were to the Columbia River. Because the proposed treatment facility discharges to the Sandy River where the more stringent 10/10 requirements would be in effect, an estimated 15 % increase in cost would be appropriate.

For a new 3 MGD treatment plant discharging to the Sandy River, an estimated construction cost of \$18 million is provided. This includes 4,400 feet of 24 inch concrete sewer for conveyance from the existing facility and a 1,000 foot outfall priced at approximately \$175 per foot. This excludes the purchase price of the land. Construction of a plant discharging to the Columbia would cost \$16 million including a 5,500 foot outfall. This excludes the purchase price of land or the outfall right-of-way and assuming right-of-way for the outfall could be obtained across the aluminum company land. This cost estimate is preliminary and for comparison purposes only.

4.3.4 Demolition of the Existing Plant and Market Value of the Land

One of the benefits of relocating the treatment plant is that the parcel of land on which the existing plant sits would be available for further development. To prepare the land for sale, the existing plant would be demolished and equipment removed. This section reports on the expected market value of the land, salvage value of equipment, and the estimated costs of demolition and site preparation.

The estimated value of land was based on its highest and best use, believed to be industrial, according to the real estate appraiser who conducted this portion of the study.³ The 10.24 acre property would be sold in two 5.1-acre parcels, one of which would contain the existing maintenance building. The building's market value is estimated at \$121,000 and the land value is estimated at \$568,000 for a total value of \$689,000.⁴

Salvage value of the treatment plant equipment was also considered.⁵ According to the contractor who evaluated this item, the market value of the equipment would be \$420,000. Together with the estimated value of \$689,000 for land and improvements, the City could potentially receive revenues of \$1,109,000.

Offsetting costs include demolition and removal expenses and the cost of environmental site assessment and sampling. No environmental cleanup costs are assumed. Demolition and removal costs for the existing plant are estimated at \$565,000. This includes removal of all above-grade structures and demolishing concrete structures 3 feet below grade, removing piping and mechanical equipment, and backfill. Environmental site assessment and sampling costs are estimated at \$20,000. Thus, potential expenses are \$585,000.

The potential net gain to the City is the difference between these expected revenues and expenses, or \$524,000.

³ The real estate appraisal of this site was conducted by Real Estate Analysis Northwest under contract to the City of Troutdale.

⁴ This does not include the 1.01 acres leased to Waste Water Management, Inc. If this parcel is included as part of the City parcel, the total market value is estimated at \$745,000. Selling the leased parcel by itself would be very difficult due to access.

⁵ The salvage value of equipment and the cost of demolition and environmental site assessment was estimated by CH2M-HILL under contract to the City of Troutdale. The report is a CH2M-HILL Technical Memorandum, "City of Troutdale Sewage Treatment Plant Demolition," February 19, 1996 with a separate report from Wayne C. Coppel, subcontractor, entitled "Environmental Site Assessment Estimated Budget", February 15, 1996.

Figure 25: Revenues and Expenses Related to Disposal of the Existing Treatment Plant Land

Item	Amount
Market value of existing treatment plant parcel (10.24 acres) and Maintenance Building	\$689,000
Salvage value of existing equipment	420,000
Potential revenue	1,109,000
Demolition/removal costs of existing treatment plant	565,000
Environmental site assessment and sampling costs	20,000
Potential expenses	585,000
Potential net gain	\$524,000

4.3.5 Other Factors

The following factors were identified which are relevant to the potential feasibility and cost of this project, but were not further investigated.

Land Cost

A cost of \$350,000 is provided as the purchase price of the land for the treatment plant site. Costs not considered include any rights-of way required for an outfall to the Columbia River if that option is considered. The crossing of a major gas pipeline would also be necessary in the Columbia River discharge option. Level I and possibly Level II site assessments including thorough investigation of the site may be necessary based on the presence of known contamination at the neighboring aluminum reduction facility. Additional record review would indicate the necessary detail of the investigations. An outfall to the Columbia River would likely pass through areas currently being considered for remediation by the aluminum company.

Pretreatment

This study is based on limited pretreatment of sewage from industrial dischargers, and assumes wastewater strength is 75 percent of average loadings in the last ten years. Treatment of wastewater to the high standards required for discharge to the Sandy River increases capital and operational costs. Even if discharge is allowed under the current permitted levels, treatment costs are elevated due to the high strength of the wastewater. Enforcement of pretreatment standards would provide the opportunity to simplify the design and operation of a new facility, and could possibly extend the life of existing facilities.

Treatment Alternatives/Technologies

This study uses conventional treatment technologies to examine the potential costs of wastewater treatment plant construction. The advantage of this approach lies in the familiarity of the present plant staff with the technology, and historical data on the cost of this type of plant construction. Selection of the technology type for this study does not preclude the possibility that new, innovative or alternative treatment technologies could be applied to this project in a cost effective manner. These alternatives could be identified during design of any new facility.

Waste Water Management, Inc.

Construction of a new treatment plant away from the existing site would not necessarily result in the closure of the Waste Water Management, Inc. private facility adjacent to the existing treatment plant. This facility accepts waste water from septage haulers carrying domestic and commercial waste. There may be odor and aesthetic concerns associated with continued operation of this plant.

4.4 Alternative 3 - Utilize City of Gresham Treatment Plant

This section describes the alternative of conveying wastewater from the city of Troutdale to the WWTP at Gresham. This section describes the capability of the Gresham facility to treat the additional flows from Troutdale and how these flows might affect the plans for expansion of the Gresham facility. A conceptual design and cost for conveying sewage from Troutdale to Gresham is provided, including other relevant factors which may affect this alternative.

4.4.1 Willingness to Participate

The city of Gresham operates a regional activated sludge wastewater treatment plant which treated an average of 10.8 MGD in 1994, serving an estimated population of 71,500. The plant currently serves domestic and industrial customers in Gresham, Fairview and Wood Village. As part of this study, Gresham was asked by the city of Troutdale to consider the possibility of permanently treating Troutdale wastewater at the Gresham facility. Gresham has indicated it would be willing to consider an arrangement with Troutdale for wastewater treatment and provided data on the Gresham plant operations, capacity, and future projected flows and treatment needs. The type of arrangement between cities or system for charging is assumed similar to the rate schedule currently used for Fairview and Wood Village. It is not known if a separate rate schedule may be negotiated.

4.4.2 Gresham Plant Capabilities

As discussed in part 4.4.1 above, the city of Gresham regional facility treated an average 10.8 MGD in 1994 serving an estimated population of 71,500. The Gresham facility was upgraded in 1990 for a 12.5 MGD ADWF capacity. The facility is nearing its capacity for sludge treatment and hydraulic flows, and according to the city's Wastewater Treatment Plant Operations 1994 Annual Report, will reach its capacity in the year 2000. Gresham currently plans to build a new digester by the year 2000 and additional treatment facilities to increase hydraulic capacity by the year 2002. The budgeted capital cost for the digester totals \$5.3 million, and the cost for the hydraulic improvements totals \$18.4 million through 2004. This upgrade will increase treatment capacity to 20 MGD ADWF. These upgrades are currently planned and budgeted regardless of whether Troutdale flows are treated at the Gresham facility.

According to Gary Ott, City of Gresham wastewater engineer, the Gresham plant could not accommodate Troutdale flows until the upgrade at Gresham is complete. The city of Troutdale would likely be asked to participate in the upgrade. At the current rate schedule, the costs to the city of Troutdale for purchasing capacity at Gresham is \$21.6 million. This is based on a 3.0 MGD ADWF flow at a cost of \$1,800 per 250 gpd capacity. This cost is more than the projected cost of Gresham's planned upgrade, and it

is not known whether Troutdale would be asked to participate with the full amount at the time of purchasing capacity.

Based on city of Gresham population and flow projections, the Gresham facility upgrade will serve the city until approximately 2018 when the Gresham population approaches 110,000. This estimate is based on a steady linear population growth projection of approximately 2,200 persons per year which is based on city and Metro planning documents. Fairview and Wood Village population and flows are included in this projection. Using figures reported in the Gresham 1994 Annual Report, the capacity of the Gresham WWTP is reached in approximately 2016, or two years earlier than currently projected if Troutdale flows are included in the wastewater treated at Gresham. This projection is based solely on hydraulic conditions. The effect of Troutdale solid and organic loads on the Gresham facility is not known. Gresham is currently conducting a Feasibility Study for future treatment needs. The affect of Troutdale flows on treatment capability should be included in the feasibility study if the option of treating Troutdale flows at Gresham is considered.

4.4.3 Conceptual Design of Conveyance Facilities

Facilities required to convey sewage from the existing treatment plant to the Gresham facility include a pump station, force main and gravity sewer, and are designed for maximum hour flows without surcharge, or 8.03 MGD. No modification to existing Troutdale collection systems are proposed. Facilities required are a new 24 inch gravity concrete sewer from a diversion structure at the existing treatment plant to a point along Marine Drive where it enters a 5,000 gpm pump station and is pumped up to Sandy Boulevard in an 18 inch force main. From there the sewage would reenter a new 24 inch gravity line on Sandy Blvd. for delivery to the plant at Gresham. A detail design will determine ultimate pipe sizes, but these preliminary sizes are appropriate for the purpose of this report. Most of the alignment is in existing rights of way with the exception of the pump station and force main. A pump station lot on Marine Drive and force main right of way would be acquired. A proposed alignment is shown on Figure 23.

4.4.4 Construction Costs

Construction costs for all conveyance systems in this report were calculated using R.S. Means Company Construction Cost Data. Costs for the conveyance system range from \$87 per linear foot for 18 inch ductile iron force main to \$175 per linear foot for 24 inch concrete sewer, with a lower cost in areas not paved. These costs are based on an average pipe depth of 12 feet and manholes located on 250 foot centers for gravity sewers. A total of 20,600 linear feet of pipeline are required for a cost including the pump station and railroad crossing of approximately \$4.1 million dollars. This cost estimate is preliminary and for comparison purposes only.

4.4.5 Other Factors

The following factors were identified which are relevant to the potential feasibility and cost of this project, but were not further investigated.

Sandy Boulevard Interceptor

The proposed gravity line down Sandy Boulevard for this project is designed as independent of other sewer lines on Sandy Boulevard. In reality, it parallels the Fairview Interceptor conveying sewage from the cities of Fairview and Wood Village to Gresham. According to the Fairview Sanitary Sewer Study, the Fairview Interceptor is currently overloaded and Fairview is planning a new parallel line to relieve overflows. The new Fairview line and the proposed Troutdale line could be combined into one interceptor to save costs for both municipalities. This option has not been priced in this report.

Demolition of Existing Treatment Plant

As explained in Section 4.3, the existing plant would be demolished and the land and equipment sold. Potential revenues are estimated at \$1,109,000 and expenses are estimated at \$585,000 for a net gain of \$524,000.

Gresham Feasibility Study

As described in Section 4.4.2, the city of Gresham is currently studying future wastewater treatment needs. If the option of treating Troutdale flows at the Gresham facility is considered, Troutdale flows should be included in the study. The study costs potentially incurred by Gresham to include Troutdale flows are unknown and are not included in this report.

Gresham Pretreatment Program

Gresham currently enforces a pretreatment ordinance with ratepayers. Municipalities discharging to the Gresham plant, are responsible for enforcing the pretreatment standards. This report does not compare Gresham pretreatment standards with those being considered at Troutdale, therefore, this report does not discuss the cost to Troutdale of enforcing the Gresham standards if this option is considered.

Waste Water Management, Inc.

As discussed in Alternative 2, this alternative would not necessarily result in the closure of Waste Water Management, Inc. private facility adjacent to the existing treatment plant.

4.5 Alternative 4 - Construct New Regional WWTP for Troutdale, Fairview, and Wood Village

This section describes the alternative of constructing a new regional wastewater treatment plant for the cities of Troutdale, Fairview and Wood Village. The cities of Fairview and Wood Village currently discharge wastewater to the city of Gresham's treatment plant under an agreement with the city of Gresham. This option considers diverting those flows and combining flows from the three cities and treating them in a new facility located along the Columbia River. This section describes the type, size and cost of the new plant and conveyance systems required for this alternative, and other relevant factors which may affect this option.

4.5.1 Type and Size of the New Regional Facility

Design Flows

Estimated flows for the cities of Fairview and Wood Village are taken from the Fairview Sanitary Sewer Study prepared for the City of Fairview by CH2MHill, November 1994. All City of Wood Village sewage flows into the Fairview Interceptor on its way to the City of Gresham WWTP. The Wood Village main interceptor connects to the Fairview interceptor and the Wood Village pump station (NE 238th and Sandy Blvd) also discharges into this gravity system as indicated on Figure 23. Fairview flows are from several drainages. The majority of Fairview's existing sewers are gravity sewers, discharging to the City of Gresham treatment plant through the Fairview Interceptor. The Fairview Sandy Boulevard LID is a small basin which is emptied by a pump station and force main to the Gresham facility. An area around Blue Lake is served by the Interlachen Interceptor, pump station and a force main to Gresham. Future buildout for the city of Fairview requires serving a large area north of Sandy Boulevard called the North Area LID with a new collection system and a new pump station termed the Fairview Pump Station.

This alternative investigates the potential to combine the wastewater flows of Troutdale, Fairview and Wood Village into a new regional wastewater treatment plant. This study will assume the flows currently flowing in the Fairview Interceptor and Sandy Boulevard force main would be rerouted to the new regional facility. For this study the Interlachen flows are not included because it would be impractical to reroute flows from a system currently in close proximity to the Gresham facility. The construction of the North Area LID sewers, which will flow to the Gresham facility, are anticipated to be completed prior to completion of this study and any subsequent construction. The planning and construction of these sewers are too far along to consider re-routing flows to a new facility; therefore, projected flows from the North Area LID are not included in this study for the proposed new regional facility. Diversion of most of the current Fairview and Wood Village flows could occur at NE Sandy Boulevard and 223rd Avenue.

The figures in Figure 26 show flows for the regional facility with a combined design flow of 4.0 MGD and a peak flow of 8.48 MGD. Flows for the city of Fairview at buildout do not include the Interlachen collection system, the North Area LID or Inflow and Infiltration (I/I). Data were not available to document daily wet weather flow, and the estimated flows from the Fairview sewer study were used. Although the city has some I/I problems, the city is planning some I/I and sewer rehabilitation work. This study assumes this work will be accomplished.

Design Loads

Little data is currently available for BOD and TSS loadings for Fairview and Wood Village. Estimated values are developed from the Troutdale Capacity and Local Limits Study. Estimated loads that Gresham uses for billing purposes are estimated and historically are lower than typical wastewater flows. Because the demographics and land use of the areas are similar, we used loadings comparable to the city of Troutdale's. The city of Troutdale has experienced high loadings in recent years due to industrial discharges. The loads at Fairview and Wood Village are not expected to be identical to these during buildout. For the sake of this report, we assume BOD and TSS concentrations are approximately 75 percent of the loadings at Troutdale over the last ten years. This computes to 280 mg/l BOD and 246 mg/l TSS. Both values are in the high end of the expected range for raw domestic wastewater (Wastewater Engineering, Metcalf and Eddy 1993) and this is considered a conservative estimate. For the purposes of this study, which are for conceptual design and cost comparison purposes, estimated loadings are adequate. For a detailed design, measurement of actual loadings will be required.

Figure 26: Flow and Loading Requirements, Tri-City Plant

	Troutdale (2021)	Fairview/ Wood Village (buildout)†	Total Design Flows Regional Plant
Design Flows			
Flow (ADWF)	2.68 MGD	1.3 MGD	4.0 MGD
Influent BOD Loading (DWMMADF)	9,230 lb/day	4,560 lb/day	13,790 lb/day
Influent TSS Loading (DWADF)	10,150 lb/day	4,350 lb/day	14,500 lb/day
Peak Flows			
Flow (WW MDF)	5.35 MGD	3.13 MGD *	8.48 MGD

* Does not include I/I

† Includes Wood Village, Fairview Interceptor, and Sandy PS

Design criteria used for the preliminary design are the treatment standards in state of Oregon for discharge into the Columbia River as described in OAR 340-41-482. These are as shown in Figure 27.

Figure 27: Oregon Treatment Standards, Columbia River Discharge

Parameter	Effluent Criteria
BOD ₅ (July 1- January 31)	20 mg/L Monthly average
TSS (July 1-January 31)	20 mg/L monthly average
BOD ₅ (February 1- June 30)	30 mg/L Monthly average
TSS (February 1-June 30)	30 mg/L monthly average
Disinfection	Equivalent to 1 ppm Cl for 60 minutes
Dissolved Oxygen	95%
Temperature	58.5°F maximum
pH	6.5 to 8.5
Bacteria	33 per 100 ml

Factors affecting the type of plant considered for this study are the same as for the Troutdale plant in Section 4.3. A conventional activated sludge plant was chosen with the same plant components as in the Troutdale facility described in Section 4.3 except discharge would probably be to the Columbia River. Based on the increased flows and approximate size increases, approximately 15 acres of land will be required for construction of the facility.

4.5.2 Proposed Site

There are few developable lots in a central location between Troutdale and Fairview near the Columbia River. A centrally located potential site is the western portion of Tax Lot No. 200 off Sundial Road and immediately south of the Troutdale Electrical Substation. According to the National Wetlands Inventory, approximately half of the needed acreage is partially drained pasturine wetland which requires mitigation. No wetlands determination has been done at the site. Assuming mitigation lands can be purchased and developed on the same property during treatment plant construction, new wetlands could be created with excavated material providing fill for the plant site. The existing wetlands could also be enhanced. Based on state ratios of acres of new wetlands required for wetlands lost, a whole project ratio of 2:1 is estimated for wetland mitigation. This assumes a combination of enhanced and created wetlands. At this ratio, with construction destroying eight acres, 31 total acres are required for the facility and mitigated wetlands, 15 acres for the plant and 16 for wetland mitigation. At a price of \$30,000 per acre, land acquisition would total \$930,000. According to the National Wetlands Newsletter article "Calculating the costs of Restoration", May/June 1994, construction costs for wetland mitigation of restored agricultural land range between \$500 and \$21,000 per acre with an average cost of \$1,000. These costs represent nearly 500 projects but do not include the costs of plantings. Including some planting costs, an estimated cost of \$5,000 per acre is used for wetland construction. Therefore, total costs for land and wetland construction are estimated at \$1,010,000.

The site is currently undeveloped pasture land owned by Reynolds Metals. At approximately 20 feet above mean sea level, it is approximately 20 feet lower in elevation than the existing treatment plant and is within the Sandy Drainage District's levee system, protected against 500 year flood event. This parcel is part of the Reynolds Metals property currently being investigated under the Superfund program. According to Chip Humphrey, the USEPA remedial project manager, the selected portion of Tax Lot No. 200 was probably not a waste disposal area, but may have local contamination in the drainage system from site runoff. The NPL site investigation is in the early stages and a decision on the site remedy is not expected for one to two years. As part of the NPL investigation, the site is currently no available. Tax Lot No. 200 is outside the city limits.

Conveyance System. A proposed routing of facilities required to convey sewage from the existing treatment plant to the new facility is designed for maximum hour flows without surcharge. No modifications of existing Troutdale conveyance facilities are proposed. Troutdale flows follow a 24-inch gravity main traversing Frontage Road and Marine Drive to the west end of the airport. Existing flows from Fairview and Wood Village are diverted in an 18-inch main at Sandy Boulevard and 223rd Avenue north along 223rd and across the railroad spur to Marine Drive and Sundial Road. Combined Troutdale and Fairview flows are conveyed in a 30-inch line along Sundial to the new facility. Most of the alignment is along public roads, but much of the line crosses private land. The ability or costs to obtain rights of way along and through private property was not investigated. Facilities required include a diversion structure at the existing plant, a gravity concrete sewer line, a bored railroad crossing, a bypass structure upstream of the new plant headworks and a bypass diversion structure upstream of the new effluent pump station wet well. The proposed alignment is shown on Figure 23.

4.5.3 Costs

Based on the method for treatment plant construction cost estimating described in Section 4.3, an order of magnitude estimate for the regional plant can be made. This method approximates a cost of \$5.0 million dollars per million gallon per day treatment capacity. Because discharge would be to the Columbia River, which has lower treatment standards than the Sandy River, no increased cost factor is applied. For a new 4 MGD treatment plant discharging to the Columbia River, an estimated cost of \$20 million is provided.

Conveyance System. Costs for the conveyance system range from \$135 per foot for 18 inch concrete sewer pipe to \$185 per foot for 30 inch concrete sewer, with a lower cost in areas not paved. A total of 19,100 feet of pipeline are required for a cost including the railroad crossing of approximately \$3.3 million dollars.

Cost Summary. The total cost of this alternative is \$24.3 million. This includes \$20.0 million for the treatment plant, \$1.0 million for the land and wetland mitigation construction, and \$3.3 million for the conveyance system. This cost estimate is preliminary and for comparison purposes only.

4.5.4 Other Factors

The following factors were identified which are relevant to the potential feasibility and cost of this project.

Demolition of Existing Treatment Plant

As explained in Section 4.3, the existing plant would be demolished and the land and equipment sold. Potential revenues are estimated at \$1,109,000 and expenses are estimated at \$585,000 for a net gain of \$524,000.

North Area LID

The North Area LID is an approximately 900 acre undeveloped area north of Interstate 84 in which the city of Fairview plans to construct sewers beginning in 1996. According to the Fairview Sanitary Sewer Study, this area has a potential ADWF of 1.9 MGD. The current city of Fairview plan proposes discharging sewage to the city of Gresham WWTP. If these flows were diverted to a new regional facility as described in this section, the cost effectiveness of the new treatment plant would be significantly raised. This option was not explored further since the new sewage system will probably be underway by the time a decision is made on the City of Troutdale's sewage system.

Mitigation Costs

Costs and acreage required for mitigation lands vary widely. The assumptions made in this report for a mitigation ratio of 2:1 may range up to 3:1. Also, a cost of \$5,000 per acre may be low, and could range up to \$20,000 per acre or higher.

Fairview Improvements

The city of Fairview is considering construction of improvements to the Fairview Interceptor. This improvement totaling \$763,000 would not be necessary if the flows were diverted to a new regional facility.

Plant Siting

Because the proposed site is currently under investigation as part of a Superfund Site, alternate siting for this alternative is necessary. Additional sites were not investigated but may be available. For the purposes of providing costs for an alternate site, costs are provided here for locating the regional facility at the proposed new Troutdale plant site on Graham Road. Adequate land at this site exists. No additional engineering was completed for this work, and this estimate assumes gravity sewer can be provided along existing rights of way. Because discharge to the Columbia River would require a long outfall across Reynolds Metals property, this estimate assumes discharge to the Sandy River.

Figure 28: Tri-City Cost Estimate for Graham Road Site

Item	Description	Cost
Treatment Plant	4 MGD x \$5.75M ⁽¹⁾	\$23,000,000
Purchase Land	15 acres x \$30,000	450,000
Conveyance System	5,400 lf of 24" CSP x \$175/lf	945,000
	18,000 lf of 18" CSP x \$135/lf	1,755,000
TOTAL COST		\$26,150,000

(1) Cost per MGD treatment is increased 15% for discharge to the Sandy

Waste Water Management, Inc.

As discussed in Alternative 2, this alternative would not necessarily result in the closure of Waste Water Management, Inc private facility adjacent to the existing treatment plant.

4.6 Alternatives Summary

4.6.1 Purpose

This section provides a brief summary of each of the four alternatives considered. Included below is a brief description of each alternative, estimated capital costs, and the advantages and disadvantages. Figure 29 below lists the costs of each alternative.

Figure 29: Alternative Cost Estimates

Alternative	Description	Estimated Capital Cost (million \$)*
1	Improve Troutdale's Existing Plant	8.1
2	Construct New Troutdale Plant	16.4 to 18.4
3	Utilize Gresham Plant	25.7
4	Construct Tri-City Plant	24.3 to 26.1

* Does not include cost to demolish existing plant or any residual value of plant or real estate.

4.6.2 Improvements to Troutdale's Existing Plant

This alternative requires expansion of Troutdale's existing treatment plant. Estimated capital costs are approximately \$8.1 million.

Advantages:

- It is the least costly alternative.
- No land acquisition is required.
- Troutdale maintains local control of sewage treatment.
- Does not require demolition of the existing treatment plant.
- Does not involve changing wastewater treatment boundaries.
- Can be initiated sooner than the other alternatives.

Disadvantages:

- Does not provide land for further downtown development.
- May not resolve all inherent inefficiencies at the existing treatment plant.
- Troutdale retains liability for the NPDES Discharge Permit.

- Does not eliminate odor and aesthetic concerns associated with the existing treatment plant.

4.6.3 Construct New Troutdale Plant

This alternative requires land acquisition on the north side of Troutdale in order to construct a new sewage treatment plant. Discharge will be either to the Sandy River, with an estimated capital cost of \$18.4 million, or to the Columbia River, at an estimated cost of \$16.4 million.

Advantages:

- It is the second least costly alternative.
- Troutdale maintains local control of sewage treatment.
- Does not involve changing wastewater treatment boundaries.
- Provides land for further downtown development.

Disadvantages:

- If discharge is to the Columbia River, significant problems may be encountered with land acquisition of 5,500 feet of easements/rights-of-way, possible environmental mitigation through a portion of a superfund site, and a mile of additional pipe to maintain.
- Troutdale retains liability for the NPDES Discharge Permit.
- Requires land acquisition.
- Requires demolition of the existing treatment plant.
- Would not necessarily result in the closure of the private facility adjacent to the existing treatment plant operated by Waste Water Management, Inc.

4.6.4 Utilize City of Gresham Treatment Plant

This alternative requires an agreement between the cities of Gresham and Troutdale in which Gresham would provide long term treatment of Troutdale's sewage. Estimated capital costs are \$25.7 million.

Advantages:

- Troutdale may no longer have liability for NPDES Discharge Permit.
- Provides land for further downtown development.

Disadvantages:

- This is the second most costly alternative. (Most costly if Troutdale only pays pro rata share of capital costs for regional plant.)
- Requires demolition of the existing treatment plant.
- Requires land acquisition for conveyance easements/rights-of-way.
- Wastewater treatment boundaries will change.
- Troutdale loses local control of sewage treatment and rate setting.
- Would not necessarily result in the closure of the private facility adjacent to the existing treatment plant operated by Waste Water Management, Inc.
- Would need to enforce pretreatment regulations in accordance with Gresham's Pretreatment Program.

4.6.5 Construct New Regional Treatment Plant for Troutdale, Fairview, and Wood Village

This alternative requires acquisition of land on the north side of Troutdale in order to construct a new sewage treatment plant for Troutdale, Fairview, and Wood Village. Estimated capital costs at the preferred site are \$24.3 million. If this site is not available from the owner, Reynolds Metals, then capital costs are estimated at \$26.1 million due to additional conveyance requirements.

Advantages:

- Provides land for further downtown development.

Disadvantages:

- This is the most costly alternative. (Second costliest if Troutdale only pays pro rata share of capital costs for this option.)
- Requires demolition of the existing treatment plant.
- Wastewater treatment boundaries will change.
- Troutdale may retain liability for the NPDES Discharge Permit.
- Requires land acquisition.
- Treatment of wastewater will become multi-jurisdictional with resulting administrative burdens.
- Would not necessarily result in the closure of the private facility adjacent to the existing treatment plant operated by Waste Water Management, Inc.

5. Operating Costs, Municipal versus Private Operation

5.1 Troutdale Sewer Rates, Revenues and O&M Costs

Troutdale's rate structure for sewer services is based upon an Equivalent Residential Unit (ERU) which is defined as a unit of wastewater which incurs the same costs for treatment as the average volume of domestic wastes discharged from a single-family residence.⁶ The City currently has approximately 3,200 utility accounts with 4,400 ERU's. The monthly sewer user fee is \$18.75 per ERU. The rate has been in effect since July 1, 1993.

System Development Charges (SDC) are a primary source of funding for capital improvements that enhance capacity. These charges are \$3,465 per equivalent residential unit. In addition to SDC, the City uses borrowed funds, including loans from Oregon Economic Development Department under the Special Public Works Facilities (SPWF) Program.

In the year ending June 30, 1995 revenues from sewer user fees amounted to just over \$1.0 million and O&M expenditures for Personnel, Materials & Services, and Service Transfers were about \$755,000. The balance was used for capital-related expenses or held as cash reserves. Approximately 52 percent of O&M expenditures, about \$395,000, are considered treatment related.⁷ System Development Charges can only be used for capital-related expenses. In 1995, SDC revenues amounted to \$873,000.

5.2 Estimated O&M Costs for the Troutdale STP

Troutdale's Public Works Department staff examined individual line items in the Sewer Fund and estimated the increase in operating costs for the alternatives under the assumption of public operation. The following summarizes these cost increases for the various alternatives:

⁶ The City has determined an ERU to be 98,500 gallons per year with a BOD concentration of 180 mg/l and a suspended solids concentration of 239 mg/l.

⁷ City staff's review of the Sewer Fund budget items indicated that about 57% (\$205,000) of Materials and Services, 48 percent (\$129,000) of Personnel, and 48 % (\$62,000) of Transfers (funds 8854, 8871, and 8872) were treatment related.

Improve Existing Plant (Alt. 1) or Construct New Troutdale Plant (Alt. 2):

The major cost increase would be for personnel because one additional employee would be required. There would also be increases for Materials & Services as presented in Figure 30. According to this estimate, O&M costs would increase about \$65,500 or about 9 percent of 1996 budgeted O&M costs. This would raise O&M costs for Personnel, Materials & Services, and Service Transfers to about \$820,000 for current population levels, of which about \$460,000 would be apportioned to treatment. O&M costs are expected to grow at about the same rate as population over the next 25 years.

Figure 30: Estimated O&M Cost Increases for Expanded Plant (Alt. 1) or New Troutdale Plant (Alt. 2)

Line Item	Increase in Costs
Personnel (+ one employee, salary & benefits)	\$40,000
Materials & Services	
Permits	2,000
Grit/Screens	Increase with Population
Utilities (+ 20 %)	15,000
Maintenance/Operation of Equipment	3,000
Insurance	5,000
Training	500
Total Increase in O&M Costs	\$65,500

Utilize Gresham Plant (Alt. 3)

Since the City would no longer operate a treatment plant under this option, direct O&M expenditures for treatment would be eliminated. O&M for collection would continue and increase due to the larger conveyance system and additional pump station. Of course, City residents and businesses would pay their share of O&M costs for the Gresham treatment plant through sewer rates.

Currently, approximately 52 percent of Personnel, Materials & Services, and Transfers are considered treatment related. This amounts to \$395,000 out of total O&M expenditures of \$755,000 in Fiscal Year 1994 to 1995. Thus, direct treatment related savings would be \$395,000 annually now and could be expected to grow over time, perhaps at the same rate as population.

Offsetting some of the avoided direct O&M costs for treatment are higher O&M costs for the larger collection system. The expanded collection system will include one new pump station which will increase energy and labor costs. Pump station energy costs are estimated at \$30/million gallons pumped/day. This is based on an estimate of \$.025 per 1000 gal per 40 feet lifted (70% efficiency and \$.055 per KWH). At average flows of 1.3 mgd, the average annual cost is \$14,000. By 2020 when flows approach 3.0 mgd the

energy cost rises to \$33,000. Maintenance costs of the pump station are estimated at \$5,000. Maintenance and repair of 20,600 feet of additional sewer line is expected to cost \$34,000, based on City budget of \$360,000 for its existing 41 miles of sewer line. Total additional O&M costs for the expanded conveyance system are \$53,000.

Gresham charges for flow, BOD, and TSS need also be considered. Based on Gresham's rate resolution for Wood Village and Faiview, Gresham O&M charges to be recovered in Troutdale's rates are presented in Figure 31. For treatment of current flows and loads, the O&M cost component is estimated at \$828,000.

Figure 31: Estimated Gresham O&M Expenses for Troutdale Flows and Loads (Based on Gresham's Rate Resolution No. 1971)

	Unit Charge	Quantity	1995		2020		
			\$/Day	\$/Year	Quantity	\$/Day	\$/Year
Flow	\$0.330 per 100 gallons	1,270,000	\$ 419	\$ 152,972	2,790,000	\$ 921	\$ 336,056
BOD	\$0.295 per lb.	2,964	\$ 874	\$ 319,149	6,500	\$ 1,918	\$ 699,888
TSS	\$0.295 per lb.	3,306	\$ 975	\$ 355,974	7,250	\$ 2,139	\$ 780,644
Total			\$ 2,269	\$ 828,094		\$ 4,977	\$1,816,587

Total estimated O&M charges for both treatment and collection are estimated at \$1,241,000 as presented in Figure 32. This is about \$486,000 greater than existing O&M expenditures.

Figure 32: Estimated O&M Costs for Alternative 3

Item	Cost
Gresham Charge for Treatment	\$828,000
Existing Conveyance System	360,000
Expanded Conveyance System	53,000
Total O&M	1,241,000

New Tri-City Plant (Alt. 4):

For the larger 4.0 mgd Tri-City regional plant, O&M costs for treatment are estimated to increase about \$146,000 to about \$540,000. The largest cost item is the cost of 2 additional employees. This estimate does not include increases in certain capital outlays that might be needed such as extra vehicles. Also, it is assumed there would be no increases in service transfers such as for Facilities Maintenance and Public Works Management.

Figure 33: Estimated O&M Cost Increases for New Tri-City Regional Plant

Line Item	Increase in Costs
Personnel (+ two employees, salary & benefits)	\$80,000
Materials & Services	
Spec. Department Expenses	
Permits	4,000
Sludge-Related Costs	1,000
Grit/Screens	3,000
Lab Supplies	3,000
Odor Control	3,000
UV Bulbs	1,000
UV Cleaning	15,000
Utilities	20,000
Maintenance/Operation of Equipment	5,000
Insurance	10,000
Training	1,000
Total Increase in O&M Costs	\$146,000

In addition to these treatment-related O&M costs, there would be additional expenses related to the expanded conveyance system. Maintenance and repair of 19,100 feet of additional sewer line is expected to cost \$32,000, based on City budget of \$360,000 for its existing 41 miles of sewer line. Total O&M costs for treatment and conveyance would be approximately \$930,000, with about \$540,000 for treatment and about \$390,000 for conveyance. Some portion of these costs would presumably be shared with Fairview and Wood Village. O&M costs would be expected to grow at about the same rate as population for the 3 cities over the next 25 years.

5.3 Private Operation

This section estimates the contract fee for private operation of the STP under Alternatives 1, 2, and 4. The estimate is based on contract costs for OMI operation of the Gresham, Hood River, Lebanon and The Dalles treatment plants. The next table summarizes costs and project operational characteristics upon which the contract cost is based.

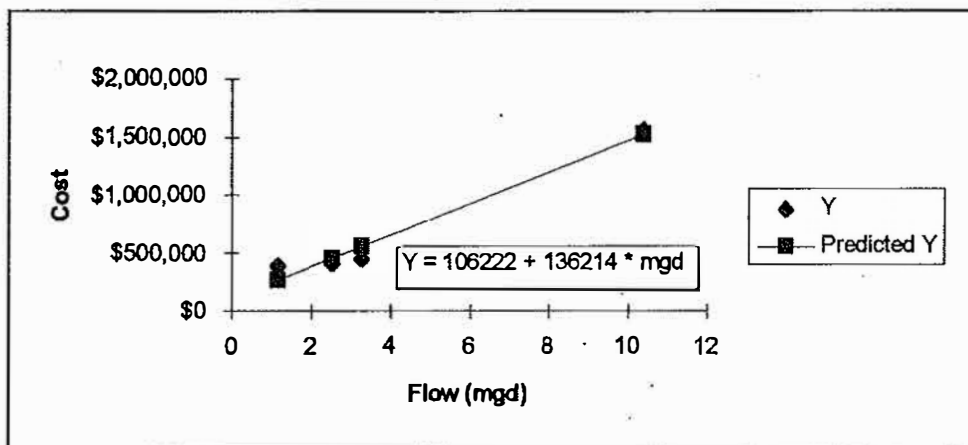
Figure 34: OMI Fees and Project Characteristics Specified in Contracts

City	Flow (mgd)	BOD (lbs/day)	TSS (lbs/day)	Fee
Gresham	10.4	13,908	13,959	\$1,555,395
Hood River	1.17	4,082	3,686	388,844
Lebanon	3.32	2,268	1,924	450,600
The Dalles	2.58	3,100	2,990	459,295 1/

1/ Includes \$50,000 for capital outlays

Figure 35 below shows the plot of actual OMI contract costs against city flows for the 4 cities (diamonds) and the estimated linear relation between cost and flow. This linear relation does not take into account BOD or Suspended Solids which also would affect operating costs and charges. Nevertheless, it may provide a first approximation of the private operating costs for different flows. Based on this relation, for example, a 1.5 mgd (estimated Troutdale flows in 2000) flow would imply a \$310,000 charge and a 3 mgd flow would indicate a charge of \$515,000. Looking at charges (\$388,000) for Hood River, which has slightly lower flows but higher loadings than Troutdale, it may be reasonable to conclude Troutdale charges would also be in this range. The Dalles, which has higher flows and higher BOD than Troutdale, has charges of \$410,000 so this is probably an upper bound for Troutdale private operation costs. Therefore, a range of likely costs for private operation of plants for Alternatives 1 and 2 now is estimated at \$310,000 to \$410,000, with a most likely value near the Hood River charge. Alternative 4 (Tri-City plant) would be somewhat higher, depending on exact flows and loads.

Figure 35: Estimated Relation Between OMI Contract Cost and Flow



5.4 Other Relevant Factors, Municipal versus Private Operation

5.4.1 Advantages and Disadvantages of Municipal Operations

The following factors in addition to costs should be considered in the evaluation of municipal versus private operations. According to City Public Works Officials, advantages of municipal operations include:

- Allows maximum efficiency of personnel and equipment among treatment, collection and storm sewer systems.

- Allows use of personnel and equipment between other City agencies when necessary.
- Centralizes emergency response to reported problems.
- Maintains in-house laboratory capability.
- The City already has a well trained, experienced and certified staff with excellent working relationship with DEQ.
- Staff have a long term stake in the plant.
- Employees' first priority is to the City rather than a profit-making corporation.
- Employees are responsive to City needs and changes. When City requirements change, there is no need to negotiate contract changes.

Possible disadvantages of municipal operation include:

- Must comply with City personnel rules and union contract.
- Due to public purchasing rules, the City often cannot take advantage of special deals, discounts, and price breaks on equipment and supplies.

5.4.2 Advantages and Disadvantages of Private Operation

Discussions with officials of several communities which contract out treatment plant operation revealed a high level of satisfaction with the private operator. These officials report the following advantages for their communities.

- Total operating costs are lower with the private operator than with municipal operation.
- The private operator has good flexibility with personnel. Some examples are:
 - * It can supply less than one full time equivalent (FTE) for certain specialties at a given plant. The reason for this is that the operator can share some personnel among two or more plants. One city reported that its privately operated plant operates with 4 FTE whereas with municipal operation employment would be more like 7 FTE.
 - * The private operator can bring in expertise as needed almost immediately to solve a problem that might arise.

- * The private operator can make quick personnel changes in the event someone quits.
- The private operator can get discounts on chemical purchases.
- The private operator assumes liability.
- The private operator has access to full-service laboratories, a benefit especially to smaller, rural communities which do not have the lab and must depend on expensive private labs.
- The private operator has expertise in regulatory requirements which smaller communities may not have.
- The private operator is good at reporting and has good contact with DEQ.
- There is rapid response to problems.

It should be pointed out that these reported advantages of private operation pertain to a single contractor (OMI). It cannot necessarily be assumed that this contractor would be the successful proposer; therefore, not all of these advantages may apply with other potential contractors.

Private operation may also have some disadvantages. Several are listed below.

- The period of transition from public to private operation would be difficult for city staff at the STP who could face the possible loss of employment at the plant.
- Only one private firm has been identified as an operator of treatment plants in Northwest Oregon. Therefore, this may indicate a lack of competition in this market, resulting in prices not justified by costs. On the other hand it may simply be a situation where this firm is the low-cost operator and bids aggressively.
- The private operator may have an advantage in negotiating a contract, especially with smaller communities which do not have the expertise or knowledge in treatment plant operation and operating costs.
- The private operator's liability in the event of a very costly incident may exceed the contractor's ability to pay.
- Once a municipality converts to private operation, it may be very difficult to return to public operation. City employees with knowledge and experience

may have been lost and equipment excised during the tenure of the contractor. Knowing this, a contractor might submit a low bid initially to "get his foot in the door" but then increase fees much higher in future years when the City has virtually no other option. This might especially be a problem if there are no other competitors in the market.

6. Financial Plan and Options⁸

6.1 Overview

In this chapter, we analyze the means and impacts of financing three of the four sewer Alternatives. We do not in this preliminary report provide a detailed forecast of Alternative 3, because it appears to be outside the realm of feasibility.

This chapter contains five sections. In section 6.2, we present historical financial information including a review of the terms and conditions of outstanding loans.

Section 6.3 contains financial and sewer rate forecasts for each Alternative. These forecasts are based on a set of economic and financial assumptions that are constant for each Alternative. The assumptions are held constant so that we can fairly compare the impacts of each Alternative on city residents' sewer rates.

In Section 6.4 we discuss the options to fund the capital improvements for each Waste Water Treatment Plant (WWTP) Alternative. We review both the city's ability to issue debt in the municipal bond market, and all of the possible federal and state grant and low-interest-loan programs that Troutdale may qualify for. Also, we explain the basic criteria needed to qualify and the likely costs to the city of using each program.

The final section concludes with a discussion of which programs the city can actually use and the consequences of each one.

6.2 Financial History of the Wastewater Enterprise

Figure 36 shows the recent financial history of the city's sewer enterprise. The city operates the sewer utility as an enterprise fund, which means that the sewer utility does not use General Fund revenues and is expected to be financially self supporting. The city uses three funds to account for operating and capital costs of the enterprise.⁹ Figure 36 is the combined cash flows of these three funds.

To facilitate our analysis, we divided the cash flows into four main groups: annual cash flows from operations, annual cash flows from capital related activities, annual cash flows from investments, and the accumulation of net cash flows over the history of the funds. This division of revenues and expenses allows us to evaluate the financial condition of the enterprise and to assess its ability to borrow money for major capital improvements.

⁸ This chapter was developed and written by the city's financial consultant, Raymond J. Bartlett, Economic & Financial Analysis, Portland, Oregon.

⁹ The three funds are the Sewer Fund, the Sewer System Improvement Fund, and the Sewer Revenue Bond Fund. The sewer fund accounts for all operating revenues and costs. The improvement fund accounts for the SDC revenues. The bond fund accounts for the SPWF bond revenues and debt service.

This division of revenues and expenses allows us to evaluate the financial condition of the enterprise and to assess its ability to borrow money for major capital improvements.

Figure 36: Historical Cash Flows Troutdale Sewer Enterprise

	1990	1991	June 30,		1994	1995
			1992	1993		
CASH FLOWS FROM OPERATING ACTIVITIES:						
Operating Receipts						
Charges for services	494,977	494,120	617,322	766,791	873,262	1,000,536
Miscellaneous	15,807	27,620	12,079	69,930	101,048	14,531
Total Operating Receipts	510,784	521,740	629,401	836,721	974,310	1,015,067
Operating Expenditures						
Personal services	133,005	135,913	153,113	185,484	225,269	252,889
Materials and services	285,536	328,021	279,021	266,479	334,004	354,246
Service transfers out	0	15,595	86,061	141,161	142,897	148,073
Total Operating Expenditures	418,541	479,529	518,195	593,124	702,170	755,208
Net Cash Provided by Operating Activities	92,243	42,211	111,206	243,597	272,140	259,859
CASH FLOWS FROM CAPITAL AND RELATED FINANCING ACTIVITIES:						
System development charges	74,237	256,534	344,750	515,229	726,729	873,469
SPWF Interest Earnings	0	0	0	0	299,939	0
Capital expenditures, Cash	-61,256	-512,929	-586,508	-2,202,782	-977,849	-587,782
Capital lease financing	0	0	-13,627	-54,507	-54,507	-40,880
SPWF loan proceeds	0	0	0	2,128,515	694,118	0
SPWF loan principal	0	0	0	0	-128,852	-137,344
SPWF loan interest	0	0	-63,262	-223,280	-209,792	-177,520
Proceeds from sale of property	171,075	0	0	0	0	0
Net Cash Provided by (Used in) Capital and Related Financing Activities	184,056	-256,395	-318,647	163,175	349,786	-70,057
CASH FLOWS FROM NONCAPITAL FINANCING ACTIVITIES:						
Operating transfers in	52,000	0	47,174	0	0	0
Operating transfers out	-15,000	0	0	-15,000	0	0
Net Cash Provided by (Used in) Noncapital Financing Activities	37,000	0	47,174	-15,000	0	0
CASH FLOWS FROM INVESTING ACTIVITIES:						
Interest income on investments	40,493	42,487	16,330	11,067	25,493	58,806
Net Increase (Decrease) in Cash & Investments	353,792	-171,697	-143,937	402,839	647,419	248,608
CASH AND INVESTMENTS - July 1	148,538	502,330	330,633	186,696	589,535	1,236,954
CASH AND INVESTMENTS - June 30	502,330	330,633	186,696	589,535	1,236,954	1,485,562

6.2.1 Operating Revenues and Costs

Cash flows from operating activities include all user fee revenues and miscellaneous revenues. Typically, an enterprise pays all of its ongoing and unavoidable operating costs from these revenues. Also, it pays these operating costs before purchasing any more capital and before paying interest and principal (debt service) on outstanding loans.

On average, revenues from sewer rates have increased 14 percent per year. The city last increased sewer rates to \$18.75 per month per equivalent residential unit (ERU) effective July 1, 1993. The increase in revenue before and after 1993 resulted from growth in the number of customers connected to the sewer system. In 1994 and 1995, the number of customers increased about 14 percent per year.

Operating costs have been increasing an average of 12 percent per year. Most of that increase resulted from transfers to the Internal Services Fund to pay for the sewer operation share of public works management costs. Between 1991 and 1993 the transfers were increased to the full estimated cost of public works management costs. Since 1993, the transfers have increased 2 percent per year. Personnel costs, including wages, benefits, and taxes have steadily increased as the allocation of public works staff to wastewater has increased. Administrative overhead charges to pay for management and financial services such as personnel management and payroll, utility billing and collections, accounting and auditing services have been relatively stable since 1991 with no reportable increase. Administrative overhead charges are reimbursements to the General Fund and are expensed as charges to Materials and Services. Materials and services increased an average of 4 percent per year; however, these costs fluctuate markedly from year-to-year in response to breakdowns. Electrical costs increased when the city shifted from chlorine disinfection to ultraviolet light in 1993, and more recently, the city began using more chemicals to improve treatment.

The net cash from operations has increased. This cash is available to use for capital improvements and debt service.

6.2.2 Capital and Related Revenues and Costs, and Outstanding Debts

Cash flows from capital and related financing activities include three sources of revenue and two types of expenses. Revenues are composed of systems development charges (SDC), proceeds from loans, and proceeds from selling equipment.

The city assesses the SDC on new real-estate developments in the city that connect to the sewer system. The city last increased the rate effective May 1, 1995 to \$3,465 per equivalent residential unit (ERU). The rate had been \$2,516, which was set in 1994. The SDC equals the capital costs of providing service to a new resident (or equivalent). The revenue produced ranged from \$74,237 in 1990 to \$873,469 in 1995. This flow of

revenue is unpredictable and dependent upon the rate of development in the city. If development stops, no revenues will be produced.

A one time sale of property was reported in 1990.

The city borrowed \$2,822,639 from the Special Public Works Fund (SPWF) of the Oregon Economic Development Department in 1992 and 1993 to construct improvements at the WWTP. The loan proceeds were received by the city over two fiscal years because the OEDD delivered the money to the city as reimbursements for completing construction. While OEDD held the unspent loan proceeds they invested it and earned \$299,939, which it gave to the city. The loan has a 20-year term at an interest rate of 6.59 percent. The city secured the bonds by pledging to keep sewer rates high enough to pay all operating and maintenance costs and annual debt service on this loan and all other loans of the sewer fund. Further, the city had to make a limited tax general obligation. The obligation means that if the sewer fund does not produce enough revenue to pay all of its expenses and debt service, then the city must use its general fund to make up the deficit. Also, this debt was structured so that only interest payments were made in 1992 and 1993. In 1994 the city began paying principal and interest. The bond can be fully repaid in the 11th year without financial penalties.

The only other debt was a lease purchase agreement the city entered into in 1992 to purchase a truck. The last payment was made in 1995.

The two expenses are debt service on outstanding bonds and loans and capital expenditures. Capital expenditures exceeded \$500,000 per year in 1991, 1992, 1994 and 1995. Expenditures exceeded \$2.2 million in 1993 to expand the WWTP.

The net of capital related revenues and expenses was negative in 1991, 1992, and 1995. In these years capital expenditures exceeded \$500,000 per year. Since 1992, SDC revenues have exceeded the sum of debt service on the OEDD loan and on the lease.

Cash flows from noncapital financing activities are unusual transfers from the wastewater utility to other city funds.

6.2.3 Cash Flows From Investing

On a daily basis, the city's finance director keeps idle funds in investments that earn interest. Changes in those daily balances and in the interest rate, result in changes in interest earnings. This source of revenue ranged from a low of \$11,067 in 1993 to a high of \$58,806 in 1995.

6.2.4 Cash Balances

The sum of net operating income, net cash from capital activities, net cash from noncapital financing activities, and interest earnings add to or subtract from the previous year's cash carryover (shown on Figure 36 as Cash and Investments - July 1). In essence, the net increase or decrease in cash and investments shows whether the enterprise gained or lost money for the year. These gains or losses result in an increase or decrease in the cash at the end of the year (Cash and Investment - June 30). Only in 1991 and 1992 did the enterprise lose money. As a result, the cash at the end of the year has increased from \$502,330 in 1990 to \$1,405,562 at the end of 1995.

6.3 Financial Forecasts and Sewer Rate Impacts for the Four Alternatives

6.3.1 Overview of Forecast Assumptions

The financial forecast begins in fiscal 1996, the current year, and is based on revenues and expenses through February 1996. For the years after 1996 we make the following sets of assumptions

- We use a set of economic assumptions to forecast operating expenses. These are shown in Figure 37.
- We use the capital costs shown in the Chapter 4 and the following financing assumptions to determine annual debt service:
 - The city will issue revenue bonds and pledge the net revenues of the enterprise to repay the bonds
 - The bonds will require the city to establish a bond reserve equal to average annual debt service, and it will require a debt coverage ratio of 1.35
 - We assume the bond will have a 30 year term at 6.5 percent

The forecast of revenues equals the amount of revenue needed to cover all operating, capital, and debt service costs, plus an amount needed to meet the "debt-coverage" requirements of issuing a revenue bond.

For each WWTP Alternative, we converted the revenue requirement into a monthly user fee. This comparison provides a reliable measure of the relative costs to city residents of each Alternative. The final costs may be somewhat higher or lower than forecasts because of the actual loan terms the city may get from the municipal bond market or from a federal or state agency that may grant and lend money to the city. The final costs also may be affected by revenues and costs not included in this preliminary forecast. For example, the city will have to pay to remove the WWTP in Alternatives 2, 3, and 4 and it will get the sale value of the land the WWTP occupies. Other financing costs may be involved in early retirement of the current OEDD loan or to renegotiate the terms of the OEDD loan. The

conditions imposed on the city by the existing OEDD loan will make it difficult for the city to enter into another loan. Finally, the annual debt service may be reduced if the city issues a general obligation bond rather than a revenue bond to finance the improvements.

Figure 37: Economic Assumptions

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Labor Costs	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%
Materials & Services	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Capital Costs	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Growth Rate	3.3%	3.3%	3.2%	3.1%	3.0%	2.9%	3.8%	3.6%	3.5%	3.4%	3.3%	3.3%

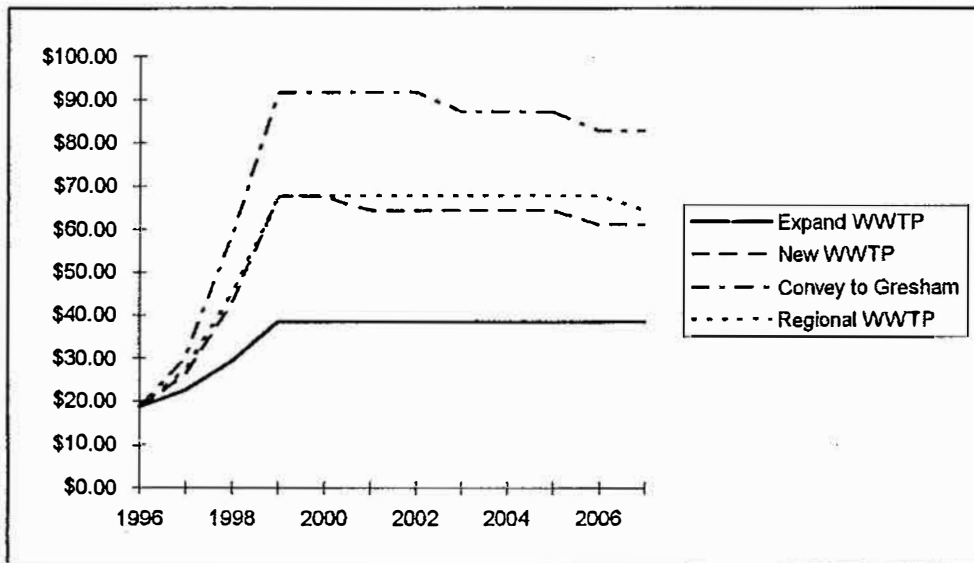
6.3.2 Forecasts and Rates for the Four Alternatives Using Revenue Bonds

Figure 38 and Figure 39 use the monthly sewer rate for a single family house to illustrate the differences in annual cost of the four Alternatives. The current sewer rate is \$18.75 per month. In Alternative 1 the rate would increase each year to 1999 where it would level off at \$38.40 per month. In Alternative 2, the second least costly Alternative, the rate would increase and level off at about \$67.60 per month. The sewer rate would be nearly equal for Alternative 4. Alternative 3, the most costly option, would drive sewer rates to over \$91 per month.

Figure 38: Comparison of Monthly Sewer Rates for an ERU for Each Alternative

Alternative	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1: Expand WWTP	\$18.75	\$22.50	\$29.25	\$38.39	\$38.39	\$38.39	\$38.39	\$38.39	\$38.39	\$38.39	\$38.39	\$38.39
Cumulative % Change		20%	50%	81%	81%	81%	81%	81%	81%	81%	81%	81%
2. New WWTP	\$18.75	\$26.25	\$42.79	\$67.60	\$67.60	\$64.22	\$64.22	\$64.22	\$64.22	\$64.22	\$61.01	\$61.01
Cumulative % Change		40%	103%	161%	161%	156%	156%	156%	156%	156%	151%	151%
3. Convey to Gresham	\$18.75	\$30.00	\$58.80	\$91.73	\$91.73	\$91.73	\$91.73	\$87.14	\$87.14	\$87.14	\$82.78	\$82.78
Cumulative % Change		60%	156%	212%	212%	212%	212%	207%	207%	207%	202%	202%
4. Regional WWTP	\$18.75	\$27.19	\$44.93	\$67.73	\$67.73	\$67.73	\$67.73	\$67.73	\$67.73	\$67.73	\$67.73	\$64.34
Cumulative % Change		45%	110%	161%	161%	161%	161%	161%	161%	161%	161%	156%

Figure 39: Graphic Display of Sewer Rates



In the following paragraphs of this section, we describe in detail the forecast for Alternative 1, and how the other Alternatives materially differ from Alternative 1. For each Alternative we provide a preliminary financial forecast and a set of capital construction and financing assumptions that are unique to each Alternative. These figures are contained in an appendix at the end of the report.

Financial forecast for Alternative 1

As we explained above, the forecast of revenue from sewer rates is determined by the total annual costs of the enterprise. So we focus our discussion on the costs.

From the economic assumptions of 6.3 (Figure 37) above, we assume personnel costs will increase at the rate of 7 percent per year. Operating costs are assumed to increase at 8 percent per year. And the cost of capital improvements at 5 percent per year. In Chapter 4, the capital costs are stated in 1995 dollars. Since the improvements will be built in future years we had to inflate their costs to the year of construction.

Besides being the least expensive of the four Alternatives, Alternative 1 has the advantage of being constructed in four phases over several years. We assume the first phase will be built in fiscal year 1998, the second phase in 2001, and the third phase in 2005. The fourth phase is beyond the planning horizon.

Since construction can be phased we can take advantage of the debt coverage ratio required by a revenue bond to fund phases 2, 3, and 4 with cash reserves, thereby saving the initial cost of financing and the annual interest expenses. This Alternative requires only an \$8.33 million bond to fund it.

We assume the city will have \$1.0 million in 1998 to apply to the expansion of the WWTP (we make this assumption for all 4 Alternatives). The amount the city borrows through bonding equals the construction cost less \$1.0 million plus bond closing costs plus the bond reserve. We assume bond closing costs will equal 5 percent of the bond amount. This cost usually is less than 3 percent. The bond buyers will insist that the city establish a bond reserve equal to one year of debt service. The reserve must be placed in a fund and held until the last payment on the bond.

As we noted above, the bond term is 30 years at 6.5 percent. In addition to these initial requirements, the bond buyers will require the city to show revenues in excess of costs. This excess is measured by means of debt-coverage ratio. A debt-coverage ratio equals the annual net operating revenue plus interest earnings divided by the annual debt service. For example, in year 2000 after all construction on phase 1 is completed the debt coverage ratio equals 1.28, that is

$$\frac{\text{net operating revenue} + \text{interest earnings}}{\text{principal} + \text{interest}}$$

$$\frac{\$1,091,991 + 122,789}{188,969 + 125,895 + 102,705 + \$535,160}$$

Total debt service is composed of debt service on the current OEDD loan plus debt service on the proposed bond¹⁰. Notice that the debt-coverage ratio requires the city to collect more revenue from rate payers than it costs to operate the system and to pay debt service. Also notice that the SDC revenues are not included in the ratio. The lenders do not trust that the SDC revenues will actually materialize. They assume that at some time during the course of the 30-year bond that economic recessions or some other factor outside of the city's control will stop development in the city.

¹⁰The OEDD requires that if the city borrows more money during the term of the OEDD loan, that a debt coverage ratio of at least 1.20 will apply to the OEDD loan. Also, the city may ask the OEDD to take a subordinate lien on system revenues to enhance the city's credit rating for a new loan. The city may also want to defease the OEDD loan through an advance refunding before applying for a new loan. These options will require careful considerations before the city actually borrows again. The OEDD has always been willing to negotiate terms that benefit the city, however, OEDD cannot act alone. Since the OEDD borrowed the money it lent to Troutdale, the State must get approval of any changes from its lender.

during the course of the 30-year bond that economic recessions or some other factor outside of the city's control will stop development in the city.

As a result of the debt coverage ratio and the SDC revenues, the ending cash and investments grow rapidly--over \$500,000 per year. Keep in mind that most of that excess revenue comes from SDCs which may in some years be zero.

The City can use these cash balances to pay for the next two phases of capital improvements. Also, while not shown in this forecast, the city would have sufficient cash to fully repay the OEDD loan in year 2002 from cash reserves--assuming of course that development continues and pays the SDC. By paying off that loan, the city could reduce its sewer rates in year 2002. Also, the bond could be structured so that the city has the option to repay part or all of the outstanding principal on the new loan, and thereby reduce annual debt service and perhaps rates.

To generate the forecast revenues, we assume the city's customer base increases at a rate greater than 3 percent per year. Figure 37 shows the annual growth rate. These new customers coupled with a 20 percent rate increase in 1997, a 25 percent rate increase in 1998, and a 25 percent rate increase in 1999 will produce the needed revenue. Cumulatively, rates will increase 81.3 percent in four years.

This forecast is based on pessimistic assumptions, which we apply uniformly to all four Alternatives so we can fairly compare them. If the city proceeds with Alternative 1 (or any other Alternative) several options are open to it to reduce the rate impacts described above.

First, the city could ask voters to approve a general obligation bond at a general election. A general obligation bond can be repaid from user fees or from property taxes. GO bonds do not require either a reserve or debt-coverage ratio, and because property taxes are the ultimate security, the interest rate is less than that of a comparably sized revenue bond. In rough terms the amount the city would have to borrow to construct the same capital improvements would be about \$1 million less with a GO bond. As a result of borrowing less, the annual debt service would be about \$78,900 less per year. The disadvantage of a GO bond is that since the city does not have to meet a debt coverage ratio or set up a bond reserve, the sewer enterprise has less in cash reserves for the next capital expansion and in the long run it may have to borrow more often.

Second, the amount of the revenue bond and its annual debt service can be reduced by a number of financing techniques. These techniques include (a) pledging some SDC revenues to debt service, (b) reducing the amount to be borrowed by using more of the cash reserves, and (c) by setting up a rate stabilization fund. The benefit of a revenue bond is that it produces excess revenues that can be used for the next capital improvements thereby reducing the city's long-term need to borrow.

Some lenders will allow the city to pledge some, but not all, of its SDC revenues to meet the debt coverage ratio. This pledge then reduces the amount needed from monthly sewer rates. An economic forecast based on regional economic growth and local land availability would be required to justify the forecast of SDC revenues. Using SDC revenues in this way will reduce the need to increase sewer rates.

To pay for more of the construction costs with cash and borrow less, the city would begin now to increase sewer rates and dedicate the increase in revenues to a savings account to be used for construction costs. By increasing rates modestly now, the sewer rate will level off at a lower rate than forecast above.

Finally, a rate stabilization fund could be established. This fund would receive excess revenues from the Sewer Fund in the first few years before and after issuing the revenue bonds. In later years, the city would draw from this fund rather than increase rates to meet the debt coverage requirement.

Not all of these options are uniformly possible for the remaining three Alternatives.

Financial forecast for Alternative 2

In contrast to Alternative 1, the city must borrow more than twice as much money, \$20.47 million. Construction cannot be phased because the entire plant must be built at one time. The resulting rate increases to cover the forecast operating costs and debt service, will require a 40 percent rate increase in 1997, a 45 percent increase in 1998, a 40 percent increase in 1999, for a cumulative increase of 161 percent in four years, double the increase necessary for Alternative 1.

Two other complicating factors cannot be costed at this time, but will be significant. First, the existing loan agreement with the Oregon Economic Development Department (OEDD) stipulates that the City “. . . shall not sell, lease, abandon or otherwise dispose of all or substantially all or any substantial portion of the Project or its System . . .” (Exhibit 1, page 12, Section 2.02 (d)). The agreement goes on to stipulate that “. . . the State must consent to any sale, lease, abandonment, or other disposition and either: . . .” meets a set of three conditions that result in the Trustee of the original loan approving the City’s decision to dispose of the existing wastewater treatment plant, or the State willingly takes over the Loan Agreement from the Trustee. The Trustee is the financial institution that lent (or insured) the money to the OEDD to loan to the city. In either event, the State must seek and obtain a favorable opinion from its bond counsel that no harm will come to the State and its bond rating as a result of the city’s proposed disposal of the wastewater treatment plant. In other words, as long as this loan is outstanding, the city will have to obtain the State and Trustee’s approval to dispose of the existing wastewater treatment plant.

This is complicated financial juggling that has no single or clear resolution. The OEDD has never been faced with the dismantling of a project it financed before the project has

been paid for. Most likely, though other plausible solutions may exist, the Trustee will want the city to fully repay the outstanding debt with penalties, or insist on an advance refunding of the outstanding debt. An advance refunding means the city comes up with an amount of money equal to the present value of all future principal and interest payments due on the loan, and deposits the money in an escrow account that a third-party trustee manages. The trustee then pays the annual debt service from the account to OEDD until the original loan is fully repaid. To come up with the money the city will have to borrow. In either event the city and state will incur significant financing costs to dispose of the outstanding OEDD loan. These costs are not included in the forecast in the Appendix.

In addition to the city's current lenders (OEDD and the Trustee), any prospective lender will question the rationale to abandon a WWTP that works for a new WWTP at a new location. The answers to their questions and the size of the loan relative to the population served will materially affect the rate of interest and bond terms. In our forecast we assume the Alternatives to have equal costs (6.5 percent interest, 1.30 debt coverage ratio), but the reasons and size of the loan needed for Alternative 2 (and Alternatives 3 and 4) may result in a higher rate and debt-coverage ratio than for Alternative 1.

Financial forecast for Alternative 3

Since this project appears to be well outside the realm of feasibility, we do not present a detailed financial forecast for it in the Appendix. One major problem with this alternative is ownership of the Gresham WWTP. Since the facilities to be built with the loan proceeds usually becomes the collateral security for the loan, the lender probably will want Gresham and Troutdale to enter into an agreement that clearly defines Troutdale's rights to the treatment plant. This agreement would have to be developed by the two cities to the satisfaction of the prospective lender, Troutdale's current lenders, and Gresham's current lenders. The agreement will complicate the loan and increase the costs of the project.

Financial forecast for Alternative 4

The revenue requirements for Alternative 4 do not differ significantly from those of Alternative 2. Alternative 4 has the complicating requirement that Troutdale will have to enter into agreements with two other cities for sewage treatment.

The agreement would have two basic forms. First, the agreement would have Troutdale borrow all of the money to build the WWTP. In this form, prospective lenders will want to see that the agreements adequately assure Troutdale that the other cities will both pledge to use the Troutdale WWTP for some discrete period of time (e.g., 30 years), and pay Troutdale whatever Troutdale may charge for services at the WWTP. Several cities use this form, including Salem/Keizer, Stayton/Sublimity.

The second form, would have each city borrow its share of the total construction cost and jointly own and operate the WWTP. This form requires each city to borrow money and

agree that Troutdale or some new entity become the administrator/operator. Again several other cities use this form, Eugene/Springfield use a regional agency, while Gresham/Fairview and White Salmon/Bingen, Washington identify one party to be the owner/operator/administrator.

Whichever Alternative the city selects, it will want to maximize its use of federal and state grants and obtain the least cost loan possible to minimize impacts on its citizens.

6.4 Financing Options and Availability of Federal and State Financial Assistance

In this section we review the basics of city issued debt, and review the available financial assistance from federal and state agencies.

6.4.1 The Municipal Bond Market

The city of Troutdale can borrow money by using either of two types of security: General Obligation bonds (property taxes) and Revenue bonds (sewer rates).

A general obligation bond is secured by the full faith and credit of the city's land owners. To issue this type of bond, the property tax payers of the city must approve by majority vote to tax themselves as necessary to repay the loan (bonds). The city may use any other revenue it wants to pay annual debt service, but lacking any other revenue it must levy property taxes annually to repay the loan. Since the voters must approve this loan, it is considered to be a high-quality low-risk investment by lenders. The interest rate will be low relative to that of a revenue bond, no reserve is required, and no debt coverage ratio is appropriate or required. On the financial assumptions for the three alternatives we produced forecasts, we include a section that shows the debt service for a general obligation bond. The bond amount and interest rate are less than for the revenue bond. The 30-year term is the same. (See the Appendix tables). Notice both the lower bond amount and annual debt service. The bond amount is less because the closing costs are usually less and no reserve is required. The interest rate also is lower.

The revenue bond is secured by the city's ability to increase user fees without voter approval. Since the city's enterprise funds, sewer and water, are monopolies, lenders perceive less risk in loans to municipalities than in loans to private firm or even to privately-owned electric and gas utilities. Also, since this lending is exempt from federal and state income taxes, the lending rate is less than for a private firm. Over the long history of revenue bonds, municipalities have proven to be good credit risks, with a few exceptions. Few have defaulted on these bonds; however, when they have the market has responded with requirements such as a reserve and debt coverage ratios.

All of the Federal and State agencies that offer lower-than-market-rate loans to municipalities in Oregon require the municipality to pledge security as either a general obligation bond or as a revenue bond, or as some nearly equal instrument.

6.4.2 Federal Funding Assistance Programs

Housing and Urban Development, Community Development Block Grant Program

This program is administered by Multnomah County. It is a grants program with a limit of \$750,000 per applicant per project. No loans are available. It is designed to benefit low to moderate income households. A recent survey of household income in Troutdale shows that average household income is too high for the city to qualify.

U.S. Department of Agriculture, Rural Economic and Community Development

The RECD makes grants and loans to rural municipalities for sewer projects. Because of its population size and location in a metropolitan region, Troutdale does not qualify. The program serves cities up to 10,000 population (Troutdale is about 11,000) with average annual household income of up to \$22,052 (Troutdale is at \$39,500). The Congress is considering increasing the population limit to 25,000 people, but not the income limit. However this may result in more cities qualifying for less money. The program's funding in Oregon was reduced from \$40 million in 1995 to \$30 million in 1996. Senator Hatfield is proposing to increase the agency's budget another \$5 million in 1996, but these funds will be earmarked for flood damaged water and sewer systems.

U.S. Department of Commerce, Economic Development Administration

Troutdale does not qualify for this program. Similar to the CDBG program, applicants must be economically depressed to qualify.

6.4.3 State Funding Assistance Programs

Oregon Department of Environmental Quality, State Revolving Loan Fund

In about 1990, the U.S. Environmental Protection Agency ended its decades-old Constructions Grants Program. This program was responsible for paying for over 50 percent of the capital costs of municipal wastewater systems built in the 1970's and 1980's. The Congress declared that water quality problems from municipal sources were largely solved. In its place, the EPA made a Capitalization Grant to each state to use as a state revolving loan fund (SRF) for the benefit of municipal wastewater systems.

Oregon received \$115,908,309 and matched that with another \$23,181,662. As of June 1, 1995, the state had lent out most of the original grant and matching funds. Each year as

these initial loans are repaid, the state can make new loans. Also, the EPA will make an additional capitalization grant in 1996 to the state of \$13,914,054 which the state will provide a match of \$2,782,811. At the current rate of payback and capitalization and after meeting loan obligations made in prior years, the state can initiate new loans of about \$10.4 million in 1996.

The Oregon Department of Environmental Quality administers the program. Each year the DEQ receives more requests for funding assistance than it has to lend. Consequently, the DEQ has set criteria to evaluate applications, and the criteria are heavily weighted in favor of those cities that have extreme health or environmental problems. Unless the DEQ's regulatory division has imposed a Stipulated and Final Order (SFO) on a city, the city has very little chance of obtaining funding from SRF. Also, the maximum loan amount approved for fiscal year 1996 is \$3,271,525.

The loans have a 20-year term, the interest rate is set equal to 66.7 percent of the municipal bond rate on revenue bonds, and the one-time loan fee is 1.5 percent of the principal amount of the loan. The SRF requires the city to maintain a bond reserve equal to one year of debt service (interest plus principal), and a debt coverage ratio of 1.15. The DEQ also charges an annual servicing fee equal to 0.5 percent of the principal balance of the loan. The loans are secured by a pledge of net sewer revenues.

Oregon Economic Development Department, Special Public Works Program

OEDD has two programs for municipal wastewater projects: (1) the Water/Wastewater Program and (2) the Special Public Works Program. The programs differ only in how an applicant such as Troutdale qualifies for assistance.

Water/Wastewater Program

The first program applies only when the municipality has been given a Stipulated and Final Order (SFO) from the Department of Environmental Quality. The SFO is given when the city is frequently violating its permit from the DEQ to discharge treated wastewater. Troutdale probably will not qualify for this program, and if it does the loan and grant conditions are the same as for the Special Public Works Program.

Special Public Works Fund (SPWF)

To qualify for the SPWF, a city must be facing the *potential* of an SFO from the Department of Environmental Quality and be able to demonstrate that new family-wage jobs may be created. The SPWF's primary objective is to create industrial and manufacturing jobs by building sewer and water capacity for future economic growth. When a city's water or wastewater system is a deterrent to employment growth, OEDD can make grants and low-cost loans available to the city to expand its water or sewer system.

The SPWF has two sub-programs: (a) a direct jobs-creation program and (b) a capacity-building program. Troutdale used the capacity-building program in 1992 to finance the last improvements made to the wastewater treatment plant. To finance one of the four Alternatives, Troutdale may be able to apply again for this assistance.

To qualify under the jobs-creation sub-program, the city will have to have an industrial or manufacturing firm willing to state in writing that by expanding the wastewater plant, the firm will build or expand in Troutdale and create a specified number of family-wage jobs. To qualify under the capacity-building sub-program, Troutdale does not have to identify a specific firm willing to invest in new plant and equipment in the city, but the city has to demonstrate three commitments to economic development: (i) that there has been recent interest by industrial or manufacturing firms in locating in Troutdale, (ii) the city must document its ongoing efforts to attract these types of firms, and (iii) it must show the city has an existing locational advantage for these types of firms.

The maximum amount of aid the program can offer is about \$10,000,000 and a grant for up to \$500,000. The loan is divided into two portions. The State uses lottery funds to make the \$500,000 grant and to make the first 17 percent of the total loan amount up to \$1 million. To obtain the rest of the loan amount, the State issues revenue bonds on the municipal bond market. This state borrowing includes the \$9 million it re-lends to the city plus bond costs and a bond reserve amount. The bond costs are generally about 2 percent of the revenue bond amount. The bond reserve usually equals 10 percent of the bond amount. The State requires the city to use its grant of \$500,000 to pay the bond closing costs and the bond reserve. An example will help illustrate the transactions.

In this example, the City would have to borrow \$10,659,091 to pay for \$10,000,000 of construction costs. The OEDD and City would use the remaining \$659,091 plus the \$500,000 grant to pay the bond issuance costs and to fund the reserve. The sources of revenue include the \$500,000 grant and a \$1,000,000 loan from the lottery, and \$9,659,000 from State-issued revenue bonds.

<u>Sources</u>	Percentage	OEDD	
			\$ Limit
Bond Amount			
Bond loan	83%		9,659,09
Collateral Loan	17%	1,000,000	1,000,00
Loan Amount			10,659,091
Grant		500,000	500,00
Total			11,159,091
<u>Uses</u>			
Construction			10,000,00
Bond Issue Costs	2%		193,18
Bond Reserve	10%		965,90
Total			11,159,091

The revenues are put to three uses: construction (\$10,000,000), the cost of issuing the bonds (\$193,182), and a bond reserve (\$965,909). The cost of issuing the bonds is taken directly from the \$500,000 grant. The bond reserve is a condition imposed on the State by the financial institution that lends the \$9,659,091 to the state to lend to the city. The State must pass onto the City all of the conditions the lender puts onto the State. The borrower (the State and the City) must keep these reserves in an interest bearing account until the bonds have been fully repaid (20 years). The City applies the interest earnings annually to the debt service and uses the reserve amount to make the last bond payment. If at any time the city draws on these funds to pay the annual principal or interest, it must within a few months replace the funds

6.5 Summary of Financing Options

The nature of each WWTP Alternative will largely determine what financing options can be used. Only Alternative 1 will qualify for any funding assistance, and then only from OEDD. This assistance can be secured by a revenue bond or a general obligation bond. Also, the City may finance Alternative 1 by issuing either a revenue or a general obligation bond in the municipal bond market. The high cost of the other Alternatives would make them difficult to qualify for any funding assistance, and, if the City issued in the municipal bond market, it would be advisable to use general obligation bonds. Since the City would have to increase sewer rates considerably above sewer rates for similar sized cities, the market may not purchase revenue bonds.

The nature and size of the other three Alternative WWTPs make them more difficult to qualify for any assistance, including from OEDD. No imminent health threat requires the treatment plant to be relocated, and the city must justify to OEDD why the plant should be moved. Unless a strong case can be made that economic benefits of relocating the WWTP exceed the additional costs, OEDD may not be interested in any of these Alternatives.

Also, the City will have to take some action to modify or to dispose of the outstanding OEDD loan before it can borrow again. This task can be accomplished but it may require substantial effort by the city, OEDD, and the Trustee. This effort will increase the cost of each of these Alternatives.

If the city decides to fund the project without federal or state assistance by issuing bonds, then for Alternative 1 the city can feasibly issue either revenue or general obligation bonds. For Alternatives 2, 3, and 4 it would be advisable to consider only a general obligation bond. Since these alternatives would drive up sewer rates beyond the average rate paid in other cities, lenders may perceive the projects as highly risky and demand significantly higher interest rates than a general obligation bond would have.

We are unaware of any other federal or state grant the city can apply to a new WWTP. Recent actions by the Congress and by the Oregon Legislature indicate decreasing funding for water and wastewater programs. The Congress is disposed to reduce federal spending

on all programs, but in particular for environmental protection. The Oregon Legislature has decided to divert more of its lottery proceeds from programs such as OEDD's SPWF to education.

6.6 Appendix to Chapter 6: Financial Spreadsheets

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Alternative 1: Expand Existing WWTP

Financing Assumptions	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
Current Construction Costs		8,080,223			201,014				814,447			
Cash Contribution		1,000,000										
Net Construction Cost to Finance		7,080,223										
Revenue Bond Proceeds		8,329,674										
Bond Closing Costs		416,484										
Interest Rate		6.75%										
Term (years)		30										
Reserve		832,967										
Debt Coverage Ratio		1.35										
Revenue Bond Debt Service												
Principal			(92,227)	(98,453)	(105,098)	(112,192)	(119,765)	(127,850)	(136,480)	(145,692)	(155,526)	
Interest			(562,253)	(556,028)	(549,382)	(542,288)	(534,715)	(526,631)	(518,001)	(508,789)	(498,954)	
Debt Coverage Ratio on Revenue Bonds			1.33	1.25	1.29	1.30	1.31	1.31	1.28	1.26	1.24	
Avg. Annual Rate Change	20.0%	25.0%	25.0%									
Cumulative % Change	20.0%	50.0%	81.3%	81.3%	81.3%	81.3%	81.3%	81.3%	81.3%	81.3%	81.3%	
Average Cost per 1,000 gallons per day	991	1,012	1,548	1,558	1,573	1,591	1,597	1,609	1,624	1,643	1,666	
General Obligation Bond Proceeds		7,299,198										
Bond Closing Costs		218,978										
Interest Rate		6.50%										
Term (Years)		30										
General Obligation Bond Debt Service												
Principal			(84,506)	(89,999)	(95,849)	(102,079)	(108,714)	(115,781)	(123,306)	(131,321)	(139,857)	
Interest		0	(474,448)	(468,955)	(463,105)	(456,875)	(450,240)	(443,173)	(435,648)	(427,633)	(419,097)	
Assessed Value	523,967,391	602,562,500	647,754,688	696,336,289	748,561,511	804,703,624	865,056,396	929,935,626	999,660,797	1,074,656,857	1,155,256,122	1,241,900,331
Percent Change	15.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	
Average Value Single Family House	127,000	133,350	140,018	147,018	154,369	162,088	170,192	178,702	187,637	197,019	206,870	
Percent Change		5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	
GO Bond Tax Rate (\$/\$1,000 AV)			\$0.80	\$0.75	\$0.69	\$0.65	\$0.60	\$0.56	\$0.52	\$0.48	\$0.45	
Annual GO Tax on Average Value House			\$112.39	\$109.78	\$107.23	\$104.73	\$102.30	\$99.92	\$97.59	\$95.32	\$93.11	

Source: Raymond J. Bartlett, Economic & Financial Analysis.

Alternative 1—Expand the Existing WWTP
Forecast Cash Flows, Revenue Bond Financing

	Estimated	Forecast, As of June 30,										
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CASH FLOWS FROM OPERATING ACTIVITIES:												
Operating Receipts												
Charges for services	1,033,554	1,274,372	1,633,745	2,092,827	2,155,612	2,218,124	2,302,413	2,385,300	2,468,785	2,552,724	2,636,964	2,723,984
Miscellaneous	18,087	19,005	19,224	19,262	19,253	19,232	19,394	19,399	19,382	18,358	19,334	19,327
Total Operating Receipts	1,051,641	1,293,377	1,652,969	2,112,089	2,174,864	2,237,356	2,321,807	2,404,699	2,488,167	2,572,083	2,656,298	2,743,311
Operating Expenditures												
Personal services	270,591	289,533	309,800	331,486	354,690	379,518	406,084	434,510	464,926	497,471	532,294	569,554
Materials and services	382,586	413,193	446,248	481,948	520,504	562,144	607,115	655,685	708,139	764,791	825,974	892,052
Service transfers out	158,438	169,529	181,396	194,093	207,680	222,218	237,773	254,417	272,226	291,282	311,672	333,469
Total Operating Expenditures	811,615	872,254	937,444	1,007,527	1,082,874	1,163,880	1,250,973	1,344,612	1,445,292	1,553,543	1,669,939	1,795,095
Net Cash Provided by Operating Activities	240,026	421,123	715,525	1,104,561	1,091,991	1,073,476	1,070,835	1,060,087	1,042,875	1,018,539	986,358	948,216
CASH FLOWS FROM CAPITAL AND RELATED FINANCING ACTIVITIES:												
System development charges	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735
SPWF Interest Earnings												
Capital expenditures, Cash	(50,000)	(52,500)	(55,125)	(57,891)	(60,775)	(63,814)	(67,005)	(70,355)	(73,873)	(77,566)	(81,445)	(85,517)
Capital expenditures, Financed			(2,693,138)	(5,387,084)		(201,014)				(814,447)		
SPWF loan proceeds												
SPWF loan principal	(146,385)	(156,042)	(166,325)	(177,286)	(188,969)	(201,422)	(214,696)	(228,845)	(243,926)	(260,000)	(277,134)	(295,397)
SPWF loan interest	(168,469)	(158,822)	(148,539)	(137,578)	(125,895)	(113,442)	(100,168)	(86,019)	(70,938)	(54,864)	(37,730)	(19,466)
Proceeds from sale of property												
Bond Proceeds			8,329,674									
Bond Closing Costs			(416,484)									
Bond Principal				(92,227)	(98,453)	(105,098)	(112,192)	(119,765)	(127,850)	(136,480)	(145,692)	(155,526)
Bond Interest				(562,253)	(556,028)	(549,382)	(542,288)	(534,715)	(526,631)	(518,001)	(508,789)	(498,954)
Property Tax Receipts												
Net Cash Provided by (Used in) Capital and Related Financing Activities	71,871	69,371	5,286,797	(5,977,575)	(593,385)	(797,438)	(599,615)	(602,965)	(606,483)	(1,424,824)	(614,055)	(618,126)
CASH FLOWS FROM INVESTING ACTIVITIES:												
Interest income on investments	55,079	68,221	170,426	187,233	122,048	180,389	191,031	208,971	225,577	226,909	233,956	253,590
Net Increase (Decrease) in Cash & Investments	366,975	558,714	6,172,748	(4,685,781)	620,653	456,427	662,251	666,093	661,970	(179,176)	606,259	583,680
CASH AND INVESTMENTS - July 1	1,485,562	1,852,537	2,411,251	8,584,000	3,898,219	4,518,872	4,975,299	5,637,550	6,303,643	6,965,613	6,786,438	7,392,697
CASH AND INVESTMENTS - June 30	1,852,537	2,411,251	8,584,000	3,898,219	4,518,872	4,975,299	5,637,550	6,303,643	6,965,613	6,786,438	7,392,697	7,976,377
Bond Reserve				832,967	832,967	832,967	832,967	832,967	832,967	832,967	832,967	832,967
Unrestricted Cash				3,065,251	3,685,904	4,142,332	4,804,583	5,470,676	6,132,646	5,953,470	6,559,730	7,143,410
Total												
Debt Coverage Ratio				1.33	1.25	1.29	1.30	1.31	1.31	1.28	1.26	1.24

Source: Raymond J. Bartlett, Economic & Financial Analysis.

Alternative 2: Construct a New WWTP at Troutdale

Financing Assumptions	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
Current Construction Costs		18,400,000										
Cash Contribution		1,000,000										
Net Construction Cost to Finance		17,400,000										
Revenue Bond Proceeds		20,470,588										
Bond Closing Costs		1,023,528										
Interest Rate		8.75%										
Term (Years)		30										
Reserve		2,047,058										
Debt Coverage Ratio		1.36										
Revenue Bond Debt Service												
Principal			(228,854)	(241,953)	(258,284)	(275,719)	(294,330)	(314,197)	(335,405)	(358,045)	(382,213)	
Interest			(1,381,785)	(1,366,466)	(1,350,134)	(1,332,700)	(1,314,089)	(1,284,221)	(1,273,013)	(1,250,373)	(1,226,205)	
Debt Coverage Ratio			1.31	1.33	1.31	1.33	1.35	1.37	1.40	1.43	1.46	
Implications for Monthly Residential Sewer Rate												
Avg. Annual Rate Changes	40.0%	45.0%	40.0%	5.0%	-5.0%							
Cummulative	40.0%	103.0%	161.0%	168.0%	162.8%	162.8%	162.8%	162.8%	162.8%	162.8%	162.8%	
Average Cost per 1,000 gallons per day	881	1,012	2,284	2,283	2,276	2,274	2,255	2,244	2,238	2,237	2,241	
General Obligation Bond Proceeds		17,938,144										
Bond Closing Costs		536,144										
Interest Rate		8.50%										
Term (Years)		30										
General Obligation Bond Debt Service												
Principal			(207,678)	(221,177)	(235,553)	(250,864)	(267,171)	(284,537)	(303,032)	(322,729)	(343,706)	
Interest		0	(1,165,979)	(1,162,480)	(1,138,104)	(1,122,793)	(1,106,487)	(1,089,121)	(1,070,826)	(1,050,829)	(1,029,951)	
Implications for Property Taxes												
Assessed Value	*****	602,562,500	647,754,888	686,336,289	748,561,511	804,703,824	865,058,398	928,835,626	999,680,787	1,074,656,857	1,155,256,122	1,241,900,331
Percent Change		15.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Average Value Single Family House		127,000	133,350	140,018	147,018	154,369	162,088	170,192	178,702	187,637	197,019	206,870
Percent Change			5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
GO Bond Tax Rate (\$/\$1,000 AV)			\$1.97	\$1.84	\$1.71	\$1.59	\$1.48	\$1.37	\$1.28	\$1.19	\$1.11	
Annual GO Tax on Average Value House			\$276.21	\$269.78	\$263.51	\$257.38	\$251.40	\$245.55	\$239.84	\$234.27	\$228.82	

Source: Raymond J. Bartlett, Economic & Financial Analysis.

Alternative 2: Construct a New WWTP at Troutdale
Forecast Cash Flows

	Estimated	Forecast, As of June 30,										
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CASH FLOWS FROM OPERATING ACTIVITIES:												
Operating Receipts												
Charges for services	1,033,554	1,481,082	2,194,964	3,140,894	3,392,273	3,321,035	3,447,235	3,571,335	3,686,332	3,822,007	3,948,134	4,078,422
Miscellaneous	18,087	19,006	19,224	33,212	55,689	62,048	60,788	26,525	21,435	24,009	34,123	47,785
Total Operating Receipts	1,051,641	1,500,088	2,214,188	3,174,206	3,447,962	3,383,084	3,498,023	3,597,860	3,717,767	3,846,016	3,982,257	4,126,217
Operating Expenditures												
Personal services	270,591	289,533	309,800	331,486	354,690	378,518	406,084	434,510	464,926	497,471	532,294	569,554
Materials and services	382,586	413,193	446,248	481,948	520,504	562,144	607,115	655,685	708,139	764,791	826,974	892,062
Service transfers out	158,438	169,529	181,396	194,093	207,680	222,218	237,773	264,417	272,226	291,282	311,872	333,489
Total Operating Expenditures	811,615	872,254	937,444	1,007,527	1,082,874	1,163,880	1,250,973	1,344,612	1,445,282	1,553,543	1,669,939	1,795,095
Net Cash Provided by Operating Activities	240,026	627,834	1,276,744	2,166,678	2,365,089	2,219,204	2,247,050	2,253,248	2,272,475	2,282,472	2,312,318	2,331,122
CASH FLOWS FROM CAPITAL AND RELATED FINANCING ACTIVITIES:												
System development charges												
	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735
SPWF Interest Earnings												
Capital expenditures, Cash	(50,000)	(52,500)	(55,125)	(57,881)	(60,775)	(63,814)	(67,005)	(70,355)	(73,873)	(77,568)	(81,445)	(85,617)
Capital expenditures, Financed			(6,133,272)	(12,266,728)								
Capital lease financing												
SPWF loan proceeds												
SPWF loan principal	(148,395)	(156,042)	(166,325)	(177,286)	(188,989)	(201,422)	(214,696)	(228,845)	(243,926)	(260,000)	(277,134)	(295,397)
SPWF loan interest	(168,469)	(168,822)	(148,539)	(137,578)	(125,895)	(113,442)	(100,188)	(86,019)	(70,938)	(54,864)	(37,730)	(19,466)
Proceeds from sale of property												
			20,470,588									
Bond Proceeds												
Bond Closing Costs												
Bond Principal			(1,023,529)									
Bond Interest				(226,654)	(241,953)	(258,284)	(275,718)	(294,330)	(314,187)	(335,405)	(358,045)	(382,213)
Property Tax Receipts				(1,381,765)	(1,366,466)	(1,350,134)	(1,332,700)	(1,314,089)	(1,294,221)	(1,273,013)	(1,250,373)	(1,228,205)
Net Cash Provided by (Used in) Capital and Related Financing Activities	71,871	69,371	13,380,532	(13,811,157)	(1,547,323)	(1,550,362)	(1,553,553)	(1,556,903)	(1,560,421)	(1,564,114)	(1,567,992)	(1,572,064)
CASH FLOWS FROM NONCAPITAL FINANCING ACTIVITIES:												
Operating transfers in												
Operating transfers out												
Net Cash Provided by (Used in) Noncapital Financing Activities												
CASH FLOWS FROM INVESTING ACTIVITIES:												
Interest income on investments												
	55,079	71,582	313,305	358,467	197,594	296,550	318,499	343,581	369,835	395,350	433,323	473,084
Net Increase (Decrease) in Cash & Investments	366,975	768,786	14,970,582	(11,286,012)	1,015,359	965,392	1,008,997	1,039,926	1,081,890	1,123,709	1,177,648	1,232,143
CASH AND INVESTMENTS - July 1	1,485,562	1,852,537	2,621,323	17,591,905	6,305,893	7,321,253	8,286,645	9,293,642	10,336,568	11,418,458	12,542,167	13,719,815
CASH AND INVESTMENTS - June 30	1,852,537	2,621,323	17,591,905	6,305,893	7,321,253	8,286,645	8,296,642	10,336,568	11,418,458	12,542,167	13,719,815	14,951,957
				<u>2,047,059</u>	<u>2,047,059</u>	<u>2,047,059</u>	<u>2,047,059</u>	<u>2,047,059</u>	<u>2,047,059</u>	<u>2,047,059</u>	<u>2,047,059</u>	<u>2,047,059</u>
				4,258,834	5,274,184	6,239,586	7,249,583	8,289,509	9,371,399	10,495,108	11,672,756	12,904,898
Debt Coverage Ratio				1.31	1.33	1.31	1.33	1.35	1.37	1.40	1.43	1.46

Source: Raymond J. Bartlett, Economic & Financial Analysis.

Alternative 3: Sewerage to Graham
Financing Assumptions

	1987	1988	1989	2000	2001	2002	2003	2004	2005	2006	2007	
Current Construction Costs		26,700,000										
Cash Contribution		1,000,000										
Net Construction Cost to Finance		24,700,000										
Revenue Bond Proceeds		28,058,824										
Bond Closing Costs		1,452,841										
Interest Rate		6.75%										
Term (years)		30										
Reserve		2,905,882										
Debt Coverage Ratio		1.35										
Revenue Bond Debt Service												
Principal			(321,744)	(343,462)	(366,845)	(391,384)	(417,813)	(446,015)	(476,121)	(508,259)	(542,567)	
Interest			(1,861,471)	(1,939,753)	(1,916,569)	(1,891,821)	(1,865,402)	(1,837,189)	(1,807,093)	(1,774,955)	(1,740,848)	
Implications for Sewer Rates												
Avg. Annual Rate Changes	80.0%	60.0%	35.0%							-5.0%		
Cummulative % Change	80.0%	156.0%	212.0%	212.0%	212.0%	212.0%	212.0%	212.0%	212.0%	207.0%	207.0%	
Average Cost per 1,000 gallons per day	991	1,012	2,823	2,785	2,773	2,757	2,721	2,694	2,672	2,657	2,647	
General Obligation Bond Proceeds		26,463,818										
Bond Closing Costs		763,818										
Interest Rate		6.50%										
Term (Years)		30										
General Obligation Bond Debt Service												
Principal			(284,807)	(313,869)	(334,378)	(356,112)	(379,259)	(403,911)	(430,165)	(458,129)	(487,904)	
Interest		0	(1,655,155)	(1,835,992)	(1,815,584)	(1,593,850)	(1,570,702)	(1,546,050)	(1,518,796)	(1,491,838)	(1,462,057)	
Assessed Value	523,967,391	602,562,500	647,754,688	696,338,289	748,561,511	804,703,624	865,056,386	829,935,628	898,680,797	1,074,656,857	1,155,256,122	1,241,800,331
Percent Change		15.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Average Value Single Family House		127,000	133,350	140,018	147,018	154,389	162,088	170,182	178,702	187,637	197,019	208,870
Percent Change			5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
GO Bond Tax Rate (\$/\$1,000 AV)				\$2.80	\$2.60	\$2.42	\$2.25	\$2.10	\$1.95	\$1.81	\$1.69	\$1.57
Annual GO Tax on Average Value House				\$382.08	\$382.87	\$374.07	\$365.37	\$358.87	\$348.57	\$340.47	\$332.55	\$324.81

Source: Raymond J. Bartlett, Economic & Financial Analysis.

Alternative 3: Construct a New WWTP at Troutdale
Forecast Cash Flows

	Estimated		Forecast, As of June 30,									
	1986	1987	1988	1989	2000	2001	2002	2003	2004	2005	2006	2007
CASH FLOWS FROM OPERATING ACTIVITIES:												
Operating Receipts												
Charges for services	1,033,554	1,687,793	2,754,478	3,803,935	3,918,053	4,031,876	4,184,880	4,336,538	4,487,279	4,639,847	4,580,870	4,711,482
Miscellaneous	18,087	19,006	19,224	33,212	56,688	62,048	50,788	26,525	21,436	24,009	34,123	47,785
Total Operating Receipts	1,051,641	1,706,799	2,773,702	3,837,147	3,973,742	4,093,725	4,235,668	4,362,060	4,508,715	4,663,856	4,595,093	4,759,277
Operating Expenditures												
Personal services	270,591	289,533	308,900	331,488	354,890	378,518	408,084	434,510	464,826	497,471	532,294	569,554
Materials and services	382,588	413,193	448,248	481,848	520,504	562,144	607,115	655,685	708,139	784,791	825,974	892,052
Service transfers out	158,438	189,529	181,396	194,093	207,680	222,218	237,773	254,417	272,226	291,282	311,672	333,489
Total Operating Expenditures	811,615	872,254	937,444	1,007,527	1,082,874	1,163,880	1,250,973	1,344,612	1,445,292	1,553,543	1,669,839	1,795,095
Net Cash Provided by Operating Activities	240,026	834,545	1,836,259	2,829,618	2,890,868	2,929,845	2,984,695	3,017,448	3,063,423	3,110,312	2,925,154	2,964,182
CASH FLOWS FROM CAPITAL AND RELATED FINANCING ACTIVITIES:												
System development charges	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735
SPWF Interest Earnings												
Capital expenditures, Cash	(60,000)	(62,500)	(55,125)	(57,881)	(60,775)	(63,814)	(67,005)	(70,355)	(73,873)	(77,568)	(81,445)	(85,517)
Capital expenditures, Financed			(8,565,810)	(17,134,190)								
Capital lease financing												
SPWF loan proceeds												
SPWF loan principal	(146,395)	(156,042)	(166,325)	(177,288)	(188,969)	(201,422)	(214,898)	(228,845)	(243,928)	(260,000)	(277,134)	(295,397)
SPWF loan interest	(168,489)	(158,822)	(148,539)	(137,578)	(125,895)	(113,442)	(100,188)	(86,018)	(70,938)	(54,864)	(37,730)	(19,466)
Proceeds from sale of property												
Bond Proceeds			29,058,824									
Bond Closing Costs			(1,452,841)									
Bond Principal				(321,744)	(343,482)	(366,645)	(391,394)	(417,813)	(446,015)	(476,121)	(508,259)	(542,567)
Bond Interest				(1,981,471)	(1,838,753)	(1,916,569)	(1,891,821)	(1,865,402)	(1,837,189)	(1,807,093)	(1,774,955)	(1,740,648)
Property Tax Receipts												
Net Cash Provided by (Used in) Capital and Related Financing Activities	71,871	69,371	19,106,818	(19,353,415)	(2,222,119)	(2,225,158)	(2,228,349)	(2,231,699)	(2,235,217)	(2,238,910)	(2,242,789)	(2,246,860)
CASH FLOWS FROM NONCAPITAL FINANCING ACTIVITIES:												
Operating transfers in												
Operating transfers out												
Net Cash Provided by (Used in) Noncapital Financing Activities												
CASH FLOWS FROM INVESTING ACTIVITIES:												
Interest income on investments	55,079	74,943	418,884	485,222	249,808	365,113	385,710	416,013	446,222	476,384	518,415	559,292
Net Increase (Decrease) in Cash & Investments	366,975	978,858	21,361,960	(16,038,574)	918,557	1,069,800	1,142,056	1,201,762	1,274,428	1,347,766	1,200,780	1,276,614
CASH AND INVESTMENTS - July 1	1,485,562	1,852,537	2,831,395	24,193,355	8,154,782	9,073,339	10,143,138	11,285,195	12,488,957	13,781,385	15,109,151	16,309,930
CASH AND INVESTMENTS - June 30	1,852,537	2,831,395	24,193,355	8,154,782	9,073,339	10,143,138	11,285,195	12,488,957	13,781,385	15,109,151	16,309,930	17,586,544
Bond Reserve				2,905,882	2,905,882	2,905,882	2,905,882	2,905,882	2,905,882	2,905,882	2,905,882	2,905,882
Unrestricted Cash				6,248,889	6,167,456	7,237,256	8,379,313	9,581,075	10,855,603	12,203,268	13,404,048	14,680,662
Total												
Debt Coverage Ratio				1.28	1.21	1.27	1.30	1.32	1.35	1.38	1.33	1.36

Source: Raymond J. Bartlett, Economic & Financial Analysis.

Alternative 4: Construct a Tri-City WWTP

Financing Assumptions	1997	1998	1998	2000	2001	2002	2003	2004	2005	2006	2007	
Current Construction Costs		19,800,000										
Cash Contribution		1,000,000										
Net Construction Cost to Finance		18,800,000										
Revenue Bond Proceeds		21,882,353										
Bond Closing Costs	5.0%	1,084,118										
Interest Rate		6.75%										
Term (years)		30										
Reserve		2,188,235										
Debt Coverage Ratio		1.35										
Revenue Bond Debt Service												
Principal			(242,285)	(258,639)	(276,087)	(294,734)	(314,628)	(335,866)	(358,537)	(382,738)	(408,573)	
Interest			(1,477,059)	(1,460,705)	(1,443,246)	(1,424,810)	(1,404,715)	(1,383,478)	(1,360,807)	(1,338,606)	(1,310,771)	
Debt Coverage Ratio			1.32	1.25	1.32	1.34	1.36	1.39	1.42	1.45	1.48	
Implications for Monthly Residential Sewer Rate												
Avg. Annual Rate Changes	45.0%	45.0%	40.0%									
Cumulative % Change	45.0%	110.3%	188.3%	188.3%	188.3%	188.3%	188.3%	188.3%	188.3%	188.3%	188.3%	
Average Cost per 1,000 gallons per day	975	995	2,364	2,349	2,339	2,334	2,312	2,298	2,288	2,264	2,285	
General Obligation Bond Proceeds		19,175,258										
Bond Closing Costs	3.0%	575,258										
Interest Rate		6.50%										
Term (Years)		30										
General Obligation Bond Debt Service												
Principal			(222,000)	(238,430)	(251,798)	(268,185)	(285,596)	(304,180)	(323,930)	(344,986)	(367,410)	
Interest		0	(1,248,392)	(1,231,982)	(1,218,594)	(1,200,227)	(1,182,796)	(1,164,232)	(1,144,482)	(1,123,406)	(1,100,982)	
Implications for Property Taxes												
Assessed Value	523,967,391	602,562,500	647,754,688	696,338,289	748,661,511	804,703,624	865,056,386	929,935,826	999,680,797	1,074,856,857	1,155,256,122	1,241,800,331
Percent Change	15.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	
Average Value Single Family House	127,000	133,350	140,018	147,018	154,369	162,088	170,192	178,702	187,637	197,019	206,870	
Percent Change		5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	
GO Bond Tax Rate (\$/\$1,000 AV)			\$2.11	\$1.98	\$1.82	\$1.70	\$1.58	\$1.47	\$1.37	\$1.27	\$1.18	
Annual GO Tax on Average Value House			\$295.26	\$288.39	\$281.69	\$275.14	\$268.74	\$262.49	\$256.38	\$250.42	\$244.60	

Source: Raymond J. Bartlett, Economic & Financial Analysis.

Alternative 4: Construct a Tri-City WWTP
Forecast Cash Flows

	Estimated 1996	Forecast As of June 30										
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CASH FLOWS FROM OPERATING ACTIVITIES:												
Operating Receipts												
Charges for services	1,033,554	1,532,780	2,271,550	3,250,589	3,348,108	3,445,202	3,576,119	3,704,859	3,834,530	3,964,904	4,095,745	4,230,905
Miscellaneous	18,087	19,005	19,224	33,212	55,689	62,048	50,788	26,525	21,435	24,009	34,123	47,795
Total Operating Receipts	1,051,641	1,551,786	2,290,774	3,283,801	3,403,796	3,507,250	3,626,907	3,731,384	3,855,965	3,988,912	4,129,869	4,278,700
Operating Expenditures												
Personal services	252,889	270,591	289,533	309,800	331,488	354,690	379,518	408,084	434,510	464,926	497,471	532,294
Materials and services	382,588	413,193	446,248	481,948	520,504	562,144	607,115	655,685	708,139	764,791	825,974	892,052
Service transfers out	158,438	169,529	181,396	194,093	207,680	222,218	237,773	254,417	272,226	291,282	311,672	333,489
Total Operating Expenditures	793,913	853,313	917,176	985,841	1,059,670	1,139,051	1,224,406	1,316,186	1,414,876	1,520,999	1,635,116	1,757,834
Net Cash Provided by Operating Activities	257,728	698,453	1,373,598	2,297,959	2,344,126	2,368,198	2,402,501	2,415,198	2,441,089	2,467,913	2,494,752	2,520,866
CASH FLOWS FROM CAPITAL AND RELATED FINANCING ACTIVITIES:												
System development charges	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735	436,735
SPWF Interest Earnings												
Capital expenditures, Cash	(50,000)	(52,500)	(55,125)	(57,881)	(60,775)	(63,814)	(67,005)	(70,355)	(73,873)	(77,566)	(81,445)	(85,517)
Capital expenditures, Financed			(6,533,268)	(13,066,732)								
Capital lease financing												
SPWF loan proceeds												
SPWF loan principal	(146,395)	(156,042)	(166,325)	(177,286)	(188,969)	(201,422)	(214,696)	(228,845)	(243,928)	(260,000)	(277,134)	(295,397)
SPWF loan interest	(168,469)	(158,822)	(148,539)	(137,578)	(125,895)	(113,442)	(100,188)	(86,019)	(70,938)	(54,864)	(37,730)	(19,488)
Proceeds from sale of property												
Bond Proceeds			21,882,353									
Bond Closing Costs			(1,094,118)									
Bond Principal				(242,285)	(258,639)	(278,097)	(294,734)	(314,828)	(335,868)	(358,537)	(382,738)	(408,573)
Bond Interest				(1,477,059)	(1,460,705)	(1,443,246)	(1,424,610)	(1,404,715)	(1,383,478)	(1,360,807)	(1,336,806)	(1,310,771)
Property Tax Receipts												
Net Cash Provided by (Used in) Capital and Related Financing Activities	71,871	69,371	14,321,713	(14,722,088)	(1,658,248)	(1,661,267)	(1,664,478)	(1,667,828)	(1,671,346)	(1,675,040)	(1,678,918)	(1,682,989)
CASH FLOWS FROM NONCAPITAL FINANCING ACTIVITIES:												
Operating transfers in												
Operating transfers out												
Net Cash Provided by (Used in) Noncapital Financing Activities												
CASH FLOWS FROM INVESTING ACTIVITIES:												
Interest income on investments	55,376	73,315	332,493	381,548	207,159	307,695	328,969	357,845	386,058	413,682	454,552	497,548
Net Increase (Decrease) in Cash & Investments	384,974	841,139	16,027,804	(12,042,581)	893,037	1,014,606	1,066,992	1,105,215	1,155,801	1,206,556	1,270,386	1,335,424
CASH AND INVESTMENTS - July 1	1,485,582	1,870,536	2,711,675	18,739,479	6,696,897	7,589,934	8,604,540	9,671,532	10,776,747	11,932,548	13,139,104	14,409,490
CASH AND INVESTMENTS - June 30	1,870,536	2,711,675	18,739,479	6,696,897	7,589,934	8,604,540	9,671,532	10,776,747	11,932,548	13,139,104	14,409,490	15,744,914
Bond Reserve				2,188,235	2,188,235	2,188,235	2,188,235	2,188,235	2,188,235	2,188,235	2,188,235	2,188,235
Unrestricted Cash				4,508,662	5,401,699	6,416,305	7,483,297	8,588,512	9,744,312	10,950,869	12,221,255	13,556,679
Total												
Debt Coverage Ratio				1.32	1.25	1.32	1.34	1.36	1.39	1.42	1.45	1.48

Source: Raymond J. Bartlett, Economic & Financial Analysis.

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