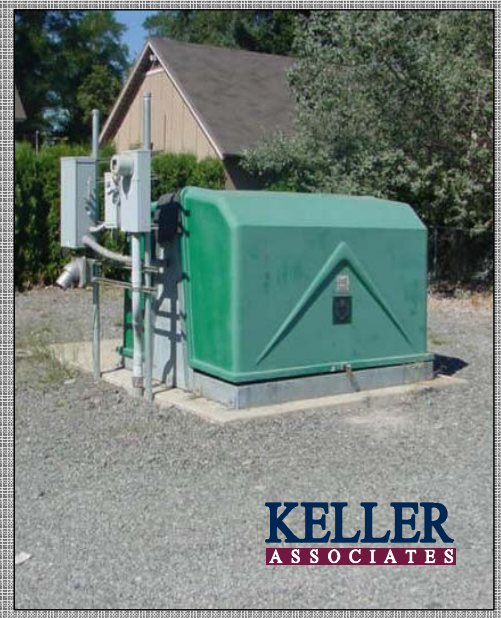
Wastewater Collection Facilities Planning Study



City of Stayton
OREGON

TABLE OF CONTENTS

Page No.

Chapter 1 Introduction
1.1 Introduction 1-1
1.2 Authorization 1-1
1.3 Public Participation 1-1
1.4 Scope 1-1
1.5 Acknowledgements 1-2

Chapter 2 Study Area Data
2.1 Study Area 2-1
2.2 Population 2-1
2.3 Land Use 2-2
2.4 Design Populations 2-4

Chapter 3 Wastewater Flow Rates
3.1 Lift Station Data 3-1
3.2 Wastewater Treatment Plant Flow Data 3-1
3.3 Infiltration and Inflow 3-7
3.4 Design Flows 3-9

Chapter 4 Regulatory Requirements
4.1 Pump Station Design 4-1
4.2 Pipeline 4-1
4.3 City Standards 4-2

Chapter 5 Collection System Inventory and Model Development
5.1 Overview of Collection System 5-1
5.2 Pump Station Inventory 5-1
5.3 Wastewater Conveyance Pipelines 5-5
5.4 Model Selection and Description 5-6
5.5 Model Construction 5-6
5.6 Model Calibration 5-8

Chapter 6 Collection System Evaluation and Alternatives
6.1 Model Evaluation of Existing Collection System 6-1

Chapter 7 Operation, Maintenance and Replacement
7.1 General 7-1
7.2 Lift Station Operation and Maintenance 7-1
7.3 Pipeline Corrosion and I/I Reduction 7-2
7.4 Staffing 7-6

Chapter 8 Summary of Recommendations & Costs

8.1 Wastewater Collection System Master Plan 8-1
8.2 Capital Improvement Plan 8-3
8.3 Funding Sources 8-4
8.4 Potential Rate and System Development Charge Impacts 8-6

Tables

2.1 Stayton and Marion County Historical Population 2-1
2.2 Summary of Stayton / Sublimity 2003 Land Use Inside City Limits .2-3
2.3 Household and Residential Densities.....2-4
2.4 Design Population Projections 2-4
3.1 2002 – 2003 Flows at Lift Stations (GPM).....3-1
3.2 Existing Sewer Flows at WWTP.....3-2
3.3 Wastewater Treatment Plant Peak Hour Flow Events 3-4
3.4 Per Capita Sewer Flows.....3-5
3.5 Stayton vs Sublimity Sewer Flows 3-6
3.6 Sewer Flows Assumed for New Residential Growth (GPCD).....3-11
3.7 Sewer Flows Assumed for Non-Residential Growth (GPAD) 3-11
3.8 Projected Peak Hour Flows at the WWTP 3-12
5.1 Lift Station Inventory 5-2
5.2 Pipe Type Summary.....5-5
5.3 Pipe Size Summary.....5-6
5.4 Calibration Results for the Average Summer Day Model 5-9
5.5 Calibration Results for the Average Winter Day Model 5-10
5.6 Calibration Results for the Peak Day Model.....5-10
8.1 Estimate of Most Probable Cost (2005 Dollars) 8-4

Charts

2.1 City of Stayton Population Projections 2-2
2.2 Study Area Population Projections.....2-5
3.1 24-Hour Wet Weather Unit Hydrograph at Stayton WWTP.....3-5
3.2 Monthly WWTP Influent and Precipitation for 2000-2003.....3-8
3.3 Daily WWTP Influent and Precipitation for Jun 02-March 03 3-8
6.1 Build-out Peak Flow Profile for Burnett-Marion Street Interceptor...6-7

Appendix A Figures

Figure 2.1: Study Area
Figure 2.2: Contour Map
Figure 2.3: Aerial Map
Figure 2.4: Existing Land Use
Figure 2.5: Future Land Use Map
Figure 3.1: Existing Sewer Sheds
Figure 5.1: Existing System
Figure 5.2: Existing Collection System Pipe Types
Figure 6.1: Exiting Pipeline Capacities at Peak Flow
Figure 7.1: Map of 2003 and 2004 TV Monitoring

Appendix A Figures – continued

Figure 7.2: Recommendations from 2003 and 2004 TV Monitoring
Figure 8.1: Stayton Interceptor System Master Plan
Figure 8.2: Stayton Interceptor System Master Plan
Figure 8.3: 2015 Peak Capacity with Priority 1, 2, and 3 Improvements
Figure 8.4: 2025 Peak Capacity with Priority 1, 2, and 3 Improvements
Figure 8.5: Build-out Peak Hour Capacities with All Improvements

Appendix B Flow Data
Appendix C Design Criteria
Appendix D I/I Analysis and TV Logs
Appendix E Cost Estimates
Appendix F Environmental Issues
Appendix G Sewer Ordinance
Appendix H Financing

CHAPTER 1.0 – INTRODUCTION

1.1 INTRODUCTION

The City of Stayton is located approximately 17 miles southeast of Oregon's capital city, Salem. The area's economic base consists of agriculture and industry. The City also serves as a bedroom community for Salem, with a 15-20 minute commute each way. The City of Stayton owns and operates a wastewater collection system and a wastewater treatment plant that treats wastewater from the Cities of Stayton and Sublimity.

The City of Stayton is committed to maintaining a quality system and providing adequate service for all residential, commercial and industrial areas. This report evaluates the existing wastewater conveyance system and makes recommendations to address future needs. A separate document titled "Wastewater Treatment Plant Evaluation" presents the evaluation and recommended improvements for the City's wastewater treatment plant (WWTP).

1.2 AUTHORIZATION

In 2002, the City of Stayton, Oregon contracted with Keller Associates, Inc. to complete wastewater master planning. Local funding for the study came from the City of Stayton.

1.3 PUBLIC PARTICIPATION

The Cities of Stayton and Sublimity have pursued many avenues to inform the public of the City's ongoing master planning efforts. Members of the Stayton-Sublimity Sewer Advisory Committee, made up of elected officials, serve in a review and advisory capacity for proposed improvements. Information has also been made available to the public through public meetings.

1.4 SCOPE

The following list highlights the major tasks included in this study:

- Review regulatory requirements
- Summarize and assist in inventorying of pipeline conditions
- Evaluate pump stations

- Determine extent of infiltration and inflow (I/I)
- Evaluate service to currently unserved area
- Select, develop, and calibrate a computer model of the collection system
- Evaluate existing and future conditions
- Develop improvement alternatives and recommendations with costs, priority, and recommended phasing
- Outline potential funding sources
- Develop maintenance recommendations and replacement program

1.5 ACKNOWLEDGEMENTS

Key to the success of this project was the support and direction of the Technical Review Committee (TRC) consisting of the following individuals: Public Works Director Mike Faught, Senior Advisor Don Albert, Wastewater Supervisor Brenda Dolby, Water Supervisor Tom Etzel, Engineering Technician Al Drawson, and Stayton's consulting engineer, Ed Sigurdson.

CHAPTER 2.0 – STUDY AREA DATA

2.1 STUDY AREA

The study area, illustrated in Figure 2.1 in Appendix A, includes areas in the Stayton city limits and urban growth boundary, Sublimity city limits and urban growth boundary, and additional areas of Marion County previously identified in the Mill Creek Sewer Basin Study. Figure 2.2 includes topographic contours for the study area. Figure 2.3 is an aerial view of the Stayton/Sublimity area.

2.2 POPULATION

2.2.1 Historic Population Trends

Past populations in the City of Stayton and in Marion County is shown in Table 2.1.

Table 2.1
Stayton and Marion County Historical Population

Year	Office of Economic Analysis, State of Oregon and US Census - Marion Co.	Stayton Population Census Data	Marion County Growth Rate	Stayton % of Marion County	Stayton Annual Growth Rate
1970	151,309	3,170		2.10%	
1975	171,700	3,650	2.56%	2.13%	**2.86%**
1980	204,692	4,396	3.58%	2.15%	**3.79%**
1985	213,019	4,815	0.80%	2.26%	**1.84%**
1990	228,483	5,011	1.41%	2.19%	**0.80%**
1995	260,600	5,907	2.34%	2.27%	**3.34%**
2000	284,834	6,816	1.06%	2.39%	**2.90%**

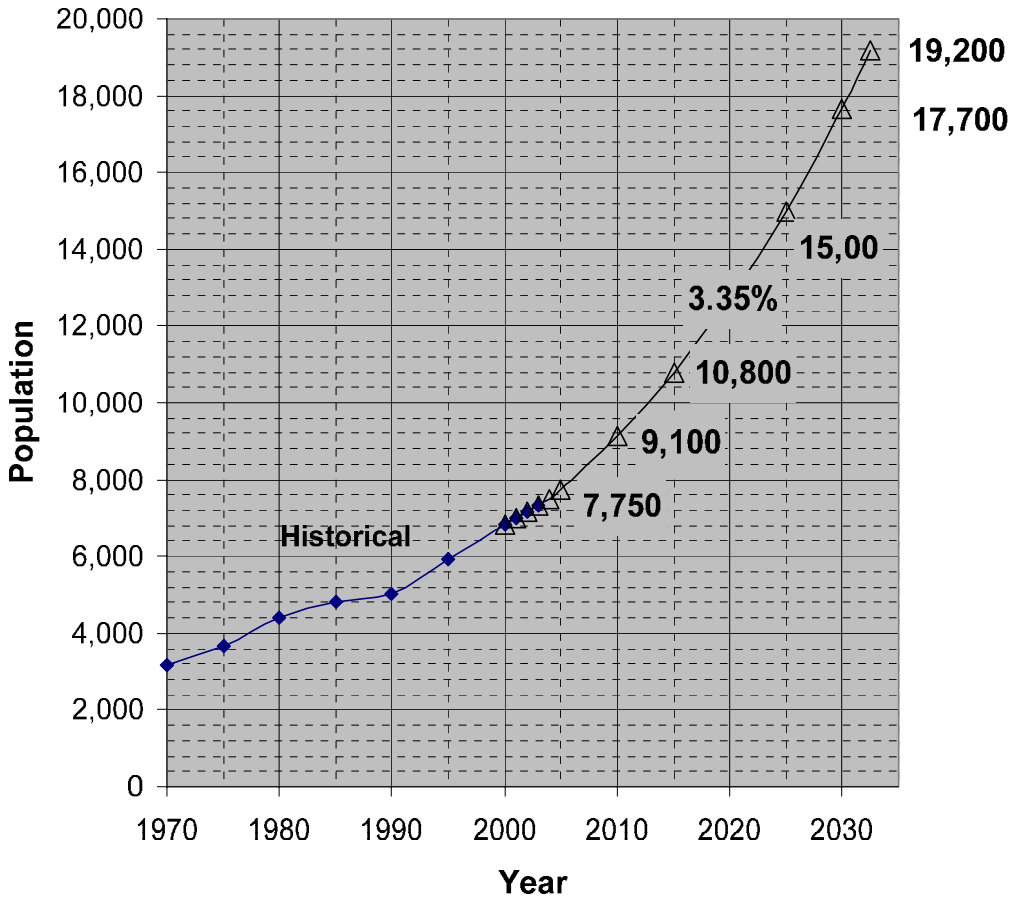
As can be seen from the preceding table, growth in Stayton hovered between 2% and 4% per year in the 1980s. The growth rate in Stayton has generally been higher than Marion County.

Both Stayton and Sublimity contribute flow to Stayton's conveyance and treatment facilities. The estimated 2005 populations for the cities of Stayton and Sublimity are 7,750 and 2,350, respectively.

2.2.2 Stayton Population Projection

In estimating future populations, an annual growth rate of 3.35% was assumed for the Stayton / Sublimity area. This growth rate was developed in consultation with the City of Stayton, Marion County, and the Department of State Lands and is consistent with historical trends for the Stayton / Sublimity area. It is also supported by improvements, such as the Mill Creek regional lift station and pipeline that will open up development within the Urban Growth Boundary (UGB).

Chart 2.1
City of Stayton Population Projections



2.3 LAND USE

2.3.1 Existing Land Use

The cities of Stayton and Sublimity include lands designated as commercial, commercial retail, industrial, industrial agriculture,

industrial commercial, light industrial, interchange development, low density residential, medium and high density residential, and public/semi-public zones inside the city limits. Figure 2.4 in the Appendix A graphically reflects the land use distribution adopted by the cities. The table below summarizes the breakdown in acreage for each land use type.

Table 2.2
Summary of Stayton / Sublimity 2003 Land Use Inside City Limits

Stayton			Sublimity		
Land Use	Acres	% of Total	Land Use	Acres	% of Total
Commercial	104	6%	Commercial	52	9%
Commercial Retail	47	3%			
Industrial Agriculture	60	3%	Industrial	10	2%
Industrial Commercial	17	1%			
Light Industrial	320	18%			
Low Density Res.	709	40%	Low Density Res.	404	70%
Medium and High Density Res.	273	15%	Medium and High Density Res.	38	6%
Public and Semi-Public	238	13%	Public and Semi-Public	76	13%
Total Acreage	**1,768**			**580**	

Notes:
1. Sublimity acreage includes 214 acres of vacant residential and 19 acres of vacant commercial land inside city limits.

2.3.2 Future Land Use

The assumed future land use map for the study area is illustrated in Figure 2.5 in Appendix A. This land use map was developed with input from the Technical Review Committee as well as the Stayton City Planner. A corridor of light industrial use is expected in the vicinity of the west urban growth boundary of Stayton. A strip of land designated as industrial commercial is anticipated around Chemeketa Community College and along the Santiam Highway. Most of the remaining growth area is designated as low density residential, with medium-high density residential areas scattered throughout.

The following development densities for residential areas were reviewed and accepted by the Technical Review Committee as targets for future residential development. These values were used in determining build-out population densities.

Table 2.3
Household and Residential Densities

Low Density Residential (EDUs/ac)*	Med-High Density Residential (EDUs/ac)	Household Size (people/EDU)
3.5	6	2.7

*EDU = Equivalent Dwelling Unit

2.3.3 Land Use Compatibility Statement

The Land Use Compatibility Statement (LUCS) is the process used by DEQ to verify that permits and other approvals that affect land use are in agreement with local comprehensive land use plans. Oregon state law requires a LUCS for nearly all DEQ permits, some general permits, and other approvals that affect land use. A LUCS was completed in 2004 as part of the Mill Creek sewer project.

2.4 DESIGN POPULATIONS

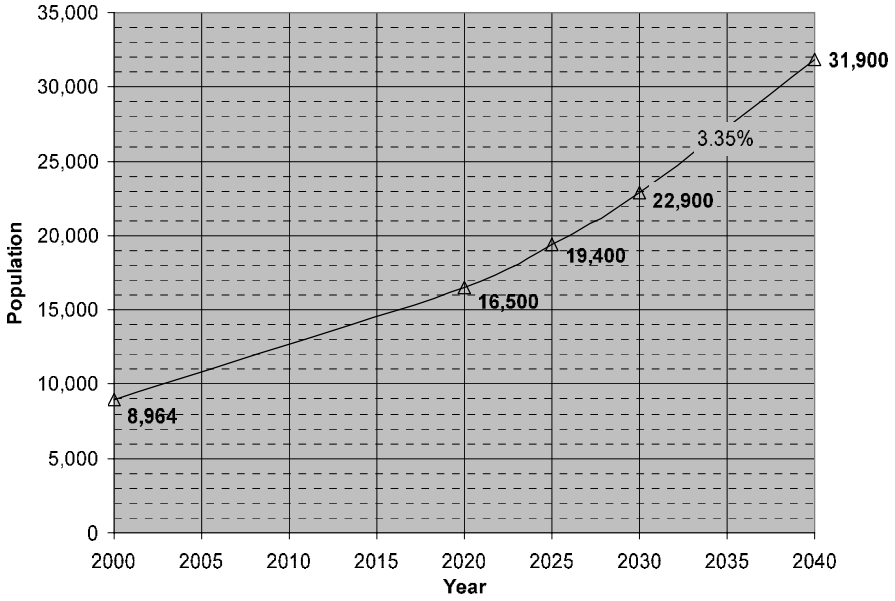
The design populations for the study are summarized in Table 2.4 and illustrated in Chart 2.2.

Table 2.4
Design Population Projections

Year	Stayton	Sublimity	Combined Population
2003	7,300	2,160	9,460
2005	7,750	2,350	10,100
2010	9,100	2,800	11,900
2015	10,800	3,200	14,000
2020	12,700	3,800	16,500
2025	15,000	4,400	19,400

The estimated build-out population for the Stayton / Sublimity wastewater service area is 34,200 people.

Chart 2.2
Study Area Population Projections



CHAPTER 3 – WASTEWATER FLOW RATES

This chapter discusses existing wastewater flows from Stayton and Sublimity. Flows are categorized by source such as commercial, industrial, residential, and infiltration and inflow. Infiltration and inflow represent extraneous groundwater and storm runoff that enters the sewer system, through indirect means (leaking joints, cracks and breaks) or directly (catch basin cross-connections, roof leaders, foundation/basement drains, manhole covers). Flow rates are categorized as averages and peaks.

3.1 LIFT STATION DATA

Flow data was developed for each main lift station identified in the table below. The sewer sheds that would flow into these lift stations are illustrated in Figure 3.1. All flows were approximated based on pump run times and flow tests conducted on each pump. The 2002 and 2003 flow data for each lift station is included in Appendix B. Days with abnormal flows (resulting from conditions such as pump mechanical problems) are highlighted in Appendix B, and were not included when determining the flows shown in the following table.

Table 3.1
2002 – 2003 Flows at Lift Stations (GPM)

Lift Station	Average Day	Peak Month	Peak Day
Fern Ridge Lift Station	51	96	206
Santiam Lift Station	26	41	150
Gardner Lift Station	195	365	464
Sublimity Lift Station	206	392	811
Wilco Lift Station	339	590	1111

In 2004, the City of Stayton purchased a portable pump and completed improvements to the Wilco lift station that would allow abnormally high flows to be pumped to the WWTP. This improvement was intended to be a temporary correction to an existing problem.

3.2 WASTEWATER TREATMENT PLANT FLOW DATA

Wastewater from Stayton and Sublimity is treated in a wastewater treatment plant (WWTP) owned and operated by the City of Stayton. Daily and monthly flow rates into the treatment plant were provided by City personnel for years 2000 through 2003. Hourly flow data was also reviewed as part of this study.

The WWTP has flow measuring devices on the influent and effluent. Influent flow information is generated by a Parshall Flume that records the flow depth with a Milltronic ultrasonic level sensor. The flow meter is verified regularly with an embedded staff gage. Effluent is measured with a 16-inch Tigermag Sparling Magmeter that was rebuilt a year and half ago. The flows on the influent and effluent are verified annually, and thus the WWTP flow rate data appears accurate for use in this study.

3.2.1 Historical Trends

A table of the WWTP influent flow data from 2000 to 2003 is included in Appendix C. This data was used to determine the minimum day, average day, peak day, and peak monthly flows shown in Table 3.2.

A three-month analysis of wet and dry period flows was also conducted to demonstrate the extent of the I/I problem. **Summer** flows **(Jun-Sep) and winter (Dec-Feb)** flows are highlighted. These three month periods were evaluated in addition to the six month dry weather and six month wet weather periods to highlight the impact of infiltration.

Table 3.2
Existing Sewer Flows at WWTP

	2000	2001	2002	2003	2000-03 Average
Minimum Day (GPM)	646	521	528	694	597
(MGD)	(0.93)	(0.75)	(0.76)	(1.00)	(0.86)
Average Day (GPM)	930	932	1,113	1,346	1,080
(MGD)	(1.34)	(1.34)	(1.60)	(1.94)	(1.56)
Peak Month (GPM)	1,596	2,064	1,874	2,102	1,909
(MGD)	(2.30)	(2.97)	(2.70)	(3.03)	(2.75)
Peak Day (GPM)	2,056	2,764	3,458	3,792	3,017
(MGD)	(2.96)	(3.98)	(4.98)	(5.46)	(4.35)
Dry Weather, May-Oct (GPM)	749	697	803	877	781
(MGD)	(1.08)	(1.00)	(1.16)	(1.26)	(1.13)
Wet Weather, Nov-Apr (GPM)	1,306	951	1,513	1,746	1,379
(MGD)	(1.88)	(1.37)	(2.18)	(2.51)	(1.99)
Average Summer Day (GPM)	749	697	803	811	765
Average Winter Day (GPM)	1,306	951	1,513	1,911	1,420
Additional Winter Flow (GPM)	557	255	710	1,100	656
Dec-Feb Average Daily Rainfall (in)	0.16	0.12	0.22	0.23	0.18

The average day flow represents the average flow during the entire year. The peak daily flow represents the highest average day flow during that year. The peak monthly flow represents the highest average flow in an entire month for that year.

3.2.2 Average Day and Peak Day Flow Rates

As can be seen from Table 3.2, average and maximum daily flows over the 4-year period were highest in 2003 at 1,346 GPM (1.94 MGD) and 3,792 GPM respectively. The lowest average day and peak day flows occurred in 2000 at 930 GPM (1.34 MGD) and 2,056 GPM (2.96 MGD). The data shows an increasing trend in the flow rates, represented by a 45% increase in the average day flow rates.

In previous years, the City of Stayton employed an active I/I program which was effective in maintaining infiltration levels at reasonable limits. In recent years, the continued deterioration of the system has resulted in increased infiltration. Inadequate time and funds have prevented the City from more actively pursuing I/I corrections.

3.2.3 Seasonal Variations in Flow Rates

Winter (Dec-Feb) flows are substantially higher than summer (Jun-Sep) flows due to I/I. This is illustrated in Table 3.2 by comparing flows in the drier winter of 2001 to 2000, 2002, and 2003. The average winter day flow in 2000, 2002 and 2003 was more than double the average summer day flow.

3.2.4 Peak Hourly Flow Rates and Trends

Hourly flow data was collected and evaluated for several wet weather and dry weather days in 2002 and 2003. (Flows began to increase substantially during the second week of December 2002, and peaked at the end of December and the first week in January of 2003.) This data was used to evaluate flows observed throughout the day during wet weather and dry weather periods. Table 3.4 lists the days and flow rates for the observed dates.

Instantaneous flows as high as 3,780 GPM (5.44 MGD) have been observed by city personnel at the WWTP. The largest peak hour events correspond to rain events, believed to result primarily from shallow groundwater infiltration into the collection system.

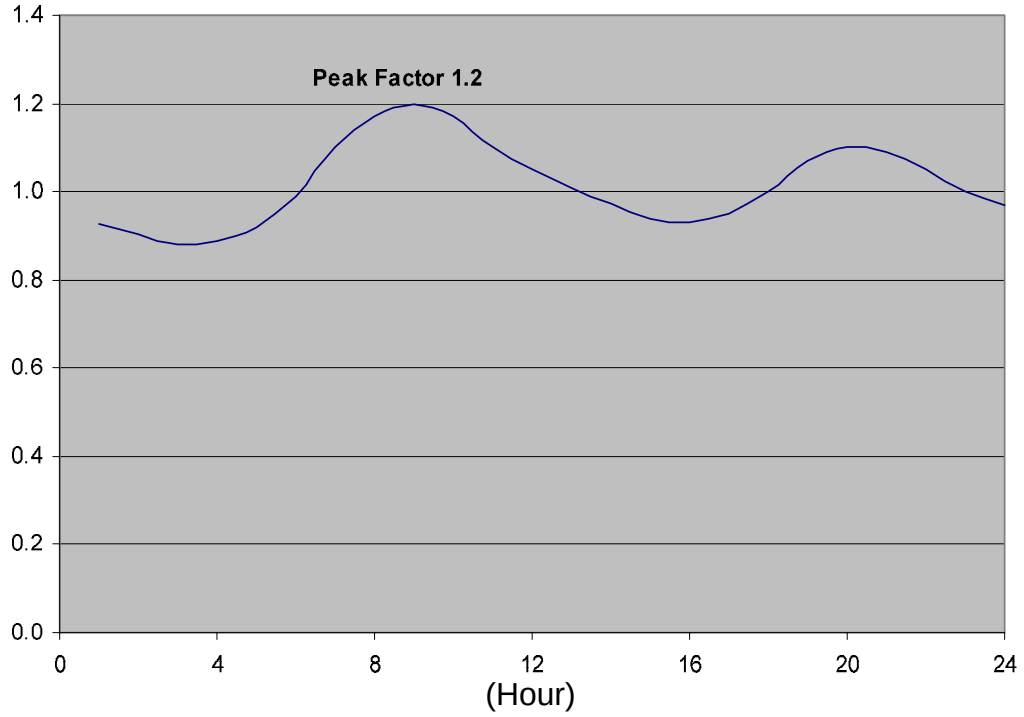
Table 3.3
Wastewater Treatment Plant Peak Hour Flow Events

Date	Avg. Day Flow (GPM)	Peak Hour Flow GPM (MGD)	Peak Hr Factor	Rainfall (in)
Dry Weather Period				
11/10/2002	1002	1260 (1.81)	1.26	0.62
11/12/2002	978	1300 (1.87)	1.33	0.14
11/13/2002	984	1300 (1.87)	1.32	0.44
11/21/2002	937	1249 (1.80)	1.33	0.00
12/1/2002	**813**	**1200 (1.73)**	**1.48**	0.00
12/2/2002	903	1200 (1.73)	1.33	0.00
12/4/2002	824	1200 (1.73)	1.46	0.00
Wet Weather Period				
12/16/2002	2319	2900 (4.18)	1.25	0.00
12/18/2002	2134	2500 (3.60)	1.17	0.00
1/2/2003	2728	3124 (4.50)	1.15	0.05
1/3/2003	**2865**	**3400 (4.90)**	1.19	**0.81**
1/4/2003	2815	3124 (4.50)	1.11	0.45
1/6/2003	2502	2850 (4.10)	1.14	0.23
1/8/2003	1955	2180 (3.14)	1.12	0.00
3/27/2003	2177	2387 (3.44)	1.10	0.39
3/31/2003	1853	2261 (3.26)	1.22	0.19
4/4/2003	2008	2387 (3.44)	1.19	0.40
4/5/2003	1755	1881 (2.71)	1.07	0.73
4/6/2003	2289	2640 (3.80)	1.15	0.07
4/7/2003	2111	2514 (3.62)	1.19	-
4/8/2003	1982	2387 (3.44)	1.20	-
4/10/2003	1894	2134 (3.07)	1.13	-
4/11/2003	1773	2200 (3.17)	1.24	-

The peak hour factors reported in Table 3.3 were calculated by dividing the observed peak hour by the observed average day flow for each day. During drier weather periods, peak factors range from 1.26 to 1.48. During wet weather periods, with higher base flow due to infiltration, the peak hour factors range from 1.07 to 1.25 since average day flows are much higher.

A typical wet weather unit hydrograph was developed from the 24-hour flow data observed at the WWTP. The hydrograph is illustrated in Chart 3.1. The highest flows occurred around 9:00 AM and 8:00 PM with peak hour factors of 1.2 and 1.1, respectively.

Chart 3.1
24-Hour Wet Weather Unit Hydrograph at Stayton WWTP



3.2.5 Per Capita Flow Data for Stayton and Sublimity

A summary of the contributing flows from Stayton and Sublimity during 2000-2003 is listed in Table 3.4. The flow per capita is based on population data or estimates for the respective years. A design peak hour factor of 1.2 was used to generate wet season peak hour flows.

Table 3.4
Per Capita Sewer Flows, gpcd (Years 2000-2003)

Condition	Stayton Only	Sublimity Only
Average Annual Day	186	125
Summer (June - September)		
Average Flow	132	73
Peak Day	**219**	**117**
Peak Hour Flow	296	158
Winter (December - February)		
Average Day	268	196
Peak Day	**462**	**433**
Peak Hour	554	520

Flows per capita were calculated by dividing the total flow by the population and thus include commercial, industrial, and public use. The calculated dry season non-residential portion of Stayton flows is approximately 15 percent.

The flows per capita for Sublimity are lower than comparable flows for Stayton. One reason for this difference is that Stayton has substantially more industry than Sublimity, which skews the per capita flow upwards. Another potential reason that explains the lower flows for Sublimity is the geography of the two cities. Sublimity is located on a hill where groundwater levels are typically deeper, which would result in less infiltration.

Table 3.5 illustrates the historical seasonal wastewater flows from 2000 to 2002. Stayton experiences a 163 and 168 gpcd increase in wastewater flows between average *summer (Jun-Sep)* and *winter (Dec-Feb)* flows in 2000 and 2002, respectively. Sublimity experiences a 141 and 155 gpcd increase in wastewater flows between average summer and winter flows in 2000 and 2002, respectively.

The increase between Dec-Feb and Jun-Sep peak day flows is even more dramatic for each city. The data for 2001 in the table below also illustrates the impact of a dry year on wastewater flows. The average Dec-Feb rainfall for 2000, 2001, and 2002 were 0.24, 0.10, and 0.27 inches per day respectively.

Table 3.5
Stayton vs Sublimity Sewer Flows

	Gallons Per Capita per Day (GPCD)					
	2000		2001-Dry Year		2002	
Condition	Stayton	Sublimity	Stayton	Sublimity	Stayton	Sublimity
Summer* Average	122	71	120	66	142	70
Winter* Average	285	212	173	121	310	225
Difference (I/I)	**163**	**141**	**53**	**55**	**168**	**155**
Summer Peak Day	155	117	140	94	210	103
Winter Peak Day	506	404	247	232	507	472
Difference	351	287	107	138	297	369

*Summer refers to the months of June through September, and Winter refers to the months of December through February

3.3 INFILTRATION AND INFLOW

Infiltration refers to groundwater that enters the wastewater collection system through leaky pipes and manholes. Inflow refers to storm water that enters the collection system through any number of sources, including the holes in manhole lids plus roof drains and storm catch basins connected to the sewer system.

An infiltration analysis was done by comparing wastewater flow rates during the summer (Jun-Sep) and winter (Dec-Feb). Summer flows at the WWTP are approximately 50% of reported winter flows. Groundwater levels in the summer are less than in the winter, which suggests that infiltration into the collection system drops substantially as groundwater levels drop. Higher groundwater levels during the winter result in higher flows where collection system infiltration exists. Chart 3.2 demonstrates that monthly wastewater influent flows in Stayton/Sublimity increase substantially during the winter of every year.

The City of Stayton appears to have slightly more infiltration than the City of Sublimity during the winter season, and substantially more infiltration during the summer. Average per capita flows for Stayton (132 gpcd) are almost double Sublimity's (73 gpcd) during the summer. This is believed to be largely because groundwater levels are higher in Stayton than Sublimity during the summer months.

In addition to the infiltration issue discussed above, a comparison between the daily WWTP flows and the daily rainfall events from June 2002 to March 2003 (see Chart 3.3) demonstrates the close correlation between rainfall events and peak wastewater flows. This correlation could indicate either inflow or shallow groundwater infiltration. The duration of the peak flows points to shallow groundwater infiltration as the likely cause.

Chart 3.2
Monthly WWTP Influent and Precipitation for 2000-2003

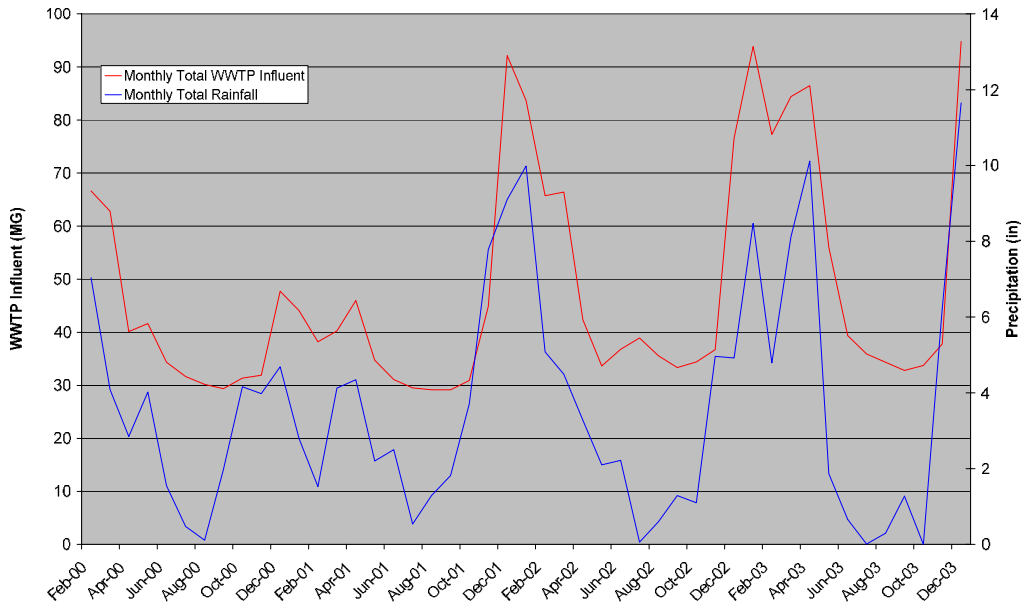
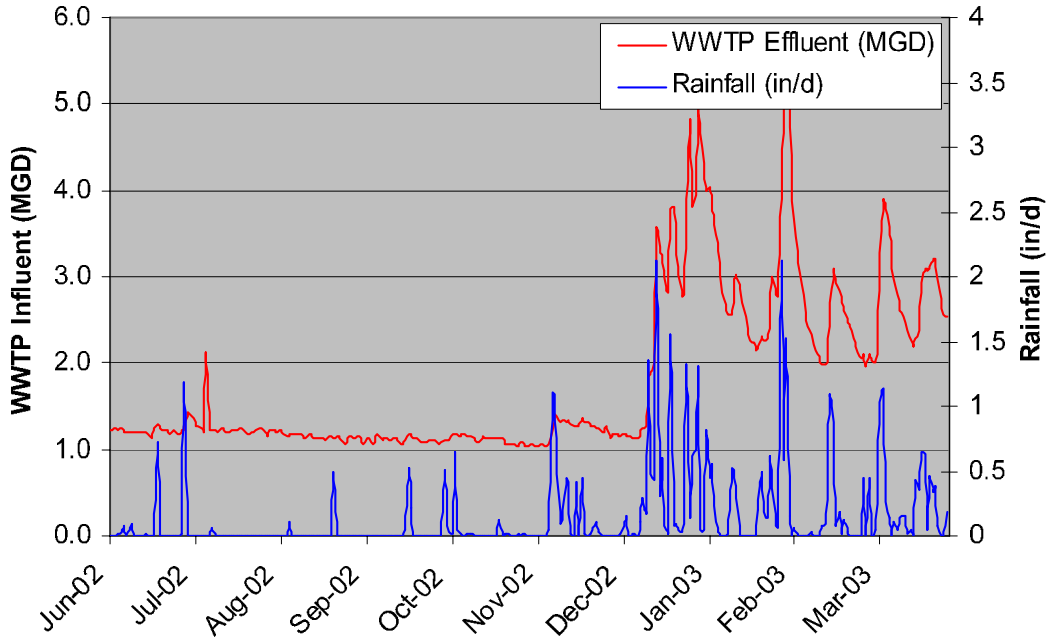


Chart 3.3
Daily WWTP Influent and Precipitation for Jun 02--March 03



Flow records indicate that significant amounts of shallow groundwater infiltration enter the collection system following rain events, especially

during the winter season when ground water levels are already relatively high. The influence of individual rainfall events on wastewater flow rates appears to be much more pronounced in the winter season than during the summer. This is believed to be a result of the saturated soil, porous nature of the soil, and high groundwater levels present during the winter. The following points support this statement:

- City staff report a notable time delay between peak rainfall and increased flow observed in the system. This is especially true in the dry weather period when groundwater levels are lower. During wet weather, the increased groundwater infiltration is observed more quickly at the plant.

- Generally speaking, peak hour winter flows are only 10 to 20 percent higher than the average daily flow indicating that the increase in flow is sustained over a longer period of time. This is illustrated in Table 3.3 which reports recorded peak hour flows and the corresponding average daily flow.

- The first few storms of the wet season typically have a much smaller impact on wastewater flows than storms later in the wet season. This is believed to be a result of rise in groundwater levels during the wet season. Once groundwater levels are high, a storm event may substantially increase plant flows.

- Smoke testing was completed for the City about 20 years ago and found few sources of inflow. The City does not allow for direct storm discharges to the sewer system and has removed such connections when found.

- Peak day and peak hour flows have steadily increased over the past several years as a result of pipeline and manhole deterioration. Implementation of an aggressive I/I identification and elimination program is one of the recommendations of this facilities planning study.

3.4 DESIGN FLOWS

Flow conditions used to evaluate the study area were calculated by adding the existing flow and the future flows projected from currently undeveloped land. These two components are described below.

3.4.1 Existing Flows

Individual average and peak day flows for each lift station summarized in Table 3.1 were used for design purposes when

estimating existing wastewater flows. A peaking factor (peak hour/peak day) of 1.2, based on typical wet weather peaking factors observed at the Stayton WWTP, was used to estimate peak hour flows at the lift stations.

Although the cities have plans to reduce the I/I occurring in the existing system, the integrity of the system naturally degrades over time. Therefore, the Technical Review Committee recommends that existing flows be used for existing developments as lift stations are displaced. This assumption also provides a slightly conservative estimate of flows when sizing sewer pipelines.

3.4.2 Projected Flow from Future Growth

Future flows from new developments were calculated by adding the wastewater flow produced by residential growth and commercial/industrial/public growth inside the study area.

Residential Growth. Table 3.6 summarizes the design flows used for projecting future residential flow rates. The population growth and the design flow in gallons per capita per day (gpcd) are multiplied together to determine the future system flow created by residential growth.

The design peak day flows are substantially less than the corresponding flow that currently exists in the WWTP plant. This is because it is anticipated that the new sewer system will be constructed with “tighter” and better construction technology and materials, that will have less inflow and infiltration than the current sewer system. A design peak day flow of 250 gpcd, which includes a conservative future I/I allowance of 100 gpcd, was used for new construction.

An I/I allowance of 100 gpcd is relatively high for new construction, but is not inconsistent with the amount observed in the existing system. In consultation with a technical review committee, a future I/I allowance of 100 gpcd was agreed upon as appropriate for the Stayton/Sublimity area given the nature of the climate, high water table, and geography of the study area.

Initially, much less I/I is anticipated with new construction. However, as infrastructure ages, infiltration will increase. Additionally, this provides conservative estimates in future flows which will allow for additional flexibility in future land use development.

Table 3.6
Sewer Flows Assumed for New Residential Growth (GPCD)

Condition	Existing Stayton	Existing Sublimity	Existing WWTP	Design for New Sewer
Summer (Jun-Sep) Average Day	132	73	118	100
Peak Day	462	433	442	**250**
Peak Hour	554	520	530	**300**

Commercial/Industrial/Public Growth. Commercial, industrial, and public facility growth will accompany residential growth. Figure 2.5 in Appendix A illustrates where this growth is anticipated to occur.

Table 3.7 lists the design flows in gallons per acre per day (gpad) used for each land use type. The commercial/industrial/public contribution to the future sewer flows is calculated by multiplying the flow rate for each land use type listed in table below (gpad) by the total acreage of each corresponding land use type listed in Table 2.4.

Table 3.7
Sewer Flows Assumed for Non-residential Growth (GPAD)

Land Use	Typical Average Day Flow (gpad) *	Design Average Day Flow (gpad)
Commercial (acres)	800-1500	1500
Commercial Retail (acres)	800-1500	1500
Industrial Ag (acres)	1500-3000	2500
Industrial Commercial (acres)	1000-1500	1500
Light Industrial (acres)	1500-3000	2000
Public (acres)	-	500
* Linsley, "Water-Resources Engineering", 4th Edition.		

Table 3.8 below summaries the anticipated peak flows for the Stayton study area.

Table 3.8
Projected Peak Hour Flows at the WWTP

Year	Population	Peak Hour Flow (MGD)	Peak Hour Flow (GPM)
2005*	10,100	6.5	4,450
2010	11,900	7.1	4,950
2015	14,000	8.0	5,540
2020	16,500	9.0	6,230
2025	19,400	10.1	7,040
Build-out	34,200	16.1	11,150

*City staff reported a peak flows of 6.5 MGD December 29, 2005 through December 31, 2005.

CHAPTER 4.0 – REGULATORY REQUIREMENTS

This chapter outlines regulatory and design requirements as they relate to wastewater conveyance. A separate report addresses the regulatory requirements associated with wastewater treatment.

4.1 PUMP STATION DESIGN

Pump stations are generally used to lift wastewater from a lower elevation and convey it to a high location where it is discharged. Typical guidelines governing pump station design include:

- Redundant pumping supply – the pump station should be capable of conveying peak hour demands with one pump out of service.

- Provisions for Hydrogen Sulfide removal, if required. Hydrogen Sulfide can be corrosive (especially to concrete materials) and often lead to odor problems. Where septic conditions are believed to occur, provisions for addressing hydrogen sulfide should be in place.

- Standby power. While standby power is not required for every pump station, it is the municipality's responsibility to ensure that sanitary sewer overflows (SSOs) do not occur. Extended power outages may lead to wastewater backing up into homes and onto the streets. Mobile generators or portable trash pumps may be acceptable for lift stations, depending on the risk of overflow, available storage in the wet well and pipelines, alarms and response time, etc.

4.2 PIPELINE

cMOM regulations. cMOM refers to Capacity Management, Operation, and Maintenance of the entire wastewater conveyance system. cMOM is a provision of the Clean Water Act which regulates sanitary sewer overflows (SSOs).

The vast majority of all sanitary sewer overflows originate from three sources in the collection system – infiltration and inflow (I/I), roots, and fats, oil and grease (FOG). Infiltration and inflow problems are best addressed through a program of regular flow monitoring, TV monitoring and pipeline rehabilitation and replacement. Blockages from roots or FOG are also addressed via a routine cleaning and monitoring program. A FOG control program may also involve public education, and city

regulations (i.e. requirements for installation and regular maintenance of grease interceptors).

Pipeline Surcharging. Surcharging of gravity pipelines is generally discouraged because of 1) the increased potential for backing up into people's homes; and 2) the increased potential of exfiltration (escape of raw wastewater into the groundwater).

In Stayton where there are virtually no basements, the trunk lines are especially deep, and groundwater levels are especially high, portions of the City's collection system were actually designed to allow surcharging. During high flow periods, a splitter structure at Jetters Way can cause surcharging in the City's main trunk line. (This has the effect of reducing I/I into the trunk line.)

As part of Keller Associates master planning, phased improvements are recommended that will eventually allow the City to eliminate surcharging in the system and thereby provide additional capacity for future growth.

4.3 CITY STANDARDS

City standards are outlined in the 1994 "City of Stayton Design Standards" and in Chapter 13 of the City Code. The City has requested that these standards be reviewed and updated as necessary. In addition, there are currently no City-adopted standards for construction.

One issue is that there are some discrepancies between the City Code and the current standards that need to be resolved to avoid confusion. Examples of discrepancies are listed below:

- "Public Sewer" is defined in Code Section 13.24.710 as a "sewer in which all owners of abutting properties have equal rights, and is controlled by public authorities." In the Standards, a public sewer is "any sewer in public right-of-way or easement operated and maintained by the City."

- "Sewage" in Code Section 13.24.710 is defined as "a combination of water-carried wastes from residences, business buildings, institutions, and industrial establishments, together with such ground, surface, and storm waters as may be present." The Standards specifically exclude storm waters and industrial wastes from the definition of sewage.

- Code Sections 13.24.740 and 13.24.750 indicate that a sewer service extends to the right-of-way line or property line, and that the city will maintain sewer service connections for one year from date

of final inspection. The Standards define sewer service lines as "those portions of the sewage system between the public sewer and the structure being served, which are installed and maintained by property owners or agencies other than the City."

Some specific recommendations relative to City standards include the following:

- Clarify City ownership of service line to eliminate discrepancies between Design Standards and City Code.
- Discourage private systems (private systems are considered satellite systems under cMOM)
- Require demolition permit to ensure proper abandonment procedures for utilities prior to demolition
- Add requirements for construction inspection and testing
- Require submittal of record drawings. Record drawings should be on the City's datum and in hard copy and electronic format.
- Update standard plans to incorporate the latest materials for items such as manhole rungs, manhole joint materials, casing insulators, etc.
- Adopt construction standards

Though the City could develop its own construction standards, there are other standards available that could be used. One option is to adopt the Oregon Standard Specifications for Construction and Oregon Standard Drawings. The City has expressed some concern that these standards may be awkward to use and are heavily weighted toward roadway projects, although they also cover sewers.

Another option would be for the City of Stayton to adopt construction standards in use by a nearby community. Both Albany and Salem have their own Standard Construction Specifications, updated as recently as 2002. The advantage of using one of these standards is that area contractors are already familiar with them. Any specific preferences that Stayton has that differ from the adopted standard can easily incorporated by issuing a simple set of Supplemental Standards.

Once standards are adopted, the City should put in place procedures and checklists to make certain all standards are met.

CHAPTER 5 – COLLECTION SYSTEM INVENTORY AND MODEL DEVELOPMENT

This chapter discusses the existing collection system and includes an inventory of the lift stations and conveyance system. Also included is a discussion of the conditions of the pipelines and pump stations. An evaluation of pipeline and lift station capacities is presented in Chapter 6. This chapter also addresses the selection, construction, and calibration of the computer software that was used to model the sewer collection system.

5.1 OVERVIEW OF COLLECTION SYSTEM

The cities of Stayton and Sublimity own and operate their own wastewater collection systems. However, all the wastewater flow generated by the City of Sublimity currently discharges into Stayton's collection system at the corner of Shaff Road and Kindle Way. A flow meter at the discharge location enables the flow from Sublimity to be measured.

Stayton's gravity collection system includes approximately 33 miles of gravity pipelines ranging from 6 to 24 inches in diameter. Figure 5.1 illustrates the pipe diameters, and Figure 5.2 illustrates the pipe types in the City's collection system. The topography of the city and the elevation of the treatment plant allow for wastewater in the southern half of the system to flow directly to the treatment plant without pumping.

The collection system also includes five pump stations to transport flow from the northern part of the system to the treatment plant.

5.2 PUMP STATION INVENTORY

Portions of the collection system are pumped by pump stations and discharged into other locations in the collection system. These lift stations include the Fern Ridge, Santiam Station, Gardner, Wilco, and Industrial lift stations. The sewer sheds (i.e. gravity service areas or drainage basins) of these lift stations have been delineated and are illustrated in Figure 3.1. Table 5.1 contains summary information for these lift stations, and each of lift station is described in more detail below.

Table 5.1
Lift Station Inventory

Name	Hp, Pump Rate	Wet Well Diameter (ft)	Year Constructed	Force Main	
				Diameter (in)	Length (ft)
Fern Ridge	23 hp, 470 gpm 23 hp, 470 gpm	6	1997 Reconstruction	6	1,260
Santiam Station	15 hp, 342 gpm 15 hp, 342 gpm	6	2002	6	1,040
Gardner	10 hp, 480 gpm 7.5 hp, 300 gpm 500 gpm (2 pumps)	8	1999 Reconstructed	6	920
Wilco	20 hp, 800 gpm 20 hp, 800 gpm 1250 gpm (2 pumps)	8	1975	10	2,565
Industrial	5 hp, 150 gpm	6	1962 Original / mid-1980s relocated	4	525

5.2.1 Fern Ridge Lift Station

The Fern Ridge Lift Station is located on the north side of Fern Ridge Road. The station has (2) twenty-three horsepower submersible sewer pumps mounted on guide rails so the pumps can be removed without entering the wet well. The level control for the pumps is an ultrasonic level control. The control equipment is located inside a fiberglass enclosure. The ultrasonic level control was installed to replace the old air bubbler system that was installed when the lift station was originally constructed.

The lift station operates on 230 volts (3-phase). The station has a manual transfer switch and power receptacle for connection of standby power for operation of the station during power outages.

SCTS has a panel installed in the lift station. A dial-out system is used to notify the central dispatch center of alarm conditions.

5.2.2 Santiam Station Lift Station

The Santiam Lift Station is a submersible lift station with two pumps. The City has experienced impeller plugging of the pumps on a continual basis over the years. The station is in a development east of the Cascade Highway.

The lift station serves a development that has a large assisted living complex within the development. The City maintenance people feel the nature of the development may be the cause of the impeller plugging rather than the pumps themselves.

The discharge side of the pumps has a compressed air injection system that pumps air into the discharge manifold. The air injection system has never been used.

The pumps are controlled on an on/off operation by a Hydroranger level control system. The sensor for the Hydroranger is an ultrasonic sensor mounted at the top of the wet well. A signal from the Hydroranger controls the motor starters for the pumps. The station has a high water alarm that calls a pager through the Santiam Communication System (SCS).

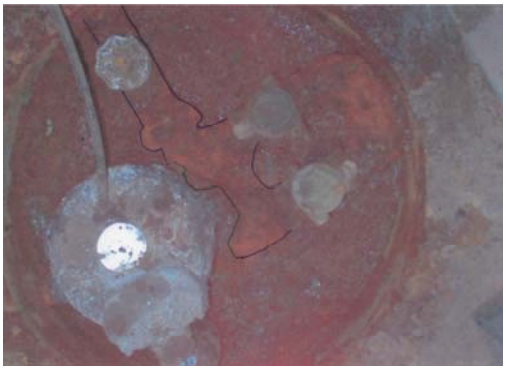
5.2.3 Gardner Lift Station

The Gardner Lift Station is located on the east side of Gardner Road between Regis Road and Locust Road. The station has two submersible sewage pumps. The piping and control equipment is mounted on the surface with fiber glass hinged covers to enclose the control panels. The station has a high and low water alarm. The alarm is transmitted by SCS to a pager.

The pumps are controlled on an on/off operation by a Hydroranger level control system. The sensor for the Hydroranger is an ultrasonic sensor mounted at the top of the wet well. A signal from the Hydroranger controls the motor starters for the pumps. The flow from the lift station is un-metered.

The power service to the station is 230 volts. It has a manual transfer switch and a receptacle for connection of a standby power source to the station to provide emergency operation of the lift station during power outages.

5.2.4 Industrial Lift Station



The Industrial Lift Station is a Smith and Loveless wet/dry lift station with two sewage pumps mounted in the bottom of the dry well side of the station. The pump operation is controlled by an air bubbler system that uses pressure in the compressed air control system to start and stop the pumps as the level in the wet well changes.

The discharge from the lift station flows to a manhole in the street. There is no metering of the sewage flow from the lift station.

The electrical power service includes provisions for connection of standby power to the lift station; however, the City has never used the standby power connection at the lift station.

The existing drywell has experienced severe corrosion. The drain pump does not work and the control panel is 40 years old. The pump station is in need of some major upgrades. Keller Associates recommends the upgrades include converting the existing wetwell into a submersible pump station. This will require two new pumps, retrieval guide rails, level sensor, a new concrete wetwell cover and hatch, housed isolation and check valves, and a new electrical panel.

5.2.5 Wilco Lift Station

The Wilco Lift Station is a Smith and Loveless wet/dry lift station with two pumps mounted in the dry side of the station. The pumps are twenty horsepower pumps. The original control system for the lift station had an air bubbler system. The air bubbler system has been removed and an ultrasonic level system has been installed at the station to control the operation of the pumps.

The station operates at 230 volts. The station has a manual transfer switch and a receptacle installed for connection of a

standby power source to operate the lift station during power outages.

The station has high level and low level alarms and a power failure alarm. The alarms are transmitted by phone. The station also has a Gemini Security System.

The Wilco Lift Station handles all the flow from Sublimity and the flow from the northwest part of Stayton. Sublimity contributes about 70% of the flow pumped by the Wilco Lift Station.

Even with both pumps running, the pumping capacity of the Wilco Lift Station is not adequate to accommodate winter peak flows without surcharging the collection system upstream. This once posed a serious risk of sanitary sewer overflows. However, in 2004 the City purchased a portable generator and pump to reduce the risks of overflows until a more permanent solution could be implemented.

5.3 WASTEWATER CONVEYANCE PIPELINES

The original wastewater collection system was constructed in 1962, and constitutes the majority of the concrete pipelines illustrated in Figure 5.2. Improvements and additions to the original wastewater collection system have been completed over time since then. There are approximately 650 sewer manholes in the City's collection system, and 33 miles of conveyance pipelines.

The type of sewer pipe is a good indicator of the age of the sewer lines. Table 5.2 summarizes the length of each type of sewer line and its approximate age. Table 5.3 summarizes the length of each size of sewer line.

Table 5.2
Pipe Type Summary

Material	Length (ft)	Length (miles)	% of Total	Approximate Age
Asbestos Cement (AC)	23,279	4.4	13%	30
Concrete	85,478	16.2	49%	40
PVC	53,362	10.1	30%	15
Unknown—most likely Concrete	13,280	2.5	8%	30
Total	**175,399**	**33**		

Table 5.3
Pipe Size Summary

Size	Length (ft)	Length (miles)	% of Total
6	497	0.1	0.3%
8	139,500	26.4	79.5%
10	9,812	1.9	5.6%
12	14,043	2.7	8.0%
15	1,494	0.3	0.9%
16	2,069	0.4	1.2%
18	915	0.2	0.5%
21	4,378	0.8	2.5%
24	2,691	0.5	1.5%
Total	**175,399**	**33**	

5.4 MODEL SELECTION AND DESCRIPTION

Several computer software models were considered for potential use in modeling the Stayton collection system. These included XP-SWMM, HYDRA, and H2OMAP. After a detailed consideration of the different modeling programs and through consultation with the City, the XP-SWMM program was selected. Factors influencing the selection of XP-SWMM were:

1. The software's ability to simulate surcharged pipe conditions.

2. XP-SWMM can also be employed to evaluate the storm water system.

3. XP-SWMM is widely used in the Pacific Northwest with technical support based out of Portland, Oregon.

4. The software's ability to perform extended period 24-hour simulations and model pump controls, pressure pipes, and interconnecting gravity collection systems.

5.5 MODEL CONSTRUCTION

After the selection of the computer model, the next step was to construct the model and input the sewer flows for the City of Stayton. Since all the wastewater produced by the City of Sublimity discharges into Stayton's collection system, Sublimity's wastewater facilities were also incorporated into the sewer model. The model consisted of components described below.

5.5.1 Pipes, Manholes, and Lift Stations

The pipes and manholes selected for modeling were constructed within XP-SWMM. The City base map, including manhole locations that were GPS-located as part of the project, provided the template by which manholes (nodes) and collection pipes (links) were entered into the model.

Manhole rim and invert elevations and pipe diameters, invert elevations, and slopes were all entered. Nodes (manholes) were also assigned the manhole ID numbers as supplied by the City. The consultant used record drawings and survey data acquired by the City to determine and confirm pipe sizes and slopes. All collection pipes were assigned a Manning's roughness coefficient of 0.014, which is a typical value used for aged pipes in open-channel flow equations.

The lift stations were also simulated in the model by entering parameters such as pump curves, discharge pipe size and elevations, pump ON/OFF settings, and wet well diameters.

5.5.2 Allocating Wastewater Flows

Wastewater flows rates were determined for the City's wastewater collection system and included residential, commercial, and industrial users. This was accomplished by approximating the number of equivalent dwelling units (EDUs) for each facility that discharges into the City system. Historical and future flow rates per EDU were calculated for all the EDUs in the system and entered into the model.

Three different models were constructed to reflect three different flow conditions including average summer day, average winter day, and peak day. The 24-hour flow pattern outlined in Chapter 4 was applied to each of these three flow conditions. Therefore, the peak day model would reflect a worst peak hour condition, which is the scenario that wastewater systems are generally evaluated and designed for.

5.5.3 Sewer Sheds

Sewer sheds are geographical sections of the collection system that are defined by a common collection drainage outlet. Flow from each sewer shed is determined and routed downstream through the collection system. Local sewer sheds can discharge into regional sewer sheds, as is the case with the Gardner, Santiam Station, and

Fern Ridge sewer sheds in Stayton. Figure 3.1 shows the sewer sheds that exist in Stayton.

5.6 MODEL CALIBRATION

Model calibration is the process of adjusting the model input flow values until the model produces flows that match actual flow conditions in the collection system. The Stayton model was calibrated at five different locations, including the WWTP, and the Fern Ridge, Santiam Station, Gardner, and Wilco lift stations. Metered flows from Sublimity were also used in model calibration.

The WWTP provides a good calibration target because a flow meter at the WWTP site provides daily flow data. The lift stations also act as good calibration targets because the number of hours of operation for each pump is metered on a daily basis. Keller Associates and City personnel completed pump flow tests at each lift station to validate pump flow rates. Daily flow data can be calculated with the pump run times and pump flow rates.

Daily flow data at each lift station and WWTP were compared against model results and used to adjust the flow contributions from each sewer shed. For example, the flow calculated by the model that discharged into the Gardner lift station was compared to the flow based on the pump run time data (observed). If the model flow was less than the observed flow, the flow contribution from the Gardner lift station was increased until the model flow matched the observed flow. This was done for all three model scenarios, including average summer day, average winter day, and peak day.

The amount by which flows were increased or decreased to match observed flows is reflected by the calibration factor. A calibration factor greater than one (1.00) suggests that flows in that sewer shed were greater than average flows and are likely a result of I/I. Calibration factors are listed in Tables 5.4, 5.5, and 5.6.

5.6.1 Average Summer Day Calibration

Flows at each lift station and WWTP vary from day to day and throughout the day. The 24-hour flow pattern observed at the WWTP illustrated in Chart 3.1 was applied to the average summary day sewer flows, and entered into the model to generate daily flow behavior. Table 5.4 lists the calibration results for the average summer day model at each calibration target or location.

Table 5.4

Calibratio

CHAPTER 6 – COLLECTION SYSTEM EVALUATION AND ALTERNATIVES

This chapter provides an evaluation of the sewer collection system. It also addresses various alternatives and recommendations to correct system deficiencies or problems.

6.1 MODEL EVALUATION OF EXISTING COLLECTION SYSTEM

The process of constructing the computer model and calibrating the model to reflect actual system conditions provided the means whereby the current system could be evaluated for flow capacity deficiencies. Also, by calibrating the computer model, the average summer, winter and peak day flow conditions were used to evaluate future flow conditions to plan for future collection system needs. The model construction and calibration process was discussed in Chapter 5.

Figure 6.1 illustrates the existing capacity of the City's collection system. The four main areas of concern where existing pipes are surcharging and/or pump stations are undersized are the Wilco lift station and incoming interceptor, Gardner lift station and incoming/downstream interceptors, the Ida-Evergreen-Marion interceptor system, and the Ida-WWTP interceptors. These four areas are discussed below.

6.1.1 Wilco Lift Station Area

The interceptor along Shaff Road and Wilco collects all of Sublimity's wastewater and the northwest portion of Stayton's wastewater system. This interceptor regularly surcharges. In addition, the Wilco Lift Station is undersized. With both Wilco pumps running, the pumping capacity is not adequate to accommodate winter peak flows without surcharging the collection system upstream.

Since this interceptor system and lift station currently collect all of the wastewater flow from Sublimity, growth in Sublimity will increase flows into this sewer system. Furthermore, the Wilco lift station sewer system is at a depth such that it could collect wastewater flows from the lands zoned as industrial just west of Wilco Road. Increased flows to this area would magnify existing problems.

Long-term alternatives for the Wilco sewer shed were discussed in the *Mill Creek Sanitary Sewer Basin Study*. The preferred alternative involved the construction of a new regional lift station which would reroute all of Sublimity's flow to a regional lift station

near Mill Creek, thereby bypassing the Wilco lift station and its associated interceptor lines (see Figure 6.2). This lift station and associated pipelines is referred to as the Mill Creek Project.

The Mill Creek project corrects the existing and immediate capacity problems at the Wilco lift station and associated upstream interceptor pipelines. Furthermore, as Sublimity's flow is eliminated from the Wilco sewer system, the existing interceptors and Wilco pumps will have sufficient capacity for future flows from nearby undeveloped industrial land.

Another improvement included in the Mill Creek Project is an inter-tie between the proposed 18-inch force main and the existing 10-inch force main from the Wilco lift station to the splitter box near Ida Road. **The forcemain inter-tie will allow for the abandonment of the old asbestos cement 10-inch force main.** Based on a hydraulic model of the inter-tie constructed by Keller Associates, the inter-tie will initially increase the pumping capacity by 150 gpm at the Wilco lift station.

Ultimately, the regional lift station included in the Mill Creek Project is intended to displace the Wilco lift station. This will be accomplished by the construction of an 18-inch interceptor from the Wilco lift station to the regional lift station, and will be completed as development occurs along the interceptor corridor. When the 18-inch interceptor is completed, the Wilco lift station can be abandoned.

Until the Wilco lift station is displaced, upgrades to the lift station will be necessary. Significant electrical upgrades will be made within the next year. For planning purposes, it was also assumed that by 2010 the existing dry well would need to be abandoned and the pump station converted to use submersible pumps mounted in the wet well. In the interim, the City is encouraged to continue pump maintenance, valve exercising, etc, to prolong the life of the facility. Additionally, we recommend that the City expose a portion of the drywell to determine if corrosion is occurring. If corrosion occurs, it may be necessary to install a sacrificial anode.

6.1.2 Gardner Lift Station Area

The Gardner lift station and the 8-inch interceptor along Gardner Road currently collect wastewater from the area illustrated in blue in Figure 3.1. In addition, approximately 1/3 of the flow from the Santiam lift station is diverted into the Gardner sewer system by a splitter manhole at the corner of 1st Avenue and Shaff Road.

There is a 6-inch inter-tie between the Wilco and Gardner sewer basins on Western Place. This inter-tie allows wastewater to overflow from one sewer basin into the other in the event that either basin surcharges. As a result, this inter-tie provides a level of protection against sanitary sewer overflows in the Gardner sewer system.

As illustrated in Figure 6.1, the 8-inch interceptors along Gardner Road both upstream and downstream of the Gardner lift station are surcharged within 3 feet of the surface. In addition, with both Gardner pumps running, the pumping capacity is not adequate to accommodate winter peak flows without surcharging the collection system upstream and posing a risk of sanitary sewer overflows.

Significant growth is not expected within this sewer system. However, peak flows can still increase in the absence of growth if an I/I reduction program and maintenance program is not pursued.

The ultimate solution for the Gardner sewer system is to reroute flow from this sewer shed to the Mill Creek sewer system. This would allow the City to abandon the Gardner lift station, which would eliminate the capacity problems at the lift station and in the interceptors both upstream and downstream of the lift station. These improvements are explained in greater detail in the *Mill Creek Sewer Basin Study.*

Keller Associates recommends that these improvements be completed within the next 5 years. Ideally, these improvements could be coordinated with development that would extend the sewer line from the proposed Mill Creek Interceptor to Shaff Road, and the City would then extend the interceptor from Shaff Road to the Gardner lift station.

It should be noted that when the Santiam lift station is displaced by the Mill Creek Project, the Gardner sewer system is expected to experience a reduction in peak sewer flows of approximately 60 gpm. While, a reduction of 60 gpm is not enough to eliminate the current capacity problems in the Gardner sewer system, it will improve the existing situation until the long-term solution can be implemented. Furthermore, the inter-tie with the Wilco sewer system provides some level of protection against sanitary sewer overflows.

Therefore, until the Gardner lift station is displaced, measures are required to correct existing capacity problems. Three alternates were considered to address the existing capacity problems, and are described below.

Gardner Lift Station - Alternative A-No Action. The first solution is to take no corrective action. Under this scenario, surcharging the collection system within 3 feet of the ground surface would continue and may become worse as I/I increases.

The inter-tie between the Gardner and Wilco sewer system provides some level of redundancy, but this inter-tie is only a 6-inch pipe and has limited capacity. If one of the pumps at Gardner fails or the inter-tie becomes plugged, the system may flood during high flow events.

This alternative would provide the following benefits:

- No capital costs for infrastructure improvements.

This alternative would have the following drawbacks:

- Increased risk of sanitary sewer overflows.

Gardner Lift Station - Alternative B-I/I Reduction Program. The second solution is to pursue an aggressive infiltration/inflow reduction program in the Gardner sewer system. As discussed in Chapter 5, the Gardner sewer system has substantial I/I which takes up needed capacity during wet weather periods.

According to City staff, I/I was recently reduced by approximately 100 gpm in the Gardner sewer system. Additional I/I reduction is needed to free up capacity during wet weather periods. This I/I reduction can be achieved by a regular flow monitoring, T.V. inspection and implementation of leak repair programs in this area. **This alternative is expected to cost $250,000** over the next five years ($50,000 per year) and could be funded from the City's pipeline rehabilitation/replacement budget.

This alternative would provide the following benefits:

- This aggressive I/I reduction program could be coordinated with the City's current T.V. inspection program.

- Reduction in I/I would free up capacity further downstream in the collection system. When the lift station is eventually displaced, the reduced flows may also delay upgrades at the Mill Creek lift station and WWTP.

- No capital costs for infrastructure improvements.

This alternative would have the following drawbacks:

- Higher O&M costs.

Gardner Lift Station - Alternative C-Pipe and Pump Upgrades. A third alternative considered is to increase the pumping capacity at the Gardner lift station, and upsize 800 feet of 8-inch sewer line upstream of the lift station to 10-inch. Since the sewer lines downstream from the lift station are already over capacity, the pumping capacity at the lift station could not be increased without also upsizing the downstream sewer lines. According to computer model simulations, approximately 3,850 feet of 10-inch sewer line downstream of the Gardner lift station would need to be upsized to 12-inch. **This alternative is expected to cost $1,236,000.**

This alternative would provide the following benefits:

- Greater sewer capacity upstream and downstream of the Gardner lift station.

This alternative would have the following drawbacks:

- High capital costs.
- All of these improvements would be unnecessary once the Gardner lift station is displaced.
- These improvements would all need to be completed at once. They could not be phased.
- No reduction in I/I.

Keller Associates **recommends the City pursue Alternative B to mitigate immediate capacity problems in the Gardner sewer system with an active I/I reduction program.** Keller Associates further recommends that the City coordinate the displacement of the Gardner lift station with development in the area. The Gardner lift station should be displaced by 2010.

6.1.3 Ida-Evergreen-Marion Interceptor System

The Ida Road interceptor refers to the 21-inch through 12-inch interceptors that extend along Ida Road. The Evergreen interceptor refers to the 10-inch and 8-inch interceptor that extends along Evergreen, Washington, and Douglas streets. The Marion Street interceptor refers to the 12-inch interceptors that extend from Ida

Road along 1st Avenue and Marion Street to 7th Avenue. This system of interceptors is referred to as the Ida-Evergreen-Marion Interceptor System.

As evident from Figure 6.1, the Ida-Evergreen-Marion interceptor system is under-sized and creates surcharging regularly during peak flow events as severe as surcharging within 1.75 feet of the surface in some locations. The section of pipe that has the most surcharging is the 15-inch and 12-inch interceptor line from the intersection of Evergreen Avenue and Ida Road to the intersection of Marion Street and 1st Avenue. Despite regular surcharging, the City is not aware of any sanitary sewer overflows in this area. Furthermore, due to high groundwater, there are no basements in these areas that would be impacted by surcharging.

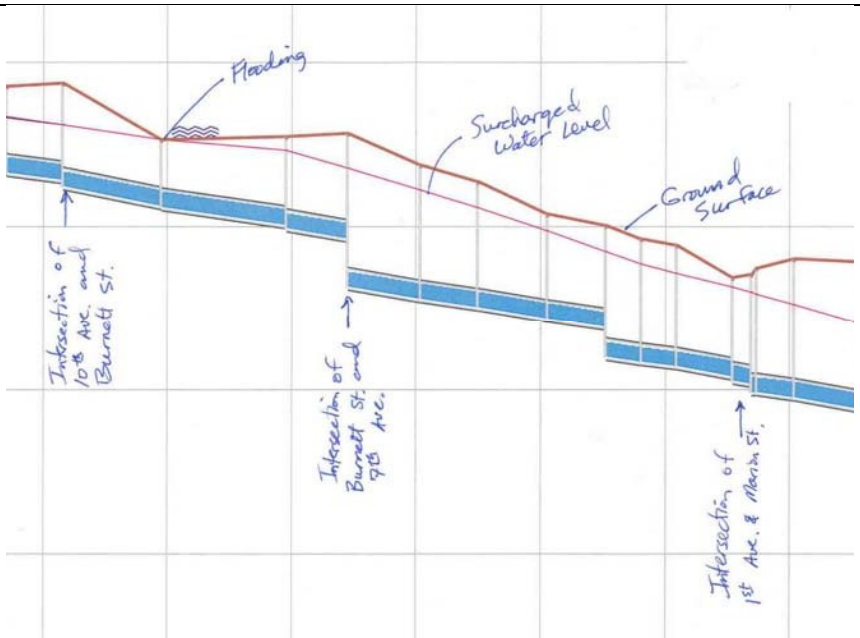
This sewer system was constructed in the early 1960s with concrete pipes, so it is approximately 40-45 years old. Due to the age and condition of these pipes, the estimated remaining life of the pipes is approximately 20 to 40 years.

The flow in the Ida Road and Marion Street interceptors will increase in the future due to development potential on the east side of Stayton. The Evergreen interceptor is not expected to serve future growth areas, but flows can still increase due to deteriorating pipe conditions.

Based on model simulations, Keller Associates estimates that the amount of surcharging in these interceptor lines may initially decrease due to the displacement of the Santiam and Fern Ridge lift stations if the City implements a pipeline program that stops the current trend of a growing I/I problem. **However, by 2025 even with the displacement of the Santiam and Fern Ridge lift stations, flow created by growth in the east part of town may create flooding along Marion Street**.

As flows approach build-out conditions without improvements in this corridor, the frequency and duration of the flooding increases along this corridor (refer to Chart 6.1). Furthermore, surcharging in this corridor creates surcharging in much of the City's other sewer lines.

Chart 6.1
Build-out Peak Flow Profile for Burnett-Marion St. Interceptor



Alternative improvements to the Ida-Evergreen-Marion interceptor system are described below.

Alternative A-No Action. One alternative is to continue to operate under the status quo with no pipe improvements. If pipes in the area are not upsized, this area will continue to function under surcharged conditions. It should be noted that this alternative would provide no safety factor. An increase in flow for any variety of reasons during peak flow conditions would likely result in sanitary sewer overflows, since existing surcharging is estimated to be within inches of the ground surface.

As growth continues and flows reach 2025 conditions, model simulations predict flooding in Marion Street and Burnett Street. Furthermore, as the pipes age, it is likely that the pipe's condition will continue to deteriorate and flooding will occur more frequently unless the City maintains an active I/I reduction program. **While this alternative is expected to have no capital costs, there may costs associated with property damage and violation fines.**

This alternative would provide the following benefits:

- No capital costs.
- Operation of system under surcharged conditions may reduce I/I.

This alternative would have the following drawbacks:

- No factor of safety.
- No capacity for future large commercial or industrial facilities that would discharge into these interceptors.
- If Santiam Station and Fern Ridge lift stations are not displaced, this interceptor corridor would likely flood.
- Planned operation of collection system under surcharged conditions increases City's liability for sanitary sewer overflows.

Alternative B-Interceptor Upgrades. The second alternative is a phased approach of upsizing the Ida-Evergreen-Marion Interceptor system. Based on 2015 model simulations, surcharging in this entire corridor can be eliminated by upsizing the sewer lines as shown in blue in Figure 8.1 along Ida Road and Evergreen Avenue. The improvements highlighted in green in the Ida-Evergreen-Marion corridor would be necessary to eliminate surcharging at build-out flow conditions and would be necessary between 2025 and build-out.

This alternative is expected to be relatively expensive because of utility conflicts, service line replacements, and the urban nature of the repairs. However, these sewer improvements should be coordinated with street repairs to minimize costs. Furthermore, these improvements could be phased over the next 10-30 years depending on growth and planned street repairs which would allow the City to accumulate funding for these improvements. **The first phase of this alternative is expected to cost $1,455,000.**

This alternative would provide the following benefits:

- Greater sewer capacity provides flexibility for industrial and commercial growth.
- Elimination of all surcharging in the collection system even at build-out peak flow conditions.
- Life of existing concrete pipes is limited and pipes will need to be replaced anyway within the next 20-40 years.
- These improvements can be phased.

- Pipe replacement will likely eliminate leaks and I/I in existing concrete lines.

This alternative would have the following drawbacks:

- High capital costs.

Alternative C-Aggressive I/I Reduction Program. It may be possible through flow monitoring and video inspection to locate and remove a substantial amount of infiltration in the basin. This approach should be coordinated with and funded by the City's pipeline and manhole rehabilitation and replacement budget.

Keller Associates **recommends the City pursue both Alternative B and Alternative C**. An aggressive I/I reduction program can reduce current surcharging and significantly increase the capacity of the existing trunkline system. As the life of the Ida – Evergreen - Marion Street interceptor pipeline expires, Keller Associates recommends replacing the pipelines with slightly larger pipes that will carry build-out flows with less risk of surcharging. Recommended timelines for pipeline upgrades are illustrated in Figure 8.1.

6.1.4 Ida-WWTP Interceptor System

The Ida-WWTP interceptor system includes parallel 21-inch and 24-inch interceptors that extend from a splitter box near the intersection of Ida and Wilco roads to the WWTP. These interceptors currently carry all of the wastewater flow from both Stayton and Sublimity. There is adequate capacity in these lines to carry existing peak wastewater flows.

When the Mill Creek project is complete, instantaneous peak flows in this corridor may increase to 8.2 MGD or 5715 GPM. While the overall flows from the system are the same, this increase in peak flows occurs due to large slugs of flow when the regional Mill Creek pumps turn on. Peak flows of 5715 gpm in the existing 21 and 24-inch pipes results in full pipe flows.

When the Gardner and Fern Ridge lift stations are displaced and their flows rerouted into the Mill Creek sewer system or the peak flow into the Regional Mill Creek lift station reaches 2000 gpm, a third pump (2 duty, 1 backup) will be needed at the Regional Mill Creek lift station. When this occurs (likely in the next 5 years), the peak flow into this corridor may increase to 6,000 gpm.

Keller Associates recommends that improvements be made to this corridor at this point. A couple of alternative solutions to the future flow conditions in the Ida-WWTP interceptor system are described below.

Alternative A-Construct Parallel 36-inch Pipe. One alternative is to continue to collect all of the Stayton and Sublimity wastewater flows through this corridor. When flows reach 6,000 gpm, a third parallel pipe would be necessary in this corridor. This new parallel pipe should be sized to handle the build-out flows from the service area.

Based on model simulations, a 36-inch pipe would be necessary for build-out flows. There is some question whether this size of pipe is even feasible in this corridor due to the shallow depth of the sewer line. Special design consideration would have to address pipe cover, traffic loads over the pipe, and flood impacts that may result if the ground above the pipe were raised.

A new pipe along this corridor would have to cross both the Power Canal and the proposed Salem water line and would require improvements or replacement of the splitter box near Ida Road. **This alternative is expected to cost $774,800.**

This alternative would provide the following benefits:

- Additional capacity in this corridor.

This alternative would have the following drawbacks:

- High capital costs.
- Expansion or replacement of the splitter box.

Alternative B-Extend Mill Creek Force Main From Splitter Box to WWTP. The second alternative is to extend the Mill Creek force main from the splitter box to the WWTP when flows reach 6,000 gpm in this corridor. This improvement would allow all the flow from the proposed regional Mill Creek lift station to be pumped directly to the WWTP, bypassing the Ida-WWTP interceptors completely. This section of force main should be 24-inch in order to handle build-out wastewater flows from the Mill Creek Regional Lift Station.

Similar to Alternative A, the new force main would have to cross the Power Canal and the proposed Salem water line. However, the force main could be constructed at a shallower depth.

Furthermore, this alternative would not require improvements to the splitter box.

This alternative is expected to cost $502,000.

This alternative would provide the following benefits:

- Additional capacity in this corridor.
- Force main could be constructed at shallower depths than a gravity sewer line.

This alternative would have the following drawbacks:

- Slightly more pumping head required at Mill Creek lift station
- High capital costs.

Keller Associates **recommends the City pursue Alternative B**.

CHAPTER 7 – OPERATION, MAINTENANCE, AND REPLACEMENT

This chapter discusses the operation, maintenance and replacement of the collection system.

7.1 GENERAL

The City of Stayton's collection system consists of four pump stations and approximately 33 miles of pipeline. Two of the pump stations are submersible type with two wet well/dry pit type. In addition to Stayton's pump stations, the Sublimity pump station and two small private lift stations pump into the Stayton collection system.

Stayton's wastewater pipelines range from 6 inches to 24 inches in diameter with approximately 60 to 65% reinforced concrete pipe (RCP) and asbestos cement with the remainder PVC. Asbestos cement and RCP are highly susceptible to corrosion while PVC is inert. The collection system has a high degree of inflow and infiltration as evidenced by the wide discrepancy in wet weather and dry weather flows entering the treatment plant.

Operation and maintenance of the City's wastewater collection system requires the following work tasks:

- Daily inspection, lubrication and repair of pumping equipment if necessary, and maintenance of the pump stations.
- Prevention of pipeline corrosion so as to optimize pipeline life.
- Mitigation of I/I where practical and economical.

Following is a discussion of these work tasks:

7.2 LIFT STATION OPERATION AND MAINTENANCE

This function is relatively routine and typically requires less than four person-hours per day on average. Repair work may occasionally require two operators but for a limited duration.

The Stayton Wastewater Master Plan presented in Chapter 8 presents a plan to displace and abandon all of the City's existing lift stations except for the Industrial lift station. Lift station upgrades at the Industrial lift station and possibly at Wilco lift station will be needed in the future.

The Master Plan also predicts the need for three additional lift stations besides the Mill Creek lift station to extend wastewater service into some of the growth areas inside the urban growth boundary. Both new lift stations would serve low lying areas near the north Santiam River.

7.3 PIPELINE CORROSION AND I/I REDUCTION

These tasks are interrelated in that it is necessary to clean the pipelines and provide TV inspection to determine pipeline conditions. Cleaning and TV Inspection work has been subcontracted out in the past. Due to the fact that a scum buildup will typically form within two years of operation and is a precursor of corrosion, the pipelines should be cleaned approximately every 2-3 years. Asbestos cement and RCP pipelines should be TV inspected every five years as they are most susceptible to corrosion. PVC pipelines should be TV inspected every ten years mainly to see if any bellies or sags have formed, or pipeline separations have occurred. Problematic areas may be T.V.ed every 1 to 2 years.

7.3.1 Overview of Flow Monitoring and TV Monitoring Program

TV inspection and flow monitoring can identify the most significant spot locations of I/I.

The City has an ongoing TV monitoring and flow monitoring program. This program is described in detail in Appendix D in a memo prepared by Ed Sigurdson dated February 13, 2003.

The City of Stayton actively monitored and implemented improvements to control infiltration and inflow (I/I) from the 1980s through most of the 1990s. In more recent years, this program has not been as active due to inadequate staffing and funding. As a result infiltration and inflow has steadily increased.

Keller Associates echoes the recommendation of Ed Sigurdson that the flow monitoring and TV monitoring programs should be continued indefinitely and sources of I/I should be repaired. To be successful, the City will need City staff able and willing to take responsibility for the program and have the time to do the time sensitive work such as flow and TV monitoring during or just after a storm.

7.3.2 2003 and 2004 T.V. Log Summaries

Extensive TV monitoring was completed in 2003 and 2004. TV log summary information is presented in Appendix D. The location of the TV monitoring is also illustrated in Figure 7.1 in Appendix A.

TV monitoring in 2003 focused on two areas that were believed to be problematic. One area was the downtown area and the other location was in the Gardner Lift Station sewer basin. Several large leaks identified in the Gardner Lift Station basin were subsequently corrected.

A summary of the problems and improvements recommended for the areas TV monitored in 2003 and 2004 are illustrated in Figure 7.2 in Appendix A. It should be noted that the TV monitoring was completed during dry periods when I/I was low.

7.3.3 Ownership Versus Contracting Out T.V. Inspection

The City is considering purchasing the necessary equipment to do their own cleaning and TV inspection work. Following is an analysis of whether undertaking that work would be economical.

The City currently has its own cleaning rig. Fully equipped rigs to TV inspect collection lines cost approximately $150,000. Annualized capital cost of the TV equipment would be $14,400 per year based on a 15 year equipment life and 5% interest rate. The City has approximately 33 miles of pipelines. Typically a two man crew can clean pipelines at the rate of 2000 feet per day and TV inspect at the rate of about 2000 feet per day. Based on a 2 year cleaning cycle and a 5 year TV inspection cycle, this would require approximately 122 man days per year, or cost about $32,000 per year. Therefore, total annual labor and equipment cost for cleaning and TV inspection for the City to do the work would be approximately $46,400 per year.

Typical subcontracted cleaning costs are $0.35 per lineal foot to clean and $0.40 to TV inspect. Based on the above cleaning and TV inspection cycle it would cost the City approximately $45,000 per year to subcontract these services. Therefore, at this time it appears it is about the same cost for the City to do this work as it costs to hire the work out. As the City grows the cost differential will increase since the collection system length will also grow, making it more cost effective for the City to do the work.

One additional reason why the City may consider purchasing their own equipment in the more immediate future, would be to give the City the flexibility to clean and T.V. monitor without scheduling it out

with a third party. For example, City staff could respond more quickly to grease blockages that may cause sanitary sewer overflows or monitoring of pipelines suspected of I/I during storm events.

7.3.4 Pipeline Maintenance

Nationwide, grease is a major contributor to sanitary sewer overflows. According to the TV logs in 2004, several pipeline logs reported grease problems. City staff are aware that there are certain portions of the downtown area that are especially susceptible to grease buildup, and schedule routine cleaning of these sections.

Keller Associates recommends that the City update their standards relative to grease interceptors, and that they consider implementing a Fats, Oils, and Grease (FOG) program. The FOG program would include education and monitoring of FOG contributors, as well as enforcement of standards and regulations. This could be part of the City's pre-treatment program/standards.

TV monitoring can also be part of the FOG program. Normal TV inspection is preceded by a pipeline cleaning. The cleaning removes all or most of the grease buildup. Completing TV inspection prior to cleaning would help define the extent of the problem and specific services from which the grease comes. The TV work would also permit enforcement of the code with respect to grease.

7.3.5 Pipeline Replacement Program

As poor pipe sections and infiltration/inflow (I/I) problems are identified through TV monitoring and flow monitoring, Keller Associates recommends that these areas be corrected. Pipeline and manhole replacement and rehabilitation needs will only increase as the sanitary sewer collection system ages.

For planning and budgeting purposes, Keller Associates has assumed that approximately 33% of all asbestos cement pipelines and 40 percent of all concrete pipelines will need to be either rehabilitated or replaced over a 20-year period. For concrete pipelines constructed in 1962 and replaced in 2025, this assumption corresponds to a pipe life of approximately 63 years. This also corresponds to approximately 2100 feet of pipeline replacement/rehabilitation work each year, or about 1.3% of the total pipeline system.

To fund an on-going replacement/rehabilitation program, Keller Associates recommends that the City work toward setting aside approximately $245,000 per year for planning purposes. Detailed calculations showing pipe lengths and replacement costs can be found in Appendix E. Manhole rehabilitation and service line repairs should be coordinated with pipeline rehabilitation work. Priority pipeline replacements/rehabilitation work identified in the 2003 and 2004 TV inspections should be funded from this program. Emphasis should be placed in areas where pipe conditions pose the largest threat of sanitary sewer overflows.

Rehabilitation Techniques: Rehabilitation techniques may include a combination of traditional and emerging trenchless techniques.

- Open cut replacements are recommended when pipeline grade corrections are needed, when spot repairs are needed, or when surface restoration / disturbance make it cost effective. New construction and open cut replacements should be made with a long lasting corrosive resistant material such as PVC. Problematic services should be replaced when the main line is replaced.

- Trenchless technologies include pipe lining and pipe bursting. Pipe lining may include slip lining with a smaller pipe, instituform, fold-in-form, and similar technologies. These approaches are cost effective where an open cut approach results in extensive surface repairs or high excavation and backfill costs. Trenchless technologies are typically faster than traditional open cut approaches and are sometimes used when minimizing traffic disruptions is critical to the project.

- Pipe bursting entails pulling a continuous HDPE black plastic pipe through an existing sewer pipe using a bursting tool. Bursting is especially cost effective for pipelines 12-inch and smaller and may result in a 20% construction savings. Pipe bursting can also be used for pipeline upsizing (typically, upsize limited to 1 nominal pipe diameter).

- Manhole rehabilitation techniques include special liners, special grouting, and replacement.

Keller Associates has had success on rehabilitation projects by allowing open cut and trenchless technologies to be competitively bid.

Maintenance Management: As part of the pipeline replacement program, Keller Associates recommends that the City track pipe conditions and problems via some kind of GIS or maintenance management software such as Oasis or Hansen or custom program suing the City's existing GIS. Logging conditions over time will help prioritize replacement projects and project replacement needs.

7.4 STAFFING

The equivalent of approximately 1.0 man year is required for lift station and collection system O&M and another 0.5 man year would be required for sewer system cleaning and TV inspection if those duties are undertaken by the City. It is assumed all I/I repair work would be subcontracted out.

Following is a summary of personnel recommended for the wastewater utility:

• Collection System and Pump Stations	1.0 person
• TV Inspection and Collection System Cleaning--if undertaken	0.5 person
• Pretreatment and GIS programs--if undertaken	1.0 person
• Treatment Plant per EPA Guidelines	6.5 people
Total Persons	9.0 People

CHAPTER 8 – SUMMARY OF RECOMMENDATIONS & COSTS

This section summarizes the recommended improvements and associated costs for collection system and lift station facilities. Future recommendations and potential rate impacts are also discussed.

8.1 WASTEWATER COLLECTION SYSTEM MASTER PLAN

A wastewater collection system master plan has been developed that presents the best alternative methods of extending sewer service to the UGB. This master plan includes Priority 1, 2, 3, and future improvements and is presented in Figure 8.1. These improvements are summarized below.

8.1.1 Priority 1 Improvements

Priority 1 improvements should be completed in the next 1 to 2 years to correct existing capacity problems. These improvements are shaded in red in Figure 8.1 and mainly include the following:

- Phase 1 & 1A improvements identified in the *Mill Creek Sewer Basin Study*. The displacement of the Santiam Station and Sublimity lift stations will eliminate capacity problems in the Wilco lft station and reduce flows in the Ida-Marion interceptors.

- Initiate an active I/I reduction program in the Gardner sewer system.

- Coordinate electrical upgrades to the Wilco pump station.

Figure 8.2 illustrates the existing peak flow capacities with the completion of the Priority 1 improvements.

8.1.2 Priority 2 Improvements

Priority 2 improvements should be completed by 2010. These improvements, shaded in orange in Figure 8.1, include the following:

- Construction of the interceptor from the Gardner lift station to the Mill Creek interceptor, which will allow the abandonment of the lift station and force main. This improvement will also correct surcharging in the 10-inch interceptor downstream of

the Gardner lift station, and reduce flows into the Ida-WWTP interceptors.

- Extension of the interceptor from the Santiam Station area to the Fern Ridge lift station, which will enable the abandonment of the Fern Ridge lift station and force main. This improvement will also reduce the peak flows in the Ida-Evergreen interceptors.

- Add 3rd pump to the Regional Mill Creek lift station to meet peak flow conditions.

- Extend the Mill Creek force main (24-inch) from the splitter box in Ida Road to the WWTP when flow into the Regional Mill Creek lift station reaches 2,000 gpm.

- Abandonment of the Wilco lift station dry well and replacement of pumps with submersible pumps.

- Upgrades to the Industrial lift station.

- Purchase T.V. inspection equipment.

These improvements displace both the Gardner and Fern Ridge lift stations.

8.1.3 Priority 3 Improvements

Priority 3 improvements should be completed by 2015. These improvements are shaded in blue in Figure 8.1 and include the following:

- Upsize a stretch of the Ida-Evergreen interceptors.

Figure 8.3 illustrates the peak flow capacities with the completion of the Priority 1, 2, and 3 improvements under 2015 wastewater flow projections. Based on model simulations, these improvements will eliminate surcharging in the City's entire collection system.

8.1.4 Future Improvements

The timing of future improvements will largely be driven and funded by development. These improvements, shaded in green in Figure 8.1, include the following:

- Extension of the sewer collection lines to and through growth areas inside the UGB.

- Construction of a parallel 18-inch Mill Creek force main.
- Upsizing of sections of the Ida-Evergreen-Marion interceptor system.
- Upgrades to Regional Mill Creek lift station.
- Displace Wilco lift station.

Figure 8.4 illustrates the peak flow capacities with the completion of the Priority 1, 2, 3 improvements under 2025 flow conditions. Figure 8.5 illustrates the peak flow capacities with the completion of the Priority 1, 2, 3, and future improvements under build-out flow conditions. Based on model simulations, these improvements will eliminate surcharging in the City's entire collection system at build-out peak flows.

8.2 CAPITAL IMPROVEMENT PLAN

The Capital Improvement Plan (CIP) outlines priority improvements necessary to ensure sufficient sewer service to the City, both now and in the future. The CIP also outlines an annual operation and maintenance program with an estimated annual budget. A table summarizing the City's estimated proportionate costs for the priority improvements is presented below.

Table 8.1
Estimate of Most Probable Cost (2005 Dollars)

Item	Project Costs			
	Priority 1	Priority 2	Priority 3	Future
Priority 1 (2005)				
Mill Creek Project	$4,482,000			
Wilco Electrical Upgrades	80,000			
Gardner Sewer System				
• Aggressive I/I Reduction Program	250,000			
City Hall – 11% of total share	409,200			
Industrial LS Upgrade	55,000			
Total Priority 1	**$ 5,276,200**			
Priority 2 (2010)				
Collection Line Improvements				
• Gardner Road Interceptor		$692,000		
• Fern Ridge Interceptor		127,000		
Other Upgrades				
• 24-inch Force Main Extension		535,000		
• Purchase TV Equipment		400,000		
• Add 3rd Pump to Mill Creek LS		100,000		
Total Priority 2		**$ 2,406,800**		
Priority 3 (2015)				
Collection Line Improvements				
• Ida-Evergreen Interceptor			$1,455,000	
Total Priority 3			**$ 1,455,000**	
Future				
Collection Line Improvements				
• E. Burnett St. Interceptor				$14,000
• Industrial Area Interceptor				1,322,000
• Golf Club Road Interceptor*				294,000
• Ida Road Interceptor				1,123,000
• Marion Street Interceptor				579,000
• Evergreen-Douglas-Locust Interceptor				787,000
Other Upgrades				
• Parallel 18-inch Force Main*				1,387,000
• Upgrades to Mill Creek LS*				780,000
TOTAL (rounded)	**$ 5,261,000**	**$ 1,935,000**	**$ 1,455,000**	**$6,286,000**

*Projects mutually benefit Stayton and Sublimity

Notes: Costs include engineering and contingencies.
Future Costs are in 2005 dollars.

8.3 FUNDING SOURCES

To accommodate the recommended system improvements, a financing program will need to be established that can support implementation of this improvement program.

A variety of funding resources exist in both the private and public sector. It is recommended that funding from both sectors be considered. Some of those resources in the public field are listed below. A more complete discussion of potential financing was prepared by Economic and Financial Analysis and can be found in Appendix F.

- **Oregon Department of Environmental Quality (Wastewater-Clean Water State Revolving Fund)**—20 year, 3.6% interest rate loans.

- **Oregon Economics and Community Development Department (Community Development Block Grant Program)**—Availability dependent on the median household income and user rates; Grant funds up to a maximum of $750,000; Priority given to cities with compliance infractions.

- **U.S. Department of Agriculture (Rural Development Program)**—Grant and loans available to communities with less than 10,000 people; 30-40 year loans at 4.25% interest rates; Eligibility based on user rates, average household income, and compliance issues.

- **U.S. Economic Development Administration**—Grant and loan funds; Priority based on economic development potential.

- **Oregon Economics and Community Development Department (Water/Wastewater Financing Program)**—State funded program (Oregon Lottery); Grant and loan funds generally provided on a 50/50 basis; Grant funds have a maximum of $750,000; 25-year loan at 4.6+% interest rate; Eligibility based on average household income and compliance issues.

- **Oregon Economics and Community Development Department (Special Public Works Program)**—State funded program (Oregon Lottery); Loan funds only; 25-year loan at 4.6+% interest rate; Eligibility based on average household income and compliance issues.

The City of Stayton is encouraged to prepare for a “One-Stop” funding workshop where an optimum funding package can be developed using the various funding sources. One-Stop meetings are held monthly and are administered by the Oregon Economic and Community Development Department (OECDD).

8.4 POTENTIAL RATE AND SYSTEM DEVELOPMENT CHARGE IMPACTS

Potential impacts and user rate system development charges were considered by the City's financial consultant. Appendix H contains a Financial Plan for the Sewer Utility.