City of Sherwood Oregon

Home of the Tualatin River National Wildlife Refuge

RESOLUTION 2007-066

A RESOLUTION ACCEPTING THE STORMWATER MASTER PLAN

WHEREAS, the City wishes to provide the citizens of Sherwood a stormwater system that has adequate collection, conveyance, treatment and detention facilities; and

WHEREAS, consultant Murray, Smith and Associates (MSA) was authorized by the City of Sherwood to develop the Stormwater Master Plan under Resolution 2006-067; and

WHEREAS, MSA has completed a comprehensive analysis of the City of Sherwood's Stormwater system to identify system deficiencies, future extension and expansion and to recommend facility improvements that correct existing deficiencies and provide future system expansion; and

WHEREAS, after due consideration and multiple public involvement opportunities, staff recommends acceptance of the Stormwater Master Plan, Exhibit A (on file at the City).

NOW, THEREFORE, THE CITY RESOLVES AS FOLLOWS:

Section 1: The City Council accepts the Stormwater Master Plan as the comprehensive, public facility planning direction for the City.

Section 2: The City Council authorizes an initiation of a plan amendment application consistent with Section 4.201 of the SZCDC to adopt the new master plan as a technical appendix to the comprehensive Plan (Part 2) and hereby directs the Planning Manager and the City Engineer to coordinate the review process.

Section 3: Upon adoption of this resolution, the Stormwater Master Plan dated June 2007 supersedes all previous Stormwater Master Plans for the City of Sherwood.

Section 4: This Resolution is and shall be effective upon its approval and adoption by Council.

Duly passed by the City Council this 17th day of July 2007.

Keith S. Mays, Mayor

ATTEST:

Sylvia Murphy, City Recorder

STORMWATER MASTER PLAN

FOR

CITY OF SHERWOOD

JUNE 2007

Prepared by:

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Authorization

On December 7, 2006, the City of Sherwood (City) authorized Murray, Smith & Associates, Inc. (MSA) to prepare this Stormwater Master Plan. This report documents the storm drainage master planning work that was conducted under this professional services agreement.

Purpose

The purpose of this study is to examine the City's stormwater system in consultation with both City and Clean Water Services (CWS) staff. The master plan documents the results of the evaluation of the conveyance system under current and future forecasted development conditions to identify operational limitations, and to recommend improvements necessary to accommodate the City's stormwater needs through the 20-year planning period.

Recommendations presented for improvements are based on long-range development of the City UGB, and include near-term and long-term projects that may be incorporated into the City's Capital Improvement Program to provide adequate stormwater conveyance capacity and stormwater treatment for improved surface water quality.

Context and Goal of Study

This plan supports the City's requirements under the Oregon Administrative Rules (OAR 660-011) Public Facilities Planning rules. The plan has been prepared in coordination with the CWS watershed-based National Pollutant Discharge Elimination System (NPDES) Permit, NPDES Municipal Separate Storm Sewer System (MS4) Stormwater Management Plan Update (2006), the CWS Healthy Streams Plan (June 2005) and Watersheds 2000 Program, and the CWS 2007 - 2011 Capital Improvements Program. Public involvement was solicited at open workshops and a formal hearing prior to adoption of the Stormwater Master Plan by the City Council.

The City's goals for this Stormwater Master Plan include:

- Provide solutions to existing problems and inadequate storm sewer systems including collection, conveyance, treatment and detention facilities.
- Guide expansion and extension of the stormwater system to serve future growth, including costs.
- Provide a review of the current funding for the stormwater program and define possible funding options.

Scope

The scope of work for this study includes the following work tasks:

- Project Management
- Data Collection / Basin Characteristics
- Existing Storm Sewer System Review
- Storm Sewer System Analysis and Master Plan Development
- Project Coordination and Master Plan Presentation
- Rate and System Development Charge (SDC) Study Update

Study Area

The study area for this Stormwater Master Plan includes the planning area, defined as all of the land within the City's Urban Growth Boundary (UGB), and the upstream areas contributing runoff to the City's five receiving waters. The City's five receiving waters include Cedar Creek, Rock Creek, Chicken Creek, Hedges Creek and Coffee Lake Creek.

Existing Drainage System

The planning area is presently drained by a system of natural features, as discussed above, combined with piped storm sewers, roadside open channels, culverts and swales. In many areas within the City, development has occurred to modern standards where streets, curbs, gutters and storm sewers have been installed. However, some portions of the City still have a stormwater collection system that consists primarily of roadside open channels intermixed with culverts and small diameter conveyance pipes. The dominant drainage feature in the City is the natural creek system. Chicken, Cedar, and Rock creeks drain roughly 92 percent of the land within the City UGB by area.

All of the stormwater conveyance facilities within the City limits flow by gravity; there are no pumps or pressurized pipes in the system. Many residential properties have direct connections between their roof drains and the public stormwater conveyance system. Many commercial and industrial properties have private stormwater collection and conveyance systems that provide drainage for their facilities including buildings and parking lots. These systems are generally connected directly to the public stormwater conveyance system.

Stormwater runoff is collected from residential, commercial, industrial and institutional lands and collected in catch basins, area drains and ditch inlets. The stormwater runoff is then conveyed via a collection of stormwater piping, open channels and culverts to the receiving surface waters where it is discharged through an outfall structure. In many locations throughout the City, stormwater runoff is treated by a water quality facility prior to discharge from the storm drainage system.

Developed areas within the City are presently served by publicly owned stormwater collection and conveyance facilities, operated through an Intergovernmental Agreement (IGA) between the City and CWS.

Identified Drainage Problems

Certain problems within the City's storm drainage system have been identified by City Public Works staff. These areas are listed below.

- Under certain significant storm events, an undersized storm sewer pipe in Ladd Hill Road just south of Sunset Boulevard has caused the conveyance system to surcharge, and forced the manhole cover to be lifted off its frame.
- A 36-inch diameter culvert crossing under SW Sunset Boulevard near Eucalyptus Terrace appears to surcharge under larger storm events.
- Known areas where drainage problems are caused by long-term or recurring maintenance problems include:
  - Silted ditches along West Division Street
  - Repeatedly blown out swale near Columbia Street and Southern Pacific Railroad
  - Non-functional swale southwest of the intersection of Ladd Hill Road and Sunset Boulevard
  - Various open channel conveyances where vegetation control or removal of invasive species is needed

City staff have also indicated that there is one known location where a public storm drainage pipe is located under a private residence. This pipe is located along Park Street near 1st Street.

In addition to the conveyance system concerns noted above, the City recognizes that there are portions of the storm drainage system that operate with no water quality treatment. These areas were generally developed prior to 1991 when CWS began requiring stormwater management facilities for treatment of runoff from impervious surfaces. These areas fall into one of two categories:

- Commercial and industrial facilities: Older commercial and industrial developments along Highway 99W and north of Tualatin-Sherwood Road were likely constructed without stormwater treatment facilities. Runoff from these types of development can have significant detrimental impact to surface water quality in locations of high motor vehicle-dependent activities, activities which require large ground disturbances and where materials storage is performed uncovered.

- Older developed residential areas: Two relatively large drainage basins in the southeast portion of the City, west of Murdock Road and south of Oregon Street, drain untreated to Rock Creek. Also, along Cedar Creek, there are several small residential basins that drain directly to the creek with no treatment.

Study Methods

The stormwater analysis consists of hydrologic and hydraulic components. The hydrologic component estimates the volume and peak flow rate of stormwater runoff entering the stormwater conveyance system in response to the rainfall associated with a particular design storm. The total volume and peak flow rate of stormwater runoff depend on the duration and intensity of the storm, the topography, soil type and amount of impervious area of the basin. These flow rate and volume estimates were based on computer modeling and were further used to complete the hydraulic component of the storm drainage system analysis.

The hydraulic component routes the stormwater that results from the hydrologic component through the conveyance system. The hydraulic component evaluates capacity of the conveyance system to pass the design storm, and is used to identify areas that may ultimately be prone to flooding. The hydraulic analysis depends on geometry (size, shape and slope) and other characteristic data of the pipe and channel system to estimate capacity. Information used to complete the hydraulic component of the drainage system analysis was provided by the City's system mapping, GIS information, and information obtained during site visits. The hydrologic and hydraulic analyses of the drainage system were used to determine the existing and required future capacity of the City's storm drainage system.

Improvement Options

Conveyance system improvements are intended to ensure the conveyance system can pass the estimated runoff from the design storm event without flooding. The conveyance system generally includes pipes, manholes, catch basins and inlets, swales, ditches, creeks and culverts. The system may also include regional detention facilities, which are publicly-owned and maintained facilities designed to store and reduce peak runoff rates. Conveyance system improvements include:

- Increase Pipe Capacity
- Increase Capacity of Natural Channel
- Construct Detention Facility
- Provide Reduction in Peak Flow Rates through LIDA (Low-Impact Development Approaches)

Water quality improvements are necessary to reduce pollutants from stormwater runoff prior to entering the downstream surface water system. CWS holds a National Pollutant Discharge Elimination System (NPDES) stormwater permit for urban areas within the Tualatin River Basin, which includes the City. CWS regulates all stormwater discharges, and has standards for requiring all new development with impervious surfaces to treat its runoff prior to discharge. The primary pollutants which CWS is concerned about are total suspended solids (TSS) and phosphorus, a nutrient which is naturally occurring in the soil. CWS standards specifically require all stormwater quality facilities to be designed to remove 65 percent of the total phosphorus from the runoff from the development's impervious area. Water quality improvements include:

- On-site Water Quality Facility
  - Vegetated Swale
  - Extended Dry Basin
  - Constructed Water Quality Wetland
  - Proprietary Filter System
- Regional Water Quality Facility
- SDC in Lieu of Water Quality Facility
- Implementation of LIDA

Financial Evaluation Overview

The purpose of the financial evaluation is to provide reasonable assurance that the City's Stormwater Fund has and will have the financial ability to maintain and operate the stormwater system on an ongoing basis, plus have the capacity to obtain sufficient funds to construct the stormwater system improvements identified in Section 7.

In completing the financial evaluation, the historical financial performance of the Stormwater Fund was documented; capital funding options available for stormwater system projects identified; a capital funding strategy for the Capital improvement Program (CIP) was developed; and revenue requirements and customer impacts considering the "total system" costs of providing stormwater service, operating and capital, were determined.

A number of forecast assumptions are used in the analysis:

- Rate revenue (under existing rate levels) is calculated to increase with growth in future years, which is projected to average 3.72 percent per year (consistent with those used in this Plan for facility planning purposes).
- Operations and maintenance expenses (O&M) are escalated assuming general inflation of 3.0% per year and labor inflation of 5.0% per year. Clean Water Services treatment costs are planned to increase in proportion to growth plus general inflation.

- In addition to O&M expenses, the revenue requirement includes debt service costs and rate-funded system reinvestment (depreciation) funding.
- Revenue bond debt financing terms include a 20-year repayment term, 5.0% interest cost and 2.0 % issuance cost.

Table ES-1 summarizes the financial performance and rate requirements for FY 2006/07 through FY 2012/13. The City's existing rates are not adequate to support the needs of the Stormwater Fund over the study period. Cash reserves are planned to cover the FY 2006/07 annual shortfall. A 100% increase is needed to meet FY 2007/08 expenditures. This increase is proposed for a September 1, 2007 implementation date. Additional annual increases, as shown in the table, are needed in each of the remaining years to meet annual obligations.

The residential stormwater charge is currently $4.38 per month. It is forecast to increase to $11.36 / month by FY 2012/13 and to $15.59 by FY 2026/27. These rates remain well within the 1.5% median household income affordability index for utility bills. Table ES-2 summarizes the rate forecast and impact to the typical residential monthly bill.

This analysis does not include evaluation of the financial impacts of shared Clean Water Services capital projects.

Table ES-1
Revenue Requirements

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Revenue							
Rate revenue under existing rates	$ 528,192	$ 547,866	$ 568,272	$ 589,438	$ 607,885	$ 626,908	$ 646,527
Use of SDCs for debt service	8,175	8,479	8,795	-	-	-	-
Non-rate revenue	12,076	10,307	6,130	10,816	15,714	20,800	25,967
Total annual revenue	$ 548,444	$ 566,652	$ 583,197	$ 600,254	$ 623,599	$ 647,708	$ 672,494
Materials and Services							
Professional & technical	$ 226,650	$ 248,004	$ 257,241	$ 274,827	$ 291,931	$ 310,099	$ 329,397
Facility & equipment	10,500	11,706	12,057	12,419	12,791	13,175	13,570
Other purchased services	27,801	34,400	35,432	36,495	37,590	38,718	39,879
Supplies	20,500	22,104	22,767	23,450	24,154	24,878	25,625
Minor Equipment	500	44,500	45,835	47,210	48,626	50,085	51,588
Non-Capitalized Vehicles	-	28,000	28,840	29,705	30,596	31,514	32,460
Reimbursements	303,638	381,979	401,078	421,132	442,188	464,298	487,513
	$ 589,589	$ 770,693	$ 803,251	$ 845,238	$ 887,877	$ 932,767	$ 980,032
Other Expenditures							
Debt Service	$ 47,622	$ 47,622	$ 136,891	$ 229,731	$ 326,284	$ 412,336	$ 471,583
Rate-Funded System Reinvestment	-	-	112,208	99,455	84,409	79,542	87,834
Transfers Out (shared capital)	10,000	157,500	50,000	51,500	53,045	54,636	56,275
Additions to meet minimum fund balance	-	-	-	-	-	-	-
	$ 57,622	$ 205,122	$ 299,099	$ 380,685	$ 463,737	$ 546,514	$ 615,693
Replenish Negative Capital Fund	$ -	$ 309,709	$ 139,799	$ -	$ -	$ -	$ -
Total annual rate-funded expenditures	$ 647,211	$ 1,285,524	$ 1,242,148	$ 1,225,924	$ 1,351,614	$ 1,479,281	$ 1,595,724
Annual Surplus (Deficiency)	$ (98,767)	$ (718,872)	$ (658,951)	$ (625,670)	$ (728,015)	$ (831,573)	$ (923,230)
Annual Rate Increase	**0.00%**	**100.00%**	**10.00%**	**4.00%**	**2.00%**	**2.00%**	**2.00%**
Cumulative Rate Increase	**0.00%**	**100.00%**	**120.00%**	**128.80%**	**133.38%**	**138.04%**	**142.80%**

Table ES-2
Current Rates Projected with Across-the-Board Increases

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Rate Increase	**0.00%**	**100.00%**	**10.00%**	**4.00%**	**2.00%**	**2.00%**	**2.00%**
Fixed Charge - per Month							
	$4.68	$9.36	$10.30	$10.71	$10.92	$11.14	$11.36
Monthly Bill							
	$4.68	$9.36	$10.30	$10.71	$10.92	$11.14	$11.36

Recommendations

The recommended CIP is presented in Table ES-3. All of the system improvements presented in this table are also shown on the Proposed Improvements Map, Plate 1 in Appendix B. Projects with labels that start with CH are located in the Chicken Creek Basin, projects with labels that start with CC are located in the Cedar Creek Basin, projects with labels that start with RC are located in the Rock Creek Basin projects with labels that start with HC are located in the Hedges Creek Basin, and projects with labels that start with CL are located in the Coffee Lake Creek Basin.

The cost estimates associated with specific improvement projects shown in Table ES-3 have been rounded to the nearest five thousand dollars. Estimates of cost developed in this plan represent the total estimated project cost for short-, mid-, and long-range recommended improvement projects described later in this section. Various improvement projects have been grouped into the following three categories based on implementation time frames. Short-range costs are those anticipated in the next 5 years. Mid-range costs are those anticipated for a period from 5-10 years hence. Long-range costs are those anticipated from 10 years hence to full build-out conditions.

Table ES-3
Recommended Capital Improvements Program

Project Identifier	Description	Estimated Cost	Potential Cost Sharing
Short-Range Improvements			
CH-1	Chicken Creek Stormwater Facility	$ 145,000	Developer requirements, green space contributions, SDCs
RC-1	Murdock Road (North) Regional Stormwater Facility	$ 350,000	N/A
CC-1	Ladd Hill Regional Stormwater Facility	$ 425,000	N/A
CC-3	Columbia Street Stormwater Facility	$ 140,000	N/A
CC-12	Area 59 Regional Stormwater Facility	$ 155,000	Developer requirements, green space contributions, SDCs
CC-13	Upper Ladd Hill Regional Stormwater Facility	$ 385,000	Developer requirements, green space contributions, SDCs
CC-14	Brookman Addition Regional Stormwater Facility	$ 560,000	Developer requirements, green space contributions, SDCs
CC-15	Pinehurst Culvert	$ 50,000	
CC-16	Washington Street Culvert	$ 1,900,000	
CC-17	West Brookman Road Regional Stormwater Facility	$ 260,000	Developer requirements, green space contributions, SDCs
	Short-Range Sub-total	***$ 4,370,000***	
Mid-Range Improvements			
RC-2	Oregon Street Regional Stormwater Facility	$ 310,000	N/A
RC-3	Lower Rock Creek Regional Stormwater Facility	$ 340,000	Washington County / CWS
RC-4	Tonquin Road (North) Stormwater Facility	$ 165,000	N/A
CC-2	West Division Street Stormwater Facility	$ 110,000	N/A
CC-4	South Stella Olsen Park Stormwater Facility	$ 200,000	N/A
CC-5	Community Campus Park Stormwater Facility	$ 200,000	N/A
CC-6	Gleneagle Drive Stormwater Facility	$ 105,000	N/A
CC-7	Glencoe Court Stormwater Facility	$ 75,000	N/A
CC-8	Gleneagle Village Water Quality Facility	$ 95,000	N/A
CC-9	Edy Road Stormwater Facility	$ 285,000	Developer requirements, green space contributions, SDCs
CC-10	Saint Charles (North) Stormwater Facility	$ 70,000	N/A
CC-11	Saint Charles (South) Stormwater Facility	$ 80,000	N/A
	Mid-Range Sub-total	***$ 2,035,000***	
Long-Range Improvements			
RC-5	Tonquin Road (South) Stormwater Facility	$ 1,100,000	Developer requirements, green space contributions, SDCs
RC-6	Murdock Road (South) Stormwater Facility	$ 240,000	Developer requirements, green space contributions, SDCs
HC-1	Hedges Creek Stormwater Facility	$ 855,000	Developer requirements, green space contributions, SDCs
CL-1	Coffee Lake Creek Stormwater Facility	$ 400,000	Developer requirements, green space contributions, SDCs
	Long-Range Sub-total	***$ 2,595,000***	
	TOTAL ESTIMATED PROJECT COSTS	**$ 9,000,000**	

SECTION 1
INTRODUCTION

Authorization

On December 7, 2006, the City of Sherwood authorized Murray, Smith & Associates, Inc. (MSA) to prepare this Stormwater Master Plan. This report documents the storm drainage master planning work that was conducted under this professional services agreement.

Background

The City of Sherwood (the City) is located south of the Tualatin River, approximately 15 miles southwest of Portland along Highway 99W in Washington County. The City of Tualatin is adjacent to the City to the east, unincorporated Washington County surrounds the City to the north and to the west, and unincorporated Washington and Clackamas counties surround the City to the south.

Clean Water Services (CWS) is the regional agency responsible for surface water management in the urban portions of the Tualatin River Watershed, which includes the City. CWS holds a regional National Pollutant Discharge Elimination System (NPDES) stormwater permit, and is ultimately responsible for stormwater discharge water quality. CWS is responsible for developing and updating the regional Surface Water Management Plan that includes the City. Through an Intergovernmental Agreement (IGA), both the City and CWS share responsibility for stormwater management plan implementation. A copy of the IGA is included in Appendix A for reference.

The City owns and operates all public stormwater facilities located within the City limits. Surface waters are managed by CWS and stormwater culverts greater than 36 inches in diameter are owned by Washington County or ODOT. Smaller diameter culverts are owned and maintained by the City within the City limits, and by CWS outside the City limits. The City is also responsible for maintenance of all public facilities within the City limits, with the exception of regional water quantity and water quality facilities (generally defined as facilities that are greater than one acre in surface area). The City's stormwater facilities consist of natural and manmade open channels, culverts, and storm sewers conveying water into five streams that ultimately flow into the Tualatin River.

The City has undertaken this Stormwater Master Plan to evaluate its stormwater system following a period of significant development within the City. The most recent Stormwater Master Plan was prepared for the City in 1993, when the City's population was approximately 3,800. Since that time, the City has experienced rapid population growth, reaching a population of approximately 16,115 residents in 2006. In recent years, four former Metro Urban Reserve Areas referred to as Areas 48, 54, 55 and 59 were brought into the City Urban Growth Boundary (UGB). The City expects to continue to grow through annexations of these urban reserve areas, as well as through infill development and increased density in previously developed areas.

Study Area and Study Period

The study area for this plan includes all area within the City's current Urban Growth Boundary. The study period for this plan is to the year 2027.

Purpose and Compliance

The purpose of this study is to examine the City's stormwater system in consultation with both City and CWS staff. The master plan documents the results of the evaluation of the conveyance system under current and future forecasted development conditions to identify operational limitations, and to recommend improvements necessary to accommodate the City's stormwater needs through the 20-year planning period. Recommendations presented for improvements are based on long-range development of the City UGB, and include near-term and long-term projects that may be incorporated into the City's Capital Improvement Program to provide adequate stormwater conveyance capacity and stormwater treatment for improved surface water quality.

This plan supports the City's requirements under the Oregon Administrative Rules (OAR 660-011) Public Facilities Planning rules. The plan has been prepared in coordination with the CWS watershed-based NPDES Permit, NPDES Municipal Separate Storm Sewer System (MS4) Stormwater Management Plan Update (2006), the CWS Healthy Streams Plan (June 2005), and the CWS 2007 - 2011 Capital Improvements Program.

Scope of Work

The scope of work for this study includes the following:

- ***Information Compilation and Review*** -- Compile and review currently available data and information relative to the stormwater system. This information includes items included in prior City and CWS studies, plans and reports, available planning guidance documents and design standards, available operation and maintenance reports, inspection records, flow monitoring data, record drawings, mapping and GIS data and land use information.
- ***Study Area and Basin Characterization*** -- Review current land use designations and characteristics based on the City's current Comprehensive Plan and other information provided by the City's Planning Department. Define the study area relative to stormwater system analysis. Identify unique hydrologic characteristics including soil types, topography, vegetation and other pertinent characteristics.
- ***General Planning Criteria Review*** -- Identify applicable general planning criteria including City and CWS standards.
- ***Base Mapping Development*** -- Develop a base map to be used for the stormwater system mapping based on key information from available infrastructure mapping provided by the

City and/or CWS. Include drainage basins and sub-basins, digital topography, rights-of-way, tax lots, land use, zoning and other important features.

- ***Existing System Inventory and Conditions Update*** -- Inventory and document existing stormwater facilities under City jurisdiction. Review City-provided mapping for the existing stormwater system and associated system data relative to prior 1993 planning conditions and plan update requirements.
- ***Evaluation of Existing Features and Data*** -- Evaluate existing stormwater system features and data.
- ***Identification of Sensitive Lands and Problem Areas*** -- Identify sensitive lands based on the National Wetlands Inventory mapping and other documentation noting sensitive lands and wetland areas. Identify problem areas based on interviews with City and CWS staff.
- ***Review of Water Quality/Regulatory/CWS Surface Management Plans*** -- Review current Federal, State and local regulations relative to the Stormwater Master Plan update.
- ***Hydrologic/Hydraulic Evaluation, System Analysis and Stormwater Master Plan Development*** -- Perform hydrologic and hydraulic system evaluation using PCSWMM modeling software under 25-year frequency return storm design criteria. Include determination of improvements, coordination with CWS, graphical representation of proposed improvements on the system map and documentation of evaluation, analysis and results in the Stormwater Master Plan.
- ***Alternative Development and Evaluation*** -- Analyze and identify potential storm sewer facility collection and conveyance alternatives. Select the most viable alternatives for further analysis. Include gravity storm sewer improvements, detention facilities, operations alternatives and infrastructure improvement alternatives. Provide guidance and recommendations to assist the City in selecting preferred alternatives.
- ***Cost Estimates*** -- Develop planning level project cost estimates for all recommended improvements. Include appropriate allowances and contingency factors, as well as cost index information. Identify SDC eligible portions of each project.
- ***Improvement Prioritization and CIP Coordination*** -- Review proposed improvements and associated costs with City staff. Develop a prioritized capital improvements plan (CIP) for inclusion in the Stormwater Master Plan. Include an implementation program that identifies and prioritizes the recommended improvements so that immediate improvements can be included in the current 5-year CIP and others can be programmed into subsequent planning horizons. Identify key regulatory dates or other critical dates when specific improvements may be required.
- ***Funding Structure Review*** -- Review capital improvement financing strategies and identify potential funding opportunities and sources. Develop recommendations for updated rate and SDC studies beyond the scope of this Master Plan update considering current IGA arrangements between the City and CWS.
- ***Stormwater Master Plan Documentation*** -- Develop a Stormwater Master Plan document that includes narrative text, tables, figures and maps that describe and present findings and recommendations.

- ***Project Coordination and Master Plan Presentation*** -- Participate in project progress reviews and workshops, coordinate with City and CWS staff, and assist City staff in presentation of the Stormwater Master Plan.
- ***Rate and System Development Charge Study Update -- Develop updated rate and SDC*** studies for the CIP recommendations in the Stormwater Master Plan. Include revenue requirement analysis, fiscal policy development, capital financing alternatives, operating forecast, revenue needs assessment, rate equity assessment, SDC analysis, and documentation and presentation of findings and results.

SECTION 2
STUDY AREA CHARACTERISTICS

General

This section presents a discussion of the City of Sherwood (the City) study area and its physical features, land uses and development characteristics relative to the preparation of this Stormwater Master Plan.

Study Area

The study area for this Stormwater Master Plan includes the planning area, defined as all of the land within the City's Urban Growth Boundary (UGB), and the upstream areas contributing runoff to the City's five receiving waters.

Planning Area

The planning area includes all of the area within the current City UGB, which encompasses approximately 3,300 acres. The planning area is the expected stormwater service area over the planning period. The current UGB boundary is shown in Figure 2-1. The current (2006) City population is approximately 16,115, and does not include the population living in the unannexed areas. While much of the land within the City is developed, considerable infill is anticipated prior to reaching saturation development. The former Metro Urban Reserve Areas 48, 54, 55, and 59 are largely undeveloped and are anticipated to experience significant growth in the upcoming years.

Receiving Waters

The City lies within four major subbasins of the Tualatin River drainage basin, and one major subbasin of the Willamette River (as shown in Figure 2-2). The City's predominant surface water features are Cedar Creek, flowing through the western portion of the City from the south, and Rock Creek flowing through the eastern portion of the City from the south. While the City lies entirely within Washington County, the headwaters of Rock Creek extend into Clackamas County, and those of Cedar Creek extend into Yamhill County. Chicken Creek, located to the west and northwest of the City, does not flow through the City, but does receive runoff from the City. Cedar Creek flows into Chicken Creek at the northwest edge of the City. The Hedges Creek Basin includes the northeast portion of the City along Tualatin-Sherwood Road. The southeast portion of Area 48, which is currently outside the City limits but within the UGB, drains to Coffee Lake Creek. Areas contributing stormwater runoff to Hedges and Coffee Lake creeks encompass roughly 10 percent of the planning area, and are the only portions of the City that do not ultimately drain to the Tualatin River National Wildlife Refuge (Refuge). The creeks and their respective drainage areas, both total and within the City UGB, are summarized in Table 2-1.

Table 2-1
Drainage Basin Area Summary

Basin Name	Total Basin Area (acres)	Area within City UGB (acres)	Percent of City's Drainage Area
Chicken Creek	4,875	214	6 %
Cedar Creek	5,752	1,784	53 %
Rock Creek	4,055	1,110	33 %
Hedges Creek	2,633	220	7 %
Coffee Lake Creek	14,765	48	1 %

Environmental Conditions

The environmental conditions within the City planning area that are relevant to this Stormwater Master Plan are summarized below.

Climate

The climate of the study area is temperate with warm, dry summers and mild, wet winters. The Oregon Climate Service reports that mean monthly temperatures for the Willamette Valley ranged from 57 to 80 degrees Fahrenheit (°F) between 1971 and 2000, with daily extremes of 8 °F and 107 °F. Average annual rainfall is 37 inches, with roughly 75 percent of the precipitation accumulating during the six months of October through March. Typical 24-hour winter storms (2-year recurrence interval storms or smaller) can drop up to 2.6 inches of precipitation. Snowfall is light, averaging 4 inches or less annually.

Topography

The ground elevations within the City range from approximately 140 feet above mean sea level (MSL) to approximately 420 feet above MSL. In general, the elevations are lowest in the northern portions of the City nearing the Tualatin River, and highest in the hilly areas of the southern portions of the City. Most of the City is near an elevation of 180 to 260 feet above MSL. Elevation change throughout the City is gradual, with typical slopes up to 6 percent. However, some steep slopes, which range up to 25 percent, are located near hills and creek banks. Topographic mapping is shown in Figure 2-2.

Geology

Detailed information on the soils found throughout the entire study area is summarized in the U.S. Soil Conservation Service's Soil Survey of Washington County, Oregon (1982), Clackamas County (1985), and Survey of Yamhill Area, Oregon (1974). The soil types identified in this survey are grouped into hydrologic groups, which are used to predict area-wide hydrologic responses to rainfall. Hydrologic soil groups are assigned a letter-designation of A, B, C, or D, based on the rate of water transmission through the soil, or how

well the soil drains. For example, Group A soils infiltrate water into the soil very quickly and are well drained, and thus have a low runoff potential, whereas Group D soils infiltrate water into the soil very slowly, are poorly drained, and have a correspondingly high runoff potential. The soil types found in the study area, their corresponding hydrologic groups, and their relative percent area are summarized in Table 2-2. Soils with a percent area less than 0.1 were omitted. The distribution of soils in the study area is shown in Figure 2-3.

Table 2-2
Study Area Hydrologic Soils Groups

Soil Classification	Group	Percent of Study Area
Aloha silt loam	C	6.2
Briedwell stony silt loam, 0 to 20 percent slopes	B	1.7
Cascade silt loam, 3 to 20 percent slopes	C	0.5
Chehalis silt loam, occasional overflow	B	0.2
Cornelius and Kinton silt loams, 2 to 60 percent s	C	8.8
Cornelius variant silt loam, 0 to 3 percent slopes	D	0.4
Cove clay	D	1.8
Cove silty clay loam	D	1.9
Delena silt loam, 3 to 12 percent slopes	D	0.2
Helvetia silt loam, 7 to 20 percent slopes	C	0.2
Hillsboro loam, 0 to 20 percent slopes	B	7.4
Huberly silt loam	D	2.8
Jory clay loam, 2 to 60 percent slopes	B	0.2
Jory silty clay loam, 2 to 60 percent slopes	B	2.6
Kinton silt loam, 3 to 8 percent slopes	C	0.4
Labish mucky clay	D	2.0
Latourell loam, 15 to 30 percent slopes	B	0.2
Laurelwood silt loam, 3 to 60 percent slopes	B	28.8
McBee silty clay loam	C	2.1
Multnomah cobbly silt loam, 0 to 7 percent slopes	B	0.1
Nekia silty clay loam, 2 to 30 percent slopes	B	0.4
Olyic silt loam, 12 to 20 percent slopes	B	0.1
Powell silt loam, 8 to 15 percent slopes	C	0.2
Quatama loam, 0 to 20 percent slopes	C	10.4
Salem silt loam, 0 to 7 percent slopes	B	0.1
Saum silt loam, 0 to 60 percent slopes	B	5.1
Urban land	D	0.4
Verboort silty clay loam	D	0.4
Wapato silty clay loam	D	3.8
Willamette silt loam, 0 to 20 percent slopes	B	1.1
Woodburn silt loam, 0 to 20 percent slopes	C	6.0
Xerochrepts and Haploxerolls, very steep	C	1.7
Xerochrepts-Rock outcrop complex, moderately steep	D	1.6

The soil surveys generally identify the soils in the study area to be moderately well-drained silt loams and loams formed in alluvial deposits. Soils in the study area are generally comprised of alluvium overlying Columbia River basalt. Within the study area watersheds, roughly 48 percent of the soil is Group B, 37 percent is Group C, and 15 percent is Group D. No Group A soils are found within the study area.

Natural Resource Areas

There are numerous natural resource areas within and surrounding the study area. These areas are shown in Figure 2-4 and are further described below.

State and federal requirements have resulted in both independent and cooperative identification and inventory of natural resource areas by multiple federal, state, and local agencies. The U.S. Fish and Wildlife Service established the 3060-acre Tualatin River National Wildlife Refuge roughly located to the north and east of the City. The Refuge was established as an urban refuge providing wetland, riparian, and upland habitats for migratory birds, threatened and endangered species, fish, other resident wildlife, and as a scenic area.

The U.S. Fish and Wildlife Service also established the National Wetlands Inventory (NWI) in 1974, which reports the extent and characterization of the nation's wetlands and deep water habitats. Locally, these wetlands are managed by the Oregon Department of State Lands and the U.S. Army Corps of Engineers. The NWI is supported by inventories conducted by local level updates such as the 2002 update by Metro and the 1992 inventory by the City.

Metro and its member cities also protect other regionally significant natural resources such as the Tonquin Scablands Geologic Area, and other Metro-identified and classified riparian corridors, upland wildlife habitats and aquatic habitats. The majority of these Metro-identified natural resource areas are located alongside or adjacent to creeks, the Refuge, and the Tualatin River. Furthermore, though not formally mapped, Clean Water Services Design and Construction Standards require a vegetated corridor, or riparian buffer, to be provided and maintained around natural water features upon urban development. The CWS buffer requirement is critical in maintaining and protecting these Metro-identified natural resource areas.

The Metro-identified resources have been recognized in the City Comprehensive Plan (2006) as environmental resources requiring planning and management. The City Comprehensive Plan also identifies a ponderosa pine forest located near the intersection of Harrison and Middleton streets for preservation. Other City efforts include the acquisition of 300 acres of stream corridor and floodplain for protection from further development. These corridors, in addition to providing protection from flooding, support the functions of the Refuge.

Also at the local level, Clean Water Services and its member cities provide for water quality management within the Tualatin River Basin. A large scale inventory and environmental

study within the urbanized basin, the Watersheds 2000 program, was conducted in support of cost-effective water quality and environmental management. The Healthy Streams Plan (2005) provides general descriptions of watershed areas, and describes the headwaters of Cedar Creek and Chicken Creek as generally undeveloped and in good condition. The plan further identifies that preserving the condition of the headwaters is important to the health of the downstream surface waters and overall watershed, and that development should be managed to protect these upper reaches of the watersheds. Additionally, Chicken, Cedar and Rock creeks have been identified by the U.S. Environmental Protection Agency (EPA) as providing habitat for anadromous fish that are listed as threatened under the Federal Endangered Species Act (ESA).

In addition to the statutory recognition of environmentally sensitive areas, grass roots organizations such as Raindrops to Refuge, the Tualatin Riverkeepers, and Friends of the Tualatin River National Wildlife Refuge have formed to advocate watershed stewardship in the Sherwood area. The City also recognizes that it is located in an area with generally good water quality and riparian habitat, and that the urban footprint can have a large impact on the local environment. Consequently, the City has formed partnerships with several of these organizations to provide educational outreach, stream enhancement projects, and assist in efforts to protect and improve the overall health of the nearby natural resources.

Floodplain

The Flood Insurance Study (FIS) conducted by the Federal Emergency Management Agency (FEMA) in 1988 indicates that some areas along Chicken, Cedar, and Rock creeks and their tributaries are at risk of flooding. The approximate FEMA 100-year floodplain for all the creeks in the planning area is shown in Figure 2-2. While the floodplains largely overlap existing wetlands and creek beds, some individual developed lots lie within the floodplain. North of the City limits, much of the Refuge lies within the 100-year floodplain of the Tualatin River that extends south from the river to the City limits.

The City has experienced significant development and growth since the FEMA maps were produced in 1988. Because Washington County as a whole has experienced significant growth since the production of FEMA floodplain maps, CWS has coordinated with FEMA to update the floodplain maps across Washington County, including the City. These updated FEMA floodplain maps are anticipated to be completed and adopted in 2007.

Demographic Characteristics

Demographic characteristics are particularly important in stormwater planning because of the impact they have on the transformation of rainfall to runoff. Of primary concern are the current and projected uses of land and the general pattern of development within the study area.

Land Use

Land use characteristics are critical in estimating existing and future stormwater flows in an urban setting. The land use determines the amount of impervious area within a basin, and stormwater runoff increases with impervious area. Through the City's Comprehensive Plan (2006), all land within the City has been assigned a land use designation, which includes various categories of commercial, industrial, institutional and residential land uses. General land use designations within the City limits are shown in Figure 2-1. Land use information was used as the basis for analyzing and projecting storm sewer flows to the collection system. Table 2-3 summarizes land uses and zoning classifications for the planning area as identified in the Comprehensive Plan.

Table 2-3
Comprehensive Plan Land Use Summary

Zone	Zoning Description	Area within City UGB (acres)
VLDR	Very Low Density Residential	105
LDR	Low Density Residential	762
MDRL	Medium Density Residential – Low	186
MDRH	Medium Density Residential – High	192
HDR	High Density Residential	161
NC	Neighborhood Commercial	1
OC	Office Commercial	17
RC	Retail Commercial	97
GC	General Commercial	80
LI	Light Industrial	231
GI	General Industrial	260
IP	Institutional/Public	142
	UGB Expansion Area 48	306
	UGB Expansion Area 54 & 55	247
	UGB Expansion Area 59	89
	Other Non-Annexed Areas in UGB	34
	Existing Rights-of-Way	390
	Total	**3,300**

Note: Land use is based on City of Sherwood Comprehensive Plan, and includes recent UGB expansion areas.

Residential Land Use

Existing residential development within the planning area is currently intermixed with some undeveloped tracts of land. Low density residential (LDR - 1/5 acre lots) is the dominant residential zoning classification within the City limits. Residential zoning classifications are generally spread evenly throughout the City; however, the southeast corner of the City is zoned very low density residential (VLDR - 1 acre minimum lot size). In general, higher ensity residential zoning is located toward the center of the City and in transition areas between areas zoned for low density residential use and areas zoned for commercial use.

Approximately 100 acres of the 1,406 acres zoned as residential are undeveloped. This undeveloped land is made up of approximately 31 acres zoned as Very Low Density Residential (VLDR), and 69 acres zoned as Medium Density Residential, Low (MDRL). However, some older areas of the City and recently annexed areas of the City are not developed up to the current zoning density. Current residential units number approximately 5,465 and the projected number at saturation development is approximately 13,550 units.

Commercial Land Use

Commercially zoned land is primarily located along Highway 99W and within the Old Town District. While most of the commercial zoning classification is general and retail, some office commercial zoning is located on the south side of Highway 99W, north of Sunset Boulevard.

Industrial Land Use

The primary industrial zoned area is located along Highway 99W north of Roy Rogers Road/Tualatin-Sherwood Road and along Tualatin-Sherwood Road east of Highway 99W. A single industrial zone is located adjacent to the Southern Pacific Railroad line south of Sunset Boulevard.

Former Metro Urban Reserve Areas

Of the four former Metro Urban Reserve Areas recently brought into the UGB, Area 48 located adjacent to existing industrial zoned land, offers the most likely expansion of industrial development. Based on Oregon Department of Revenue data, existing uses within Area 48 include primarily residential uses, with some commercial, industrial, rural, public and undeveloped. Area 48 planning will likely follow the direction identified in the prior City of Tualatin/City of Sherwood Quarry Area Concept Planning project, which proposes primarily industrial uses for Area 48. The total acreage of Area 48 that will be included in the study area is approximately 306 acres, using the UGB boundary and the City's proposed 124th Street divider boundary line as the assumed delineation.

Areas 54, 55, and 59 are anticipated to develop as primarily residential and public lands with limited areas identified for commercial or industrial uses. Existing uses within these areas include primarily rural residential with some agricultural and undeveloped lands.

Development Patterns

Based on the current UGB, roughly 676 acres of urban reserve are available within the UGB to accommodate anticipated development needs through the year 2025. The ultimate geographical growth of the City is limited by the City of Beaverton to the north, the City of Tualatin to the east and the City of Wilsonville to the south.

Drainage Basins

The contributing basins for the five receiving waters included in this study, Chicken, Cedar, Rock, Hedges, and Upper Coffee Lake creeks, are shown in Figure 2-2. Geographic Information System (GIS) software was used to determine the watershed areas.

A brief description of each basin follows.

Chicken Creek Basin

Chicken Creek is largely located north and west of the City limits passing along the northwestern edge of the City. Chicken Creek flows northeasterly and feeds into the Refuge and the Tualatin River. Chicken Creek receives flow directly from approximately 6 percent of the 3,300 acres within the City UGB.

The basin encompasses approximately 4,875 acres, only 214 acres of which are within the City UGB. Of these 214 acres located within the City UGB, approximately 149 acres have been developed. Roughly half of the area within the City UGB is a mix of low and medium density residential land uses. The other half is a mix of commercial land uses. Outside of the City UGB, the basin is generally undeveloped and lightly forested.

The soils in the basin are largely Group C outside the City UGB and Group B within the City UGB (see Figure 2-3). Within the UGB, slopes are generally less than 10 percent except near the creek where they are approximately 10 percent. Higher slopes, approaching 25 percent, are common in the basin's headwaters.

Cedar Creek Basin

Cedar Creek is the main tributary to Chicken Creek. Cedar Creek feeds into Chicken Creek northwest of the City after meandering northward through the City. The creek is the dominant feature of the stormwater drainage system for the western portion of the City, and drains roughly 53 percent of the 3,300 acres within the City UGB. Under base flow conditions, the creek is shallow and narrow, but flows through wide, flat floodplains.

The 5,752-acre Cedar Creek Basin includes 1,784 acres of the western half of the City. Within the City UGB much of the area is developed and encompasses many land uses. Land use within the City UGB in this basin includes a large range of residential densities, including all of the City's High Density Residential zoning. The basin includes public lands such as Sherwood High School and Stella Olsen Memorial Park. Much of the commercially zoned land in the City is located within the basin, including the Old Town district and the commercial area along Highway 99W south of Sherwood Boulevard. A single industrial zone is located in the basin at the intersection of Sunset Boulevard and Greengate Drive. The remaining two-thirds of the basin located outside of the City UGB extends southwest from the City and is largely undeveloped and lightly forested.

The soils in the basin are largely Group C outside the City UGB (see Figure 2-3). Within the City UGB, the southern portion or the basin is largely comprised of Group C soils and the northern portion is largely comprised of Group B soils, with some small areas of Group D soils. Within the UGB, slopes are generally less than 10 percent except near the creek where they are approximately 10 percent. Higher slopes, approaching 25 percent, are common in the basin's headwaters.

Rock Creek Basin

Rock Creek flows north by northeast through the City to the Refuge and the Tualatin River. Rock Creek is the dominant surface water feature for the eastern portion of the City, and drains roughly 33 percent of the 3,300 acres within the City UGB. Under base flow conditions, the creek is shallow and narrow, and flows through wide, flat floodplains. Under severe dry weather conditions, Rock Creek has exhibited periods of negligible base flow.

The 4,055-acre Rock Creek Basin includes 1,110 acres within the City UGB. The basin is generally developed within the City limits, and zoned residential in the southern portion with industrial and commercial zoning in the northern portion. Of the remaining 2,945 acres within the basin that are located outside of the City UGB, approximately 1,000 acres are located between the City UGB and the Tualatin River and approximately 1,945 acres are located to the south of the City UGB, partially in Clackamas County.

Soils in the basin are a mix of Groups B, C, and D. Group B soils are concentrated south of the UGB (see Figure 2-3). Group C soils are concentrated within the UGB. Group D soils are concentrated along the creek, especially north of the UGB and southeast of the Southern Pacific Railroad. The ground has slopes near 10 percent in the regions of the headwaters. Within the UGB, the slopes are relatively flat except near the creek where they are approximately 10 percent. Some steep slopes of 25 percent or greater are associated with the hills in the southern part of the City.

Hedges Creek Basin

Hedges Creek is located in the northeastern corner of the City and is a tributary to the Tualatin River. Within the City UGB, the basin topography is gently sloping to the northeast, away from the center of the City. The basin drains roughly 7 percent of the 3,300 acres within the City UGB.

The 2,633-acre Hedges Creek Basin covers roughly 220 acres of northeastern Sherwood, and extends eastward through the City of Tualatin terminating at the Tualatin River. Hedges Creek does not flow into or through the Refuge. Within the City, the contributing area along Tualatin-Sherwood Road is lightly developed commercial and industrial land. A large portion of the contributing area within the City UGB includes the recently added and largely undeveloped former Metro Reserve Area known as Area 48. This area, sometimes referred to as the Quarry Area due to the large number of rock quarries, is anticipated to be zoned for industrial uses. The remaining 2,413 acres of the Hedges Creek Basin are located to the north and east of the City and include developed portions of the City of Tualatin.

The soils in the basin, both within and outside of the City UGB, are a mix of soil Groups B, C, and D (see Figure 2-3). In the southwestern corner of the basin within the City UGB, the soils are largely comprised of Group C and Group D soils. The ground slopes within the basin are relatively flat, with slopes generally 10 percent or less over the entire basin.

Upper Coffee Lake Creek Basin

The Coffee Lake Creek Basin is a large basin located to the southeast of the City. Coffee Lake Creek is tributary to the Willamette River and is the only receiving water for the City that is not tributary to the Tualatin River. Only a small section of the upstream portion of the basin lies within the City UGB. The study area for the basin will include only this small section which will be referred to as the Upper Coffee Lake Creek Basin. This basin comprises roughly 2.5 percent of the total basin area. The entire basin was not included in the study area as consideration of the full basin is unnecessary for the purposes of this study. Coffee Lake Creek drains roughly one percent of the 3,300 acres within the City UGB.

The 367-acre Upper Coffee Lake Creek Basin includes roughly 48 acres within the City UGB, between the existing City limits and the City UGB. None of the contributing area within the City UGB is currently served by the constructed municipal storm sewer system. Development in this area is light and includes isolated rural residential lands and lands used for agriculture and quarries. Coffee Lake Creek flows southerly from the City and through the City of Wilsonville prior to discharging into the Willamette River. Much of the downstream portions of the larger basin are developed.

The soils in the basin are largely Group D in the western third of the basin, and are generally Group B in other areas (see Figure 2-3). Ground slopes in the Upper Coffee Lake Creek

Basin vary from being virtually flat in the northwest corner to being up to and greater than 25 percent over the rest of the basin.

Regulatory Considerations

Traditionally, the primary focus of municipal stormwater management programs has been to optimize the conveyance of stormwater for the purposes of protecting private property and increasing public safety. Point sources of pollution were the primary cause of water quality degradation resulting from sanitary sewers and industrial discharges. Through the passage and enforcement of the Federal Clean Water Act (CWA) in 1977, these point sources were identified and regulated. Consequently, pollutant discharges were substantially reduced from historic levels. In the last three decades there has been a growing awareness of the potential of non-point sources of pollution to degrade surface water quality and reduce the beneficial uses of the receiving water bodies. It has been estimated that non-point sources of pollution now cause up to two-thirds of the degraded stream miles in the United States. Non-point sources of pollution are typically carried to streams through stormwater runoff. Because of the extent of the surface water degradation caused by non-point sources of pollution, the regulations of the CWA have been extended to apply to stormwater runoff.

In an effort to comply with the CWA, it is becoming increasingly common for large and medium sized cities to incorporate water quality enhancement into their stormwater management programs. The City implements the stormwater management program developed by CWS. CWS holds the National Pollutant Discharge Elimination System program Municipal Separate Sanitary and Stormwater System (MS4) permit for its 12 member cities and Washington County, including the City of Sherwood. Because CWS holds the discharge permit, they are ultimately responsible for water quality within the stormwater system. While the member cities can maintain jurisdiction over their systems, coordination with CWS is required to meet the requirements of the MS4 permit.

Compliance with the Federal ESA also requires adoption of stormwater management practices. The regulatory environment surrounding the ESA has been rapidly changing, and it is expected that there will be future changes. The current compliance strategy is to adopt Best Management Practices (BMP) to stay ahead of future changes in guidance and regulations.

National Pollutant Discharge Elimination System (NPDES)

The NPDES program, as administered by the EPA and the Oregon Department of Environmental Quality (DEQ), is part of a program to identify the beneficial uses of each water body and ensure that the water quality is sufficient to allow for the beneficial uses.

The NPDES permit requires regulated communities to develop a plan to address six major program elements regarding stormwater quality, referred to as minimum control measures.

Pursuant to the MS4 permit, CWS developed guidelines in the Stormwater Management Plan to address the minimum control measures. These measures are:

1. Public Education and Outreach on Stormwater Impacts
2. Public Involvement/Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Stormwater Runoff Control
5. Post-Construction Stormwater Management in New Development and Redevelopment
6. Pollution Prevention/Good Housekeeping for Municipal Operations

The regional NPDES permit held by CWS is atypical in that it regulates water quality over the Tualatin River watershed. Traditionally, NPDES permits apply to individual point discharges. The regional permit approach allows for flexibility in watershed management and encourages widespread water quality treatment and pollution prevention practices.

Endangered Species and Critical Habitat

Endangered and threatened species can be found in this study area. These include:

- Bald eagle (threatened; proposed delisted)
- Chinook salmon (threatened; Upper Willamette River Evolutionary Significant Unit)
- Steelhead (threatened; Upper Willamette River Evolutionary Significant Unit)

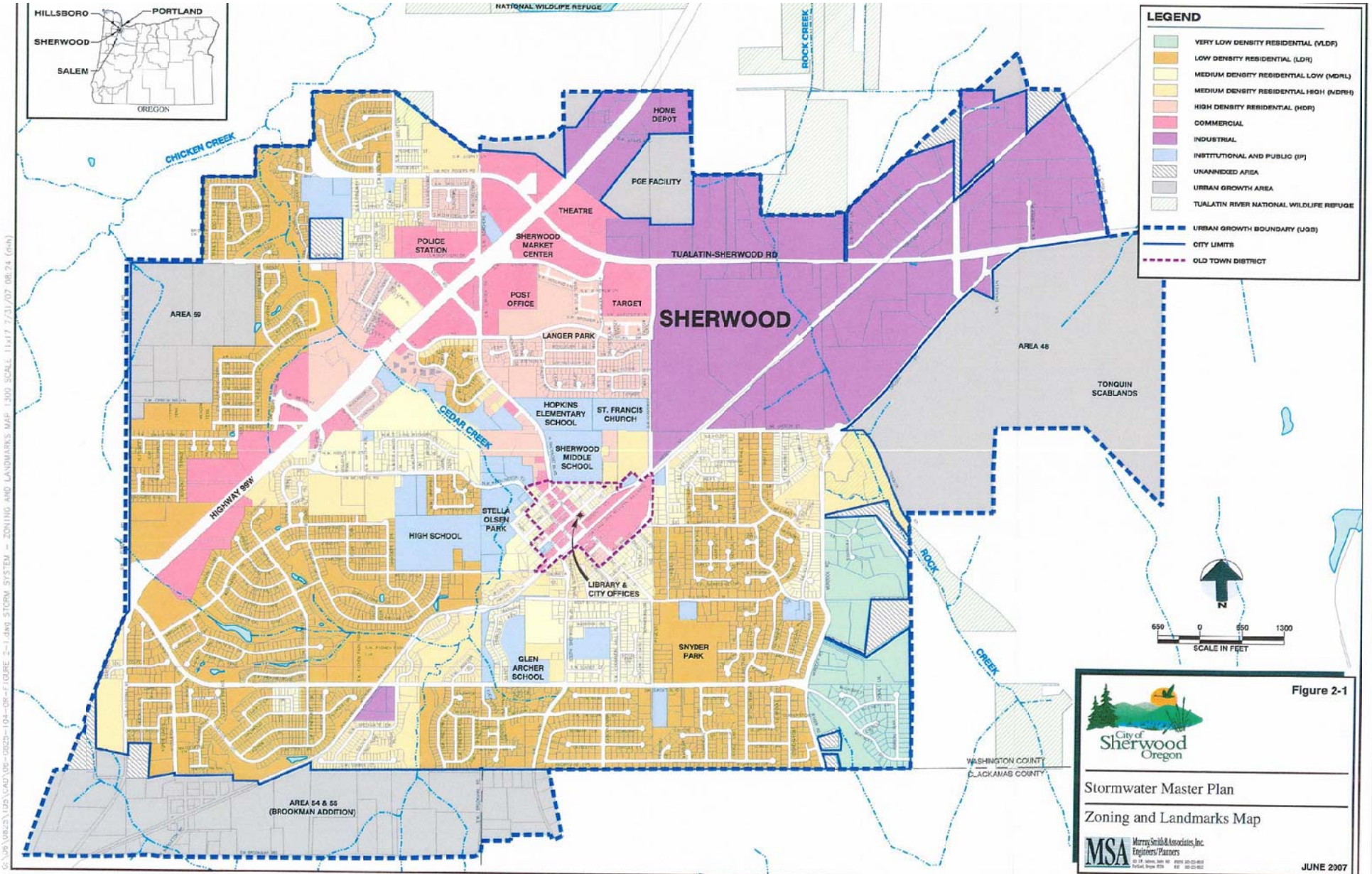
Within the Tualatin River basin, the CWS Watersheds 2000 program inventoried and collected data on watersheds, creeks and tributaries and culverts. These data were used by CWS to develop the Healthy Streams Plan (HSP) in 2005 to

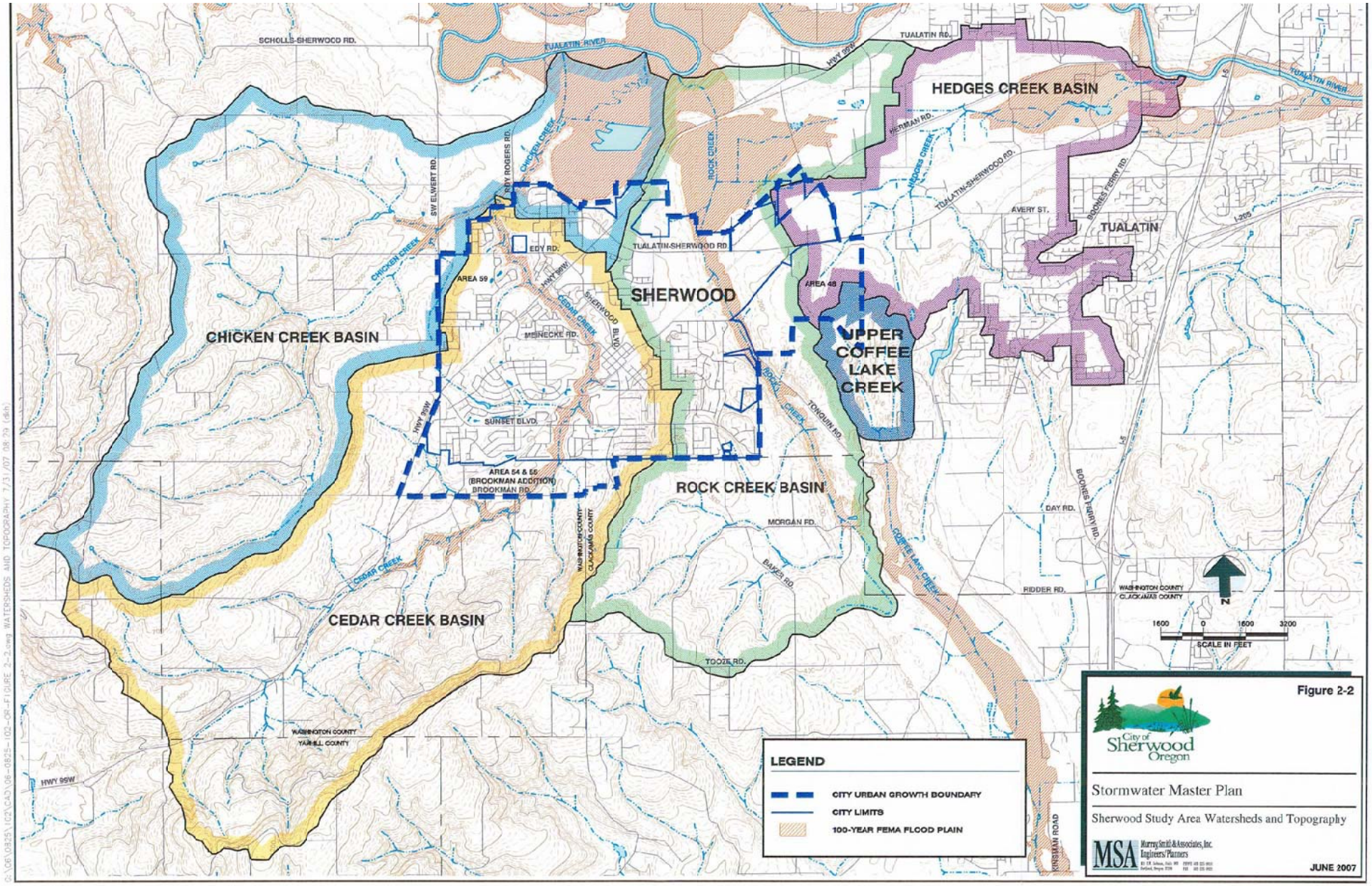
> "Conduct systematic project and policy identification and selection, integrating ecological science with socioeconomic values and public preferences, to determine implementation priorities and meet regulatory requirements, including moving toward the goals of the Clean Water Act and Endangered Species Act."

In accordance with the HSP, CWS is implementing a strategic program to meet or exceed water quality standards set forth in the NPDES permit as well as providing best management practices consistent with the goals of the ESA. The concepts outlined by the HSP to better manage stormwater include:

- Disperse and retain low-intensity rainfall to facilitate groundwater recharge and protect stream channels from scouring flows. Allow the use of effective impervious area management techniques, such as improved landscape design and impervious surface alternatives, to eliminate and/or slow the flow coming from the site during smaller storm events.

- Manage the change in storm peaks and volumes resulting from development to more closely mimic the pre-existing hydrographs in the watershed. Allow the use of other creative site design alternatives to manage infrequent large storm events that will reduce the impacts to stream channels while managing conveyance and flood risk.
- Treat only the runoff that is contaminated, which is predominantly generated from auto-related surfaces. Allow the use of alternative, cost-effective and easy-to-maintain treatment technologies that are effective in capturing the type and mass of pollutants anticipated to runoff from a site.


HILLSBORO
PORTLAND
SHERWOOD
SALEM
OREGON
NATIONAL WILDLIFE REFUGE
ROCK CREEK
CHICKEN CREEK
HOME DEPOT
PGE FACILITY
THEATRE
POLICE STATION
SHERWOOD MARKET CENTER
TUALATIN-SHERWOOD RD
POST OFFICE
TARGET
SHERWOOD
LANGER PARK
AREA 59
AREA 48
TONQUIN SCABLANDS
HOPKINS ELEMENTARY SCHOOL
ST. FRANCIS CHURCH
CEDAR CREEK
SHERWOOD MIDDLE SCHOOL
HIGHWAY 99W
STELLA OLSEN PARK
HIGH SCHOOL
LIBRARY & CITY OFFICES
SNYDER PARK
GLEN ARCHER SCHOOL
ROCK CREEK
WASHINGTON COUNTY
CLACKAMAS COUNTY
AREA 54 & 55 (BROOKMAN ADDITION)
LEGEND
VERY LOW DENSITY RESIDENTIAL (VLDF)
LOW DENSITY RESIDENTIAL (LDR)
MEDIUM DENSITY RESIDENTIAL LOW (MDRL)
MEDIUM DENSITY RESIDENTIAL HIGH (MDRH)
HIGH DENSITY RESIDENTIAL (HDR)
COMMERCIAL
INDUSTRIAL
INSTITUTIONAL AND PUBLIC (IP)
UNANNEXED AREA
URBAN GROWTH AREA
TUALATIN RIVER NATIONAL WILDLIFE REFUGE
URBAN GROWTH BOUNDARY (UGB)
CITY LIMITS
OLD TOWN DISTRICT
N
650 0 650 1300
SCALE IN FEET
Figure 2-1
City of Sherwood Oregon
Stormwater Master Plan
Zoning and Landmarks Map
MSA Murray, Smith & Associates, Inc. Engineers/Planners
JUNE 2007


SCHOLLS-SHERWOOD RD.
TUALATIN RIVER
TUALATIN RD.
HWY 99W
HEDGES CREEK BASIN
I-5
HERMAN RD.
HEDGES CREEK
TUALATIN-SHERWOOD RD.
AVERY ST.
BOONES FERRY RD.
TUALATIN
I-205
SW ELWERT RD.
ROY ROGERS RD.
CHICKEN CREEK
ROCK CREEK
EDY RD.
TUALATIN-SHERWOOD RD.
AREA 59
HWY 99W
CEDAR CREEK
SHERWOOD BLVD.
SHERWOOD
AREA 48
UPPER COFFEE LAKE CREEK
CHICKEN CREEK BASIN
MEINECKE RD.
SUNSET BLVD.
HWY 99W
ROCK CREEK
TONQUIN RD.
AREA 54 & 55
(BROOKMAN ADDITION)
BROOKMAN RD.
ROCK CREEK BASIN
DAY RD.
MORGAN RD.
BAKER RD.
COFFEE LAKE CREEK
RIDDER RD.
WASHINGTON COUNTY
CLACKAMAS COUNTY
CEDAR CREEK
CEDAR CREEK BASIN
TOOZE RD.
WASHINGTON COUNTY
YAMHILL COUNTY
HWY 99W
KINSMAN ROAD
N
1600 0 1600 3200
SCALE IN FEET
LEGEND
CITY URBAN GROWTH BOUNDARY
CITY LIMITS
100-YEAR FEMA FLOOD PLAIN
Figure 2-2
City of Sherwood Oregon
Stormwater Master Plan
Sherwood Study Area Watersheds and Topography
MSA Murray, Smith & Associates, Inc. Engineers/Planners
JUNE 2007

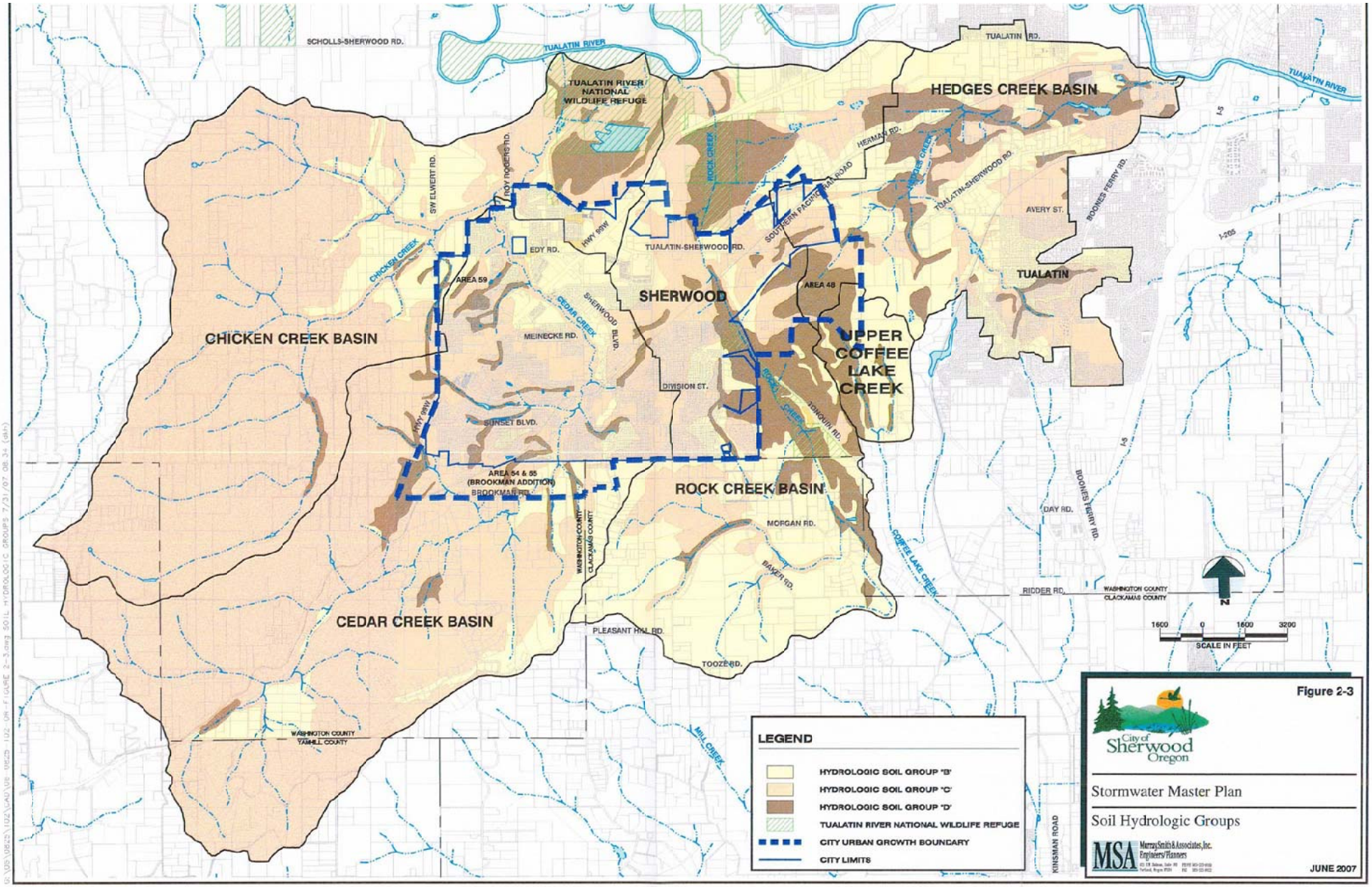


Figure 2-3

City of Sherwood Oregon

Stormwater Master Plan

Soil Hydrologic Groups

MSA Murray, Smith & Associates, Inc. Engineers/Planners

JUNE 2007

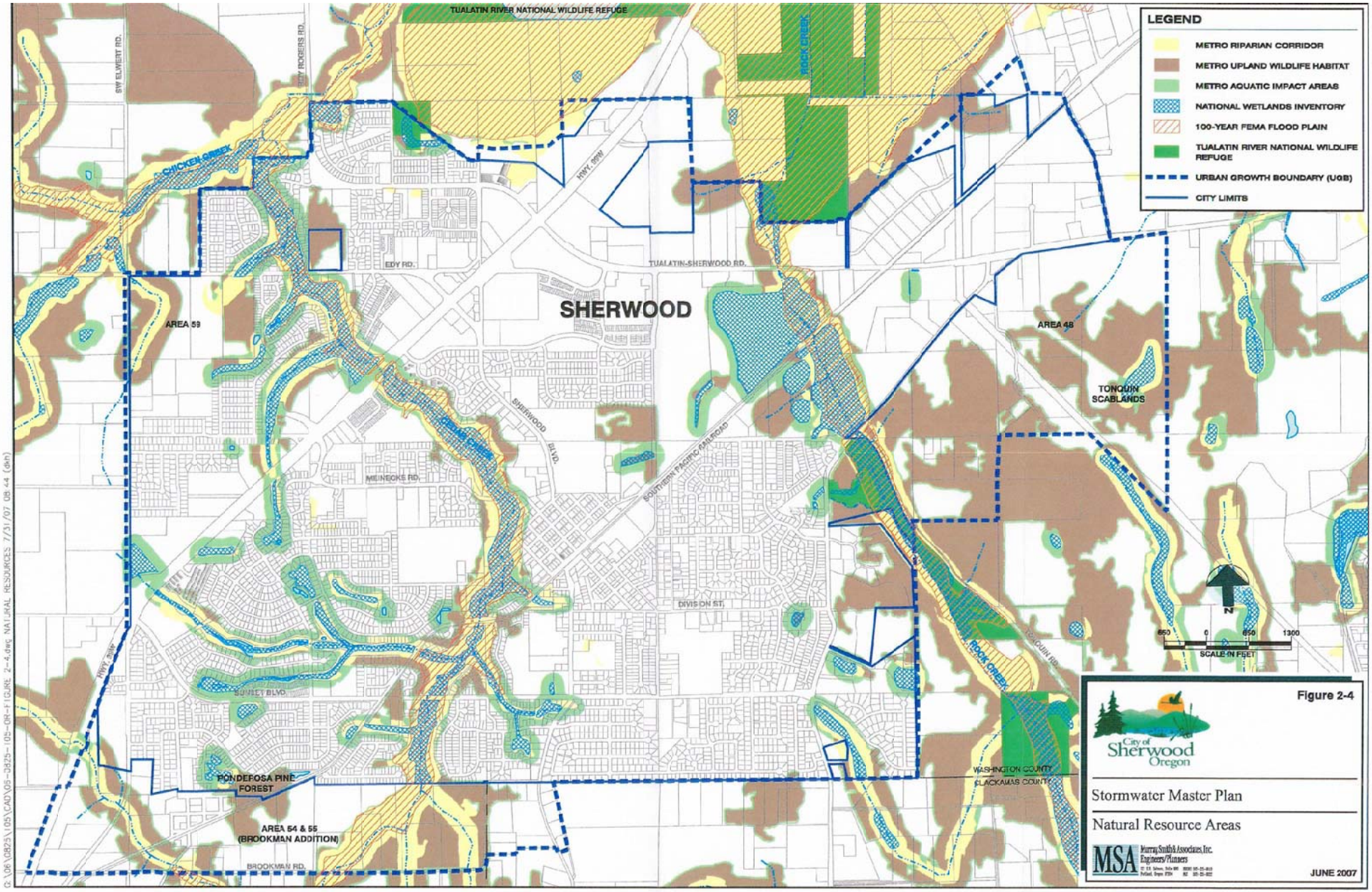


Figure 2-4

City of Sherwood Oregon

Stormwater Master Plan

Natural Resource Areas

MSA Murray, Smith & Associates, Inc. Engineers/Planners

JUNE 2007

Q:\06\0825\105\CAD\05-0825-105-OR-FIGURE 2-4.dwg NATURAL RESOURCES 7/31/07 08:44 (dkh)

SECTION 3
EXISTING STORMWATER SYSTEM

General

This section describes the facilities in the City of Sherwood (the City) stormwater system. Facilities include pipes, open channel conveyances, culverts, swales, and water quality and quantity management features. Discussion of the problems and benefits which are currently associated with the facilities is also included. Existing facilities are shown on Plate 1 in Appendix C.

Stormwater Conveyance System Overview

Developed areas within the City are presently served by publicly owned stormwater collection and conveyance facilities, operated through an Intergovernmental Agreement (IGA) between the City and Clean Water Services (CWS). Under the IGA, included in Appendix A for reference, the City owns, maintains, and operates the stormwater collection and conveyance system within the City limits. The City maintains the public creeks and open-channels, while CWS is responsible for water quality within the creeks. Additionally, the City maintains and operates local water quality facilities and local water quantity facilities while CWS maintains and operates all regional water quality or quantity facilities both within and outside of the City limits. Stormwater culverts greater than 36 inches in diameter are owned by Washington County or the Oregon Department of Transportation (ODOT). County-owned roadside ditches and piping systems are maintained by CWS. Additionally, an ODOT-owned and maintained water quantity facility (pond) is located northwest of the intersection of Tualatin-Sherwood Road and Highway 99W.

All of the stormwater conveyance facilities within the City limits flow by gravity; there are no pumps or pressurized pipes in the system. Many residential properties have direct connections between their roof drains and the public stormwater conveyance system. Many commercial and industrial properties have private stormwater collection and conveyance systems that provide drainage for their facilities including buildings and parking lots. These systems are generally connected directly to the public stormwater conveyance system.

Stormwater runoff is collected from residential, commercial, industrial and institutional lands and collected in catch basins, area drains and ditch inlets. The stormwater runoff is then conveyed via a collection of stormwater piping, open channels and culverts to the receiving surface waters where it is discharged through an outfall structure. In many locations throughout the City, stormwater runoff is treated by a water quality facility prior to discharge from the storm drainage system.

In general, all developments built since 1991 include water quality facilities, and in some cases, water quantity or detention facilities. These stormwater quality and quantity facilities

are owned and maintained by the City, by homeowner associations in residential developments or by private property owners in commercial and industrial developments.

Existing Drainage Facilities

The planning area is presently drained by a system of natural features, as discussed above, combined with piped storm sewers, roadside open channels, culverts and swales. The dominant drainage feature in the City is the natural creek system. Chicken, Cedar, and Rock creeks drain roughly 92 percent of the land within the City UGB by area. An inventory of stormwater system data provided by the City includes 53.8 miles of existing storm drainage piping, 2.9 miles of open channels, 11.8 miles of natural streams, 6.4 miles of vegetated swales, 270 culverts, 100 stormwater outfalls and 62 water quality or quantity facilities. Several structural and mechanical facilities, including ponds, diversion structures and water quality vaults are also included in the existing stormwater system. These facilities are generally owned and maintained by the City.

In many areas within the City, development has occurred to modern standards where streets, curbs, gutters and storm sewers have been installed. However, some portions of the City still have a stormwater collection system that consists primarily of roadside open channels intermixed with culverts and small diameter conveyance pipes.

Construction materials in the existing storm water system vary. Generally, pipes and culverts are either concrete or plastic. Summaries of stormwater pipe materials and sizes found within the planning area shown in Tables 3-1 and 3-2.

Table 3-1
Existing Storm Sewer Pipe Materials Summary

Pipe Material	Length (feet)	Length (miles)	Percent of System
Circular Concrete (CSP, RCP or RCSP)	96,364	18.25	33.9
Cylindrical Concrete (CCP)	19,339	3.66	6.8
Aluminum	153	0.03	< 0.1
Corrugated Metal Pipe (CMP)	2,186	0.41	0.8
Ductile Iron Pipe (DIP)	5,160	0.98	1.8
Plastic[1]	158,626	30.04	55.8
Perforated Pipe	492	0.09	0.2
Unreported	1,840	0.35	0.6
Total	***284,159***	***53.82***	***100.0***

Note: 1. Plastic pipe includes the following types of pipes: ADS, ABS, C-900, CPP, HDPE, N-12, and PVC.

Table 3-2
Existing Storm Sewer Pipe Size Summary

Pipe Diameter (inches)	Length (feet)	Length (miles)	Percent of System
72	153	0.03	< 0.1
48	140	0.03	< 0.1
42	728	0.14	0.2
36	3,134	0.59	1.1
30	9,745	1.85	3.4
27	2,405	0.46	0.8
24	21,702	4.11	7.6
21[1]	1,171	0.22	0.4
18	26,522	5.02	9.3
15[2]	31,010	5.87	10.9
12	152,256	28.84	53.6
10	16,166	3.06	5.7
Less than 10[3]	18,396	3.48	6.5
Unreported	630	0.12	0.2
Total	***284,159***	***53.82***	***100.0***

Note: 1. This includes pipes with reported diameters of 21 and 20 inches.
2. This includes pipes with reported diameters of 15 and 16 inches.
3. This includes pipes with reported diameters of 8, 6, 5, and 4inches.

Existing Water Quality and Water Quantity Facilities

At this time, the City manages over 60 water quality facilities. Of these, the City owns and maintains approximately 37. The City inspects, but does not maintain, another 18 facilities owned by homeowner associations and other private ownership interests. Also, as development occurs within the City, some facilities have their operations responsibilities transferred from the developers and owners to the City after a two-year warranty and vegetation establishment period. The City anticipates accepting inspection responsibilities for seven additional privately-owned facilities in the near future. In addition to the facilities that the City inspects, there are many other private facilities which are operated and maintained by the facility owner. Many of these private facilities were constructed after 1991 when new development standards were adopted. The City does not have information regarding the location of these facilities.

The City also owns and maintains over 60 water quality manholes. In many cases, these facilities are installed ahead of vegetated water quality facilities to provide pre-treatment by sedimentation, as is required by current CWS standards.

The City-inspected water quality facilities and City-owned water quality manholes are shown on Plate 1 in Appendix B and inventoried in Appendix C.

The City does not currently own or operate any designated detention ponds. There are two areas where stormwater detention is provided in underground, oversized storm sewer pipes. These two areas are located on Smith Road and west of Murdock Road.

Existing Stormwater Problem Areas

Certain problems within the City's storm drainage system have been identified by City Public Works staff. These areas are listed below.

- Under certain significant storm events, an undersized storm sewer pipe in Ladd Hill Road just south of Sunset Boulevard has caused the conveyance system to surcharge, and forced the manhole cover to be lifted off its frame.

- A 36-inch diameter culvert crossing under SW Sunset Boulevard near Eucalyptus Terrace appears to surcharge under larger storm events.

- Known areas where drainage problems are caused by long-term or recurring maintenance problems include:

  - Silted in ditches along West Division Street
  - Repeatedly blown out swale near Columbia Street and Southern Pacific Railroad
  - Non-functional swale southwest of the intersection of Ladd Hill Road and Sunset Boulevard
  - Various open channel conveyances where vegetation control or removal of invasive species is needed

City staff have also indicated that there is one known location where a public storm drainage pipe is located under a private residence. This pipe is located along Park Street near 1st Street.

Developed Areas Lacking Water Quality Facilities

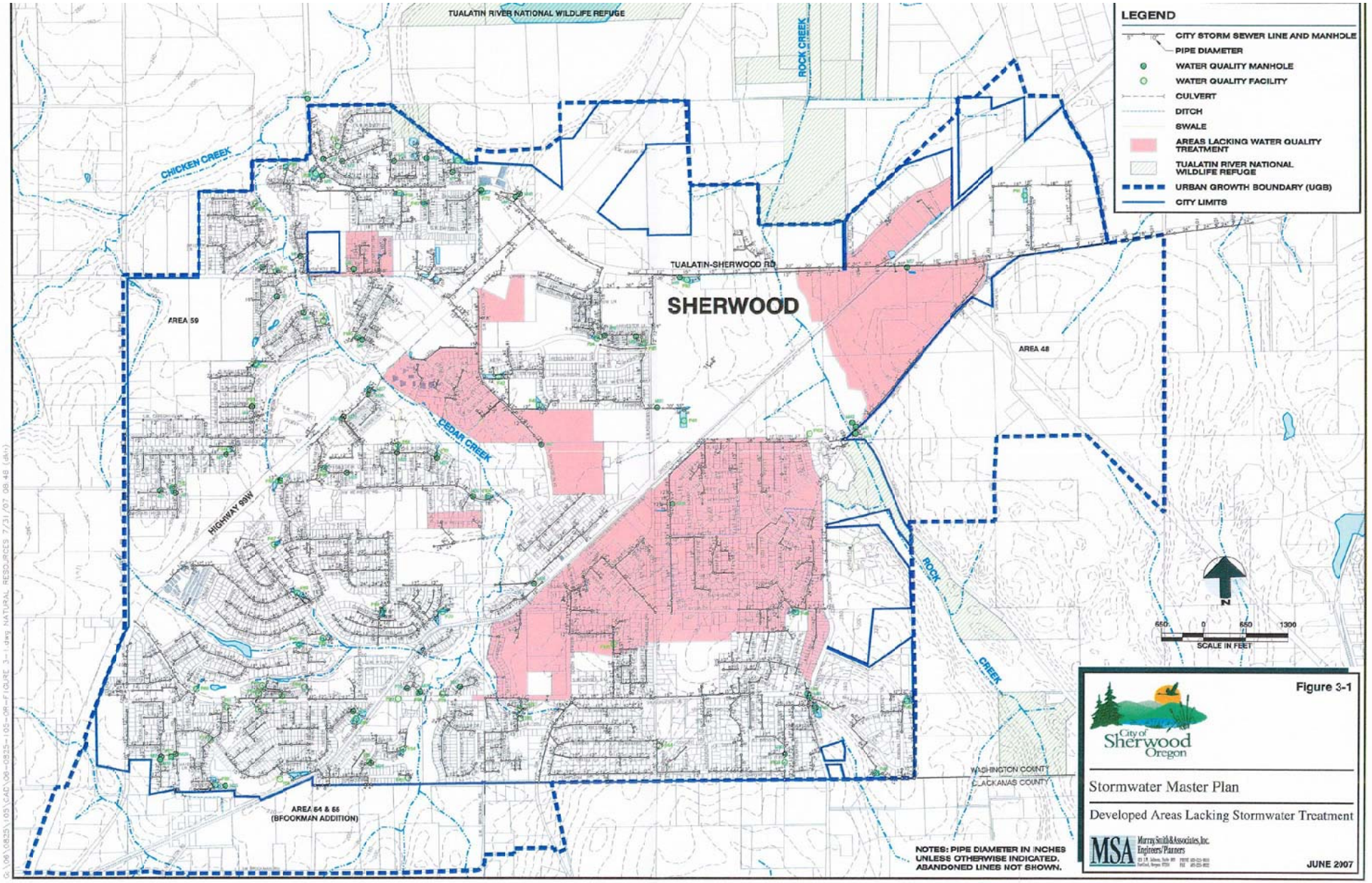
In 1991, CWS began requiring stormwater management facilities for treatment of runoff from impervious surfaces prior to discharge to any surface water. A significant portion of the City has been developed since 1991, and it is assumed that runoff from these areas is routed through stormwater treatment facilities in accordance with CWS rules at that time. Those portions of the City developed prior to 1991 generally lack treatment of stormwater prior to discharge to surface waters. These areas were identified as part of this master planning effort, and are shown in Figure 3-1.

Generally, the developed portions of the City currently lacking stormwater treatment fall into two categories:

- Commercial and industrial facilities: Older commercial and industrial developments along Highway 99W and north of Tualatin-Sherwood Road were likely constructed without stormwater treatment facilities. Runoff from these types of development can have significant detrimental impact to surface water quality in locations of high motor vehicle-dependent activities, activities which require large ground disturbances and where materials storage is performed uncovered.

- Older developed residential areas: Two relatively large drainage basins in the southeast portion of the City, west of Murdock Road and south of Oregon Street, drain untreated to Rock Creek. Also, along Cedar Creek, there are several small residential basins that drain directly to the creek with no treatment.

These untreated areas are considered good candidates for future stormwater quality improvement projects.


TUALATIN RIVER NATIONAL WILDLIFE REFUGE
ROCK CREEK
CHICKEN CREEK
TUALATIN-SHERWOOD RD
SHERWOOD
AREA 59
AREA 48
CEDAR CREEK
HIGHWAY 99W
ROCK CREEK
AREA 54 & 55
(BROOKMAN ADDITION)
WASHINGTON COUNTY
CLACKAMAS COUNTY
LEGEND
CITY STORM SEWER LINE AND MANHOLE
PIPE DIAMETER
WATER QUALITY MANHOLE
WATER QUALITY FACILITY
CULVERT
DITCH
SWALE
AREAS LACKING WATER QUALITY TREATMENT
TUALATIN RIVER NATIONAL WILDLIFE REFUGE
URBAN GROWTH BOUNDARY (UGB)
CITY LIMITS
N
650 0 650 1300
SCALE IN FEET
NOTES: PIPE DIAMETER IN INCHES UNLESS OTHERWISE INDICATED. ABANDONED LINES NOT SHOWN.
Figure 3-1
City of Sherwood Oregon
Stormwater Master Plan
Developed Areas Lacking Stormwater Treatment
MSA Murray, Smith & Associates, Inc. Engineers/Planners
JUNE 2007

SECTION 4
ANALYSIS METHODOLOGY

General

This section describes the analysis methodology used to evaluate the stormwater system under existing and future development conditions. The analysis is used to guide improvement recommendations which are presented in Section 7. The analysis methodology adopted herein is consistent with the methodologies generally accepted by Clean Water Services (CWS) in their current Design and Construction Standards (anticipated to be adopted June 1, 2007).

The stormwater analysis consists of hydrologic and hydraulic components. The hydrologic component estimates the volume and peak flow rate of stormwater runoff entering the stormwater conveyance system in response to the rainfall associated with a particular design storm. The total volume and peak flow rate of stormwater runoff depends on the duration and intensity of the storm, the topography, soil type and amount of impervious area of the basin. The hydraulic component routes the stormwater that results from the hydrologic component through the conveyance system. The hydraulic component evaluates capacity of the conveyance system to pass the design storm, and is used to identify areas that may ultimately be prone to flooding. The hydraulic analysis depends on geometry (size, shape and slope) and other characteristic data of the pipe and channel system to estimate capacity.

Analysis Criteria

As holder of the National Pollutant Discharge Elimination System (NPDES) stormwater permit surface water management within the Tualatin River Basin is under the jurisdiction of CWS. As a requirement of the permit, CWS has developed standards for design and construction of stormwater facilities. All stormwater facilities planned, designed and/or constructed in the City of Sherwood must be in accordance with CWS standards. To ensure CWS' acceptance of the analyses performed for this plan, CWS design standards were used to evaluate the City's system under existing and future conditions. The primary analysis criteria, as described in CWS' current Design and Construction Standards, are as follows:

- All stormwater facilities shall be designed to convey runoff generated by a 24-hour duration storm having a 25-year recurrence interval (typically referred to as the 25-year storm).
- Design of the storm conveyance system shall provide a minimum one foot of freeboard between the hydraulic grade line and the top of the structure, or finish grade above the pipe for the 25-year, post-development peak rate of runoff.
- Design surcharge (hydraulic grade line) in pipe systems for the 25-year design storm event shall not cause flooding in portions of a habitable structure, including

below floor crawl spaces, or otherwise create a hazard or danger to the health and safety of the public.

- Open channel systems shall be designed for a minimum of one-foot of freeboard from bank full provided no structures are impacted by the design water surface elevation.
- The Manning's roughness coefficient value ("n") to be used in design shall be 0.013 for all stormwater piping systems.
- Sewers of sizes which are obviously larger than necessary for flows, but which are oversized to meet grade requirements are not allowed.
- Sewers shall not decrease in size as they move downstream.
- Storm sewers shall have sufficient slope to maintain a minimum flow velocity of 2.5 feet per second when flowing full.

Hydrologic Analysis Methodology

Runoff Estimation Method

There are a number of hydrologic methods available to estimate rate and volume of stormwater runoff. The Natural Resources Conservation Service (NRCS) Method was selected for use in this study because it is widely used, is accepted by CWS for planning and design purposes and because basin characteristic data required for the NRCS Method is readily available.

PCSWMM 2005 Software (Version 1.0.43) was utilized to perform the NRCS runoff estimation method for this study. PCSWMM, developed by Computational Hydraulics, Intl., uses the core processes of the U.S. Environmental Protection Agency's (EPA's) Stormwater Management Model (SWMM), and has been in common use for stormwater analysis for over 25 years.

The NRCS Method requires a number of variable inputs to determine stormwater runoff volumes and rates conveyed and discharged by the City's stormwater facilities. These inputs include precipitation information including total depth and time distribution, and basin characteristics including soil types, land use, surface roughness, subbasin size and topography. These are described as follows.

Precipitation

The two precipitation components needed for a hydrologic analysis are the total depth of precipitation for the design storm event, and the rainfall distribution over the duration of the storm event. CWS standards prescribe total rainfall depths for 24-hour duration storms ranging from 2-year recurrence intervals to 100-year recurrence intervals, for the Sherwood

vicinity. Table 4-1 summarizes the rainfall depth associated with the 24-hour storm event for recurrence intervals ranging from 2- to 100-years, as provided in CWS standards.

Table 4-1
Rainfall Depths for 24-Hour Duration Storms in the Sherwood Vicinity

Recurrence Interval (years)	24-Hour Rainfall Depth (inches)
2	2.50
5	3.10
10	3.45
25	3.90
50	4.20
100	4.50

CWS requires all stormwater facilities to be designed to convey the 25-year, 24-hour duration storm. As shown in Table 4-1, the total rainfall depth for this storm is 3.90 inches. The rainfall depth is distributed over the 24-hour time period using the NRCS 24-hour Type 1A rainfall distribution, which is generally accepted by CWS and others as the standard rainfall distribution for storms in western Oregon. The Type 1A storm is characterized by a peak rainfall intensity occurring approximately eight hours into the 24-hour event. Figure 4-1 shows the hourly rainfall distribution over the 24-hour period, with a total rainfall depth of 3.90 inches, as utilized in the NRCS Method described above.

Basin Characteristics

Hydrologic analysis requires the input of several subbasin attributes to characterize each basin: subbasin area, subbasin width, percent impervious groundcover, average ground slope, manning's roughness coefficient, depression storage and infiltration potential of the soils. These factors are identified for each subbasin and are presented in Table D-1 located in Appendix D.

Basin Delineation

The existing stormwater system in the City consists of some interconnected drainages as well as many independent drainages. To facilitate the analyses conducted in this Master Plan, the planning area was divided into a total of approximately 362 subbasins with an average size of approximately 8.4 acres. The subbasins are shown on the Model Systems Map in Appendix D, and are symbolically delineated using a two letter abbreviation representing the receiving water to which each ultimately discharges. Table 4-3 shows the abbreviations associated with these subbasin delineations.

Figure 4-1
25-yr 24-hr NRCS Type 1A Design Storm for Sherwood, Oregon

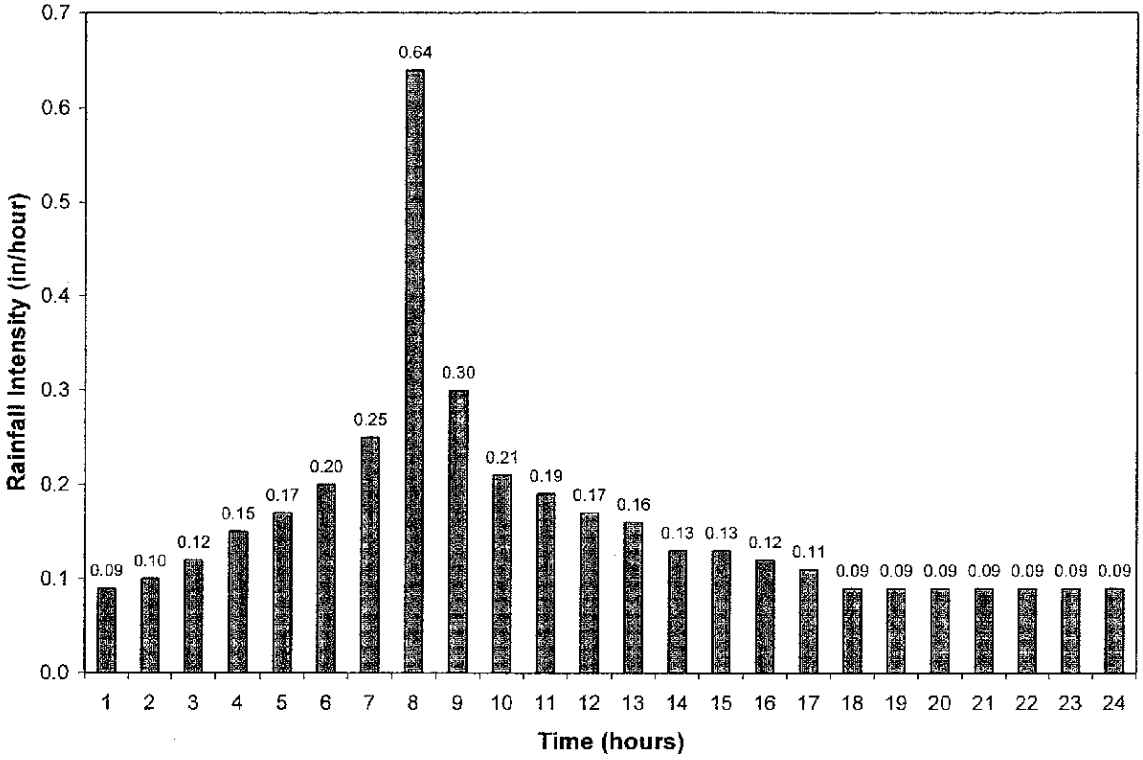


Table 4-2
Geographic Basins Summary

Receiving Water	Geographic Basin Description	Abbreviation
Chicken Creek	Roy Rogers Rd	CH
Cedar Creek	Old Town South of Sunset SE of HW 99 NW of HW 99	CC
Rock Creek	North of Tualatin-Sherwood Rd South of Tualatin-Sherwood Rd Oregon St-Murdock Rd SE Sherwood	RC
Hedges Creek	Hedges Cr	HC
Coffee Lake Creek	Coffee Lake Cr	CL

Land Use and SCS Curve Numbers

Land use types were used to estimate the percent impervious area within each subbasin. This is the percent of surfaces in the basin through which no water can penetrate, such as rooftops and pavement. The percent impervious area is a critical factor in determining the amount of runoff generated in the basin because rainfall that is not able to infiltrate into the soil flows overland as runoff.

For analysis purposes, each land use type was assigned a percent imperviousness according to the amount of impervious surfaces projected for a fully developed area of that land use type. Additionally, curve numbers (CN) have been developed for various land use types within the urban watershed based on the soil cover type, the percent impervious area and the hydrologic soil groups. Table 4-2 shows the percent imperviousness assigned to each land use type for this study as well as the CN associated with each hydrologic soil group for that type of land use, as published in the SCS Technical Release 55 (TR-55). The open space land use category is assigned to areas zoned as public parks and undeveloped areas. Designated land use over the planning area is shown in Figure 2-1.

Table 4-3
Percent Imperviousness and SCS Curve Number by Land Use

Land Use	City Zoning Classification	Percent Imperviousness[1]	Curve Numbers for Hydrologic Soil Groups[1]			
			A	B	C	D
Urban Land Use:						
Commercial and Business	GC, OC, NC, RC, IP[2]	85 %	89	92	94	95
Industrial	GI, LI	72 %	81	88	91	93
Residential Districts:						
1/8 acre lots or less	HDR, MDRH, MDRL	65 %	77	85	90	92
1/4 acre lots	LDR	38 %	61	75	83	87
1/3 acre lots	VLDR	30 %	57	72	81	86
Open Space, (grass cover > 75%)	IP[3]	10 %	39	61	74	80

Notes: 1. Source: SCS Technical Release 55, Second Edition, June 1986.
2. Schools and governmental buildings
3. Parks

The CN assigned to each subbasin are shown in Table D-1 in Appendix D.

Hydraulic Analysis Methodology

Hydraulic analysis considers open channel and pipe flow under dynamic conditions that include backwater effects, manhole losses, surcharged (pressurized) pipe conditions and channel storage. Hydraulic system information consists of conveyance system geometry, flow line elevations, pipe or channel characteristics, backwater effects caused by the receiving water and other effects caused by existing stormwater management facilities.

Conveyance Facility Geometry and Flow Line Elevations

Conveyance facilities within the planning area include piped systems and open channel systems. The piped systems were modeled under the 25-year storm event to determine if there is adequate capacity within the system to meet the design criteria outlined above. In general, because geometry and flow line elevations for open channel systems were not available, pipes and culverts adjoining open channel systems were used to determine the capacity of a flow pathway and to determine if there is adequate capacity within the system to meet the design criteria outlined above. Additionally, outfall invert elevations were assumed to be above the high water elevation.

Conveyance system data utilized in this analysis was provided by the City. Pipe invert elevation and slope data were not available for all pipes. Where possible, interpolation was used to fill the data gaps. Otherwise, missing pipe reaches were assigned the minimum design slope based on CWS design standard of a minimum full-flow velocity of 2.5 feet per second. If application of the minimum grade was found to result in inadequate capacity, further investigation was made. Commonly, the slope of the ground surface was conservatively used to estimate the pipe slope. Site investigations were also used to investigate critical areas.

A single split-manhole was included in the model. This diversion is located at Handley Street and Stein Terrace. The SWMM program can only analyze split-manholes under non-surcharging conditions (the kinematic wave solution scheme). Other modeled areas were analyzed allowing for some surcharging (the dynamic wave solution scheme) to facilitate the inclusion of the critical detention facilities (see next section) and allow for backwater effects.

Conveyance Facility Characteristics

CWS design standards prescribe a Manning's "n" roughness coefficient of 0.013 for storm sewer pipes regardless of the pipe material. Open channels (ditches) were analyzed using a Manning's n-value of 0.02.

Receiving Waters

The primary receiving waters of stormwater discharges are the surface water features of Chicken Creek, Cedar Creek, Rock Creek, Hedges Creek, and Coffee Lake Creek. All water entering the conveyance facilities ultimately discharges to one of these creeks or tributary

thereof. These surface waters and their associated culverts are under the jurisdiction of CWS, and hydraulic analysis of the surface water system was not performed. Due to the topography of the surface water system, the City's stormwater system outfalls are generally outside the 100-year flood plain elevations of the receiving waters. It was assumed for this study that the City's outfalls are in a free-discharge condition with no backwater effects caused by the receiving stream.

Water Quality and Quantity Facilities

The City's stormwater system contains several water quality and quantity facilities which create some effect and attenuation to peak runoff rates. Water quality swales and ponds within the City are generally designed so that flows greater than the peak runoff from the 2-year storm bypass the facility in order to prevent damage to the facility. These facilities were excluded from hydraulic capacity analysis. Outflow from water quality facilities was included in the hydraulic analysis for purposes of evaluating the downstream facilities. Outflow was limited to the full-flow capacity of the outlet pipe, and accounts for some nominal stormwater detention that may be provided by the facility.

SECTION 5
STORMWATER SYSTEM ANALYSIS

General

This section describes the results from the hydraulic analysis conducted on the City's stormwater system. Facilities were analyzed for their ability to carry peak flows from the 25-year storm event under both existing and ultimate development conditions in all of the contributing drainage basins within the City's UGB.

Hydraulic Analysis Results

Results of the hydraulic analysis showed that the significant majority of the City's existing stormwater facilities are adequate to convey the 25-year storm for both the existing and ultimate development conditions. Modeling results are presented in tabular format in Appendix D.

Evaluation of Hydraulic Analysis

The hydraulic modeling identified a number of locations as possibly being under capacity to convey the 25-year flow. Further investigation was performed on each of these locations to determine if improvements to the system were indeed warranted. If upon closer examination, the stormwater system was able to accommodate the flows through minor surcharging of structures as allowed by CWS standards and did not appear to have any negative impacts to property or natural resources, it was determined that the improvements to the system were not warranted. These areas are described in the following section.

The flow modeling effort also indicated that several water quality facilities appear to be providing important stormwater detention in addition to their intended water quality functions. These facilities are considered critical in terms of conveyance system capacity, since they provide attenuation of peak flows to fit the capacity of the downstream drainage system. The model-identified critical water quality facilities are listed in Table 5-2. Detailed flow modeling of the identified facilities was not performed as part of this analysis. Instead, downstream sensitivity to the detention function of these facilities was modeled by assuming a full-pipe flow of the facility's outlet piping. In each case, this assumption resolved the model-identified capacity concerns found downstream of each of the facilities. It is recommended the City pay particular attention to the operation and maintenance of these facilities to assure their continued function to attenuate peak flows and minimize flooding potential near the facility.

Table 5-1
Model-Identified Critical Water Quality Facilities Providing Detention

Location	City ID No.
Bushong Terrace	33
Edy Road and Borchers Drive	Private ownership (Police Station & Ice Haus)
Lavender Avenue	40
Middleton Road	71
Murdock Park (SE Roy)	49
Noble Fir Court	98
Pinehurst Drive and Portland & Western Railroad	58

Model-Identified Restrictions Not Warranting System Improvements

The following areas were identified through the model analysis as having insufficient capacity to convey the peak flow from a 25-year storm event. Considering the recent construction of many of these facilities, comparing the model uncertainty with the severity of the capacity concern, and weighing the potential risk to human health, safety and property damage against costs, these areas do not appear to warrant improvements to the system.

12" Storm Drain in Bowman Court and Bowman Lane

The City's mapping indicates a run of 12-inch diameter storm drain lines Bowman Lane and Bowman Court. This run has 15-inch diameter pipes both on its upstream and downstream ends. The piping could actually be 15-inch diameter, which would be customary practice, in which case the piping has sufficient capacity for the modeled flow conditions. If the pipe is in fact a 12-inch diameter line, the model indicates minor surcharging, but within limits required by CWS standards.

SE Cochran and Willamette Streets

Runoff from the residential areas above SE Cochran and Willamette streets pass through a 12-inch pipe at SE Willamette. The model indicates this pipe may not have sufficient capacity at full-pipe, but can provide the required capacity under minor surcharging.

SW Golden Pond Terrace

Modeling results indicate the 18-inch storm drain line in Golden Pond Terrace and north of SW Cobble Court is slightly over capacity at current development conditions. The storm drain provides necessary capacity under minor surcharging conditions. No improvements are warranted, however it is recommended the City require future development upstream of

Golden Pond Terrace to provide detention for reduction of peak flows to existing pre-development rates.

Ladd Hill Road near Sunset Boulevard

Modeling results show that the 25-year peak runoff exceeds the capacity of a number of pipes in this vicinity under existing development conditions:

- 21-inch diameter pipe in Ladd Hill Road, adjacent to Willow Drive
- 18-inch diameter pipe in Ladd Hill Road, flowing south from Sunset Boulevard
- 12-inch diameter pipe draining Hawk Court

Under allowable surcharging conditions, these pipes have sufficient capacity for the future development conditions. The pipes have several feet of ground cover which further reduces the risk of overflows. Minor flooding in the area has been observed by Public Works, but is attributed to a capacity restriction caused by excessive sedimentation in the open channel downstream.

Pinehurst Drive

Modeling results indicate the 12-inch diameter storm drain along Pinehurst Drive that drains the easternmost portion of Fitch Drive to be undersized. The piping discharges to a water quality facility located nearby. Further investigation suggests that the pipe has sufficient capacity to convey the intended flow without surcharging.

Sunset Boulevard, Murdock Road and Baker Road Intersection

Runoff from the areas immediately surrounding the intersection of Sunset Boulevard, Murdock Road and Baker Road are conveyed to two separate water quality facilities at the northwest and southeast corners of the intersection. The modeling results provided using piping configuration shown in the City's mapping indicate possible capacity restrictions in the storm drain piping located near the intersection. The City's mapping indicates an unusual piping arrangement where flow is moving from larger to smaller pipes, and it is possible the mapping is incorrect. It is recommended the City perform additional field investigation to verify the as-constructed condition of the piping, and then re-assess the capacity of the system as it is constructed.

Identified Problem Areas Warranting System Improvements

The hydraulic analysis identified a single location where capacity is insufficient to convey the peak flow from a 25-year storm event under both existing and future development conditions. System improvements are warranted at this locations to provide 25-year peak flow capacity.

Runoff from the developed areas east of Ladd Hill Road flow west through existing storm drain to a low spot in Ladd Hill Road approximately 200 feet south of Sunset Boulevard. Runoff is discharged to a surface water channel on the west side of Ladd Hill Road via a 15-inch and a 27-inch concrete storm drain. Capacity of the natural channel is significantly reduced by excessive sedimentation, estimated to be two feet thick, occurring just a few feet downstream of the pipe outlets. The sedimentation has created a backwater which nearly surcharges the pipes under dry-weather conditions. The channel restriction has significantly reduced the capacity of the drainage system.

Furthermore, modeling results indicate the pipes do not have sufficient capacity for existing conditions. The pipes are located very close to the road surface, and surcharging of the system causes minor flooding of the roadway. Since the road is an important connector to local urban areas within the City as well as rural areas south, it is recommended this area be maintained to restore lost capacity, and the stormwater system improved to provide increased capacity to minimize flooding.

SECTION 6
IMPROVEMENT OPTIONS

General

This section describes the various improvement options that may be utilized to address system deficiencies and provide system improvements to serve future growth areas within the City of Sherwood (the City).

There are generally two types of improvement options considered for stormwater improvements: structural and non-structural. An example of a structural improvement is the construction of a diversion pipe around a flow restriction. A non-structural improvement could include increased cleaning of catch basins to reduce the potential for sediments filling up natural conveyance channels downstream. The City typically relies on a combination of both structural and non-structural improvements to provide cost-effective stormwater management.

The focus of this section is to describe structural improvement options that could be used to correct existing system deficiencies, or to accommodate future growth within the planning areas. Preferred alternatives were selected for each improvement required for the City's 20-year Capital Improvement Program (CIP), based on the discussion presented below. The 20-year CIP, and specific recommended projects, are presented in Section 7 of this study.

Conveyance System Improvements

Conveyance system improvements are intended to ensure the conveyance system can pass the estimated runoff from the design storm event without flooding. The conveyance system generally includes pipes, manholes, catch basins and inlets, swales, ditches, creeks and culverts. The system may also include regional detention facilities, which are publicly-owned and maintained facilities designed to store and reduce peak runoff rates.

Increase Pipe Capacity

Increasing pipe capacity is the traditional approach to increasing overall stormwater system conveyance. Increased capacity can be accomplished by replacing undersized pipes and by installing parallel pipes. Larger pipes are typically recommended when existing pipes are in poor condition. Stormwater piping is often relatively shallow in comparison with other buried utilities, and pipe enlargement under roadways can be limited by the requirement for structural cover over the pipe. Stormwater pipes flow by gravity and are additionally constrained by existing utilities and the downstream discharge elevation. Parallel pipes are often recommended where existing pipes can remain in service. Problems associated with undersized culverts can often be alleviated by constructing an adjacent parallel culvert.

Increase Capacity of Natural Channel

All stormwater runoff in the City is ultimately discharged to the natural surface water system. In some cases, the stormwater flows through smaller natural channels before reaching the larger receiving waters. Where capacity in these natural channels may be limited, increasing capacity can be approached in two ways. Larger flows can be accommodated by increasing the cross-sectional area of the channel or by reducing the frictional resistance of the channel. Increasing cross-sectional area typically requires increasing the width, because channel depth is often limited by the available elevation drop in the system. Frictional resistance can be improved through routine maintenance, such as clearing vegetation, or by cleaning or resurfacing the channel.

Under current environmental regulations, natural channels are considered natural resource areas, providing valuable habitat for fish and wildlife as well as other water quality benefits. Construction work within these areas often requires a lengthy process to obtain permits from various regulatory agencies with restrictions put on the type and timing of work performed. Mitigation work is often required to improve surrounding natural areas, thereby increasing overall project cost. Because of the cost and uncertainty of the permitting process and the requirements imposed, improvements to the natural channels usually consist of minor maintenance only to restore historical stream capacity. Upstream detention facilities and other low-impact development methods may be used to limit peak runoff rates to the capacity of the channel.

Construct Detention Facilities

Detention facilities temporarily store peak stormwater runoff from a developed area and then discharge the water to the receiving system at a lower controlled rate. This is traditionally performed where an analysis demonstrates the downstream conveyance system may be overburdened by increased flow. Often these facilities are constructed on a site-by-site basis. Generally, a site developer must construct permanent on-site stormwater quantity detention facilities to reduce the peak runoff rates from the site to the pre-development peak runoff rates, or improve the downstream receiving system capacity to accommodate the increased runoff.

More specifically, under current Clean Water Services (CWS) standards, the City and CWS have the option to require on-site detention if any of the following conditions exist:

- There is an identified downstream deficiency, and the City or CWS determines that detention rather than conveyance system enlargement is the more effective solution.
- There is an identified regional detention site within the boundary of the development.

- Water quantity facilities are required by CWS-adopted watershed management plans and subbasin master plans.

A third option exists which allows a developer to pay a Storm and Surface Water Management System Development Charge (SDC) in lieu of detention or conveyance system improvements. These fees, in lieu of improvements, are then used by the City and CWS to construct improvements to convey and/or detain the flow.

The majority of the City is bisected by two creeks, Cedar Creek and Rock Creek, both under the jurisdiction of CWS. Cedar Creek has several roadway culverts along its length which may be impacted by increased runoff rates from future development. The creek also flows through Stella Olsen Park, which is a valued City facility. Furthermore, the City recognizes the importance of the natural riparian habitat provided by the creek. The City has taken a number of steps to improve the creek's condition and natural function. In light of this, the City has significant investment in the long-term health and proper functioning of the creek. It is believed that increased peak flows in the creek due to upstream development will not contribute to the health of the creek, and cumulatively, will likely degrade the condition of the creek over time.

It is recommended that the City incorporate regional detention facilities in developments that discharge to Cedar Creek, where considered feasible. Generally, regional facilities are preferable to individual on-site facilities because they are publicly-owned and maintained, and their continued performance is better assured. Rock Creek is a more open natural channel with a wide flood plain and relatively unimpeded flow to its confluence with the Tualatin River. Cumulative impacts due to increased runoff rates and volumes from development are not anticipated to be a problem in the Rock Creek Basin. A similar assessment is made regarding Chicken Creek.

Hedges Creek flows through neighboring Tualatin, and it is recommended the City utilize regional detention prior to discharging to the creek to minimize impacts to that jurisdiction. Coffee Lake Creek flows through the neighboring city of Wilsonville on its way to discharge into the Willamette River. Wilsonville city staff have previously indicated that this creek is already significantly impacted due to peak runoff, and therefore the City should ensure that all development within the Upper Coffee Lake Creek Basin includes detention, or that regional detention is provided.

Provide Reduction in Peak Flow Rates through LIDA

Over the years, traditional stormwater management techniques have adapted to the development of impervious surfaces by typically increasing conveyance capacity. The compounded effects of increased runoff are shown in many cases to degrade the natural environment, with peak runoff rates resulting in erosion, increased pollutant loads and reduced stream base flows caused by reduced groundwater infiltration. There is now an increased awareness of these impacts, and a desire by citizens, community leaders and

developers to reduce hydrologic impacts caused by stormwater. One method that has received increased attention recently is the use of Low-Impact Development Approaches (LIDA). LIDA are methods for stormwater management which are intended to reduce the impact of stormwater runoff from a development's impervious surfaces to the natural environment. This is accomplished through the reduction of peak runoff rates from impervious surfaces such as building roofs or pavement, and through infiltration, which reduces the overall volume of runoff. Examples of LIDA include vegetated infiltration swales, pervious asphalt and Portland cement concrete pavements, eco-roofs, vegetated filter strips and "green streets".

In adopting their new Design and Construction Standards, CWS has recently acknowledged that LIDA can be acceptable in some cases to provide control of overall flow quantity from a particular development. The use of these techniques is relatively new and usage on a system-wide basis to reduce overall conveyance system requirements has not yet been tested in this area. LIDA does promise to have positive water quality impacts and it is expected that usage of these techniques will increase over the planning period. It is recommended that the City allow LIDA consistent with CWS standards, and where utilized throughout the City, the City and CWS should closely monitor their effectiveness.

Some LIDA depend on permeable soil to allow infiltration for runoff control. A significant portion of the City is located on less permeable soil types, classified as 'C' or 'D' (as described in Section 2). Other areas have more permeable soil, classified as type 'B'. It is important that proper assessment of each development site is provided to determine infiltration ability, so that proper LID techniques are utilized. Proper maintenance is also essential in the long-term effectiveness of LIDA, and should be considered in the application of these techniques.

Water Quality Improvements

Water quality improvements are necessary to reduce pollutants from stormwater runoff prior to entering the downstream surface water system. CWS holds a National Pollutant Discharge Elimination System (NPDES) stormwater permit for urban areas within the Tualatin River Basin, which includes the City. CWS regulates all stormwater discharges, and has standards for requiring all new development with impervious surfaces to treat its runoff prior to discharge. The primary pollutants which CWS is concerned about are total suspended solids (TSS) and phosphorus, a nutrient which is naturally occurring in the soil. CWS standards specifically require all stormwater quality facilities to be designed to remove 65 percent of the total phosphorus from the runoff from the development's impervious area.

CWS allows several approaches to meeting the treatment design efficiency standard. These include a vegetated swale, extended dry basin, and a constructed water quality wetland. CWS provides specific guidelines for design of each of these approaches to ensure required treatment levels are met. Furthermore, a water quality manhole to reduce sediment loads is required as pre-treatment prior to each facility. CWS also allows proprietary stormwater

treatment systems in certain applications. These systems are typically constructed in underground concrete structures and are often used in areas of high-intensity developments and/or otherwise restrictive locations such as the public right-of-way. LIDA are also allowed to be used to meet treatment efficiency standards where applicable.

On-site Water Quality Facility

New water quality facilities in the City are typically developed on a site-by-site basis, in accordance with CWS standards. In a majority of cases, this is the proper approach.

As described in Section 3, there are several areas of the City which were developed prior to 1991, when CWS began requiring water quality treatment facilities. CWS is not currently requiring the City to specifically retrofit these areas with stormwater treatment facilities. However, the City has expressed interest in the construction of treatment facilities for these areas where feasible. Therefore, Section 7 presents a number of projects which address water treatment for these areas. In general, it is recommended the City develop all water quality facilities in close cooperation with CWS standards. Where land availability is very limited for development of traditional CWS-approved vegetated facilities, recommendations have been provided for proprietary treatment systems.

Regional Water Quality Facility

In future urban development areas, potential locations for regional water quality facilities have been recommended. City staff generally prefers this approach, as it allows the City to manage and maintain a single facility rather than several smaller on-site facilities. Subbasin master plans for stormwater management in these areas are highly recommended to ensure both water quality and water quantity requirements are met, proper and efficient siting of the facilities can be accomplished and appropriate funding mechanisms are established.

SDC in Lieu of Water Quality Facility

For already-developed areas where infill or redevelopment is occurring, site development may be difficult or infeasible due to land requirements of traditional water quality facilities. In these cases, the City and CWS may wish to accept the Storm and Surface Water Management SDC and apply the funds to development of a regional facility in the same drainage basin, or in another City basin where a treatment facility could provide needed benefit.

SECTION 7
RECOMMENDATIONS AND CAPITAL IMPROVEMENT PROGRAM

General

The City of Sherwood's (the City) existing stormwater system has been investigated in this study and its apparent adequacy in meeting present and future stormwater needs has been evaluated. This section presents a recommended Capital Improvement Program (CIP) for the City of Sherwood's stormwater system. This CIP includes proposed system improvements selected from the improvement options presented in Section 6 for the correction of identified system capacity deficiencies, the need for additional future capacity due to development, and water quality treatment both in existing developed areas where no water quality treatment is currently provided, and in areas expected to develop in the next twenty years.

Estimates of Cost

Estimates of cost are summarized by subbasin in Table 7-1 and represent the total estimated project cost for short-, medium-, and long-range recommended improvement projects described in this master plan. These cost estimates are planning level estimates in 2007 dollars, generally having an accuracy of no more than plus or minus approximately 25 percent. Project costs also include an allowance of 45 percent for administration, engineering and contingencies in addition to estimated basic construction costs. For purposes of updating these estimates in the future, the current Engineering News Record, Construction Cost Index is 8629 (Seattle, Washington, April 2007). Estimated costs for land acquisition are not included in the project cost estimates.

A detailed cost breakdown for each project in each of the subbasins is presented in spreadsheet format in Appendix E. The condensed summary of these cost estimates shown in Table 7-1.

Various improvement projects have been grouped into the following three categories based on implementation time frames. Short-range costs are those anticipated in the next 5 years. Mid-range costs are those anticipated for a period from 5-10 years hence. Long-range costs are those anticipated from 10 years hence to full build-out conditions.

Capital Improvements Program

The recommended CIP is presented in Table 7-2. All of the system improvements presented in this table are also shown on the Proposed Improvements Map, Plate 1 in Appendix C. The implementation timeframe and basin names are also shown in Table 7-2 for easy reference to the cost estimate tables shown in Appendix E. The cost estimates associated with specific improvement projects shown in Table 7-2 have been rounded to five thousand dollar increments.

Table 7-1
Summary of Estimated Stormwater Related Costs

Basin	Recommended Capital Improvements			
	Short Range	Mid Range	Long Range	Total
Chicken Creek	$ 145,000	$ 0	$ 0	$ 145,000
Cedar Creek	$ 3,875,000	$ 815,000	$ 0	$ 4,690,000
Rock Creek	$ 350,000	$ 1,220,000	$ 1,340,000	$ 2,910,000
Hedges Creek	$ 0	$ 0	$ 855,000	$ 855,000
Coffee Lake Creek	$ 0	$ 0	$ 400,000	$ 400,000
Total Estimated Stormwater Related Costs	**$ 4,370,000**	**$ 2,035,000**	**$ 2,595,000**	**$ 9,000,000**

Table 7-2
Recommended Capital Improvements Program

Project Identifier	Description	Estimated Cost	Potential Cost Sharing
Short-Range Improvements			
CH-1	Chicken Creek Stormwater Facility	$ 145,000	Developer requirements, green space contributions, SDCs
RC-1	Murdock Road (North) Regional Stormwater Facility	$ 350,000	N/A
CC-1	Ladd Hill Regional Stormwater Facility	$ 425,000	N/A
CC-3	Columbia Street Stormwater Facility	$ 140,000	N/A
CC-12	Area 59 Regional Stormwater Facility	$ 155,000	Developer requirements, green space contributions, SDCs
CC-13	Upper Ladd Hill Regional Stormwater Facility	$ 385,000	Developer requirements, green space contributions, SDCs
CC-14	Brookman Addition Regional Stormwater Facility	$ 560,000	Developer requirements, green space contributions, SDCs
CC-15	Pinehurst Culvert	$ 50,000	
CC-16	Washington Street Culvert	$ 1,900,000	
CC-17	West Brookman Road Regional Stormwater Facility	$ 260,000	Developer requirements, green space contributions, SDCs
	Short-Range Sub-total	***$ 4,370,000***	
Mid-Range Improvements			
RC-2	Oregon Street Regional Stormwater Facility	$ 310,000	N/A
RC-3	Lower Rock Creek Regional Stormwater Facility	$ 340,000	Washington County / CWS
RC-4	Tonquin Road (North) Stormwater Facility	$ 165,000	N/A
CC-2	West Division Street Stormwater Facility	$ 110,000	N/A
CC-4	South Stella Olsen Park Stormwater Facility	$ 200,000	N/A
CC-5	Community Campus Park Stormwater Facility	$ 200,000	N/A
CC-6	Gleneagle Drive Stormwater Facility	$ 105,000	N/A
CC-7	Glencoe Court Stormwater Facility	$ 75,000	N/A
CC-8	Gleneagle Village Water Quality Facility	$ 95,000	N/A
CC-9	Edy Road Stormwater Facility	$ 285,000	Developer requirements, green space contributions, SDCs
CC-10	Saint Charles (North) Stormwater Facility	$ 70,000	N/A
CC-11	Saint Charles (South) Stormwater Facility	$ 80,000	N/A
	Mid-Range Sub-total	***$ 2,035,000***	
Long-Range Improvements			
RC-5	Tonquin Road (South) Stormwater Facility	$ 1,100,000	Developer requirements, green space contributions, SDCs
RC-6	Murdock Road (South) Stormwater Facility	$ 240,000	Developer requirements, green space contributions, SDCs
HC-1	Hedges Creek Stormwater Facility	$ 855,000	Developer requirements, green space contributions, SDCs
CL-1	Coffee Lake Creek Stormwater Facility	$ 400,000	Developer requirements, green space contributions, SDCs
	Long-Range Sub-total	***$ 2,595,000***	
	TOTAL ESTIMATED PROJECT COSTS	**$ 9,000,000**	

Recommended Improvements

This section includes a general discussion of recommended improvements within each basin included in the CIP above. The recommended improvements are shown on the Proposed Improvements Map, Plate 1 in Appendix C. This map shows general locations of proposed improvements.

The recommended facility sizes and locations designated in this master plan are preliminary only. During final design of facilities, it will be necessary to confirm design flows, pipe and facility sizes, required flow line elevations or inverts, and flow routing based upon the current land use plan, proposed development, detailed soil surveys, soil investigations, physical constraints and other relevant field conditions.

Projects with labels that start with CH are located in the Chicken Creek Basin, projects with labels that start with CC are located in the Cedar Creek Basin, projects with labels that start with RC are located in the Rock Creek Basin, projects with labels that start with HC are located in the Hedges Creek Basin, and projects with labels that start with CL are located in the Coffee Lake Creek Basin. A brief description of each project is presented below.

CH-1: Chicken Creek Stormwater Facility

Project Location

Northwest corner of Area 59, east bank of the unnamed tributary to Chicken Creek.

Project Need

Provide regional stormwater facility for impervious surfaces created as part of development of Area 59 future urban services area. Project would allow consolidation of stormwater facilities required at time of development into a single facility at the point of discharge into a tributary of Chicken Creek.

Project Description

Construct a combined stormwater quality and quantity facility for stormwater runoff from the northwesterly portion of Area 59. The facility would handle stormwater from Chicken Creek drainage basin only. The facility is assumed to be an extended dry basin, designed to Clean Water Services (CWS) standards. If desired by the City or CWS, the facility may also include water quantity control (detention) to reduce impacts to existing downstream culverts and sensitive riparian areas.

CC-1: Ladd Hill Regional Stormwater Facility

Project Location

Crossing Ladd Hill Road, approximately 250 feet south of the intersection with Sunset Boulevard.

Project Need

The facilities have multiple problems. The high volume of sediment at the end of the culverts under Ladd Hill Road has significantly reduced conveyance capacity of the downstream channel and may be causing backwater effects. These culverts may also be undersized and the storm lines leading to the culverts also have little or no extra capacity. Inlet and outlet piping for the existing grassy swale on east side of street appear to be improperly configured and likely do not provide water quality benefits in accordance with current CWS standards. The swale is known to excessively flood.

Project Description

Preliminary studies may significantly influence the scope of the project. At a minimum, there is a maintenance problem with silt build-up. The downstream build-up should be cleared and provisions to prevent future sedimentation should be considered. Water quality manholes may be required. The swale should be reconfigured to meet current CWS standards. Investigate the capacity of the downstream channel to determine if sufficient capacity is available for the 25-year peak runoff. If required following additional study, construct peak flow diversion piping in Sunset Boulevard or Willow Drive to the surface stream to minimize conveyance problem at the Ladd Hill culverts.

CC-2: West Division Street Stormwater Facility

Project Location

West Division Street, approximately 600 feet west of S. Sherwood Boulevard.

Project Need

Runoff from existing residential area is currently not directed to a water quality facility before discharge to a tributary of Cedar Creek.

Project Description

Construct facility to provide treatment of runoff from impervious surfaces. Construct facility adjacent to the paved pathway. A vegetated swale may be suitable due to the linear site configuration, and is proposed. A proprietary stormwater treatment system may also be appropriate if site constraints do not warrant open excavation. The swale is expected to run

parallel to the existing conveyance facilities, and would require a diversion structure and a water quality manhole.

CC-3: Columbia Street Stormwater Facility

Project Location

South of Columbia Street, approximately 350 feet west of S. Sherwood Boulevard.

Project Need

Runoff from existing residential area is currently not directed to a water quality facility before discharge to a tributary of Cedar Creek.

Project Description

Construct facility to provide treatment of runoff from impervious surfaces. A vegetated swale may be suitable due to the linear site configuration, and is proposed. A proprietary stormwater treatment system may also be appropriate if site constraints do not warrant open excavation. The swale is expected to run parallel to the existing conveyance facilities, and would require a diversion structure and a water quality manhole.

CC-4: South Stella Olsen Park Stormwater Facility

Project Location

Stella Olsen Memorial Park, northeast of the Sheridan High School ball fields, approximately 800 feet south of N. Washington Street.

Project Need

Runoff from existing residential area is currently not directed to a water quality facility before discharge to Cedar Creek. The ditches draining the ballfields and some of the parking lots are not expected to be operating as water quality facilities meeting CWS standards.

Project Description

Construct a swale to provide treatment of runoff from small residential area and high school impervious areas and ballfields. The swale is anticipated to be located just off the school property on the park. An alternative could include reconfiguring the existing facilities on the school grounds to meet current CWS water quality swale standards. Further investigation of the contributing area, site conditions, and operation of the existing private ditching will likely influence the approach to the facility design and cost.

CC-5: Community Campus Park Stormwater Facility

Project Location

East bank of Cedar Creek near intersection of N. Sherwood Boulevard and NW Gleneagle Drive.

Project Need

Provide treatment for runoff from surrounding vicinity with significant impervious area constructed prior to 1990. Areas include nearby Sherwood Boulevard right-of-way, the shopping center at Langer Drive and Highway 99W, the residential area on Gleneagle Drive, and the Hopkins Elementary School and a portion of the Sherwood Middle School sites. Areas drain into the Sherwood Boulevard storm drain trunk line, with discharge to the surface water system via a 24-inch diameter pipe south of Gleneagle Drive.

Project Description

Construct an extended dry basin or vegetated swale water quality facility downstream of outfall. The City is interested in developing a footpath along the east bank of Cedar Creek in this area. This project could be included as part of the footpath project, and could be sized to accommodate water quality treatment required by the paving from the footpath. It is assumed that the footpath could be used to provide maintenance access to the facility and that no separate access road would be required.

CC-6: Gleneagle Drive Stormwater Facility

Project Location

East bank of Cedar Creek, near intersection of NW Gleneagle Drive and NW 10th Street.

Project Need

Runoff from existing residential area is currently not directed to a water quality facility before discharge to Cedar Creek.

Project Description

Construct a proprietary treatment system in pre-cast manhole or vault to provide removal of total suspended solids (TSS) and total phosphorus from runoff from older residential area. Facility may be constructed within Gleneagle Drive right-of-way to facilitate maintenance access.

CC-7: Glencoe Court Stormwater Facility

Project Location

East bank of Cedar Creek, near intersection of NW Gleneagle Drive and Glencoe Court.

Project Need

Runoff from existing residential area is currently not directed to a water quality facility before discharge to Cedar Creek.

Project Description

Similar to Project CC-7. Construct a proprietary treatment system in pre-cast manhole or vault to provide removal of TSS and total phosphorus from runoff from older residential area. Facility may be constructed within Glencoe Court right-of-way to facilitate maintenance access.

CC-8: Gleneagle Village Water Quality Facility

Project Location

East bank of Cedar Creek, on NW Gleneagle Drive near entrance of Gleneagle Village Condominiums.

Project Need

Runoff from existing residential area is currently not directed to a water quality facility before discharge to Cedar Creek.

Project Description

Similar to Projects CC-7 and CC-8. Construct a proprietary treatment system in pre-cast manhole or vault to provide removal of TSS and total phosphorus from runoff from older residential area. Facility may be constructed within Gleneagle Drive right-of-way to facilitate maintenance access.

CC-9: Edy Road Stormwater Facility

Project Location

SW Edy Road - north side of Edy Road on east side of Cedar Creek.

Project Need

Runoff from existing residential area around Houston Drive as well as SW Edy Road right-of-way is not directed to a water quality facility before discharge to Cedar Creek.

Project Description

Provide water quality facility for Edy Road and upstream residential area when Edy Road is improved, and/or nearby land outside City limits is brought into the City and developed. It is assumed an extended dry basin can be constructed in conjunction with adjacent land development.

CC-10: Saint Charles (North) Stormwater Facility

Project Location

On Saint Charles Way approximately 1,000 feet north of SW Sunset Boulevard.

Project Need

Runoff from existing residential area is currently not directed to a water quality facility before discharge to Cedar Creek.

Project Description

Construct a proprietary treatment system in pre-cast manhole or vault to provide removal of TSS and total phosphorus from runoff from older residential area. Facility may be constructed within right-of-way to facilitate maintenance access.

CC-11: Saint Charles (South) Stormwater Facility

Project Location

On Saint Charles Way approximately 300 feet north of SW Sunset Boulevard.

Project Need

Runoff from existing residential area is currently not directed to a water quality facility before discharge to Cedar Creek.

Project Description

Similar to Project CC-10. Construct a proprietary treatment system in pre-cast manhole or vault to provide removal of TSS and total phosphorus from runoff from older residential area. Facility may be constructed within right-of-way to facilitate maintenance access.

CC-12: Area 59 Regional Stormwater Facility

Project Location

South side of Edy Road, east of Cedar Creek, and northeast end of Area 59.

Project Need

Provide regional stormwater facility for impervious surfaces created as part of development of Area 59 future urban services area. Project would allow consolidation of stormwater facilities required at time of development into one single facility at the point of discharge into an unnamed tributary of Cedar Creek.

Project Description

Similar to Project CH-1. Construct a combined stormwater quality and quantity facility for stormwater runoff from the easterly portion of Area 59. The facility would handle stormwater from Cedar Creek drainage basin only.

CC-13: Upper Ladd Hill Regional Stormwater Facility

Project Location

North boundary of Area 54-55 (Brookman Study Area), along the east bank of Cedar Creek.

Project Need

Provide a regional stormwater facility for impervious surfaces created as part of development of Area 54-55 future urban services area. Project would allow consolidation of stormwater facilities required at time of development into one single facility.

Project Description

Construct a combined regional water quality and detention facility for runoff from future development area and improved Ladd Hill and Brookman Road rights-of-way. Facility would discharge directly to Cedar Creek system. The facility is assumed to be an extended dry basin, designed to CWS standards. If desired by the City or CWS, the facility may also

include water quantity control (detention) to reduce impacts to existing downstream culverts and sensitive riparian areas.

CC-14: Brookman Addition Regional Stormwater Facility

Project Location

North boundary of Area 54-55 (Brookman Study Area), just east of railroad tracks.

Project Need

Provide detention facility where future storm drainage lines will connect to existing public storm drainage system in SW Cobble Court.

Project Description

Construct a combined regional water quality and detention facility for future development area, where new storm drainage facilities will connect to existing public storm drainage system in SW Cobble Court. Project would allow consolidation of stormwater facilities required at time of development into one single facility. The facility is assumed to be an extended dry basin, designed to CWS standards, with additional volume to reduce peak runoff rates sufficiently to minimize impacts to existing downstream stormwater facilities.

CC-15: Pinehurst Culvert

Project Location

Crossing Pinehurst Drive, north of Fitch Drive.

Project Need and Description

This culvert was identified by CWS as a priority culvert in the Healthy Streams Plan. The culvert is a fish barrier but also has capacity issues. Improvements will be limited to improving fish passage.

CC-16: Washington Street Culvert

Project Location

Crossing Washington Street, north of Stella Olsen Park.

Project Need and Description

This culvert was identified by CWS as a priority culvert in the Healthy Steams Plan. Evaluation of the existing culvert identifies it to be both a barrier to fish and to have severe

capacity issues. Improvements will include conveyance improvements to meet an ultimate 100-year storm event, stream simulation design for fish passage, and wildlife passage.

CC-17: West Brookman Road Stormwater Facility

Project Location

Between Old Highway 99W and Middleton Road, north of the railroad tracks.

Project Need

Provide regional stormwater facility for impervious surfaces created as part of development of Area 54-55 future urban services area. Project would allow consolidation of stormwater facilities required at time of development into one single facility.

Project Description

Construct a combined regional water quality and detention facility for runoff from future development area and improved rights-of-way. Facility would discharge directly to Cedar Creek system. The facility is assumed to be an extended dry basin, designed to CWS standards. If desired by the City or CWS, the facility may also include water quantity control (detention) to reduce impacts to existing downstream culverts and sensitive riparian areas.

RC-1: Murdock Road Regional Stormwater Facility

Project Location

East side of Murdock Road, approximately 800 feet south of intersection with Oregon Street.

Project Need

Runoff from portions of upstream residential area around Murdock Road (downstream of the existing Murdock Park water quality facility) is currently not treated prior to discharge to Rock Creek.

Project Description

Construct a water quality and retention/detention facility on City-owned land surrounded by National Wildlife Refuge. Facility would provide reduction of peak runoff rates, provide removal of TSS and total phosphorus, and allow maintenance activity to ensure long-term viability of facility. Depending on site conditions, a water quality wetland or vegetated swale may be most appropriate. Construct facility in off-line configuration with peak flow bypassing to minimize potential for re-suspension of sediments during large storm events.

RC-2: Oregon Street Regional Stormwater Facility

Project Location

North side of NE Oregon Street, approximately 500 feet west of intersection with Murdock Road.

Project Need

Runoff from older residential area south of Oregon Street is currently not treated in a maintainable water quality facility before discharge to Rock Creek.

Project Description

Construct water quality facility to provide TSS and total phosphorus removal. Depending on site conditions, an extended dry basin or vegetated swale may be appropriate. Construct facility in off-line configuration with high flow bypassing to minimize potential for re-suspension of pollutants during large storm events.

RC-3: Lower Rock Creek Regional Stormwater Facility

Project Location:

North side of SW Tualatin-Sherwood Road, just east of Rock Creek culvert crossing.

Project Need

Runoff from some adjacent industrial developments and Tualatin-Sherwood Road right-of-way is not currently treated in a maintainable water quality facility before discharge to Rock Creek.

Project Description

Construct water quality facility to provide TSS and total phosphorus removal. Depending on site conditions, an extended dry basin or vegetated swale may be appropriate. Construct facility in off-line configuration with high flow bypassing to minimize potential for re-suspension of pollutants during large storm events.

RC-4: Tonquin Road Stormwater Facility

Project Location

North side of NE Oregon Street at Tonquin Road junction, along east bank of Rock Creek.

Project Need

Runoff from portion of Oregon Street right-of-way does not run through water quality facility before discharge to Rock Creek.

Project Description

Construct water quality facility to provide TSS and total phosphorus removal. Depending on site conditions, extended dry basin or vegetated swale may be appropriate. Construct facility in off-line configuration with high flow bypassing to minimize potential for re-suspension of pollutants during large storm events.

RC-5: Tonquin Road (South) Stormwater Facility

Project Location

South of Oregon Street and East of Tonquin Road, on a tributary to Rock Creek.

Project Need

Provide regional stormwater facility for impervious surfaces created as part of development of the future urban services area within the Rock Creek drainage basin, east of Oregon east of Oregon Street and north of Tonquin Road. This area is anticipated to develop as primarily industrial use land. Project would allow consolidation of stormwater facilities required at time of development into one single facility at the point of discharge into a tributary of Rock Creek near the Refuge.

Project Description

Construct a combined stormwater quality facility for stormwater runoff. The facility is assumed to be an extended dry basin, designed to CWS standards. If desired by the City or CWS, the facility may also include water quantity control (detention) to reduce impacts to existing downstream culverts and sensitive riparian areas.

RC-6: Murdock Road (South) Stormwater Facility

Project Location

East of Murdock Road, north of SE. Roy Road.

Project Need

Provide detention facility where future storm drainage lines will connect to existing public storm drainage system in Murdock Road.

Project Description

Construct a combined regional water quality and detention facility for future development area, where new storm drainage facilities will connect to existing public storm drainage system in Murdock Road. The future development is anticipated to consist mainly of very low density residential property. Project would allow consolidation of stormwater facilities required at time of development into one single facility. The facility is assumed to be an extended dry basin, designed to CWS standards, with additional volume to reduce peak runoff rates sufficiently to minimize impacts to existing downstream stormwater facilities.

HC-1: Hedges Creek Stormwater Facility

Project Need

Provide regional stormwater facility for impervious surfaces created as part of development of future urban services area within Hedges Creek drainage basin. Project would allow consolidation of stormwater facilities required at time of development into one single facility at the point of discharge into a tributary of Hedges Creek.

Project Description

Construct a combined stormwater quality facility for stormwater runoff. The facility is assumed to be an extended dry basin, designed to CWS standards. If desired by the City or CWS, the facility may also include water quantity control (detention) to reduce impacts to existing downstream culverts and sensitive riparian areas.

CL-1: Coffee Lake Creek Stormwater Facility

Project Need

Provide regional stormwater facility for impervious surfaces created as part of development of future urban services area within Coffee Lake Creek drainage basin. Project would allow consolidation of stormwater facilities required at time of development into one single facility at the point of discharge into Coffee Lake Creek.

Project Description

Construct a combined stormwater quality facility for stormwater runoff. The facility is assumed to be an extended dry basin, designed to CWS standards. If desired by the City or CWS, the facility may also include water quantity control (detention) to reduce impacts to existing downstream culverts and sensitive riparian areas.

SECTION 8
FINANCIAL EVALUATION

Introduction

The purpose of the financial evaluation is to provide reasonable assurance that the City's Stormwater Fund has and will have the financial ability to maintain and operate the stormwater system on an ongoing basis, plus have the capacity to obtain sufficient funds to construct the stormwater system improvements identified in Section 7.

In completing the financial evaluation, the historical financial performance of the Stormwater Fund was documented; capital funding options available for stormwater system projects were identified; a capital funding strategy for the Capital improvement Program (CIP) was developed; and revenue requirements and customer impacts considering the "total system" costs of providing stormwater service, operating and capital, were determined. The evaluation includes the following elements:

- ***Historical Financial Performance***
    - Comparative statements of revenue and expenses fiscal year (FY) 2002/03 to 2005/06
    - Comparative balance sheets FY 2002/03 to 2005/06
    - Debt service schedules
- ***Funding Sources***
- ***Fiscal Policies***
- ***Capital Financing Plan***
    - Six-year CIP with revenue sources FY 2007/08 to 2012/13
    - Total stormwater system projects with revenue sources FY 2007/08 to 2026/27
- ***Projected Financial Performance***
    - Revenue requirement forecast FY 2006/07 to 2012/13 (one actual year and the 6-year CIP)
- ***Current Rate Structure, Rate Forecast and Affordability Test***

Historical Financial Performance

The City of Sherwood provides stormwater collection and conveyance services. Clean Water Services (CWS) provides regional transmission/treatment services.

The financial statements presented below show the historical financial performance of the Stormwater Fund. Net income has declined over the last few years, with the Fund experiencing a net operating loss in FY 2005/06 (including depreciation expense). A comprehensive rate study is currently underway that will address rate levels necessary to fund depreciation expense in addition to meeting ongoing operating and capital costs, as well as maintaining appropriate levels of cash reserves.

Comparative Statements of Revenues, Expenses and Fund Equity

Table 8-1 summarizes the Statement of Revenues, Expenses and Fund Equity for the Stormwater Fund from FY 2002/03 through 2005/06.

Table 8-1
Statements of Revenues, Expenses and Fund Equity

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Operating revenues						
Charges for services:						
Utility charges for services			$ 417,477	$ 434,955	$ 456,442	$ 541,097
Other charges for services						
Infrastructure development fees:						
System development charges			178,121	355,642	277,129	140,705
System development credits						
Utility connection fees			25,552	32,671	37,954	25,548
Utility Meters and Connections						
Other revenue						
Total operating revenues			621,150	823,268	771,525	707,350
Operating Expenses						
Materials and Services:						
Professional and technical services			179,813	230,926	215,584	217,273
Facility and equipment			4,946	5,361	5,574	11,993
Other purchased services			33	365	23,425	31,737
Supplies			8,884	9,355	5,985	20,697
Minor equipment purchases			-	2,753	1,203	3,133
Other materials and services			-			
Reimbursements			139,317	199,402	236,777	314,549
Contracted Services						
Other						
Depreciation			132,563	133,057	143,558	143,558
Total operating expenses			465,556	581,219	632,106	742,940
Operating income (loss)			155,594	242,049	139,419	(35,590)
Nonoperating revenue (expenses):						
Interest revenue			44,221	36,654	69,325	113,179
Interest expense			(17,404)	(13,299)	(16,080)	(11,159)
Payment for debt service			(22,772)	(31,736)	(33,220)	(34,784)
Total nonoperating revenue			4,045	(8,381)	20,025	67,236
Income before contributions			159,639	233,668	159,444	31,646
Capital contribution-private developers				1,030,044	1,872	
Reclass capital assets between funds				(26)		
Transfers from other funds						
Transfers to other funds						(247,713)
Prior period adjustment			12,073,101			
Net Assets - beginning			2,569,133	14,801,873	16,065,559	16,226,875
Net Assets- ending			$ 14,801,873	$ 16,065,559	$ 16,226,875	$ 16,010,808

Comparative Balance Sheets

Table 8-2 presents the Balance Sheet for the Stormwater Fund from FY 2002/03 through 2005/06.

Table 8-2
Balance Sheet

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
ASSETS						
Current Assets:						
Cash and cash equivalents			$ 2,769,012	$ 3,139,404	$ 3,430,286	$ 3,055,913
Receivables			21,944	21,393	26,017	30,754
Advances to other funds						300,000
Total current assets			2,790,956	3,160,797	3,456,303	3,386,667
Noncurrent assets:						
Advances from other funds						
Capital assets:						
Land			13,718	14,968	14,968	14,968
Infrastructure			13,256,307	14,355,787	14,355,787	14,355,787
Buildings and improvements						-
Machinery and equipment			26			-
Licensed vehicles						-
Construction work in progress			66,143			
Less accumulated depreciation			(1,315,769)	(1,448,825)	(1,592,383)	(1,735,941)
Total noncurrent assets			12,020,425	12,921,930	12,778,372	12,634,814
Total assets			$ 14,811,381	$ 16,082,727	$ 16,234,675	$ 16,021,481
LIABILITIES AND FUND EQUITY						
Current liabilities:						
Accounts payable			$ 5,050	$ 15,297	$ 6,120	$ 10,673
Other current liabilities			4,458	1,871	1,680	-
Total current liabilities			9,508	17,168	7,800	10,673
Noncurrent liabilities:						
Other noncurrent liabilities						-
Total liabilities			9,508	17,168	7,800	10,673
Fund equity:						
Invested in capital assets			12,020,425	12,921,930	12,778,372	12,634,814
Restricted for Capital Projects			-		3,168,400	
Unrestricted			2,781,448	3,143,629	280,103	3,375,994
Total fund equity			14,801,873	16,065,559	16,226,875	16,010,808
Total liabilities and fund equity			$ 14,811,381	$ 16,082,727	$ 16,234,675	$ 16,021,481

Existing Debt

The City currently has only one outstanding debt obligation for the Stormwater Fund – a Public Works & Fieldhouse loan obtained in 2002 with Bank of America. The Stormwater Fund's share of this debt obligation is 20 percent. Table 8-3 shows the Stormwater Fund's share of the outstanding debt service schedule for this loan.

Table 8-3
Debt Repayment

Type	Loan
Purpose	2002 Public Works faciltiy & fieldhouse
Original principal	$1,900,000
Payee	Bank of America
	Stormwater Fund Share 20%

Payment date		Beginning balance	Principal	Interest	Ending balance
Nov	2002	380,000	7,536	4,370	372,464
Feb	2007	239,405	9,152	2,753	230,253
May	2007	230,253	9,258	2,648	220,995
Aug	2007	220,995	9,364	2,541	211,631
Nov	2007	211,631	9,472	2,434	202,159
Feb	2008	202,159	9,581	2,325	192,579
May	2008	192,579	9,691	2,215	182,888
Aug	2008	182,888	9,802	2,103	173,086
Nov	2008	173,086	9,915	1,990	163,171
Feb	2009	163,171	10,029	1,876	153,142
May	2009	153,142	10,144	1,761	142,997
Aug	2009	142,997	10,261	1,644	132,736
Nov	2009	132,736	10,379	1,526	122,357
Feb	2010	122,357	10,498	1,407	111,859
May	2010	111,859	10,619	1,286	101,240
Aug	2010	101,240	10,741	1,164	90,498
Nov	2010	90,498	10,865	1,041	79,633
Feb	2011	79,633	10,990	916	68,644
May	2011	68,644	11,116	789	57,528
Aug	2011	57,528	11,244	662	46,284
Nov	2011	46,284	11,373	532	34,911
Feb	2012	34,911	11,504	401	23,406
May	2012	23,406	11,636	269	11,770
Aug	2012	11,770	11,770	135	(0)

Funding Sources

The City may fund the stormwater capital program from a variety of sources. In general, these sources can be summarized as: 1) governmental grant and loan programs; 2) publicly issued debt (tax-exempt or taxable); and 3) cash resources and revenues. These sources are described below.

Government Programs

Special Public Works Fund

The Special Public Works Fund program provides funding for the infrastructure that supports

job creation in Oregon. Loans and grants are made to eligible public entities for the purpose of studying, designing and building public infrastructure that leads to job creation or retention.

In 2003 the rules for the Special Public Works Fund (Division 42) underwent a dramatic revision. The rules are now broken out into five (5) major divisions:

- Infrastructure (e.g., public infrastructure needed to support job creation)
- Community Facilities (e.g., publicly owned facilities that support the local economy)
- Essential Community Facilities Emergency Projects (e.g., city halls, community centers)
- Railroads

Storm drainage systems are listed among the eligible infrastructure projects to receive funding. The Special Public Works Fund is comprehensive in terms of the types of project costs that can be financed. As well as actual construction, eligible project costs can include costs incurred in conducting feasibility and other preliminary studies and for design and construction engineering. The Fund is primarily a loan program. Grants can be awarded, up to the program limits, based on job creation or on a financial analysis of the applicant's capacity for carrying debt financing. The total loan amount per project cannot exceed $15 million. The department is able to offer very attractive interest rates that typically reflect low market rates for very good quality creditors. In addition, the department absorbs the associated costs of debt issuance thereby saving applicants even more on the overall cost of borrowing. Loans are generally made for 20-year terms, but can be extended to 25 years under special circumstances.

Water/Wastewater Fund

The Water/Wastewater Fund was created by the Oregon State Legislature in 1993. It was initially capitalized with lottery funds appropriated each biennium and with the sale of state revenue bonds since 1999. The purpose of the program is to provide financing for the design and construction of public infrastructure needed to ensure compliance with the Safe Drinking Water Act or the Clean Water Act.

Eligible activities include reasonable costs for construction improvement or expansion of drinking water, wastewater or storm drainage systems. To be eligible a system must have received, or is likely to soon receive, a Notice of Non-Compliance by the appropriate regulatory agency, associated with the Safe Drinking Water Act or the Clean Water Act. Projects also must meet other state or federal water quality statutes and standards. Criteria include projects that are necessary to ensure that municipal water, storm drainage and wastewater systems comply with the Safe Drinking Water Act or the Clean Water Act. In addition, other limitations apply:

- The project must be consistent with the acknowledged local comprehensive plan.

- The municipality will require the installation of meters on all new service connections to any distribution lines that may be included in the project.
- Recipient shall certify that a registered professional engineer will be responsible for the design and construction of the project.

The Fund provides both loans and grants, but it is primarily a loan program. The loan/grant amounts are determined by a financial analysis of the applicant's ability to afford a loan (debt capacity, repayment sources and other factors). The Program's guidelines, project administration, loan terms and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less. The maximum loan amount is $15 million per project through a combination of direct and/or bond funded loans. Loans are generally repaid with utility revenues or voter approved bond issues. A limited tax general obligation pledge may also be required. "Credit worthy" borrowers may be funded through sale of state revenue bonds.

Public Debt

Revenue Bonds

Revenue bonds are commonly used to fund utility capital improvements. The debt is secured by the revenues of the issuing utility and the debt obligation does not extend to other City resources. With this limited commitment, revenue bonds typically require security conditions related to the maintenance of dedicated reserves (a bond reserve) and financial performance measures (added bond debt service coverage). In order to qualify to sell revenue bonds, the City must show that the net revenue (less operating and maintenance expense) for the Stormwater Fund (or on a combined basis with other enterprise funds, if applicable) is equal to or greater than a factor, typically 1.2 to 1.4, times the annual revenue bond debt service. This factor is commonly referred to as the coverage factor, and is applicable to revenue bonds sold on the commercial market. There is no bonding limit, except perhaps the practical limit of the utility's ability to generate sufficient revenue to repay the debt and meet other security conditions. In some cases, poor credit might make issuing bonds problematic.

Revenue bonds incur relatively higher interest rates than government programs, but due to the highly competitive nature of the low-interest government loans, revenue bonds are assumed to be a more reliable source of funding. To be conservative, the analyses presented herein assume that capital projects above the amount available from cash reserves will be funded with revenue bonds. However, the City should pursue the low-interest loans for eligible capital projects.

Stormwater Fund Cash Resources and Revenues

Stormwater Fund financial resources available for capital funding include rate funding, cash reserves, and system development charges.

- *Rate Funding* -- As part of the rate study in progress, a policy to fund depreciation expense through rates will be established. The annual funding level will be available to help fund future system replacement projects.

- *Capital Cash Reserves* -- Cash reserves are comprised of previously collected system development charge revenues, transfers of operating revenues in excess of requirements and interest earnings on capital cash reserves. The Stormwater Fund does not currently have available capital cash reserves to help fund the capital program.

- *System Development Charges* -- The City imposes a system development charge (SDC) on all new connections to the stormwater system. The current SDC is $0.031 per square foot of impervious surface and is intended to recover a fair share of collection and conveyance system infrastructure from new connections. CWS imposes an additional SDC of $500 per residential equivalent to recover transmission/treatment related infrastructure. The City's SDC will be updated as part of the rate study process to reflect current and planned eligible system infrastructure. The regional charge is expected to remain the same. The capital projects included in this Plan include only the City's collection/conveyance projects; thus, only the City's SDC is assumed to be available to help fund these projects. The regional charge is assumed to fund the City's share of eligible CWS projects (not included in this Plan).

Fiscal Policies

Critical to the long-term financial health and performance of the Stormwater Fund is the development of sound fiscal policies to guide financial performance. The key policies incorporated into this financial evaluation include:

- Minimum operating fund balance equal to 30 to 45 days of annual operating and maintenance (O&M) expense. Year-end cash balances in excess of 45 days to be transferred to the capital fund to help pay for capital projects.
- Capital contingency reserve equal to at least 1 percent of system assets.
- System reinvestment funding through rates, using depreciation expense as the benchmark for the appropriate level of funding. The annual contribution is based on "net depreciation funding" from rates, which equals the annual depreciation expense less annual principal payments. This benchmark is roughly equivalent to "break-even" performance from a balance sheet perspective. This policy is assumed to begin in FY 2008/09.

Capital Financing Plan

The capital financing plan evaluates planned capital costs and available resources to determine whether additional funding will be required from rates, either to pay for new debt

service or to directly fund the capital projects.

Table 8-4 summarizes the 6-year capital funding strategy. Total capital costs from FY 2007/08 through FY 2012/13 equal $4.8 million in current dollars. Costs have been escalated annually at 4.0 percent for a total cost of $5.4 million.

Table 8-4
6-year Capital Funding Strategy

Capital Financing 2007/08-2012/13	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	Total
Capital Projects	$ 908,960	$ 945,318	$ 983,131	$ 1,022,456	$ 1,063,355	$ 514,985	$ 5,438,205
Funding Sources							
Capital Fund Balance	$ -	$ -	$ -	$ 26,734	$ 98,487	$ 54,052	$ 179,273
Revenue Bond Proceeds	908,960	945,318	983,131	995,723	964,868	460,932	5,258,932
Total Funding Sources	$ 908,960	$ 945,318	$ 983,131	$ 1,022,456	$ 1,063,355	$ 514,985	$ 5,438,205
Revenue Bond Issued	$ 1,018,083	$ 1,058,806	$ 1,101,158	$ 1,115,262	$ 1,080,702	$ 516,268	$ 5,890,279

Table 8-5 shows the total capital projects from FY 2007/08 through FY 2026/27 and the anticipated funding sources. Capital projects over this planning horizon total $9.0 million in current dollars and $12.5 million escalated.

Table 8-5
20-year Capital Funding Strategy

Capital Financing 2007/08 through 2026/27	Total
Capital Projects	$ 12,508,844
Funding Sources	
Capital Fund Balance	$ 458,343
Revenue Bond Proceeds	12,050,501
Total Funding Sources	$ 12,508,844

Roughly 3 percent of both the 6-year and the 20-year capital programs are forecasted to be funded with cash reserves. The remaining 97 percent is forecasted to be funded with revenue bonds.

Projected Financial Performance

The FY 2007/08 Stormwater Fund operating budget forms the baseline for forecasting future operating costs and estimating the impacts of recommended stormwater system capital improvements.

Revenue Requirement Analysis

The revenue requirement analysis determines the amount of rate revenue needed in a given year to meet that year's expected financial obligations. Two separate conditions must be satisfied for each year of the analysis period in order for rates to be sufficient. Annual cash needs must be met, and the minimum revenue bond debt service coverage requirement (if any) must be realized.

The cash flow test identifies cash requirements for the Stormwater Fund in the year addressed. Those requirements can include cash operating and maintenance expenses, debt service, directly funded capital outlays, capital transfers, and any forecasted additions to reserves. The total cash needs are then compared to forecasted utility revenues. Any projected shortfalls are identified and the level of rate increase necessary to make up the shortfall is estimated.

The coverage test is based on bond covenants applicable to outstanding revenue bonds, which require that a specific test of revenue sufficiency be met. This requirement typically stipulates that annual revenues must be sufficient to meet operating expenses plus a factor multiplied times annual debt service on all revenue bond debt issued. The City does not currently have any revenue bonds outstanding. This analysis assumes a coverage factor of 1.25 on all future revenue bond issues, excluding SDC revenues.

A number of forecast assumptions are used in the analysis:

- Rate revenue (under existing rate levels) is calculated to increase with growth in future years, which is projected to average 3.72 percent per year (consistent with those used in this Plan for facility planning purposes).
- O&M expenses are escalated assuming general inflation of 3.0 percent per year and labor inflation of 5.0 percent per year. CWS treatment costs are planned to increase in proportion to growth plus general inflation.
- In addition to O&M expenses, the revenue requirement includes debt service costs and rate-funded system reinvestment (depreciation) funding.
- Revenue bond debt financing terms include a 20-year repayment term, 5.0 percent interest cost and 2.0 percent issuance cost.

Table 8-6 summarizes the financial performance and rate requirements for FY 2006/07 through FY 2012/13. The City's existing rates are not adequate to support the needs of the

Stormwater Fund over the study period. Cash reserves are planned to cover the FY 2006/07 annual shortfall. A 100 percent increase is needed to meet FY 2007/08 expenditures. This increase is proposed for a September 1, 2007 implementation date. Additional annual increases, as shown in the table, are needed in each of the remaining years to meet annual obligations.

Table 8-6
Revenue Requirements

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Revenue							
Rate revenue under existing rates	$ 528,192	$ 547,866	$ 568,272	$ 589,438	$ 607,885	$ 626,908	$ 646,527
Use of SDCs for debt service	8,175	8,479	8,795	-	-	-	-
Non-rate revenue	12,076	10,307	6,130	10,790	15,662	20,721	25,852
Total annual revenue	$ 548,444	$ 566,652	$ 583,197	$ 600,229	$ 623,547	$ 647,629	$ 672,379
Materials and Services							
Professional & technical	$ 226,650	$ 248,004	$ 257,241	$ 274,827	$ 291,931	$ 310,099	$ 329,397
Facility & equipment	10,500	11,706	12,057	12,419	12,791	13,175	13,570
Other purchased services	27,801	34,400	35,432	36,495	37,590	38,718	39,879
Supplies	20,500	22,104	22,767	23,450	24,154	24,878	25,625
Minor Equipment	500	44,500	45,835	47,210	48,626	50,085	51,588
Non-Capitalized Vehicles	-	28,000	28,840	29,705	30,596	31,514	32,460
Reimbursements	303,638	381,979	401,078	421,132	442,188	464,298	487,513
	$ 589,589	$ 770,693	$ 803,251	$ 845,238	$ 887,877	$ 932,767	$ 980,032
Other Expenditures							
Debt Service	$ 47,622	$ 47,622	$ 136,383	$ 228,695	$ 324,699	$ 410,027	$ 468,531
Rate-Funded System Reinvestment	-	-	112,154	99,463	84,491	79,760	87,951
Transfers Out (shared capital)	10,000	157,500	50,000	51,500	53,045	54,636	56,275
Additions to meet minimum fund balance	-	-	-	-	-	-	-
	$ 57,622	$ 205,122	$ 298,537	$ 379,657	$ 462,234	$ 544,423	$ 612,757
Replenish Negative Capital Fund	$ -	$ 309,709	$ 139,237	$ -	$ -	$ -	$ -
Total annual rate-funded expenditures	$ 647,211	$ 1,285,524	$ 1,241,025	$ 1,224,896	$ 1,350,111	$ 1,477,190	$ 1,592,788
Annual Surplus (Deficiency)	$ (98,767)	$ (718,872)	$ (657,828)	$ (624,667)	$ (726,564)	$ (829,561)	$ (920,409)
Annual Rate Increase	**0.00%**	**100.00%**	**10.00%**	**4.00%**	**2.00%**	**2.00%**	**2.00%**
Cumulative Rate Increase	**0.00%**	**100.00%**	**120.00%**	**128.80%**	**133.38%**	**138.04%**	**142.80%**

Table 8-7 summarizes the rate forecast and impact to the typical residential monthly bill.

Table 8-7
Current Rates Projected with Across-the-Board Increases

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Rate Increase	**0.00%**	**100.00%**	**10.00%**	**4.00%**	**2.00%**	**2.00%**	**2.00%**
Fixed Charge - per Month							
	$4.68	$9.36	$10.30	$10.71	$10.92	$11.14	$11.36
Monthly Bill							
	$4.68	$9.36	$10.30	$10.71	$10.92	$11.14	$11.36

Affordability Test

A median household income index analysis is one way to gauge rate level affordability. To complete the test, residential stormwater bills are compared to 1.5 percent of median household income for the period of analysis. This analysis provides an indication of a residential customer's ability to pay the existing and forecasted rates. If rates exceed 1.5 percent of the median household income in any of the years, it suggests the system's rates might not be affordable.

The 2000 Census data shows that the median household income for the City of Sherwood in 1999 was $62,518. This amount inflated at historical and projected inflation rates (Portland-Salem CPI Urban Wage Earners and Clerical Workers) is equivalent to about $74,000 in 2007 and $83,000 in 2012. One and a half percent of these amounts are about $1,108 annually for 2007 and $1,242 annually for 2012, or a maximum monthly stormwater bill of $92 in 2007 and $104 in 2013.

The residential stormwater charge is currently $4.38 per month. It is forecast to increase to $11.36/month by FY 2012/13 and to $15.59 by FY 2026/27. These rates remain well within the 1.5 percent median household income affordability index for utility bills.

Summary

This section presented a financial evaluation of the capital funding needs of the recommendations presented in Section 7. The analysis found that rate increases were needed to meet ongoing operating and capital funding needs. This analysis does not include evaluation of the financial impacts of shared CWS capital projects.

INTERGOVERNMENTAL AGREEMENT
BETWEEN CITY OF SHERWOOD AND
CLEAN WATER SERVICES

THIS AGREEMENT is made and entered into as of the 4th day of January, 2005, between the **City of Sherwood** a municipal corporation of the State of Oregon, hereinafter referred to as "City," and **Clean Water Services**, formerly Unified Sewerage Agency, a municipal corporation and county service district, hereinafter referred to as the "District."

WHEREAS the City has authority to operate and maintain sewerage and surface water management systems as provided for under its charter, relevant laws, rules and the Agreement. The City performs a variety of functions critical to the operation, maintenance and management of sewerage and surface water management facilities as outlined in the Agreement. It is anticipated that this Agreement may periodically require updating or modification by agreement of the parties; and

WHEREAS as a county service district organized under ORS 451, the District has the legal authority for the sanitary sewerage and storm water (surface water) management programs within its boundaries consistent with relevant laws, rules and agreements. The District performs watershed, sub-basin and facility planning, develops standards and work programs, is the permit holder, and operates and maintains wastewater treatment facilities, surface water collection system and sanitary sewer systems within unincorporated areas and within certain cities within its boundaries. The District also performs various ancillary functions throughout the basin and within various cities; and

WHEREAS in 1970, City, by action of its Council pursuant to an election duly conducted within the boundaries of the District, agreed to be within such sanitary sewer district; and

WHEREAS in 1989, City consented by action of its Council to have District manage storm and surface water drainage within the District's boundary, including those portions of the system within the City, and consented to the petition to the Portland Metropolitan Area Boundary Commission (Boundary Commission) to expand District's authority to include storm and surface water drainage management, which was granted by the Boundary Commission; and

WHEREAS District and Washington County Cities have enjoyed a strong and effective partnership over more than three decades since District's formation. This partnership has greatly enhanced protection of public health and the environment and has been the foundation of enormous economic growth. Collaboration built through communication must remain as its cornerstone. Accordingly, the District and the City commit to cooperatively and openly engage each other in the timely discussion of topics of interest to the other party. A variety of forums and means will be employed to

promote the above such as the Washington County Managers meetings, the City/District Technical Committee as well as ongoing individual communications.; and

WHEREAS, City and District have the authority to enter into contracts for the cooperative operation of service facilities under ORS 451.560 and ORS Chapter 190; and

WHEREAS, City and District previously entered into an Agreement for the cooperative operation of sanitary sewer and surface water facilities, and said Agreement is in need of amendment.

NOW, THEREFORE, in consideration of the covenants and agreements to be kept and performed by the parties hereto, it is agreed as follows:

Section 1. Definition of Terms

Wherever the following terms are used in this agreement they shall have the following meaning unless otherwise specifically indicated by the context in which they appear:

A. Area of Geographic Responsibility means the area set forth in the map attached as Exhibit A as may be amended.

B. Board means the Board of Directors of the District, its governing body.

C. Chief Executive Officer means the City official responsible for managing the day-to-day business affairs of City.

D. Council means the City Council, governing body of City.

E. Industrial Waste means any liquid, gaseous, radioactive or solid waste substance or a combination thereof resulting from any process of industrial or manufacturing business, or from the development or recovery of natural resources. For the purposes of this agreement, Industrial Waste shall also include any substance regulated under 33 USC Sec 1317, together with regulations adopted thereunder.

F. Operation and Maintenance means the regular performance of work required to assure continued functioning of the storm and surface water system and the sanitary sewerage system and corrective measures taken to repair facilities to keep them in operating condition, and in compliance with the requirements of applicable laws, regulations, and permits.

G. Order means Resolutions, Orders and Directives of the District prescribing general standards and conditions for construction or use of the storm and surface water facilities and the sanitary sewerage facilities, and Rates and Charges.

H Person means the state of Oregon, any individual, public or private corporation, political subdivision, governmental agency, municipality, industry, co-partnership, association, firm, trust, estate or any other legal entity whatsoever.

I. Program Funding means the revenues made available to City through Section 4. of this agreement to follow the adopted work programs and performance standards.

J. Rates and Charges are defined in the District's "Rates and Charges" Resolution and Order (R&O) No. 01-34, or as may be amended. The following terms when used in this agreement shall be as defined in that R&O:

1. Dwelling Unit Equivalent (DUE)
2. Equivalent Service Unit (ESU)
3. Impervious Surface Area
4. Permit Application and Inspection
5. Sanitary Sewer Service Charge
6. Sanitary System Development Charge (SDC; Connection Charge)
7. Storm and Surface Water Service Charge
8. Storm and Surface Water System Development Charge

K. Sanitary Sewerage System means any combination of sewer treatment plant, pumping or lift facilities, sewer pipe, force mains, laterals, manholes, side sewers, laboratory facilities and equipment, and any other facilities for the collection, conveyance, treatment and disposal of sanitary sewage comprising the total publicly-owned Sanitary Sewerage System within District jurisdiction, to which storm, surface and ground waters are not intentionally admitted.

L. Standards means the standards and conditions of use of the storm and surface water system and the sanitary sewer system as specified and adopted by the District. Standards also shall mean applicable statutes and rules of the United States and the State of Oregon.

M. Storm and Surface Water System means any combination of publicly owned storm and surface water quality treatment facilities, pumping or lift facilities, storm drain pipes and culverts, open channels, creeks and rivers, force mains, laterals, manholes, catch basins and inlets, grates and covers, detention and retention facilities, laboratory facilities and equipment, and any other publicly owned facilities for the collection, conveyance, treatment and disposal of storm and surface water comprising the total publicly owned Storm and Surface Water System within District's jurisdiction, to which sanitary sewage flows are not intentionally admitted.

N. Work Program and Performance Standards are adopted by the District after considering input from the cities to define the activities required to operate and maintain the sanitary sewer and storm and surface water systems.

Section 2. Determination of Programs, Rules, Policies and Standards

The District is responsible for the management and operation of the sanitary sewer and storm and surface water systems within its boundary, and is the designated permittee who shall obtain and enforce timely compliance with relevant federal and delegated state Clean Water Act permits for treatment plants, collection systems, and stormwater. The District, after considering input from the cities, shall adopt orders, standards, specifications, work programs, and performance criteria for the proper and effective operation of the sanitary sewer and storm and surface water systems and to comply with state and federal permits, laws and regulations. In addition, the District, after considering input from the cities, shall have the authority to make changes to its orders, work programs and performance Standards. Any such changes to work programs and performance standards that the Board determines are required by state and/or federal permits or regulations will become effective 90 days from the date of notice to City by District or as mutually agreed to. Any changes to work programs and performance standards, not required by state and/or federal permits and regulations, shall be mutually agreed to by the District and City before they become effective. Proposed changes not required by state and/or federal permits and regulations should be communicated between the District and the City in or before September of the year before they are to be implemented to allow District and City to budget appropriately for the following fiscal year.

A. City agrees to follow and enforce the Orders, Standards, specifications, work programs, and performance criteria promulgated by the District, subject, however, to program funding and to the extent that City may be lawfully authorized to act. The City shall not be responsible for any failure to act or defect in performance caused by lack of adequate program funding, inadequacies in the Work Program and Performance Standards as adopted by the District, or lack of lawful authority to act. Lack of adequate funding from the District and compliance with the Work Program and Performance Standards as adopted by the District shall be absolute defenses to any claim against the City under this Agreement. City further agrees to notify District of apparent violations of the subject Orders, Standards, specifications, work programs, and performance criteria, of which it has knowledge, which may require District legal action or enforcement.

Section 3. Division of Responsibilities

A. Division of Responsibilities

1. The purpose of this agreement is to delegate to and contract with the City to perform specific functions. The responsibilities of the District and City are defined in this Section and Appendix A. Exhibit A is a map

showing boundaries of responsibility between the District and City and is hereby made a part of Appendix A and incorporated into this agreement.

2. All functions relating to the subject matter of this Agreement not specifically listed in this Section or Appendix A as being the responsibility of City shall remain the responsibility of the District.

B. Procedure for Modifying the Division of Responsibilities

1. Responsibilities defined in this Section and Appendix A may be modified from time to time with approval in writing by the City Manager or designee and the District General Manager or designee.

2. Responsibilities defined in this Section and Appendix A may be modified by the District Board after receiving input from the City and determining the change is necessary to comply with state or federal permits, laws or regulations. The District Board shall not reduce the total scope of City responsibilities without consent of the City unless there is a change in the program or funding requiring the reduction, or unless the Board determines the City has failed to correct identified instances of nonperformance related to the adopted standards that are necessary to comply with state or federal permits, laws or regulations.

3. Upon reasonable notice from City to District, District shall assume responsibility for any portion of the program defined in this Section and Appendix A. Reasonable notice shall be at least six (6) months, unless agreed to in writing by the District and City. Corresponding adjustments to the revenue allocation shall be made to reflect the change in responsibility upon implementation of such changes. City shall be responsible for correcting or paying to have corrected any deficiencies in the system resulting from non-performance of the programs under its responsibility, subject, however, to funding availability.

4. The responsibilities defined in Appendix A and responsibility boundaries defined in Exhibit A are not changed due to City annexations of area currently inside the District's boundary. Provided that after formal adoption and subsequent consultation between the City and District, service area boundaries may be altered based on Senate Bill 122 boundary revisions. For annexations of territory not currently within the District's boundary, the District will amend Appendix A and Exhibit A to define the responsibilities for the new area in cooperation with the City and in cooperation with adjacent cities.

C. Additional City Responsibilities

1. Prior to issuing any non-residential sanitary sewer permit, City shall require the applicant to prepare and submit to City a District Sewer Use Information form. City shall submit the completed form to the District. The District will determine if an Industrial Waste Discharge Permit is required. The District will respond within 15 days.

2. Require persons who are proposing 'development', as defined in the District's Design and Construction Standards Resolution and Order, to obtain a Service Provider Letter from the District.

3. Following City review and initial approval, forward proposed construction drawings to the District for the following:

   a) Any addition, modification, construction, or reconstruction (other than repairs) of the publicly-owned sanitary sewerage system and storm and surface water system. District will review these drawings to assure conformance to adopted District standards, orders, and master plans.

   b) Any "development" as defined in the District's Design and Construction Standards Resolution and Order. District will review these drawings to assure conformance with the conditions of the Service Provider Letter issued following the provisions in Section 3.C.2.

   The District shall not charge a fee for these types of reviews. The City shall not approve or issue permits for such work until it receives notification of District approval. The District shall complete its reviews within 15 working days from its receipt of complete construction drawings from the City, otherwise the City may consider the drawings as being approved by the District.

4. The City may notify the District in writing that it wishes the District to issue Connection Permits for either or both of the sanitary or storm water systems. In such cases, the District shall not issue Connection Permits until the City indicates in writing that the development complies with the City's standards. City will collect all connection, permit, and development fees for developments within the City unless City and District agree that the District will collect the fees.

5. Other than for issuance of connection permits, obtain District review and approval prior to entering into any agreement for the use of the Storm and Surface Water System or the Sanitary Sewerage System.

6. Inform the District in writing not less than 30 days prior to initiating or entering into any agreement for the financing or incurring of

indebtedness relating to the storm and surface water system or the sanitary sewerage system. Revenues allocated by the District to the City for the performance of functions identified in Appendix A are considered restricted, and may only be used to perform those functions (including reasonable administration and security for bonds) delegated to the City for such things as operation and maintenance of the sanitary or storm and surface water system. City shall not obligate any assets or facilities of the District's sanitary or storm and surface water system for any debt. For purposes of debt funding, the District's asset schedule for storm and surface water and sanitary sewer facilities shall be the basis for determining ownership within City boundaries. In general, sanitary sewer lines 24" and over are the property of the District regardless of location, as are sanitary treatment plants and pump stations, and storm and surface water quality and quantity facilities that are one acre or greater in surface area.

7. Allow the District access at any reasonable time upon reasonable notice to inspect and test storm and surface water facilities and sewerage facilities within City and City Area of Geographic Responsibility.

8. Grant the District permits from time to time as may be necessary for the installation of storm and surface water facilities and sewerage facilities in the public streets and ways of City without imposing permit issuance fees, but only to the same extent as the City waives such fees for itself, and provided that the District shall adhere to any conditions required pursuant to ORS 451.550(6).

9. To issue no new permit for the construction within, or modification to, a wetland, floodway, or floodplain without first receiving the written approval by the District, pursuant to Section 5.D. This paragraph shall not apply to permits issued by City pursuant to a current permit under 33 USC Section 1344(e) (a section 404 general permit), and within the scope of such permit. This section does not apply to actions related to City flood insurance program. The City retains the responsibility to issue land use approvals and building permits.

10. To pursue, when City deems feasible and appropriate, the conversion of storm and surface water facilities from private to public ownership, through the acquisition of easements and other property rights as necessary, for those privately owned storm and surface water facilities which are identified as being necessary or appropriately a part of the public system.

11. To the extent that it is so required by law or regulation, City shall comply with Oregon Administrative Rules (OAR) Chapter 340, Division 49, "Regulations Pertaining to Certification of Wastewater System

Operator Personnel," including the obligation that City shall have its wastewater collection system supervised by one or more operators certified at a grade level equal to or higher than the system classification shown on page 1 of District's NPDES permit, issued by the State. The District shall notify City of any modification to the NPDES permits affecting their operations.

D. City Responsibilities Outside of its City Limits

1. Not withstanding the procedures in Section 3.B, City is not obligated by this agreement to accept responsibility for any programs or work activities outside of its City limits unless the City agrees to accept responsibilities outside of the City limits as set forth in Appendix A.

2. To the extent City has agreed to responsibilities both inside and outside of its City limits, for activities which are the responsibility of City, City shall perform the work to meet the minimum requirements specified in the District's adopted Work Programs and Performance Standards. When the same type of service is being performed by City both inside and outside City, the service shall be prioritized and performed in a like manner in each area, including the response to storms and other emergencies. The exception shall be if City provides a higher degree of service inside City due to its own supplemental funding.

Section 4. Determination and Division of Revenue; Operating Procedures and Rules Relating to Revenue

A. After consultation between City and District staff, the District Board shall determine and certify annually for both the sanitary sewerage system and for the storm and surface water system the monthly service charge and system development charge. The City agrees to impose these charges as a minimum. The City may impose additional charges as allowed in Section 4.E.4.

B. After consultation between City and District staff, the District Board shall determine and certify annually for both the sanitary sewerage system and for the storm and surface water system the portion of the monthly service charge and system development charge to be retained by the City for performance of the functions defined in this Agreement and for the City's share of annual debt service payment. Except as provided in Section 4.D, District shall notify City by the September preceding the start of the next Fiscal Year of any proposed decrease in the monthly service charge and system development charge to be retained by the City and any other proposed changes that could affect the City's 5-Year Sanitary Sewer or Stormwater Financial Forecast Plans..

C. The District Board shall not implement any significant change in the division of monthly service charge revenue from that shown in the Rates and Charges

Resolution and Order No. 01-34 effective Fiscal Year 2001/2002 until July 1, 2004 with the following exceptions:

1. The Board may make routine principal and interest adjustments for debt service repayment.

2. The Board may make adjustments in response to significant increases or decreases in program responsibilities

D. Changes in the division of revenue will typically be made as a part of the annual Fiscal Year budget process. However, the division of revenue may be adjusted by the District to recognize changes in responsibilities that occur outside the normal budget cycle after coordination and communication with the Cities. Any such mid-year changes in the division of revenue initiated by the District Board shall only be implemented when the Board determines such a change is necessary to comply with state or federal permits, laws or regulations. If there is a mid-year change in responsibilities, which the District determines to be significant, the District Board may, upon 60 days notice to City, adjust the division of revenue outside of the annual budget process

E. Operating Procedures Relating to Revenue

1. City shall remit to the District the portion of sanitary sewer service charges and systems development charges collected, and storm and surface water service charges and systems development charges collected, less the City Portion, as identified in Section 4.B.

2. Payments shall be remitted on a monthly basis, with a report on District designated forms.

3. Payments to the District of revenue collected by the billing party shall be due within 20 days following the end of each month, unless the payment has been appealed by the billing party.

4. City may charge and collect a service charge or system development charge at a higher rate per DUE and ESU than that set by the District when the City determines it is needed for the local City system. The City shall retain 100% of these additional revenues collected. Such additional charge shall be consistent with the services provided by City and with applicable federal rules in order to preserve eligibility for grants and other funding programs.

5. City may request District to perform permit and inspection services for private development construction of public storm and surface water facilities and sanitary sewer facilities, and for erosion control. City

shall remit to the District the fee set forth in District's Rates and Charges to compensate District for its costs for such services performed relative to these fees, as prescribed by District Order or separate agreement with City.

6. For Industrial Waste fees, District shall remit to City a percentage of system development charges, volume, and monthly service charges collected equal to the percentages of service charges retained by the City as defined in Section 4.B. District shall retain one hundred percent (100%) of the annual Industrial Waste permit fee, and any penalty fees, COD, SS (as those terms are defined in the Rates and Charges) and other fees related to Industrial Waste that may be assessed.

7. City will institute administrative procedures to diligently maintain regular billings and collection of fees, adjust complaints thereto, and pursue delinquency follow-ups and take reasonable steps for collection thereof.

8. City and District shall each establish separate accounts for the storm and surface water program and sanitary sewerage program for the purpose of accounting for service charges and systems development charges collected and received pursuant to this agreement.

9. District or City may at any reasonable time upon reasonable notice inspect and audit the books and records of the other with respect to matters within the purview of this Agreement.

10. City and District shall each prepare and submit to each other a performance report of the storm and surface water functions, and the sanitary sewer functions for which each is responsible. After consultation with the City, District will specify the requirements, frequency, and content of the performance report.

11. The City and District may, each at its own cost, install permanent and temporary volume and quality monitoring stations, and other monitoring equipment, to determine the effectiveness of City and District programs.

12. Interest may accrue on late monthly payments as specified in Section 4.E.1 at a rate of 1.25 times the monthly Local Government Investment Pool (LGIP) earnings rate as posted for the previous month, and will be applied each month to the unpaid balance.

Section 5. Administrative and Operating Provisions

A. The District will not extend sewer service to areas outside the City except with prior approval of the City where such areas are included in the Urban Planning Area Agreement between the City and the appropriate county or counties and any of the following exists:

1. A new or existing single family property desires sewer service and needs to directly connect to a sewer line within the city.

2. A new development desires sewer service and needs to directly connect a lateral or mainline public sewer directly to a sewer line within the city.

B. Each party shall obtain and maintain in full force and effect for the term of this agreement, at its own expense, comprehensive general liability and automobile insurance policies for bodily injury, including death, and property damage, including coverage for owned, hired or non-owned vehicles, as applicable, for the protection of the party, and the other party, its elected and appointed officials, officers, agents, employees and volunteers as additional insureds. The policies shall be primary policies, issued by a company authorized to do business in the State of Oregon and providing single limit general liability coverage of $2,000,000 and separate automobile coverage of $1,000,000 or the limit of liability contained in ORS 30.260 to 30.300, whichever is greater. If either party is unable to obtain insurance as required by this sentence, the parties shall cooperate on amending this Section to require types and levels of insurance that are available. The certificates shall provide that the other party will receive thirty (30) days' written notice of cancellation or material modification of the insurance contract at the address listed below. Each party shall provide certificates of insurance to the other party prior to the performance of any obligation under this agreement. If requested, complete copies of insurance policies shall be provided to the other party. Each party shall be financially responsible for their own deductibles, self-insurance retentions, self-insurance, or uninsured risks.

C. District will not establish local assessment districts within City, without first obtaining City approval.

D. District will process applications from City pursuant to Section 3.C.9 for Wetland, Floodplain, and Floodway modifications. Timely review of the application shall be provided by the District. Upon review and approval by District, and upon request by City, the District shall act as a facilitator and liaison for State and Federal review and permit processes.

E. The City shall report all sanitary sewer overflows that it becomes aware of to the District within 24 hours of learning of the overflow. The City shall require all permittees of the City to report sanitary sewer overflows to the City. City agrees to reimburse District for any expense, costs, damages,

claims, fines, or penalties incurred by District that result from or are related to City's failure to so timely and adequately report.

F. This agreement is for the benefit of the parties only. Each party agrees to indemnify and hold harmless the other party and its officers, employees, and agents, from and against all claims, demands and causes of actions and suits of any kind or nature for personal injury, death or damage to property or the environment on account of or rising out of the operation of this Agreement, including the performance or non-performance of duties under this Agreement, or in any way resulting from the negligent or wrongful acts or omissions of the indemnifying party and its officers, employees, and agents. In addition, each party shall be solely responsible for any contract claims, delay damages or similar items arising from or caused by the action or inaction of the party under this agreement. Inability to perform an activity or to properly perform because of insufficient funding from the District is not a negligent act or omission or willful misconduct of the party charged with the activity but shall be the responsibility of the District. Performance of any activity in compliance with the Work Program and Performance Standards as adopted by the District is not a negligent act or omission or willful misconduct.

G. District and City acknowledge that District may receive notices of violation or fines from state or federal agencies for violations of state or federal rules. As the permittee and the entity that establishes standards and controls payment, District shall be responsible for responding to notices of violations and for payment of all fines. District shall invite the City to participate in any discussions with state and federal agencies regarding notices of violation involving City actions or responsibility. City will cooperate with District in the investigation and response to any notice of violation involving actions relating to actions or responsibilities of the City. If a fine is imposed, City shall reimburse District to the extent that the fine results from non-performance of adopted programs or non-compliance with District, state, or federal rules or policies by the City and those acting on behalf of the City. If possible, the City shall reimburse the District prior to the date due for payment of the fine. The City shall not be responsible for reimbursement if the City's non-performance or non-compliance was caused by lack of adequate funding by District. If more than one party is responsible, the City's responsibility for reimbursement payment will be allocated based on the degree of responsibility and degree of fault of the City. Disputes over the amount of reimbursement shall be resolved by the dispute resolution process set out in Section 6 of this Agreement. To the extent that the City is required to perform any work to correct a violation, District shall provide adequate funding for the work to be performed, unless the violation was caused by the City's omission or misconduct.

H. Nothing in this Agreement shall be construed as a limitation upon or delegation of the statutory and home rule powers of City, nor as a delegation or limitation of the statutory powers of District. This Agreement shall not limit any right or remedy available to City or District against third parties arising from illegal acts of such third parties.

I. Where this Agreement calls for review or approval of a fee or charge, District shall perform such review in a timely manner, shall not unreasonably withhold approval, and shall provide its decision to City in writing. If, within 30 days of written request by City for approval by District, the District has failed to provide a written response, the request shall be deemed approved.

Section 6. Dispute Resolution; Remedies

A. In the event of a dispute between the parties regarding their respective rights and obligations pursuant to this Agreement, the parties shall first attempt to resolve the dispute by negotiation. If a dispute is not resolved by negotiation, the exclusive dispute resolution process to be utilized by the parties shall be as follows:

1. Step 1. Upon failure of those individuals designated by each party to negotiate on its behalf to reach an agreement or resolve a dispute, the nature of the dispute shall be put in writing and submitted to City's Chief Executive Officer and District's General Manager, who shall meet and attempt to resolve the issue. If the issue in dispute is resolved at this step, there shall be a written determination of such resolution, signed by City's Chief Executive Officer and District's General Manager, which determination shall be binding on the parties. Resolution of an issue at this step requires concurrence of both parties' representatives.

2. Step 2. In the event a dispute cannot be resolved at Step 1, the matters remaining in dispute after Step 1 shall be reduced to writing and forwarded to the Mayor and the Chairman of the Board of Directors. Upon receipt of the written issue statement, the Mayor and Chairman shall meet and attempt to resolve the issue. If the issue is resolved at this step, a written determination of such resolution shall be signed by the Mayor and Chairman. Resolution of an issue at this step requires concurrence of both the Mayor and the Chairman.

3. Step 3. In the event a dispute cannot be resolved at Step 2, the parties shall submit the matter to mediation. The parties shall attempt to agree on a mediator. In the event they cannot agree, the parties shall request a list of five (5) mediators from the American Arbitration Association, or such other entity or firm providing mediation services to which the parties may further agree. Unless the parties can

mutually agree to a mediator from the list provided, each party shall strike a name in turn, until only one name remains. The order of striking names shall be determined by lot. Any common costs of mediation shall be borne equally by the parties, who shall each bear their own costs and fees therefor. If the issue is resolved at this step, a written determination of such resolution shall be signed by both parties. Resolution of an issue at this step requires concurrence by both parties. In the event a dispute is not resolved by mediation, the aggrieved party may pursue any remedy available to it under applicable law.

B. Neither party may bring a legal action against the other party to interpret or enforce any term of this Agreement in any court unless the party has first attempted to resolve the matter by means of the dispute resolution of subsection A above. This shall not apply to disputes arising from a cause other than interpretation or enforcement of this Agreement.

C. Parties may mutually agree in writing to waive any of the above steps, or to enter into alternate processes or additional processes such as binding arbitration prior to filing legal action.

Section 7. Effect of this Agreement

This Agreement shall supersede all prior agreements of similar scope and subject matter, including amendments and the "City Committee Agreement" between the parties with respect to sanitary sewerage and service, storm and surface water management; provided that, except as expressly modified herein, all rights, liabilities, and obligations of such prior agreements shall continue. This Agreement shall be effective upon its execution by both parties hereto, and shall continue in effect for four renewable terms of five years each. This Agreement shall be deemed automatically renewed for a single succeeding five year term up to a limit of 25 years, unless either party gives the other written notice not less than one year prior to the nominal expiration of term of its intent not to renew this agreement. If District enters into an intergovernmental agreement with any other city in its territory covering the same subject as this Agreement and if any of the provisions of the other agreement differ from this Agreement, the City may elect to replace any provision of this Agreement with the parallel provision from the other agreement, with the exception of Appendix A and Exhibit A. The replacement shall be effective on receipt by District of written notice from the City. This Agreement may not otherwise be modified except by written amendment or as otherwise specified in this Agreement.

Section 8. Amendments

At any time, either party may request in writing to open this Agreement for specific amendment. If such request is made, the other party must respond within 90 days. If the parties do not agree and the party requesting such amendment desires to proceed with the

amendment, then remedies pursuant to Section 6 shall apply. All amendments shall be in writing and approved by the governing body of the respective parties.

Section 9. Severability

In the event a court of competent jurisdiction shall deem any portion or part of this Agreement to be unlawful or invalid, only that portion or part of the Agreement shall be considered unenforceable. The remainder of this Agreement shall continue to be valid.

IN WITNESS WHEREOF, this instrument has been executed in duplicate by authority of lawful actions by the Council and District Board of Directors.

CLEAN WATER SERVICE
OF WASHINGTON COUNTY, OREGON

By _____
FOR ~~Chairman, Board of Directors~~ -
GENERAL MANAGER

Approved as to Form:

_____
Attorney for District

CITY OF SHERWOOD, OREGON

By _____
City Manager

Attest: _____
City Recorder

_____
City Attorney

APPENDIX A			
DIVISION OF RESPONSIBILITIES	**EFFECTIVE THROUGH JUNE 30, 2004**		
SHERWOOD			
Basic Workplan	Inside City Limits	Outside City Limits	
Sanitary Maintenance			
Lines under 24"			
Line Cleaning	City	District	
Root Cutting	City	District	
Emergency response	City	District	
Overflow and Complaint response and investigation	City	District	
Cross connection investigation and response	City	District	
Manhole adjustment	City	District	
Non-structure line sealing and point repair	City	District	
Manhole rehabilitation (sealing)	City	District	
TV inspection	City	District	
Compilation of TV reports and system evaluation	City	District	
I&I abatement and system rehabilitation projects	District and City	District	
Root Foaming	City	District	
Structural line repairs	City	District	
Line replacements	City	District	
Pump station maintenance	District	District	
Lines 24" and Larger			
All maintenance, inspection, repair, and replacement	District	District	
SWM Maintenance			
Line Cleaning	City	District	
Root Cutting	City	District	
Catch Basin cleaning	City	District	
Water quality manhole maintenance	City	District	
Storm and emergency response	City	District	
Complaint response and investigation	City	District	
Street Sweeping	City	District	
Water Quality facility maintenance	City for local District for Regional	District	
Water Quantity facility maintenance	City for local District for Regional	District	
Maintenance of public Streams/creeks/open channels	City	District	
Processing and disposal of sweeper, catch basin and storm line material	City	District	
Structural line repairs	City	District	
Line replacements	City	District	
Pump station maintenance and operation	District	District	

Roadside ditches and piping system in County Roads	District	District	
TV inspection	City	District	
Compilation of TV reports and system evaluation	City	District	
Proactive Leaf management program	City	District	
ENGINEERING, INSPECTION, AND SUPPORT ELEMENTS			
Development Process (development review, plan review)	City	District	
Sanitary Sewer connection permit issuance	City	District	
SWM connection permit issuance	City	District	
Billing and collection of monthly service charges	City	District	
Inspection of developer projects	City	District	
Installation of Sanitary Sewer Masterplan Projects	City 21" and less, District 24" & up	District	
Installation of Masterplan Pump Station Projects	District	District	
Installation of SWM Masterplan Projects	City	District	
Erosion control permit issuance	City	District	
Erosion control inspection	City	District	
Accounting	City	District	
Industrial Waste Program	District	District	
Maintaining GIS information	City and District	District	
Maintaining system mapping	City and District	District	
Maintaining Engineering records of systems	City and District	District	
Preparing and revising sanitary sewer masterplans	District	District	
Preparing and revising SWM masterplans	District	District	
Response to customer billing inquiries	City	District	
Public information, newsletters, etc., for SWM and Sanitary programs	City and District	District	

APPENDIX A **DIVISION OF RESPONSIBILITIES**	4-Jan **EFFECTIVE JULY 1, 2004 to JUNE 30, 2005**		
Sherwood	Inside City, and Inside Responsibility Boundary	Outside City, and Inside Responsibility Boundary	Inside City, and Outside Responsibility Boundary
Sanitary Maintenance			
Lines under 24"			
Line Cleaning	City	City	
Root Cutting	City	City	
Emergency response	City	City	
Overflow and Complaint response investigation and reporting	City	City	
Cross connection investigation and response	City	City	
Manhole adjustment	City	City	
Non-structure line sealing and point repair	**City and District**	District	
Manhole rehabilitation (sealing)	**City and District**	District	
TV inspection	City	City	
Compilation of TV reports and system evaluation	District	District	
I&I abatement and system rehabilitation projects	**City and District**	District	
Root Foaming	**City and District**	District	
Structural line repairs	**City**	District	
Lateral Repairs in Public Right of Way	**City**	District	
Line replacements	**City**	District	
Pump station maintenance	District	District	
Vector Control	City	City	
Offroad inspection and locator post maintenance	City	City	
Easement and Access Road Maintenance	City	City	
Lines 24" and Larger			
All maintenance, inspection, repair, and replacement	District	District	
SWM Maintenance			
Line Cleaning	City	City	
Root Cutting	City	City	
Catch Basin cleaning	City	City	
Water quality manhole maintenance	City	City	
Storm and emergency response	City	City	
Complaint response investigation and reporting	City	City	
Street Sweeping	City	City	
Water Quality facility maintenance	City for local, District for Regional	City for local, District for Regional	

Water Quantity facility maintenance	City for local, District for Regional	City for local, District for Regional	
Maintenance of public Streams/creeks/open channels	City	City	
Processing and disposal of sweeper material	**City and District**	City	
Processing and disposal of catch basin and storm line material (excluding leaves)	**City and District**	District	
Structural line repairs	**City**	District	
Line replacements	**City**	District	
Pump station maintenance and operation	District	District	
Roadside ditches and piping system in County Roads	District	District	
Roadside ditches and piping system in City Roads	City, Funded by Street Fund	None	
TV inspection	City	City	
Compilation of TV reports and system evaluation	District	District	
Proactive Leaf management program	City	City	
Utility Locates	City	City	
ENGINEERING, INSPECTION, AND SUPPORT ELEMENTS			
Development Process (development review, plan review)	City	District	
Sanitary Sewer connection permit issuance	City	District	
SWM connection permit issuance	City	District	
Billing and collection of monthly service charges	City	District	
Inspection of developer projects	City	District	
Installation of Sanitary Sewer Masterplan Projects	City 21" and under, District 24" & up	District	
Installation of Masterplan Pump Station Projects	District	District	
Installation of SWM Masterplan Projects	City	District	
Erosion control permit issuance	City	District	
Erosion control inspection	City	District	
Accounting	City	District	
Industrial Waste Program	District	District	
Fat, Oil and Grease Program	**City and District**	District	
Maintaining GIS information	City and District	City and District	
Maintaining system mapping	City and District	City and District	
Maintaining Engineering records of systems	City and District	City and District	
Preparing and revising sanitary sewer masterplans	District	District	
Preparing and revising SWM masterplans	**City and District**	District	
Response to customer billing inquiries	City	District	
Public information, newsletters, etc., for SWM and Sanitary programs	City and District	City and District	

Flow Monitoring	District	District	
Formation and Administration of LID's	City and District	District	
Inspection of Private Facilities	City	District	
Marking Utilities	City	City	
Fixture Counting	City	District	
Field Yard General Maintenance	City	City	

APPENDIX A	4-Jan		
DIVISION OF RESPONSIBILITIES	**EFFECTIVE JULY 1, 2006**		
Sherwood	Inside City, and Inside Responsibility Boundary	Outside City, and Inside Responsibility Boundary	Inside City, and Outside Responsibility Boundary
Sanitary Maintenance			
Lines under 24"			
Line Cleaning	City	City	
Root Cutting	City	City	
Emergency response	City	City	
Overflow and Complaint response investigation and reporting	City	City	
Cross connection investigation and response	City	City	
Manhole adjustment	City	City	
Non-structure line sealing and point repair	District	District	
Manhole rehabilitation (sealing)	District	District	
TV inspection	City	City	
Compilation of TV reports and system evaluation	District	District	
I&I abatement and system rehabilitation projects	District	District	
Root Foaming	District	District	
Structural line repairs	District	District	
Lateral Repairs in Public Right of Way	District	District	
Line replacements	District	District	
Pump station maintenance	District	District	
Vector Control	City	City	
Offroad inspection and locator post maintenance	City	City	
Easement and Access Road Maintenance	City	City	
Lines 24" and Larger			
All maintenance, inspection, repair, and replacement	District	District	
SWM Maintenance			
Line Cleaning	City	City	
Root Cutting	City	City	
Catch Basin cleaning	City	City	
Water quality manhole maintenance	City	City	
Storm and emergency response	City	City	
Complaint response investigation and reporting	City	City	
Street Sweeping	City	City	
Water Quality facility maintenance	City for local, District for Regional	City for local, District for Regional	

Water Quantity facility maintenance	City for local, District for Regional	City for local, District for Regional	
Maintenance of public Streams/creeks/open channels	City	City	
Processing and disposal of sweeper material	City	City	
Processing and disposal of catch basin and storm line material (excluding leaves)	District	District	
Structural line repairs	District	District	
Line replacements	District	District	
Pump station maintenance and operation	District	District	
Roadside ditches and piping system in County Roads	District	District	
Roadside ditches and piping system in City Roads	City, Funded by Street Fund	None	
TV inspection	City	City	
Compilation of TV reports and system evaluation	District	District	
Proactive Leaf management program	City	City	
Utility Locates	City	City	
ENGINEERING, INSPECTION, AND SUPPORT ELEMENTS			
Development Process (development review, plan review)	City	District	
Sanitary Sewer connection permit issuance	City	District	
SWM connection permit issuance	City	District	
Billing and collection of monthly service charges	City	District	
Inspection of developer projects	City	District	
Installation of Sanitary Sewer Masterplan Projects	City 21" and under, District 24" & up	District	
Installation of Masterplan Pump Station Projects	District	District	
Installation of SWM Masterplan Projects	City	District	
Erosion control permit issuance	City	District	
Erosion control inspection	City	District	
Accounting	City	District	
Industrial Waste Program	District	District	
Fat, Oil and Grease Program	District	District	
Maintaining GIS information	City and District	City and District	
Maintaining system mapping	City and District	City and District	
Maintaining Engineering records of systems	City and District	City and District	
Preparing and revising sanitary sewer masterplans	District	District	
Preparing and revising SWM masterplans	District	District	
Response to customer billing inquiries	City	District	
Public information, newsletters, etc., for SWM and Sanitary programs	City and District	City and District	

Flow Monitoring	District	District	
Formation and Administration of LID's	City and District	District	
Inspection of Private Facilities	City	District	
Marking Utilities	City	City	
Fixture Counting	City	District	
Field Yard General Maintenance	City	City	

COPY

City of Sherwood, Oregon

Resolution No. 2000-903

A RESOLUTION AUTHORIZING THE CITY MANAGER TO SIGN THE INTERGOVERNMENTAL AGREEMENT WITH THE UNIFIED SEWERAGE AGENCY OF WASHINGTON COUNTY (USA)

WHEREAS, the current intergovernmental agreement between the City of Sherwood and USA was originally written in 1970 and is out of date; and

WHEREAS, USA and the cities are under increasing regulatory control and financial risk for water pollution; and

WHEREAS, during the past two years USA and the cities of Washington County have extensively studied more efficient methods to provide storm and sanitary sewer services; and

WHEREAS, USA recently developed a revised intergovernmental agreement with cities that better addresses current realities.

NOW, THEREFORE, THE CITY RESOLVES AS FOLLOWS:

The City Manager is authorized to finalize and sign the Intergovernmental Agreement with USA.

Duly passed by the City Council this 26th day of September 2000.

Walt H Hitchcock

Walt Hitchcock, Mayor

ATTEST:

C L Wiley

C.L. Wiley, Recorder

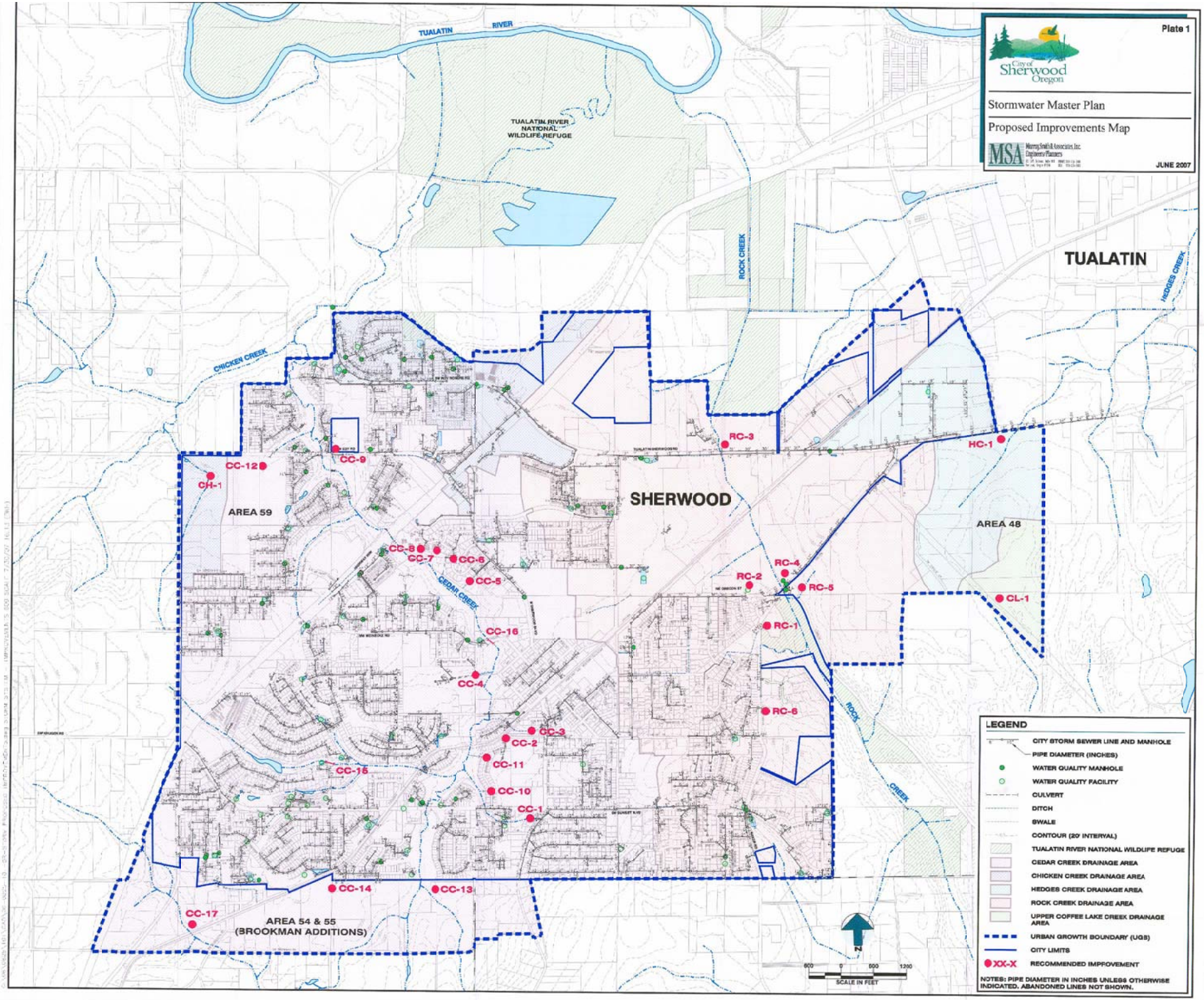


Plate 1
City of Sherwood Oregon
Stormwater Master Plan
Proposed Improvements Map
MSA Murray, Smith & Associates, Inc. Engineers/Planners
JUNE 2007
TUALATIN RIVER
TUALATIN RIVER NATIONAL WILDLIFE REFUGE
ROCK CREEK
TUALATIN
HEDGES CREEK
CHICKEN CREEK
SHERWOOD
AREA 59
AREA 48
AREA 54 & 55 (BROOKMAN ADDITIONS)
CEDAR CREEK
CC-12
CH-1
CC-9
CC-8
CC-7
CC-6
CC-5
CC-16
CC-4
CC-3
CC-2
CC-11
CC-15
CC-10
CC-1
CC-14
CC-13
CC-17
RC-3
HC-1
RC-4
RC-2
RC-5
CL-1
RC-1
RC-6
LEGEND
CITY STORM SEWER LINE AND MANHOLE
PIPE DIAMETER (INCHES)
WATER QUALITY MANHOLE
WATER QUALITY FACILITY
CULVERT
DITCH
SWALE
CONTOUR (20' INTERVAL)
TUALATIN RIVER NATIONAL WILDLIFE REFUGE
CEDAR CREEK DRAINAGE AREA
CHICKEN CREEK DRAINAGE AREA
HEDGES CREEK DRAINAGE AREA
ROCK CREEK DRAINAGE AREA
UPPER COFFEE LAKE CREEK DRAINAGE AREA
URBAN GROWTH BOUNDARY (UGB)
CITY LIMITS
XX-X RECOMMENDED IMPROVEMENT
NOTES: PIPE DIAMETER IN INCHES UNLESS OTHERWISE INDICATED. ABANDONED LINES NOT SHOWN.
N
600 0 600 1200
SCALE IN FEET

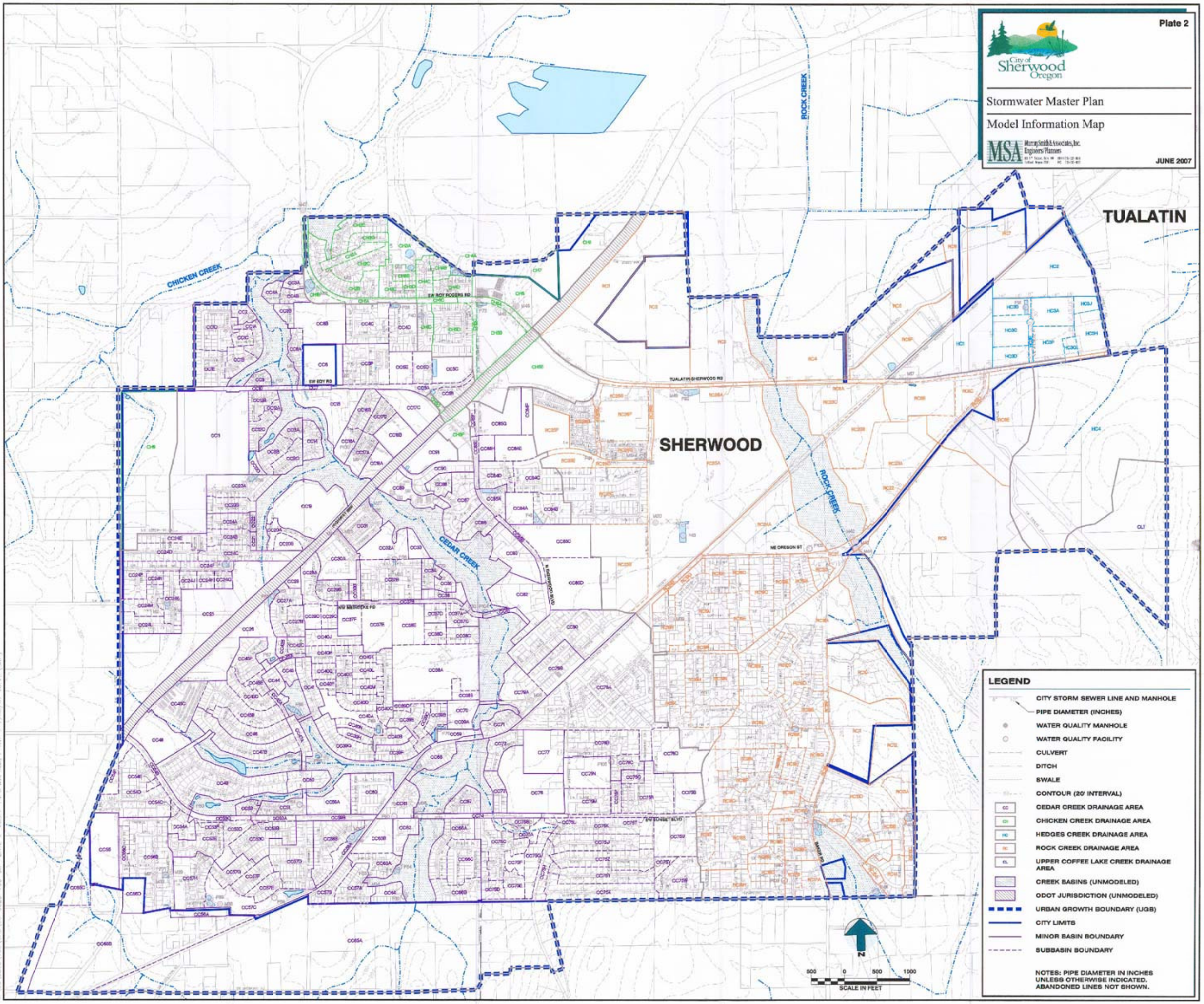


Plate 2
City of Sherwood Oregon
Stormwater Master Plan
Model Information Map
MSA Murray, Smith & Associates, Inc. Engineers/Planners
JUNE 2007
TUALATIN
SHERWOOD
CHICKEN CREEK
ROCK CREEK
CEDAR CREEK
TUALATIN-SHERWOOD RD
NE OREGON ST
SW ROY ROGERS RD
SW EDY RD
N SHERWOOD BLVD
SW SUNSET BLVD
BAKER RD
LEGEND
CITY STORM SEWER LINE AND MANHOLE
PIPE DIAMETER (INCHES)
WATER QUALITY MANHOLE
WATER QUALITY FACILITY
CULVERT
DITCH
SWALE
CONTOUR (20' INTERVAL)
CEDAR CREEK DRAINAGE AREA
CHICKEN CREEK DRAINAGE AREA
HEDGES CREEK DRAINAGE AREA
ROCK CREEK DRAINAGE AREA
UPPER COFFEE LAKE CREEK DRAINAGE AREA
CREEK BASINS (UNMODELED)
ODOT JURISDICTION (UNMODELED)
URBAN GROWTH BOUNDARY (UGB)
CITY LIMITS
MINOR BASIN BOUNDARY
SUBBASIN BOUNDARY
NOTES: PIPE DIAMETER IN INCHES UNLESS OTHERWISE INDICATED. ABANDONED LINES NOT SHOWN.
N
500 0 500 1000
SCALE IN FEET

Table E-2
Chicken Creek Stormwater Facility
Project Identifier CH-1
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,500 CY Excavation and Grading		$30,000
2.	0.33 Acres Landscaping		$9,900
3.	100 LF Access Road		$5,000
4.	800 LF Access Control Fencing		$20,000
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$2,475
8.	5% Erosion Control		$4,745
	Total Estimated Construction Cost		$99,620
	45% Contingency, Administration and Engineering		$44,829
	Total Estimated Project Cost		$144,449
		SAY	$145,000

Assumptions:

1. Construct regional water quality facility (extended dry basin) that would treat a water quality flow of 2.01 cubic feet per second of stormwater runoff.
2. The facility could be oversized to provide detention to mitigate up to the 25-year storm event peak flow, if necessary. The cost of detention is anticipated to be borne by the developer at the time of development.
3. Assume access road 100 feet long meeting CWS design standards for access to facility.
4. Assume planting maintenance required for 3 years.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-3
Ladd Hill Regional Stormwater Facility
Project Identifier CC-1
Cost Estimate Summary

Item No.	Description	Estimated Construction Cost
1.	Sediment Removal from Existing Channel	$25,000
2.	5,200 CY Excavation to Restore Existing Water Quality Facility	$104,000
3.	1.06 Acres Landscaping and Temporary Irrigation	$31,800
4.	Inlet and Outlet Structures	$17,500
5.	Pre-treatment (Sedimentation MH)	$10,000
6.	300 LF 24-inch Diameter Bypass Piping and Flow Splitter Manhole	$65,000
7.	Plant Maintenance for Two Years	$7,950
8.	5% Erosion Control	$13,065
	Total Estimated Construction Cost	$274,312
	45% Contingency, Administration and Engineering	$123,440
	Downstream Channel Capacity Study	$25,000
	Total Estimated Project Cost	$422,752
	SAY	$425,000

Assumptions:

1. High flow bypass facility will be located in existing right-of-way and will not require land acquisition.
2. Existing swale is located in right-of-way or an easement. No land acquisition will be required to reconfigure swale.
3. Water quality swale shall have capacity to treat a stormwater runoff flow rate of 6.8 cubic feet per second.
4. Study to determine capacity of downstream channel assumed to be performed by consultant, not in-house by City staff, for estimating purposes.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-4
West Division Street Stormwater Facility
Project Identifier CC-2
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	850 CY Excavation and Grading		$17,000
2.	0.20 Acre Landscaping and Temporary Irrigation		$6,000
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	Inlet and Outlet Structures		$17,500
6.	High Flow Bypass Facility		$12,500
7.	Plant Maintenance		$1,500
8.	5% Erosion Control		$3,500
	Total Estimated Construction Cost		$73,000
	45% Contingency, Administration and Engineering		$32,850
	Total Estimated Project Cost		$105,850
		SAY	$110,000

Assumptions:

1. Construct water quality facility that would treat a water quality flow of 1.13 cubic feet per second of stormwater runoff. Assume linear vegetated swale.
2. Assume fencing of facility will be required.
3. No rock excavation will be required.
4. No dewatering will be required.

Table E-5
Columbia Street Stormwater Facility
Project Identifier CC-3
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	608 CY Excavation and Grading		$12,170
2.	0.72 Acre Landscaping and Temporary Irrigation		$20,100
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	404 LF Access Control Fencing		$10,100
6.	Inlet and Outlet Structures		$17,500
7.	High Flow Bypass Facility		$12,500
8.	Plant Maintenance		$5,025
9.	5% Erosion Control		$4,620
	Total Estimated Construction Cost		$97,010
	45% Contingency, Administration and Engineering		$43,655
	Total Estimated Project Cost		$140,670
		SAY	$140,000

Assumptions:

1. Construct water quality facility that would treat a water quality flow of 4.6 cubic feet per second of stormwater runoff. Assume linear vegetated swale.
2. Assume fencing of facility will be required.
3. No rock excavation will be required.
4. No dewatering will be required.

Table E-6
South Stella Olsen Park Stormwater Facility
Project Identifier CC-4
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,174 CY Excavation and Grading		$23,475
2.	1.50 Acres Landscaping and Temporary Irrigation		$39,300
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	478 LF Access Control Fencing		$11,950
6.	Inlet and Outlet Structures		$17,500
7.	High Flow Bypass Facility		$12,500
8.	Plant Maintenance		$9,825
9.	5% Erosion Control		$6,480
	Total Estimated Construction Cost		$136,025
	45% Contingency, Administration and Engineering		$61,210
	Total Estimated Project Cost		$197,235
		SAY	$200,000

Assumptions:

1. Construct water quality facility that would treat a water quality flow of 9.58 cubic feet per second of stormwater runoff. Assume linear vegetated swale.
2. No rock excavation will be required.
3. No dewatering will be required.
4. Facility will be located on public land (Stella Olsen Park) and no land acquisition will be required.
5. Assume access control fencing will be required.

Table E-7
Community Campus Park Stormwater Facility
Project Identifier CC-5
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	3,300 CY Excavation and Grading		$66,000
2.	0.68 Acre Landscaping and Temporary Irrigation		$20,400
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Inlet and Outlet Structures		$17,500
5.	High Flow Bypass Facility		$12,500
6.	Plant Maintenance		$5,100
7.	5% Erosion Control		$6,575
	Total Estimated Construction Cost		$138,075
	45% Contingency, Administration and Engineering		$62,135
	Total Estimated Project Cost		$200,210
		SAY	$200,000

Assumptions:

1. Construct water quality facility that would treat a water quality flow of 4.35 cubic feet per second of stormwater runoff. Assume linear vegetated swale.
2. Assume that no access road will be required as facility will be accessed off of adjacent City-owned footpath.
3. Assume no access control fencing will be required.
4. No rock excavation will be required.
5. No dewatering will be required.

Table E-8
Gleneagle Drive Stormwater Facility
Project Identifier CC-6
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	320 CY Excavation and Surface Restoration		$6,400
2.	0.09 Acres Seeding and Landscaping		$2,700
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$33,600
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$70,200
	45% Contingency, Administration and Engineering		$31,590
	Total Estimated Project Cost		$101,790
		SAY	$105,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.42 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-9
Glencoe Court Stormwater Facility
Project Identifier CC-7
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	90 CY Excavation and Surface Restoration		$1,800
2.	0.04 Acres Seeding and Landscaping		$1,200
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$19,200
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$49,700
	45% Contingency, Administration and Engineering		$22,365
	Total Estimated Project Cost		$72,065
		SAY	$75,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.12 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-10
Gleneagle Village Water Quality Facility
Project Identifier CC-8
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	270 CY Excavation and Surface Restoration		$5,400
2.	0.08 Acre Seeding and Landscaping		$2,400
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$28,800
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$64,100
	45% Contingency, Administration and Engineering		$28,845
	Total Estimated Project Cost		$92,945
		SAY	$95,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.36 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-11
Edy Road Stormwater Facility
Project Identifier CC-9
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,475 CY Excavation and Grading		$16,225
2.	0.32 Acre Landscaping		$9,600
3.	100 LF Access Road		$5,030
4.	780 LF Access Control Fencing		$19,500
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	650 LF 24-inch Diameter Storm Sewer Piping		$113,750
8.	Plant Maintenance		$2,400
9.	5% Erosion Control		$9,700
	Total Estimated Construction Cost		$194,005
	45% Contingency, Administration and Engineering		$87,302
	Total Estimated Project Cost		$284,307
		SAY	$285,000

Assumptions:

1. Construct water quality facility (extended dry basin) that would treat a water quality flow of 1.95 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. No rock excavation will be required.
3. No dewatering will be required.
4. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-12
Saint Charles (North) Stormwater Facility
Project Identifier CC-10
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	150 CY Excavation and Surface Restoration		$3,000
2.	0.005 Acre Seeding and Landscaping		$150
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$15,200
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$45,850
	45% Contingency, Administration and Engineering		$20,635
	Total Estimated Project Cost		$66,485
		SAY	$70,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.19 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-13
Saint Charles (South) Stormwater Facility
Project Identifier CC-11
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	200 CY Excavation and Surface Restoration		$4,000
2.	0.005 Acre Seeding and Landscaping		$150
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$21,600
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$53,250
	45% Contingency, Administration and Engineering		$23,965
	Total Estimated Project Cost		$77,215
		SAY	$80,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.27 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-14
Area 59 Regional Stormwater Facility
Project Identifier CC-12
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	2,010 CY Excavation and Grading		$40,200
2.	0.28 Acre Landscaping and Temporary Irrigation		$8,400
3.	100 LF Access Road		$5,000
4.	680 LF Access Control Fencing		$17,000
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$2,100
8.	5% Erosion Control		$5,010
	Total Estimated Construction Cost		$105,210
	45% Contingency, Administration and Engineering		$47,345
	Total Estimated Project Cost		$152,555
		SAY	$155,000

Assumptions:

1. Construct regional water quality facility (extended dry basin) that would treat a water quality flow of 2.65 cubic feet per second of stormwater runoff.
2. The facility could be oversized to provide detention to mitigate up to the 25-year storm event peak flow if necessary. The cost of detention is anticipated to be borne by the developer at the time of development.
3. No rock excavation will be required.
4. No dewatering will be required.
5. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-15
Brookman Addition Regional Stormwater Facility
Project Identifier CC-13
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,150 CY Excavation and Grading		$23,000
2.	0.25 Acre Landscaping and Temporary Irrigation		$7,500
3.	100 LF Access Road		$5,000
4.	650 LF Access Control Fencing		$16,250
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$1,875
8.	5% Erosion Control		$4,060
	Sub-total without Oversizing for Detention		$85,185
9.	Oversize to Provide Detention		$42,590
10.	900 LF 18-inch Diameter Storm Sewer Trunk Piping		$135,000
	Total Estimated Construction Cost		$262,775
	45% Contingency, Administration and Engineering		$118,250
	Total Estimated Project Cost		$381,025
		SAY	$385,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.51 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-16
Upper Ladd Hill Road Regional Stormwater Facility
Project Identifier CC-14
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,510 CY Excavation and Grading		$30,200
2.	0.33 Acre Landscaping and Temporary Irrigation		$9,900
3.	100 LF Access Road		$5,000
4.	800 LF Access Control Fencing		$20,000
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$2,475
8.	5% Erosion Control		$4,755
	Sub-total without Oversizing for Detention		$99,830
9.	Oversize to Provide Detention		$137,100
10.	975 LF 18-inch Diameter Storm Sewer Trunk Piping		$146,250
	Total Estimated Construction Cost		$383,180
	45% Contingency, Administration and Engineering		$172,430
	Total Estimated Project Cost		$555,610
		SAY	$560,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.99 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-17
West Brookman Road Regional Stormwater Facility
Project Identifier CC-17
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	850 CY Excavation and Grading		$17,000
2.	0.19 Acre Landscaping and Temporary Irrigation		$5,700
3.	100 LF Access Road		$5,000
4.	500 LF Access Control Fencing		$12,500
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$1,425
8.	5% Erosion Control		$3455
	Sub-total without Oversizing for Detention		$72,580
9.	Oversize to Provide Detention		$38,575
10.	450 LF 18-inch Diameter Storm Sewer Trunk Piping		$67,500
	Total Estimated Construction Cost		$178,655
	45% Contingency, Administration and Engineering		$80,395
	Total Estimated Project Cost		$259,050
		SAY	$260,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.11 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-18
Murdock Road (North) Regional Stormwater Facility
Project Identifier RC-1
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	4,750 CY Excavation and Grading		$95,000
2.	1.0 Acre Landscaping and Temporary Irrigation		$30,000
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	Inlet and Outlet Structures		$17,500
6.	High Flow Bypass Facility		$12,500
7.	Plant Maintenance		$7,500
8.	5% Erosion Control		$8,875
	Total Estimated Construction Cost		$186,375
	45% Contingency, Administration and Engineering		$83,870
	Permitting		$75,000
	Total Estimated Project Cost		$345,245
		SAY	$350,000

Assumptions:

1. Construct water quality and detention/retention facility (constructed wetland or vegetated swale) that would treat a water quality flow of 6.27 cubic feet per second of stormwater runoff.
2. No rock excavation will be required.
3. No dewatering will be required.
4. Project will be constructed based on City-owned land. No land acquisition will be required.
5. Allowance for permitting work includes anticipated environmental permitting because of proposed location of the facility.

Table E-19
Oregon Street Regional Stormwater Facility
Project Identifier RC-2
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	3,865 CY Excavation and Grading		$77,300
2.	0.80 Acre Landscaping and Temporary Irrigation		$24,000
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	Inlet and Outlet Structures		$17,500
6.	High Flow Bypass Facility		$12,500
7.	Plant Maintenance		$6,000
8.	5% Erosion Control		$7,615
	Total Estimated Construction Cost		$159,915
	45% Contingency, Administration and Engineering		$71,965
	Permitting		$75,000
	Total Estimated Project Cost		$306,880
		SAY	$310,000

Assumptions:

1. Construct water quality and detention facility that would treat a water quality flow of 5.1 cubic feet per second of stormwater runoff. Assumed to be extended dry basin.
2. No rock excavation will be required.
3. No dewatering will be required.
4. Allowance for permitting work includes anticipated environmental permitting because of proposed location of the facility.

Table E-20
Lower Rock Creek Regional Stormwater Facility
Project Identifier RC-3
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	4,530 CY Excavation and Grading		$90,600
2.	0.95 Acre Landscaping and Temporary Irrigation		$28,500
3.	100 LF Access Road		$5,000
4.	2,100 LF Access Control Fencing		$52,500
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	High Flow Bypass Facility		$12,500
8.	Plant Maintenance		$7,125
9.	5% Erosion Control		$11,185
	Total Estimated Construction Cost		$234,910
	45% Contingency, Administration and Engineering		$105,710
	Total Estimated Project Cost		$340,620
		SAY	$340,000

Assumptions:

1. Construct water quality and detention facility (extended dry basin or vegetated swale) that would treat a water quality flow of 5.97 cubic feet per second of stormwater runoff.
2. No rock excavation will be required.
3. No dewatering will be required.

Table E-21
Tonquin Road (North) Stormwater Facility
Project Identifier RC-4
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,010 CY Excavation and Grading		$20,200
2.	0.07 Acres Landscaping		$2,100
3.	100 LF Access Road		$5,000
4.	250 LF Access Control Fencing		$6,250
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	High Flow Bypass Facility		$12,500
8.	Plant Maintenance		$525
9.	5% Erosion Control		$3,705
	Total Estimated Construction Cost		$77,780
	45% Contingency, Administration and Engineering		$35,000
	Permitting		$50,000
	Total Estimated Project Cost		$162,780
		SAY	$165,000

Assumptions:

1. Construct water quality facility (extended dry basin or vegetated swale) that would treat a water quality flow of 0.28 (1.33) cubic feet per second of stormwater runoff.
2. Study should be conducted to determine that a facility with no detention will not cause capacity concerns at either the existing Rock Creek culvert that passes under the railroad tracks or the existing culvert that passes under Tualatin-Sherwood Road.
3. No rock excavation will be required.
4. No dewatering will be required.
5. Allowance for permitting work includes anticipated environmental permitting because of proposed location of the facility.

Table E-22
Tonquin Road (South) Stormwater Facility
Project Identifier RC-5
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,450 CY Excavation and Grading		$29,000
2.	0.31 Acre Landscaping and Temporary Irrigation		$9,300
3.	100 LF Access Road		$5,000
4.	760 LF Access Control Fencing		$19,000
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$2,325
8.	5% Erosion Control		$4,610
	Sub-total without Oversizing for Detention		$96,735
9.	Oversize to Provide Detention		$412,250
10.	900 LF 24-inch Diameter Storm Sewer Trunk Piping		$157,500
11.	600 LF 18-inch Diameter Storm Sewer Trunk Piping		$90,000
	Total Estimated Construction Cost		$756,485
	45% Contingency, Administration and Engineering		$340,420
	Total Estimated Project Cost		$1,096,905
		SAY	$1,100,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.51 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-23
Murdock Road (South) Stormwater Facility
Project Identifier RC-6
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	295 CY Excavation and Grading		$5,900
2.	0.09 Acre Landscaping and Temporary Irrigation		$2,700
3.	100 LF Access Road		$5,000
4.	270 LF Access Control Fencing		$6,750
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$675
8.	5% Erosion Control		$2,430
	Sub-total without Oversizing for Detention		$50,955
9.	Oversize to Provide Detention		$24,215
10.	600 LF 18-inch Diameter Storm Sewer Trunk Piping		$90,000
	Total Estimated Construction Cost		$165,170
	45% Contingency, Administration and Engineering		$74,325
	Total Estimated Project Cost		$239,495
		SAY	$240,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.51 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-24
Hedges Creek Stormwater Facility
Project Identifier HC-1
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	5,800 CY Excavation and Grading		$116,000
2.	1.18 Acres Landscaping and Temporary Irrigation		$35,400
3.	100 LF Access Road		$5,000
4.	2,650 LF Access Control Fencing		$66,250
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$8,850
8.	5% Erosion Control		$12,950
	Sub-total without Oversizing for Detention		$271,950
9.	Oversize to Provide Detention		$165,025
10.	750 LF 30-inch Diameter Storm Sewer Trunk Piping		$150,000
	Total Estimated Construction Cost		$586,975
	45% Contingency, Administration and Engineering		$264,140
	Total Estimated Project Cost		$851,115
		SAY	$855,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 7.66 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-25
Coffee Lake Creek Stormwater Facility
Project Identifier CL-1
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,925 CY Excavation and Grading		$38,500
2.	0.41 Acre Landscaping and Temporary Irrigation		$12,300
3.	100 LF Access Road		$5,000
4.	970 LF Access Control Fencing		$24,250
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$3,075
8.	5% Erosion Control		$5,530
	Sub-total without Oversizing for Detention		$116,155
9.	Oversize to Provide Detention		$54,060
10.	600 LF 24-inch Diameter Storm Sewer Trunk Piping		$105,000
	Total Estimated Construction Cost		$275,215
	45% Contingency, Administration and Engineering		$123,850
	Total Estimated Project Cost		$399,065
		SAY	$400,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 2.54 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table D-1
Model Subbasin Information Summary

Model ID	Slope (feet/feet)	Width (feet)	Curve Number	Area (acres)	Percent Impervious Area	
					Existing	Buildout
Cedar Creek Basin						
CC 1A	0.033	150	64	2.7	51	51
CC 1B	0.033	350	61	3.5	51	51
CC 1C	0.033	350	61	1.8	51	51
CC 1D	0.033	750	61	10.0	51	51
CC 1E	0.033	550	61	6.5	51	51
CC 2	0.033	300	66	2.1	51	51
CC 3A	0.057	200	61	1.5	51	51
CC 3B	0.057	200	64	1.9	51	51
CC 4A	0.057	200	70	1.9	51	51
CC 4B	0.057	200	61	2.0	51	51
CC 4C	0.010	600	61	9.3	65	65
CC 4D	0.010	350	61	7.4	65	65
CC 5A	0.000	50	64	4.3	98	98
CC 5B	0.010	150	61	2.7	85	85
CC 5C	0.010	350	66	5.3	50	**85**
CC 5D	0.010	300	62	3.3	25	**85**
CC 5E	0.010	350	61	4.1	42	**85**
CC 5F	0.010	600	64	10.0	32	**65**
CC 6	0.033	50	61	8.7	10	**51**
CC 7	0.050	50	64	0.8	98	98
CC 8A	0.133	200	64	3.3	51	51
CC 8B	0.033	600	61	10.7	10	**85**
CC 9	0.020	300	73	1.7	51	51
CC 10	0.010	50	68	2.2	98	98
CC 11	0.023	800	72	56.5	10	**64**
CC 12A	0.125	150	62	1.0	51	51
CC 12B	0.125	250	64	3.4	51	51
CC 12C	0.125	150	68	3.2	51	51
CC 12D	0.125	150	78	1.4	51	51
CC 13A	0.125	300	66	1.9	51	51
CC 13B	0.125	525	74	3.8	51	51
CC 13C	0.125	250	67	3.5	51	51
CC 14	0.067	600	61	3.8	51	51
CC 15	0.083	450	71	10.3	58	58
CC 16A	0.083	250	68	3.0	65	65
CC 16B	0.017	250	61	3.9	65	65

Model ID	Slope (feet/feet)	Width (feet)	Curve Number	Area (acres)	Percent Impervious Area	
					Existing	Buildout
CC 17A	0.083	250	64	4.0	65	65
CC 17B	0.017	250	61	3.2	65	65
CC 17C	0.020	450	61	8.0	85	85
CC 18A	0.100	325	64	3.3	85	85
CC 18B	0.040	450	61	5.5	65	65
CC 19	0.020	800	66	16.3	10	**73**
CC 20A	0.020	250	74	3.0	98	98
CC 20B	0.020	250	74	2.1	10	**85**
CC 21	0.067	300	75	0.6	51	51
CC 22	0.067	300	75	0.7	51	51
CC 23A	0.031	800	66	8.0	51	51
CC 23B	0.031	800	79	4.1	51	51
CC 24A	0.040	800	76	3.6	51	51
CC 24B	0.040	800	77	3.8	51	51
CC 24C	0.020	1400	77	6.8	54	54
CC 24D	0.033	800	75	6.7	51	51
CC 24E	0.033	300	75	4.1	51	51
CC 24F	0.025	800	78	2.8	51	51
CC 24G	0.073	275	76	1.7	51	51
CC 24H	0.073	275	76	1.7	51	51
CC 24J	0.073	275	74	1.7	51	51
CC 24K	0.060	250	74	5.2	51	51
CC 24L	0.050	250	74	5.3	51	51
CC 24M	0.050	200	74	4.8	51	51
CC 24N	0.040	200	74	1.2	51	51
CC 24P	0.025	800	74	6.6	51	51
CC 25	0.067	600	75	43.0	10	**68**
CC 26	0.040	300	75	15.0	10	**74**
CC 27A	0.020	200	75	4.1	65	65
CC 27B	0.020	200	74	3.0	65	65
CC 28	0.010	225	74	1.2	10	10
CC 29A	0.025	300	74	5.6	50	**73**
CC 29B	0.025	300	74	3.5	65	65
CC 29C	0.040	200	74	1.7	10	**65**
CC 29D	0.040	200	74	1.7	10	**65**
CC 30A	0.029	300	64	8.3	75	75
CC 30B	0.031	100	72	1.8	65	65
CC 31	0.029	400	61	6.7	65	65
CC 32A	0.029	300	61	6.8	65	65
CC 32B	0.029	600	69	13.3	65	65
CC 33	0.067	200	61	2.2	65	65
CC 34	0.067	200	61	2.5	65	65
CC 35	0.067	200	62	1.9	65	65
CC 36	0.067	100	66	2.4	65	65
CC 37A	0.080	50	74	0.8	98	98

Model ID	Slope (feet/feet)	Width (feet)	Curve Number	Area (acres)	Percent Impervious Area	
					Existing	Buildout
CC 37B	0.020	50	73	3.0	98	98
CC 37C	0.025	250	74	3.2	51	51
CC 37D	0.025	325	74	2.3	51	51
CC 37E	0.033	750	74	7.4	65	65
CC 37F	0.025	400	74	3.8	65	65
CC 38A	0.025	800	74	24.2	25	25
CC 38B	0.025	200	74	1.9	51	51
CC 38C	0.025	200	74	3.0	51	51
CC 38D	0.025	250	74	3.0	51	51
CC 38E	0.020	600	74	7.3	85	85
CC 39A	0.013	50	76	0.5	51	51
CC 39B	0.013	250	76	2.4	51	51
CC 39C	0.013	100	75	1.5	51	51
CC 39D	0.013	50	75	1.5	51	51
CC 39E	0.013	200	74	4.7	51	51
CC 39F	0.013	300	74	3.8	51	51
CC 39G	0.050	300	75	6.7	51	51
CC 39H	0.029	100	74	1.7	51	51
CC 40A	0.030	150	75	5.3	51	51
CC 40B	0.013	250	75	3.0	51	51
CC 40C	0.030	150	74	5.0	51	51
CC 40D	0.030	250	74	3.7	51	51
CC 40E	0.030	250	74	3.2	51	51
CC 40F	0.030	250	74	1.3	51	51
CC 40G	0.030	250	74	2.1	51	51
CC 40H	0.030	250	74	3.4	51	51
CC 40J	0.050	150	74	5.2	65	65
CC 40K	0.030	250	74	1.9	51	51
CC 40L	0.030	250	74	2.5	51	51
CC 40M	0.030	250	74	2.5	51	51
CC 40N	0.029	150	76	2.1	51	51
CC 41	0.017	250	74	5.1	51	51
CC 42A	0.010	50	75	1.2	98	98
CC 42B	0.010	150	75	1.2	51	51
CC 42C	0.010	150	74	1.6	51	51
CC 43	0.017	250	74	2.2	51	51
CC 44	0.017	250	74	2.1	51	51
CC 45A	0.033	100	74	1.3	51	51
CC 45B	0.033	250	74	9.5	51	51
CC 45C	0.040	450	75	9.4	51	51
CC 45D	0.033	200	74	4.4	51	51
CC 45E	0.033	200	75	1.7	51	51
CC 45F	0.033	300	77	5.8	51	51
CC 46	0.033	250	74	0.0	51	51
CC 47A	0.033	100	76	2.7	51	51

Model ID	Slope (feet/feet)	Width (feet)	Curve Number	Area (ACRES)	Percent Impervious Area	
					Existing	Buildout
CC 47B	0.033	300	75	10.4	51	51
CC 48	0.050	500	75	9.1	51	51
CC 49	0.025	400	75	21.9	51	51
CC 50	0.025	500	75	4.2	51	51
CC 51	0.040	200	75	4.1	51	51
CC 52	0.040	200	79	1.7	51	51
CC 53A	0.040	50	74	1.3	98	98
CC 53B	0.050	25	74	0.2	10	10
CC 53C	0.050	250	70	8.8	57	57
CC 53D	0.050	100	79	4.2	10	10
CC 53E	0.050	500	75	7.7	51	51
CC 53F	0.050	100	74	0.5	10	10
CC 53G	0.040	50	75	2.2	98	98
CC 54A	0.067	300	74	3.2	51	51
CC 54B	0.067	50	74	3.1	98	98
CC 54C	0.067	100	74	0.5	51	51
CC 54D	0.067	600	74	15.8	51	51
CC 54E	0.067	100	74	0.6	51	51
CC 54F	0.067	100	74	3.2	65	65
CC 55	0.040	450	74	11.3	65	65
CC 56A	0.029	125	74	2.6	98	98
CC 56B	0.050	550	74	18.9	51	51
CC 56C	0.041	150	74	2.9	51	51
CC 56D	0.089	300	74	4.3	10	51
CC 57A	0.025	250	76	5.9	65	65
CC 57B	0.025	150	77	4.2	65	65
CC 57C	0.010	200	75	10.1	51	51
CC 57D	0.040	500	68	11.8	51	51
CC 57E	0.040	350	74	3.2	51	51
CC 57F	0.040	350	71	4.0	51	51
CC 57G	0.040	300	76	4.0	51	51
CC 57H	0.040	450	76	9.7	51	51
CC 58A	0.033	250	77	3.4	51	51
CC 58B	0.033	500	71	21.4	51	51
CC 59A	0.040	500	74	6.2	51	51
CC 59B	0.025	50	74	2.7	98	98
CC 60	0.040	550	74	8.7	51	51
CC 61	0.033	400	74	5.4	65	65
CC 62	0.150	250	74	3.6	65	65
CC 63A	0.025	150	77	4.8	72	72
CC 63B	0.040	450	76	5.8	72	72
CC 64	0.022	300	65	3.1	65	65
CC 65A	0.042	1100	71	168.0	0	64
CC 65B	0.067	1100	75	62.0	0	64
CC 65C	0.100	175	77	6.4	10	65

Model ID	Slope (feet/feet)	Width (feet)	Curve Number	Area (acres)	Percent Impervious Area	
					Existing	Buildout
CC 66A	0.067	200	74	7.3	51	51
CC 66B	0.067	150	74	5.5	51	51
CC 66C	0.067	500	74	7.7	51	51
CC 67	0.010	300	74	4.0	65	65
CC 68	0.010	300	74	5.4	65	65
CC 69	0.067	225	74	2.2	51	51
CC 70	0.150	500	75	4.4	51	51
CC 71	0.033	250	74	3.8	65	65
CC 72	0.033	600	74	4.6	65	65
CC 73	0.033	600	74	3.2	65	65
CC 74	0.100	50	75	3.3	98	98
CC 75A	0.067	100	79	3.7	51	51
CC 75B	0.067	100	69	1.6	51	51
CC 75D	0.067	300	74	3.7	51	51
CC 75E	0.067	300	74	3.0	51	51
CC 75F	0.067	250	71	2.0	51	51
CC 75G	0.055	150	62	4.5	51	51
CC 75H	0.067	150	61	4.3	51	51
CC 75J	0.050	250	66	9.0	51	51
CC 75K	0.075	250	70	9.2	51	51
CC 75L	0.075	50	78	0.6	98	98
CC 75M	0.073	400	72	5.9	65	65
CC 75N	0.073	400	74	7.4	85	85
CC 75P	0.100	100	74	1.7	65	65
CC 75Q	0.077	200	74	1.7	65	65
CC 75R	0.125	400	74	10.8	59	59
CC 75S	0.067	450	74	14.3	20	20
CC 75T	0.075	50	71	2.5	98	98
CC 75U	0.117	650	74	9.0	62	62
CC 75V	0.150	250	74	1.4	51	51
CC 75W	0.100	650	74	8.9	51	51
CC 75X	0.080	250	73	10.7	51	51
CC 75Y	0.040	250	71	8.3	51	51
CC 75Z	0.040	250	70	9.6	51	51
CC 76	0.022	600	71	15.8	52	52
CC 77	0.043	600	69	9.4	65	65
CC 78A	0.100	1000	74	52.3	71	71
CC 78B	0.100	400	73	10.5	65	65
CC 78C	0.100	200	74	3.2	65	65
CC 78D	0.100	400	74	9.7	51	51
CC 79A	0.033	700	64	8.2	65	65
CC 79B	0.010	800	74	8.1	85	85
CC 80	0.013	400	73	21.3	68.5	68.5
CC 81	0.025	50	68	1.3	98	98
CC 82	0.100	900	62	11.9	68.5	68.5

Model ID	Slope (feet/feet)	Width (feet)	Curve Number	Area (acres)	Percent Impervious Area	
					Existing	Buildout
CC 83	0.010	300	62	10.6	75	75
CC 84A	0.010	350	61	4.8	65	65
CC 84B	0.010	400	62	5.9	65	65
CC 84C	0.010	400	61	8.0	65	65
CC 84D	0.010	400	61	5.0	65	65
CC 84E	0.010	400	61	5.6	65	65
CC 84F	0.010	401	61	3.0	25	**85**
CC 85A	0.010	300	61	3.6	65	65
CC 85B	0.010	50	62	2.0	98	98
CC 85C	0.010	500	73	11.6	5	5
CC 85D	0.010	800	71	15.4	25	25
CC 85E	0.010	50	61	1.7	98	98
CC 85F	0.010	50	61	1.1	98	98
CC 85G	0.010	400	61	8.7	85	85
CC 85H	0.010	400	61	2.2	85	85
CC 86	0.010	300	64	4.4	59	59
CC 87	0.040	250	64	8.9	52	52
CC 88	0.040	250	61	2.5	51	51
CC 89	0.100	200	68	6.0	65	65
CC 90	0.100	200	68	5.4	65	65
CC 91	0.022	350	61	6.6	80	80
Chicken Creek Basin						
CH 1A	0.057	50	73	4.6	98	98
CH 1B	0.057	50	74	2.9	5	5
CH 1C	0.057	50	68	1.3	98	98
CH 1D	0.010	200	74	4.0	65	65
CH 2A	0.100	200	64	3.0	25	25
CH 2B	0.040	200	62	9.6	51	51
CH 2C	0.017	300	62	5.7	51	51
CH 2D	0.017	150	61	2.5	51	51
CH 2E	0.017	300	62	6.1	51	51
CH 3A	0.167	350	68	7.1	10	**65**
CH 3B	0.010	150	61	1.7	65	65
CH 3C	0.010	200	61	3.5	58	58
CH 3D	0.010	150	61	1.1	65	65
CH 4A	0.300	50	61	0.5	65	65
CH 4B	0.100	300	71	2.2	65	65
CH 4C	0.010	300	62	3.5	65	65
CH 4D	0.010	300	68	4.2	65	65
CH 5A	0.010	50	64	2.6	98	98
CH 5B	0.010	400	64	12.0	85	85
CH 5C	0.010	600	62	11.4	65	65
CH 5D	0.010	150	61	8.4	98	98
CH 5E	0.010	350	61	22.0	85	85

Model ID	Slope (feet/feet)	Width (feet)	Curve Number	Area (acres)	Percent Impervious Area	
					Existing	Buildout
CH 5F	0.010	400	61	5.6	85	85
CH 5G	0.010	50	64	1.9	98	98
CH 6	0.017	500	64	6.2	85	85
CH 7	0.017	200	64	9.1	10	**72**
CH 8	0.017	500	64	18.7	36	**72**
CH 9	0.040	500	66	28.6	10	**64**
Upper Coffee Lake Creek Basin						
CL 1	0.063	800	72	48.4	10	**72**
Hedges Creek Basin						
HC 1	0.010	600	75	25.8	72	72
HC 2	0.010	700	71	27.7	72	72
HC 3A	0.015	450	73	6.6	72	72
HC 3B	0.015	250	74	3.3	72	72
HC 3C	0.015	500	76	6.0	72	72
HC 3D	0.067	300	77	3.8	0	**72**
HC 3E	0.040	50	76	1.0	98	98
HC 3F	0.040	500	75	6.3	0	**72**
HC 3G	0.040	200	74	1.4	72	72
HC 3H	0.033	650	73	2.0	0	**72**
HC 3J	0.015	250	73	6.7	72	72
HC 4	0.054	1400	78	117.7	**18**	**72**
Rock Creek Basin						
RC 1	0.017	500	62	56.9	76	76
RC 2	0.017	1000	68	33.8	72	72
RC 3	0.057	800	74	29.0	35	35
RC 4	0.025	650	61	16.0	72	72
RC 5	0.010	500	69	24.7	72	72
RC 6	0.023	200	71	8.9	72	72
RC 7	0.023	750	71	32.6	72	72
RC 8A	0.025	50	71	5.3	98	98
RC 8B	0.017	450	71	14.1	72	72
RC 8C	0.017	450	66	14.4	36	**72**
RC 8D	0.017	450	76	13.8	72	72
RC 8E	0.025	250	74	7.5	72	72
RC 8F	0.025	50	64	2.5	98	98
RC 8G	0.033	800	76	32.5	0	**72**
RC 8H	0.010	400	71	17.6	50	50
RC 9	0.040	2200	71	111.8	0	**72**
RC 10	0.067	900	75	21.1	10	**30**
RC 11	0.120	600	72	22.6	10	**30**
RC 12	0.120	650	78	10.0	10	**30**
RC 13A	0.010	400	80	3.7	30	30
RC 13B	0.117	400	71	6.1	30	30
RC 13C	0.033	300	64	4.8	30	30

Model ID	Slope (feet/feet)	Width (feet)	Curve Number	Area (acres)	Percent Impervious Area	
					Existing	Buildout
RC 13D	0.117	400	72	16.2	10	30
RC 14	0.040	350	74	5.4	30	30
RC 15A	0.133	150	73	1.1	30	30
RC 15B	0.025	350	74	7.1	30	30
RC 16A	0.143	400	70	2.5	98	98
RC 16B	0.117	400	70	3.4	30	30
RC 16C	0.050	450	63	4.7	51	51
RC 16D	0.060	450	63	3.6	51	51
RC 16E	0.060	400	61	2.2	51	51
RC 16F	0.064	450	72	5.7	51	51
RC 16G	0.064	300	74	10.9	51	51
RC 17A	0.040	350	61	5.1	51	51
RC 17B	0.010	250	64	3.0	51	51
RC 18A	0.100	750	70	22.3	65	65
RC 18B	0.080	450	62	9.7	51	51
RC 18C	0.080	450	61	7.4	51	51
RC 18D	0.083	150	69	4.5	58	58
RC 18E	0.050	400	75	5.7	65	65
RC 18F	0.050	50	61	0.9	98	98
RC 18G	0.030	400	72	8.0	51	51
RC 18H	0.030	50	71	2.7	98	98
RC 18J	0.122	650	68	16.4	51	51
RC 18K	0.022	100	74	1.5	5	5
RC 18L	0.022	400	75	3.3	51	51
RC 18M	0.022	150	74	2.0	51	51
RC 18N	0.122	500	74	5.2	51	51
RC 18P	0.122	400	74	4.3	51	51
RC 18Q	0.100	300	71	13.7	51	51
RC 18R	0.100	300	69	4.1	51	51
RC 18S	0.050	750	70	9.7	51	51
RC 18T	0.114	450	74	4.3	51	51
RC 19A	0.040	300	73	6.4	65	65
RC 19B	0.040	300	73	3.3	65	65
RC 19C	0.040	250	73	10.3	51	51
RC 19D	0.033	300	71	4.1	65	65
RC 19E	0.011	300	73	6.8	51	51
RC 19F	0.011	300	74	4.5	65	65
RC 19G	0.010	100	74	2.0	65	65
RC 19H	0.010	350	74	7.7	64	64
RC 19J	0.011	400	74	15.7	58	58
RC 19K	0.100	50	74	2.3	51	51
RC 19L	0.050	500	74	16.6	51	51
RC 19M	0.050	250	74	10.8	51	51
RC 19N	0.050	550	73	9.9	51	51
RC 20	0.050	350	80	2.8	65	65

Model ID	Slope (feet/feet)	Width (feet)	Curve Number	Area (acres)	Percent Impervious Area	
					Existing	Buildout
RC 21	0.050	250	80	3.7	98	98
RC 22	0.040	50	90	4.3	98	98
RC 23	0.040	750	71	29.3	72	72
RC 24A	0.067	800	82	25.4	25	**72**
RC 24B	0.000	50	0	3.0	50	50
RC 25A	0.025	1500	73	104.9	10	**72**
RC 25B	0.010	900	75	23.0	10	**71**
RC 25C	0.010	900	66	24.9	10	**65**
RC 25D	0.010	50	61	3.5	98	98
RC 25E	0.010	250	61	3.6	10	10
RC 25F	0.000	550	0	7.6	65	65
RC 26A	0.017	50	66	1.6	98	98
RC 26B	0.010	750	61	14.3	85	85
RC 26C	0.010	50	61	1.8	98	98
RC 26D	0.010	750	61	10.1	65	65
RC 26E	0.010	750	61	4.8	65	65
RC 26F	0.010	50	61	2.0	98	98

APPENDIX E
IMPROVEMENT ELEMENT COST ESTIMATES

Included in this appendix are conceptual level cost estimates for the recommended improvement elements. The assumptions used to compile each estimate are recorded below the cost information. The project costs are based upon recent experience with construction costs for similar work in the area and assume improvements will be completed by private contractors. Cost estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for construction, regulatory factors, final project scope, project schedules and other factors. Table E-1 below shows the unit costs used to develop cost estimates for the recommended improvements. Estimated costs for land acquisition are not included in the project cost estimates.

The project costs presented in this study provisions for estimated construction costs plus an aggregate 45-percent allowance over construction cost is provided for contingencies, engineering, legal, administration, permitting and other project-related costs. Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating, the April 2007 ENR CCI for Seattle, Washington is 8629.

Table E-1
Estimated Unit Costs Summary

Item	Unit Cost	Unit
Excavation and Surface Restoration	$20	Cubic Yard
Water Quality (Sedimentation) Manhole	$10,000	Each
Inlet Structure for Water Quality Facility	$5,000	Each
Outlet Structure for Water Quality Facility (Basin)	$12,500	Each
Outlet Structure for Water Quality Facility (Swale)	$5,000	Each
High Flow Bypass Facility (Flow Splitter Manhole)	$12,500	Each
Fencing (4-Feet Tall, Coated Chain Link)	$25	Linear Foot
Water Quality Facility Access Road (15 Feet Wide, 3" AC Over 8" Aggregate Base)	$50	Linear Foot
Landscaping, Planting and Temporary Irrigation for Water Quality Facility	$30,000	Acre
Plant Maintenance (2-year)	25 % of Landscaping Cost	Lump Sum
Proprietary Filter System	$80,000	Cfs to be Treated
Storm Sewer Pipe - 12-inch Diameter	$100	Linear Foot
Storm Sewer Pipe - 18-inch Diameter, 10-Foot Depth	$150	Linear Foot
Storm Sewer Pipe - 24-inch Diameter[1]	$175	Linear Foot
Storm Sewer Pipe - 30-inch Diameter[1]	$200	Linear Foot
Storm Sewer Pipe - 36-inch Diameter[1]	$250	Linear Foot
Erosion Control for Water Quality Facility	5 % of Cost	Lump Sum

Table E-2
Chicken Creek Stormwater Facility
Project Identifier CH-1
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,500 CY Excavation and Grading		$30,000
2.	0.33 Acres Landscaping		$9,900
3.	100 LF Access Road		$5,000
4.	800 LF Access Control Fencing		$20,000
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$2,475
8.	5% Erosion Control		$4,745
	Total Estimated Construction Cost		$99,620
	45% Contingency, Administration and Engineering		$44,829
	Total Estimated Project Cost		$144,449
		SAY	$145,000

Assumptions:

1. Construct regional water quality facility (extended dry basin) that would treat a water quality flow of 2.01 cubic feet per second of stormwater runoff.
2. The facility could be oversized to provide detention to mitigate up to the 25-year storm event peak flow, if necessary. The cost of detention is anticipated to be borne by the developer at the time of development.
3. Assume access road 100 feet long meeting CWS design standards for access to facility.
4. Assume planting maintenance required for 3 years.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-3
Ladd Hill Regional Stormwater Facility
Project Identifier CC-1
Cost Estimate Summary

Item No.	Description	Estimated Construction Cost
1.	Sediment Removal from Existing Channel	$25,000
2.	5,200 CY Excavation to Restore Existing Water Quality Facility	$104,000
3.	1.06 Acres Landscaping and Temporary Irrigation	$31,800
4.	Inlet and Outlet Structures	$17,500
5.	Pre-treatment (Sedimentation MH)	$10,000
6.	300 LF 24-inch Diameter Bypass Piping and Flow Splitter Manhole	$65,000
7.	Plant Maintenance for Two Years	$7,950
8.	5% Erosion Control	$13,065
	Total Estimated Construction Cost	$274,312
	45% Contingency, Administration and Engineering	$123,440
	Downstream Channel Capacity Study	$25,000
	Total Estimated Project Cost	$422,752
	SAY	$425,000

Assumptions:

1. High flow bypass facility will be located in existing right-of-way and will not require land acquisition.
2. Existing swale is located in right-of-way or an easement. No land acquisition will be required to reconfigure swale.
3. Water quality swale shall have capacity to treat a stormwater runoff flow rate of 6.8 cubic feet per second.
4. Study to determine capacity of downstream channel assumed to be performed by consultant, not in-house by City staff, for estimating purposes.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-4
West Division Street Stormwater Facility
Project Identifier CC-2
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	850 CY Excavation and Grading		$17,000
2.	0.20 Acre Landscaping and Temporary Irrigation		$6,000
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	Inlet and Outlet Structures		$17,500
6.	High Flow Bypass Facility		$12,500
7.	Plant Maintenance		$1,500
8.	5% Erosion Control		$3,500
	Total Estimated Construction Cost		$73,000
	45% Contingency, Administration and Engineering		$32,850
	Total Estimated Project Cost		$105,850
		SAY	$110,000

Assumptions:

1. Construct water quality facility that would treat a water quality flow of 1.13 cubic feet per second of stormwater runoff. Assume linear vegetated swale.
2. Assume fencing of facility will be required.
3. No rock excavation will be required.
4. No dewatering will be required.

Table E-5
Columbia Street Stormwater Facility
Project Identifier CC-3
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	608 CY Excavation and Grading		$12,170
2.	0.72 Acre Landscaping and Temporary Irrigation		$20,100
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	404 LF Access Control Fencing		$10,100
6.	Inlet and Outlet Structures		$17,500
7.	High Flow Bypass Facility		$12,500
8.	Plant Maintenance		$5,025
9.	5% Erosion Control		$4,620
	Total Estimated Construction Cost		$97,010
	45% Contingency, Administration and Engineering		$43,655
	Total Estimated Project Cost		$140,670
		SAY	$140,000

Assumptions:

1. Construct water quality facility that would treat a water quality flow of 4.6 cubic feet per second of stormwater runoff. Assume linear vegetated swale.
2. Assume fencing of facility will be required.
3. No rock excavation will be required.
4. No dewatering will be required.

Table E-6
South Stella Olsen Park Stormwater Facility
Project Identifier CC-4
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,174 CY Excavation and Grading		$23,475
2.	1.50 Acres Landscaping and Temporary Irrigation		$39,300
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	478 LF Access Control Fencing		$11,950
6.	Inlet and Outlet Structures		$17,500
7.	High Flow Bypass Facility		$12,500
8.	Plant Maintenance		$9,825
9.	5% Erosion Control		$6,480
	Total Estimated Construction Cost		$136,025
	45% Contingency, Administration and Engineering		$61,210
	Total Estimated Project Cost		$197,235
		SAY	$200,000

Assumptions:

1. Construct water quality facility that would treat a water quality flow of 9.58 cubic feet per second of stormwater runoff. Assume linear vegetated swale.
2. No rock excavation will be required.
3. No dewatering will be required.
4. Facility will be located on public land (Stella Olsen Park) and no land acquisition will be required.
5. Assume access control fencing will be required.

Table E-7
Community Campus Park Stormwater Facility
Project Identifier CC-5
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	3,300 CY Excavation and Grading		$66,000
2.	0.68 Acre Landscaping and Temporary Irrigation		$20,400
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Inlet and Outlet Structures		$17,500
5.	High Flow Bypass Facility		$12,500
6.	Plant Maintenance		$5,100
7.	5% Erosion Control		$6,575
	Total Estimated Construction Cost		$138,075
	45% Contingency, Administration and Engineering		$62,135
	Total Estimated Project Cost		$200,210
		SAY	$200,000

Assumptions:

1. Construct water quality facility that would treat a water quality flow of 4.35 cubic feet per second of stormwater runoff. Assume linear vegetated swale.
2. Assume that no access road will be required as facility will be accessed off of adjacent City-owned footpath.
3. Assume no access control fencing will be required.
4. No rock excavation will be required.
5. No dewatering will be required.

Table E-8
Gleneagle Drive Stormwater Facility
Project Identifier CC-6
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	320 CY Excavation and Surface Restoration		$6,400
2.	0.09 Acres Seeding and Landscaping		$2,700
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$33,600
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$70,200
	45% Contingency, Administration and Engineering		$31,590
	Total Estimated Project Cost		$101,790
		SAY	$105,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.42 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-9
Glencoe Court Stormwater Facility
Project Identifier CC-7
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	90 CY Excavation and Surface Restoration		$1,800
2.	0.04 Acres Seeding and Landscaping		$1,200
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$19,200
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$49,700
	45% Contingency, Administration and Engineering		$22,365
	Total Estimated Project Cost		$72,065
		SAY	$75,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.12 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-10
Gleneagle Village Water Quality Facility
Project Identifier CC-8
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	270 CY Excavation and Surface Restoration		$5,400
2.	0.08 Acre Seeding and Landscaping		$2,400
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$28,800
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$64,100
	45% Contingency, Administration and Engineering		$28,845
	Total Estimated Project Cost		$92,945
		SAY	$95,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.36 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-11
Edy Road Stormwater Facility
Project Identifier CC-9
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,475 CY Excavation and Grading		$16,225
2.	0.32 Acre Landscaping		$9,600
3.	100 LF Access Road		$5,030
4.	780 LF Access Control Fencing		$19,500
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	650 LF 24-inch Diameter Storm Sewer Piping		$113,750
8.	Plant Maintenance		$2,400
9.	5% Erosion Control		$9,700
	Total Estimated Construction Cost		$194,005
	45% Contingency, Administration and Engineering		$87,302
	Total Estimated Project Cost		$284,307
		SAY	$285,000

Assumptions:

1. Construct water quality facility (extended dry basin) that would treat a water quality flow of 1.95 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. No rock excavation will be required.
3. No dewatering will be required.
4. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-12
Saint Charles (North) Stormwater Facility
Project Identifier CC-10
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	150 CY Excavation and Surface Restoration		$3,000
2.	0.005 Acre Seeding and Landscaping		$150
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$15,200
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$45,850
	45% Contingency, Administration and Engineering		$20,635
	Total Estimated Project Cost		$66,485
		SAY	$70,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.19 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-13
Saint Charles (South) Stormwater Facility
Project Identifier CC-11
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	200 CY Excavation and Surface Restoration		$4,000
2.	0.005 Acre Seeding and Landscaping		$150
3.	Pre-treatment (Sedimentation MH)		$10,000
4.	Proprietary Treatment System		$21,600
5.	50 LF 12-inch Diameter Bypass Piping		$5,000
6.	High Flow Bypass Facility		$12,500
	Total Estimated Construction Cost		$53,250
	45% Contingency, Administration and Engineering		$23,965
	Total Estimated Project Cost		$77,215
		SAY	$80,000

Assumptions:

1. Construct proprietary water quality treatment system in pre-cast manhole or vault that would treat a water quality flow of 0.27 cubic feet per second of stormwater runoff.
2. Target pollutants to be removed are total suspended solids (TSS) and phosphorous
3. Treatment system would be located in public right-of-way and no land acquisition would be required.
4. Bypass piping is 12-inch diameter storm sewer pipe, assumed maximum depth of 5 feet.
5. No rock excavation will be required.
6. No dewatering will be required.

Table E-14
Area 59 Regional Stormwater Facility
Project Identifier CC-12
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	2,010 CY Excavation and Grading		$40,200
2.	0.28 Acre Landscaping and Temporary Irrigation		$8,400
3.	100 LF Access Road		$5,000
4.	680 LF Access Control Fencing		$17,000
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$2,100
8.	5% Erosion Control		$5,010
	Total Estimated Construction Cost		$105,210
	45% Contingency, Administration and Engineering		$47,345
	Total Estimated Project Cost		$152,555
		SAY	$155,000

Assumptions:

1. Construct regional water quality facility (extended dry basin) that would treat a water quality flow of 2.65 cubic feet per second of stormwater runoff.
2. The facility could be oversized to provide detention to mitigate up to the 25-year storm event peak flow if necessary. The cost of detention is anticipated to be borne by the developer at the time of development.
3. No rock excavation will be required.
4. No dewatering will be required.
5. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-15
Brookman Addition Regional Stormwater Facility
Project Identifier CC-13
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,150 CY Excavation and Grading		$23,000
2.	0.25 Acre Landscaping and Temporary Irrigation		$7,500
3.	100 LF Access Road		$5,000
4.	650 LF Access Control Fencing		$16,250
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$1,875
8.	5% Erosion Control		$4,060
	Sub-total without Oversizing for Detention		$85,185
9.	Oversize to Provide Detention		$42,590
10.	900 LF 18-inch Diameter Storm Sewer Trunk Piping		$135,000
	Total Estimated Construction Cost		$262,775
	45% Contingency, Administration and Engineering		$118,250
	Total Estimated Project Cost		$381,025
		SAY	$385,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.51 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-16
Upper Ladd Hill Road Regional Stormwater Facility
Project Identifier CC-14
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,510 CY Excavation and Grading		$30,200
2.	0.33 Acre Landscaping and Temporary Irrigation		$9,900
3.	100 LF Access Road		$5,000
4.	800 LF Access Control Fencing		$20,000
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$2,475
8.	5% Erosion Control		$4,755
	Sub-total without Oversizing for Detention		$99,830
9.	Oversize to Provide Detention		$137,100
10.	975 LF 18-inch Diameter Storm Sewer Trunk Piping		$146,250
	Total Estimated Construction Cost		$383,180
	45% Contingency, Administration and Engineering		$172,430
	Total Estimated Project Cost		$555,610
		SAY	$560,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.99 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-17
West Brookman Road Regional Stormwater Facility
Project Identifier CC-17
Cost Estimate Summary

Item No.	Description	Estimated Construction Cost
1.	850 CY Excavation and Grading	$17,000
2.	0.19 Acre Landscaping and Temporary Irrigation	$5,700
3.	100 LF Access Road	$5,000
4.	500 LF Access Control Fencing	$12,500
5.	Pre-treatment (Sedimentation MH)	$10,000
6.	Inlet and Outlet Structures	$17,500
7.	Plant Maintenance	$1,425
8.	5% Erosion Control	$3455
	Sub-total without Oversizing for Detention	$72,580
9.	Oversize to Provide Detention	$38,575
10.	450 LF 18-inch Diameter Storm Sewer Trunk Piping	$67,500
	Total Estimated Construction Cost	$178,655
	45% Contingency, Administration and Engineering	$80,395
	Total Estimated Project Cost	$259,050
	SAY	$260,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.11 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-18
Murdock Road (North) Regional Stormwater Facility
Project Identifier RC-1
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	4,750 CY Excavation and Grading		$95,000
2.	1.0 Acre Landscaping and Temporary Irrigation		$30,000
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	Inlet and Outlet Structures		$17,500
6.	High Flow Bypass Facility		$12,500
7.	Plant Maintenance		$7,500
8.	5% Erosion Control		$8,875
	Total Estimated Construction Cost		$186,375
	45% Contingency, Administration and Engineering		$83,870
	Permitting		$75,000
	Total Estimated Project Cost		$345,245
		SAY	$350,000

Assumptions:

1. Construct water quality and detention/retention facility (constructed wetland or vegetated swale) that would treat a water quality flow of 6.27 cubic feet per second of stormwater runoff.
2. No rock excavation will be required.
3. No dewatering will be required.
4. Project will be constructed based on City-owned land. No land acquisition will be required.
5. Allowance for permitting work includes anticipated environmental permitting because of proposed location of the facility.

Table E-19
Oregon Street Regional Stormwater Facility
Project Identifier RC-2
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	3,865 CY Excavation and Grading		$77,300
2.	0.80 Acre Landscaping and Temporary Irrigation		$24,000
3.	100 LF Access Road		$5,000
4.	Pre-treatment (Sedimentation MH)		$10,000
5.	Inlet and Outlet Structures		$17,500
6.	High Flow Bypass Facility		$12,500
7.	Plant Maintenance		$6,000
8.	5% Erosion Control		$7,615
	Total Estimated Construction Cost		$159,915
	45% Contingency, Administration and Engineering		$71,965
	Permitting		$75,000
	Total Estimated Project Cost		$306,880
		SAY	$310,000

Assumptions:

1. Construct water quality and detention facility that would treat a water quality flow of 5.1 cubic feet per second of stormwater runoff. Assumed to be extended dry basin.
2. No rock excavation will be required.
3. No dewatering will be required.
4. Allowance for permitting work includes anticipated environmental permitting because of proposed location of the facility.

Table E-20
Lower Rock Creek Regional Stormwater Facility
Project Identifier RC-3
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	4,530 CY Excavation and Grading		$90,600
2.	0.95 Acre Landscaping and Temporary Irrigation		$28,500
3.	100 LF Access Road		$5,000
4.	2,100 LF Access Control Fencing		$52,500
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	High Flow Bypass Facility		$12,500
8.	Plant Maintenance		$7,125
9.	5% Erosion Control		$11,185
	Total Estimated Construction Cost		$234,910
	45% Contingency, Administration and Engineering		$105,710
	Total Estimated Project Cost		$340,620
		SAY	$340,000

Assumptions:

1. Construct water quality and detention facility (extended dry basin or vegetated swale) that would treat a water quality flow of 5.97 cubic feet per second of stormwater runoff.
2. No rock excavation will be required.
3. No dewatering will be required.

Table E-21
Tonquin Road (North) Stormwater Facility
Project Identifier RC-4
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,010 CY Excavation and Grading		$20,200
2.	0.07 Acres Landscaping		$2,100
3.	100 LF Access Road		$5,000
4.	250 LF Access Control Fencing		$6,250
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	High Flow Bypass Facility		$12,500
8.	Plant Maintenance		$525
9.	5% Erosion Control		$3,705
	Total Estimated Construction Cost		$77,780
	45% Contingency, Administration and Engineering		$35,000
	Permitting		$50,000
	Total Estimated Project Cost		$162,780
		SAY	$165,000

Assumptions:

1. Construct water quality facility (extended dry basin or vegetated swale) that would treat a water quality flow of 0.28 (1.33) cubic feet per second of stormwater runoff.
2. Study should be conducted to determine that a facility with no detention will not cause capacity concerns at either the existing Rock Creek culvert that passes under the railroad tracks or the existing culvert that passes under Tualatin-Sherwood Road.
3. No rock excavation will be required.
4. No dewatering will be required.
5. Allowance for permitting work includes anticipated environmental permitting because of proposed location of the facility.

Table E-22
Tonquin Road (South) Stormwater Facility
Project Identifier RC-5
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,450 CY Excavation and Grading		$29,000
2.	0.31 Acre Landscaping and Temporary Irrigation		$9,300
3.	100 LF Access Road		$5,000
4.	760 LF Access Control Fencing		$19,000
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$2,325
8.	5% Erosion Control		$4,610
	Sub-total without Oversizing for Detention		$96,735
9.	Oversize to Provide Detention		$412,250
10.	900 LF 24-inch Diameter Storm Sewer Trunk Piping		$157,500
11.	600 LF 18-inch Diameter Storm Sewer Trunk Piping		$90,000
	Total Estimated Construction Cost		$756,485
	45% Contingency, Administration and Engineering		$340,420
	Total Estimated Project Cost		$1,096,905
		SAY	$1,100,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.51 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-23
Murdock Road (South) Stormwater Facility
Project Identifier RC-6
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	295 CY Excavation and Grading		$5,900
2.	0.09 Acre Landscaping and Temporary Irrigation		$2,700
3.	100 LF Access Road		$5,000
4.	270 LF Access Control Fencing		$6,750
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$675
8.	5% Erosion Control		$2,430
	Sub-total without Oversizing for Detention		$50,955
9.	Oversize to Provide Detention		$24,215
10.	600 LF 18-inch Diameter Storm Sewer Trunk Piping		$90,000
	Total Estimated Construction Cost		$165,170
	45% Contingency, Administration and Engineering		$74,325
	Total Estimated Project Cost		$239,495
		SAY	$240,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 1.51 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-24
Hedges Creek Stormwater Facility
Project Identifier HC-1
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	5,800 CY Excavation and Grading		$116,000
2.	1.18 Acres Landscaping and Temporary Irrigation		$35,400
3.	100 LF Access Road		$5,000
4.	2,650 LF Access Control Fencing		$66,250
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$8,850
8.	5% Erosion Control		$12,950
	Sub-total without Oversizing for Detention		$271,950
9.	Oversize to Provide Detention		$165,025
10.	750 LF 30-inch Diameter Storm Sewer Trunk Piping		$150,000
	Total Estimated Construction Cost		$586,975
	45% Contingency, Administration and Engineering		$264,140
	Total Estimated Project Cost		$851,115
		SAY	$855,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 7.66 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

Table E-25
Coffee Lake Creek Stormwater Facility
Project Identifier CL-1
Cost Estimate Summary

Item No.	Description		Estimated Construction Cost
1.	1,925 CY Excavation and Grading		$38,500
2.	0.41 Acre Landscaping and Temporary Irrigation		$12,300
3.	100 LF Access Road		$5,000
4.	970 LF Access Control Fencing		$24,250
5.	Pre-treatment (Sedimentation MH)		$10,000
6.	Inlet and Outlet Structures		$17,500
7.	Plant Maintenance		$3,075
8.	5% Erosion Control		$5,530
	Sub-total without Oversizing for Detention		$116,155
9.	Oversize to Provide Detention		$54,060
10.	600 LF 24-inch Diameter Storm Sewer Trunk Piping		$105,000
	Total Estimated Construction Cost		$275,215
	45% Contingency, Administration and Engineering		$123,850
	Total Estimated Project Cost		$399,065
		SAY	$400,000

Assumptions:

1. Construct regional water quality and detention facility (extended dry basin) that would treat a water quality flow of 2.54 cubic feet per second of stormwater runoff. The facility would be oversized to provide detention to mitigate up to the 25-year storm event, if detention is determined to be necessary.
2. Oversizing costs for detention include additional grading due to increased size of facility, additional landscaping and plant maintenance, and additional length of access control fence.
3. Length of storm sewer trunk sizing assumes service from the proposed facility location to the approximate geographic center of the contributing area. Size of storm sewer trunk assumes pipe full flow at a velocity of 3 fps, conveying the 25-year storm event peak flow.
4. No rock excavation will be required.
5. No dewatering will be required.
6. Project will be constructed based on when land is developed. Land may be provided to the City by developer, which may allow developer to pay reduced SDC.

APPENDIX F
REFERENCES

1. Area 59 Project, Revised Concept Plan, updated September, 2006.

2. City of Sherwood Comprehensive Plan Part II, August, 2003.

3. City of Sherwood, Stormwater Master Plan, May, 1993, David Evans and Associates, Inc.

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12. *User's Guide to SWMM,* Computational Hydraulics, Inc., 2005.

13. *Recommended Best Management Practices for Stormwater Discharges,* Oregon Department of Environmental Quality, August, 1997.