City of Eugene

Stormwater Basin Master Plan

Willakenzie Basin

Volume V of VII

CITY OF EUGENE
STORMWATER
MANAGEMENT PROGRAM

August 2002
Prepared by:
City of Eugene
URS Corporation
Lane Council of Governments

Local Stormwater Planning Can Make a World of Difference

Stormwater Basin Master Plan

Volume V of VII

Willakenzie Basin

December 2002

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ACKNOWLEDGEMENTS

The Stormwater Basin Master Plan represents the culmination of a long term planning effort by a multi-agency team consisting of representatives from the City of Eugene, Lane Council of Governments (LCOG), and URS Corporation.

The project team would like to gratefully acknowledge the efforts of the many present and former city and consultant staff who provided input for and review of this document. The following acknowledgements include a representative from each of the divisions, departments and agencies involved over the years. The project team would like to especially acknowledge the leadership, guidance, commitment and contribution to this effort by Christine Andersen, former Public Works Director and the late Les Lyle, City Engineer (1983-2001) for Eugene.

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The information published in this report is subject to revision. Please contact the City of Eugene's Engineering Division for potential changes before proceeding with any engineering design that uses the information published herein.

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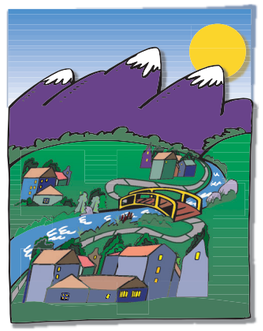
City of Eugene



Vision for a Green Infrastructure

Willakenzie Basin

Stormwater Management Strategy

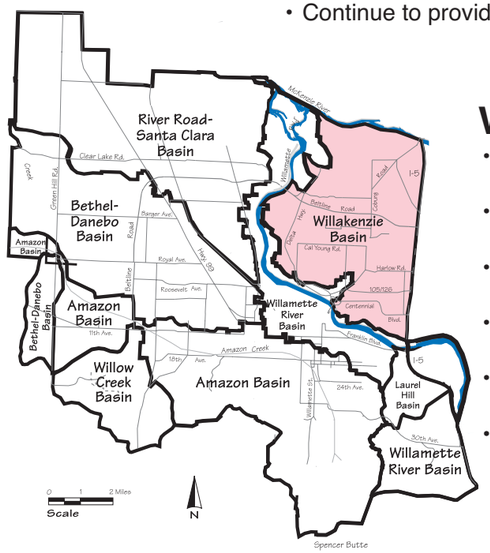
Located in northeast Eugene, the basin is wedged between the Willamette River on the south and west and the McKenzie River to the north. Flat topography and permeable soils combine to create environmental conditions somewhat different than in other city basins, such as less runoff during storm events and fewer wetlands and waterways. Mostly developed and residential in character, there are few remaining vacant acres in the basin. The basin assessment process for this basin revealed:

- Drainage problems are nearly nonexistent under existing conditions and few problems are projected under future buildout conditions.
- Untreated stormwater runoff from existing land uses is the primary water quality issue.
- Existing waterways and riparian areas will be moderately impacted by increased runoff volumes, rates, and pollutants due to new development.
- Waterway restoration potential exists along most of the waterways.

Strategy

The recommended strategy for this basin is:

- Reduce existing pollutants to the extent feasible through system retrofits, especially in high source areas.
- Minimize future pollutants through on-site development standards.
- Protect waterways through a combination of development standards and other techniques including acquisition.
- Address existing stream bank stabilization problems through capital projects.
- Restore waterways through federal-local partnerships.
- Continue to provide flood protection services basin wide.



Basin Context Map

Willakenzie Basin Facts

- Ranks fourth among all the basins in total size (7,314 acres).
- Ranks third in the amount of area designated as 100-year floodplain (1,928 acres).
- Ranks fourth in total length of local open waterways (25 miles) and fifth in proportion of waterways to basin size.
- Impervious surface area in the UGB is projected to increase from 37% to 47% at full buildout.
- Is home to Spring Chinook, listed as a threatened fish species.
- Named after the two major river systems in the Southern Willamette Valley, the Willamette and McKenzie rivers.

August 2002

Comprehensive Plan

Cleaner, Safer, Healthier Environment

Adoption of the **Comprehensive Stormwater Management Plan** (CSWMP) in November 1993 ushered in a new vision for managing the City of Eugene's stormwater program. In addition to protecting the community from flooding problems, CSWMP expanded the program to include protection of stormwater water quality and related natural resources.

Basin Planning

Bringing CSWMP into Focus

Basin Planning is one of many action items for implementing CSWMP. The basin planning process includes assessing existing conditions, identifying stormwater system problems and opportunities, and recommending management strategies for implementing several CSWMP policies. Each of the City's seven drainage basins offers unique conditions and opportunities for implementing capital projects and development standards. Basin planning, therefore, is a refinement of CSWMP's broader policy direction representing what is feasible and practical to implement at the stormwater system level.

Other Activities

In addition to Basin Planning, many other city activities are conducted to enhance water quality, protect stormwater-related natural resources, and prevent flooding. A few examples include:

- Erosion control for construction activities
- Education and outreach
- Monitor stormwater discharges of certain industrial uses
- Street sweeping
- Volunteer programs
- Vegetation management

Green Infrastructure

Green Infrastructure uses the beneficial flood control and water quality treatment characteristics of the natural landscape to help meet stormwater management objectives. When linked with the constructed system, the two work together to form a coordinated drainage system of streams, ponds, streets, and pipes.

Why This Strategy?

Flood Control

- Capital projects are the most cost-effective solutions for correcting existing problems and will be designed to address the incremental effects of new development.

Water Quality

- *Existing Pollution Problem:* Capital projects are the most cost-effective solutions for addressing existing conditions, along with other ongoing program activities.
- *Pollution Associated with New Development:* Development standards are most effective for addressing pollutants at their source.

Stormwater-Related Natural Resources

- Capital projects are the most viable method for addressing negative effects of high runoff volumes in open waterways for existing developed areas.
- Stream corridor acquisition can be used to protect a limited number of high-priority waterways.
- Development standards are effective at preventing encroachment into waterways and preserving water quality functions.

More Information

- Visit the City's website at www.ci.eugene.or.us/pw/storm
- Contact Therese Walch at (541) 682-6839

EUGENE

The Management Strategy

Flood Control

Issue: **Some areas do not meet existing stormwater protection requirements.**

Desired Outcome: Flood protection requirements are met basin-wide.

Actions: **Capital Projects – see map**
- WK07 – River Point Pond outlet channel.
- WK08A – Gilham Road system culvert replacement.
- WK16A – Enhance capacity of Ascot Park waterway.

Stormwater-Related Natural Resources

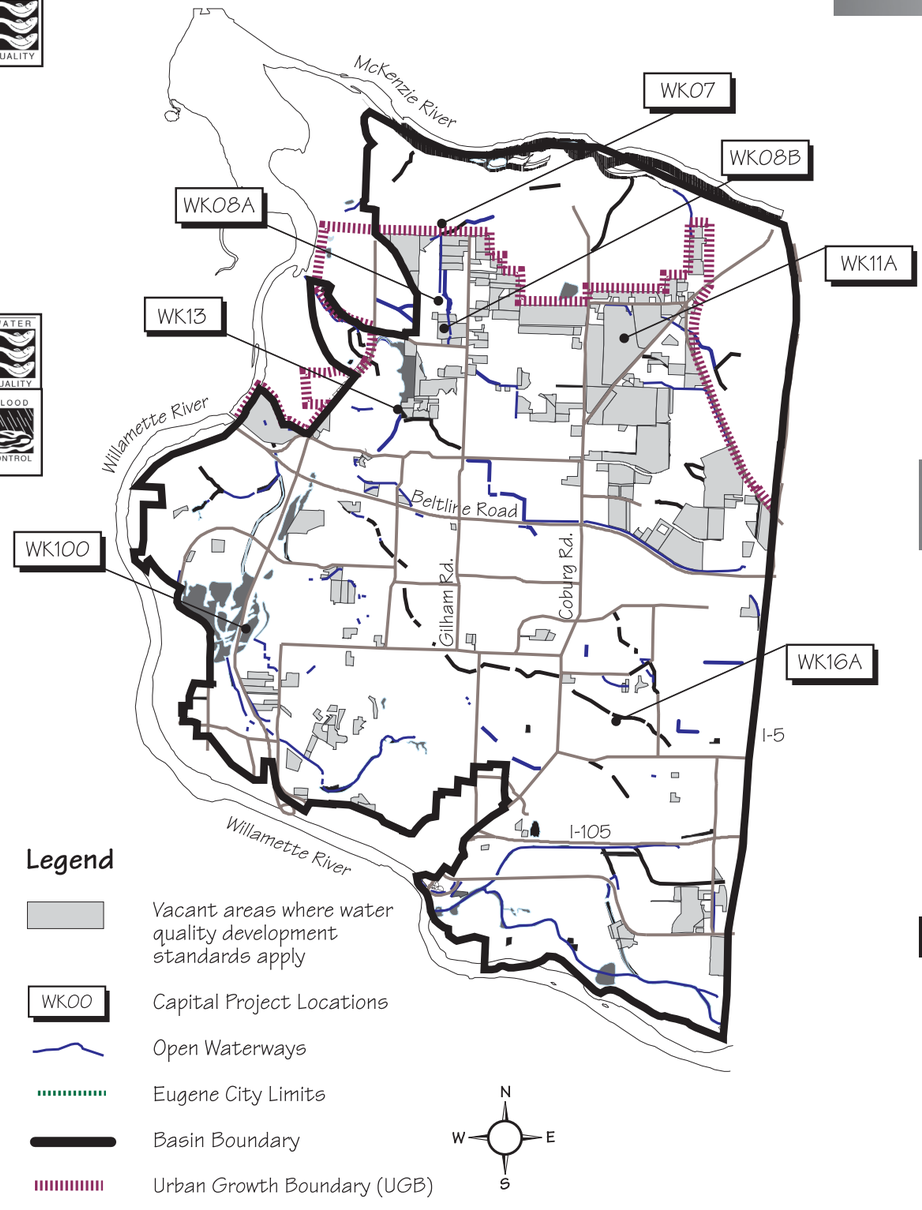
Issue: **Natural resources functions and values are being lost or are degraded due to lack of an overall management and implementation plan.**

Desired Outcome: Maintain and improve the extent and quality of existing stormwater-related natural resources.

Actions: **Capital Projects – see map**
- WK11A – Riparian-wetland waterway protection at Coburg and County Farm roads.
- Yearly budget item: Streambank Stabilization Projects.
- Ongoing: Restore waterways through federal-local partnerships (to be identified).

Development Standards – see map
- Prohibit filling/piping of important storm waterways.
- Require streamside setbacks.

Acquisition
- Acquire stream corridors according to the *City's Stream Corridor Acquisition Study.*



Water Quality

Issue: **Runoff from existing development is a major source of pollutants.**

Desired Outcome: Pollutants from existing land uses are reduced.

Actions: **Capital Projects – see map**
- WK13 – Ayers Pond outfall retrofit.
- WK08B – Gilham Road system water quality facility.
- WK100 – Federal priority project for Delta Ponds enhancement.
- Yearly Budget Item – water quality facilities in high source areas.
- Yearly Budget Category – retrofit tip-ups.
- Yearly Budget Category – outfall stabilization.

Issue: **Runoff from future development will increase pollutant discharges.**

Desired Outcomes: Reduce stormwater pollution from new development.

Actions: **Development Standards – see map**
- New and significant redevelopment projects are required to treat all runoff from City's water quality design standard.
- Incentives – provide incentives for existing development to reduce effective impervious surface areas and treat stormwater runoff.

Other Elements of the Strategy

- General Stormwater Rehabilitation Projects.
- Channel Easement Acquisition.

CITY OF EUGENE
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MANAGEMENT PROGRAM

SECTION 1 Introduction

Adoption of the City of Eugene's *Comprehensive Stormwater Management Plan* (CSWMP) in November 1993 marked a significant shift in the City's approach to stormwater management. In addition to drainage and flood control services, the stormwater program was expanded to include the protection and enhancement of stormwater quality and related natural resources. Since the previous *Storm Drainage Master Plan* (OTAK, 1990) was developed solely for the purpose of addressing drainage and flood control issues, an update of that Plan was necessary to bring it into compliance with current City policy. As a result, the City initiated a project to develop multiple-objective Stormwater Basin Master Plans.

In addition to CSWMP, other locally adopted policy documents were reviewed for applicability to the Basin Master Planning effort. The following were identified for containing policies related to and supportive of protection of water quality and related natural resources:

1) Eugene/Springfield Metro Area General Plan (1987 Update) in general and, specifically, the following refinement plans:

   - Bethel-Danebo, 1982
   - Eugene Downtown Plan, 1984
   - Eugene Parks and Recreation Plan, 1989
   - Jefferson/Far West, 1983
   - Public Facilities and Services Plan, December 2001
   - Laurel Hill, 1982
   - Riverfront Park Study, 1985
   - River Road-Santa Clara Urban Facilities Plan, 1985
   - South Hills Study, 1974
   - Willakenzie Neighborhood, 1991
   - Willow Creek, 1982

2) Eugene Growth Management Study, 1998

The overall goal of the Stormwater Basin Master Plans was to provide a stormwater management strategy for each basin that proactively addresses the multiple objectives of CSWMP. In addition to flood control, these multiple objectives include:

- Protect and improve water quality.
- Protect natural resources that provide beneficial stormwater functions.
- Use best management practices that promote a green infrastructure.
- Address the unique qualities of each drainage basin.
- Meet federal, state, and local laws and policies (including CSWMP, the Clean Water Act, the Endangered Species Act, and State Underground Injection Control Rules – for these broader topics and other issues, please refer to Volume I).
- Complement other existing BMPs that are part of the City's stormwater program.
- Balance responsibilities community-wide.
- Provide a dynamic and flexible program that can be refined based on a changing regulatory climate.

SECTION 1 Introduction

This report presents the integrated stormwater management strategy (integrated strategy) for the Willakenzie basin. It represents Volume V of a seven volume report generated to summarize and document the city-wide Stormwater Basin Master Plans. Volume I provides an overview of the project, describes the process for developing integrated strategies, and summarizes the information that is presented in detail in the six companion volumes, each of which covers one of the following City's six drainage basins: *Volume II - Amazon Creek, Volume III - Bethel-Danebo, Volume IV – Laurel Hill, Volume V - Willakenzie, Volume VI - Willamette River, Volume VII - Willow Creek.* Volumes II through VII provide more detailed information regarding development of stormwater management strategies for each of the six basins including: characteristics unique to the basin; results of the basin evaluation for flood control, water quality and stormwater related natural resources; and resulting integrated stormwater management strategies. A basin specific plan was not produced for River Road Santa Clara, pending resolution of inter-jurisdictional issues as well as additional information gathering and analysis.

NOTE: It should be noted that the term basin is typically used to refer to a defined surface area that drains to a common discharge point. However, for the purposes of this study, the term basin is used to refer to a specific planning or study area. While the planning or study areas were developed based on topography and drainage patterns, they may include several discharge points, or they may exclude specific tributary areas based on convenience for planning purposes. In some cases, portions of the basin were not included in the planning area as they are managed by other jurisdictions. The basin areas as defined in this plan are also further divided into major subbasins and subbasins as described in Section 3.0.

The process conducted to develop integrated strategies for each of the six basins included the following thirteen steps. The details regarding each of these steps are provided in Volume I.

Step 1) Compile information regarding the unique characteristics of each basin that are related to the stormwater drainage system.
Step 2) Identify problems and opportunities associated with the stormwater drainage system with respect to flood control, water quality, natural resources, and maintenance.
Step 3) Develop potential solutions in the form of capital projects and development standards for addressing identified problems.
Step 4) Evaluate and compare potential solutions in terms of feasibility, costs, and effectiveness.
Step 5) Evaluate capital projects to address problems expected under existing conditions.
Step 6) Evaluate capital projects and development standards to address problems expected as a result of future build-out.
Step 7) Select an integrated stormwater management strategy based on the evaluations conducted in steps 5 and 6.
Step 8) Develop a maintenance strategy for the proposed solutions.
Step 9) Obtain feedback regarding integrated stormwater management strategies and the maintenance strategy from the public and refine the strategies as appropriate.
Step 10) Prioritize selected capital projects for implementation and conduct a financial analysis.

Step 11) Develop stormwater basin master plans to summarize the integrated stormwater management strategies including proposed capital projects and development standards.
Step 12) Develop an ordinance to implement the proposed development standards.
Step 13) Develop a best management practices manual to help guide developers in meeting the requirements of the development standards.

The process for conducting these steps is outlined in Figure 1-1. As a result of this process, a mix of capital projects and development standards was proposed for each of the basins. A total of 44 multiple-objective capital projects were selected for the integrated stormwater management strategies city-wide (not including the Santa Clara/River Road basin). Seven of these are located in the Willakenzie basin. In addition, development standards were selected for treating the quality of runoff from new development and for protecting open waterways. These standards were proposed city-wide and therefore would apply to the Willakenzie basin when enacted. A development standard was adopted in April 2000 (Open Waterways Ordinance) that prohibited waterways from being filled and/or piped. The ordinance was subsequently appealed and remanded back to the City by the Oregon Court of Appeals (July 2001) and is no longer in effect. Additional methods and options for protecting open waterways are under review. In the meantime, waterway protection efforts will include stream corridor acquisitions and land use approval criteria where applicable.

Information updates related to this plan are provided at the end of this section. The integrated basin strategy specific to the Willakenzie basin is described in the following sections. Section 2.0 provides a summary of the specific characteristics in the Willakenzie basin. Sections 3.0, 4.0, and 5.0 provide summaries of the flood control, water quality, and stormwater related natural resources evaluations respectively. Section 6.0 describes the resulting integrated basin strategy and Section 7.0 provides information regarding the implementation of the strategy including scheduling and financing.

Information Updates

The information contained in this document represents a "snapshot-in-time." The Study Area Characteristics data (Section 2) is current through 1998, and the evaluation data (Sections 3, 4, 5, and 6) are current through June, 2001. As conditions in this basin change, the information in this document will need to be updated to reflect those conditions.

The following recent or imminent changes to conditions, information, or the integrated basin strategy are not reflected in this document, but will be addressed in the next update:

- Subbasin boundaries changes in County Farm subbasin WKCF-010. Updated information is available by contacting the City of Eugene Public Works Department Engineering Division.
- Culvert replacement at the most upstream end of subbasin WKGN-070 (this change is reflected on the maps but not in the model results in Table 3-2.
- The subbasins WKCF-040 and WKCF-050 have changed since the time the models were completed. The model results in Tables 3-1 and 3-2 reflect the old subbasin delineations. The map (Figure 3-3) reflects the updated subbasin delineations where subbasins WKCF-040

and WKCF-050 have been further delineated into subbasins WKCF040, WKCF-041, WKCF-042, WKCF-050, WKCF-051, WKCF-052, and WKCF-053.

- The narrative description of existing and future parks and schools in subsections 2.10.1 and 2.10.2 has been updated to the time of printing of this document. Map 12 (Section 2), Parks, Recreation, and Educational Facilities, has not been updated to match. Map 12 changes will be included in the next document update.
- Eugene is participating in a Metropolitan Waterways Restoration project with the Army Corps of Engineers and other metro partners under authority of the Water Resources Development Act. This Study will further define and prioritize needs for waterway restoration throughout the metro area including waterways in the Willakenzie basin, and will allow the City to partner with, and cost share with, the Corps and other agencies to optimize the use of local funds for stream restoration. The first phase of this study, the Reconnaissance Phase, was initiated in February 2002. The second phase, Feasibility, is expected to begin in spring 2003. Implementation of on-the-ground projects is anticipated by 2007.
- Relationship to and compliance with the State of Oregon's Underground Injection Well requirements.
- Eugene Water and Electric Board's (EWEB) wellfield development plans in the Coburg Road/County Farm Road and Crescent Meadows area.
- Relationship to Eugene's ESA/Salmon response strategy.
- Updates to rare plant and animal species inventories through the Oregon Natural Heritage Program data base.

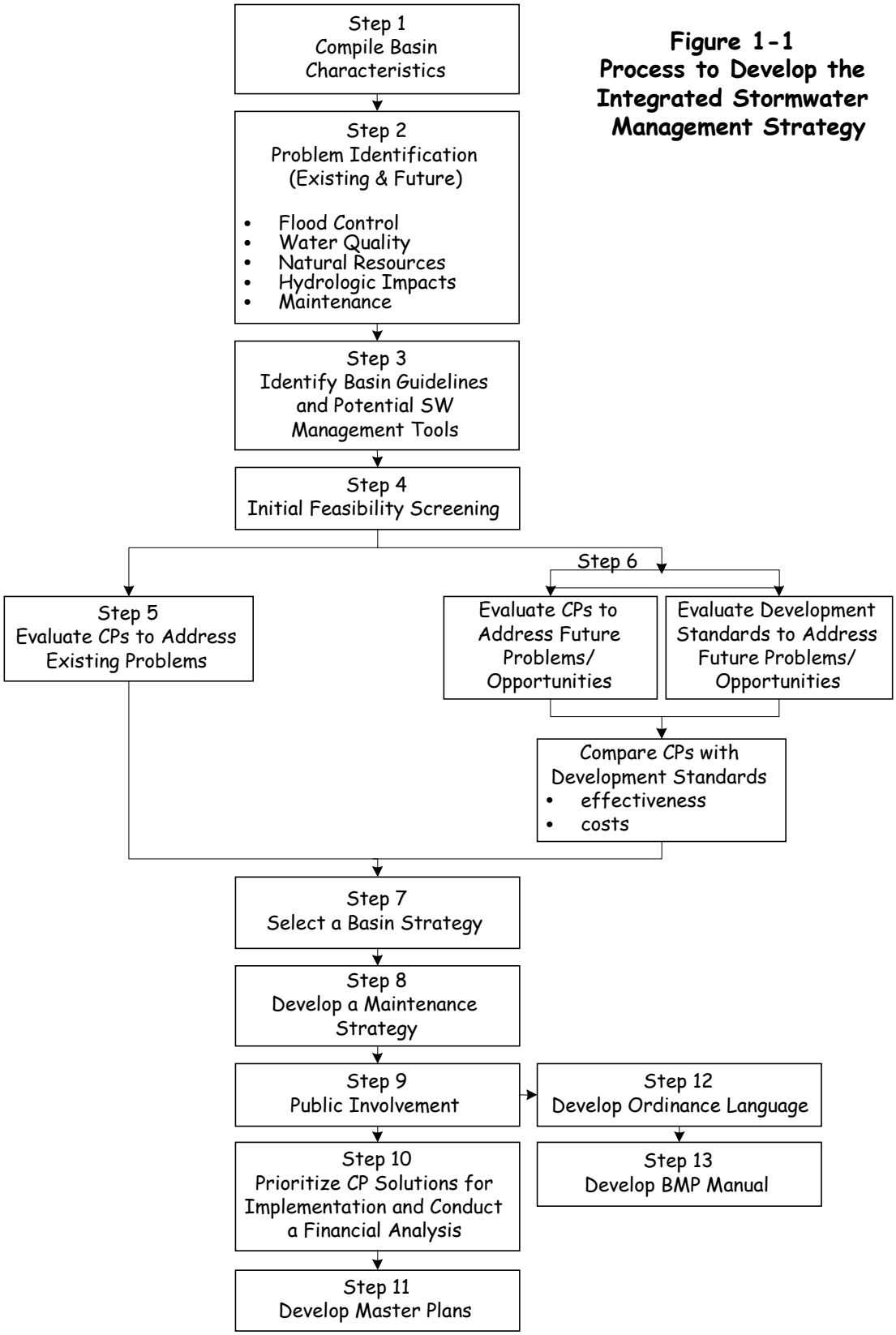


Figure 1-1
Process to Develop the Integrated Stormwater Management Strategy

SECTION 2 Study Area Characteristics

This section provides background information regarding the existing physical characteristics of the Willakenzie basin. This information was used to assess opportunities and constraints for meeting the multiple-objective goals of the Stormwater Basin Master Plans. Specifically this section includes the following information for the Willakenzie basin: location and area; climate; land use and surface cover; land form; topography and slopes; surface water features and drainage system; water quality; rare, threatened and endangered plants, animals and communities; soils; groundwater; and recreational and educational facilities.

2.1 Location and Area

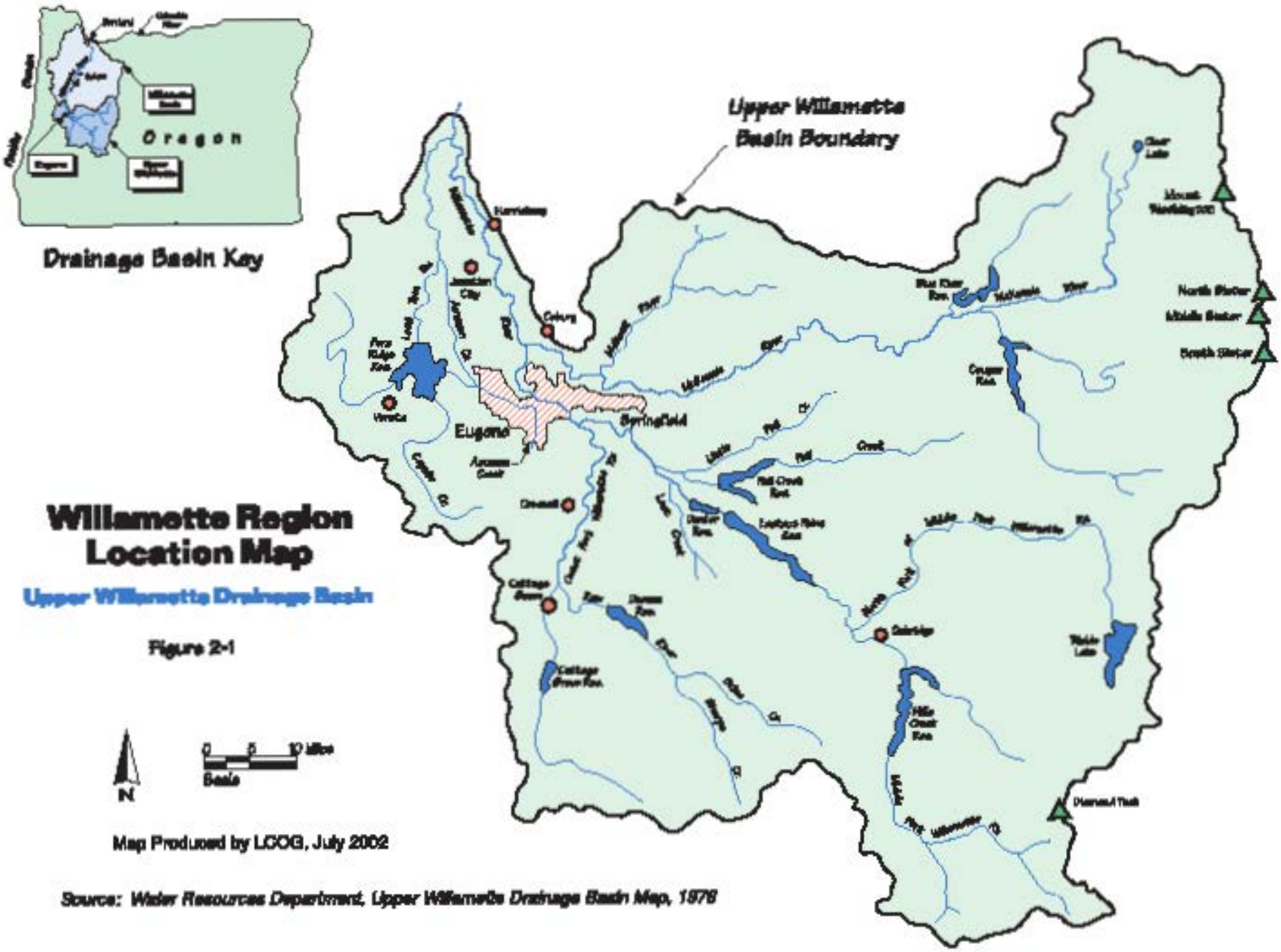
2.1.1 Regional Drainage Context

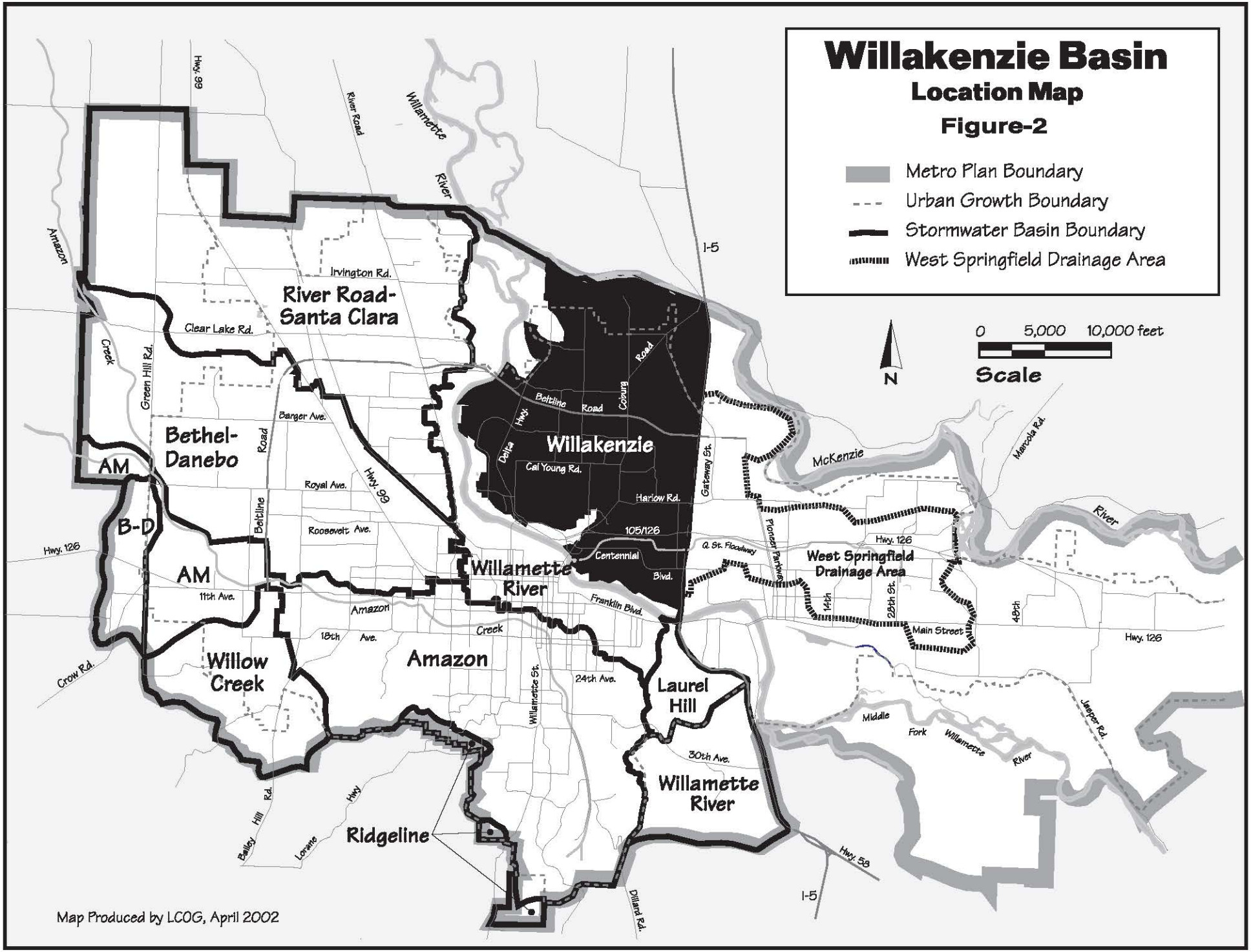
Eugene is located in the western third of the Upper Willamette Drainage Basin as shown on Figure 2-1. Drainage in the southern Willamette Valley is a combination of natural and built systems that have evolved over time. The natural system is composed of rivers, waterways, and a series of interconnected ponds and wetlands. Historically, the natural system had an extensive floodplain that typically experienced over-bank flooding every 1-2 years. The built drainage system includes a series of dams, pipes, and waterways that were built to contain over-bank flooding, and to retain water for recreational and irrigation purposes. The primary drainage features of the Upper Willamette Drainage Basin are: Main Stem of the Willamette River, Middle Fork of the Willamette River, Coast Fork of the Willamette River, McKenzie River, Amazon Creek, Coyote Creek, and the Long Tom River. From 1940 to 1960, the U.S. Army Corps of Engineers built nine dams on this system.

The cities of Cottage Grove, Creswell, and Springfield are all upstream from the City of Eugene and contribute urban runoff to the regional drainage system. Runoff from Cottage Grove, Creswell, and South Springfield flows through Eugene via the Willamette River. Approximately 4,800 acres of west Springfield's drainage area, as shown on Figure 2-2, discharges urban runoff into the Q Street Floodway, which is within Eugene's public drainage system. Eugene public drainage system refers to the system of stormwater facilities (i.e., pipes, ditches, open waterways) that Eugene is responsible for operating and maintaining.

2.1.2 City of Eugene

The City of Eugene is currently responsible for managing the stormwater quantity, quality, and related natural resources for the drainage area within its city limits. The area outside of the City limits but within the urban growth boundary (UGB) is expected to be annexed into the city as urban development occurs. Therefore, this Stormwater Basin Master Plan includes both the current city limits and the area within the UGB. The *Eugene-Springfield Metro Area General Plan (Metro Plan)* boundary covers the city limits, the UGB and, in some cases, areas beyond the UGB. For the purposes of characterizing the study area in this chapter, the area covered includes the *Metro Plan* boundary.


Oregon
Drainage Basin Key
Upper Willamette
Basin Boundary
Eugene
Springfield
Coburg
Harrisburg
Junction City
Veneta
Cottage Grove
Dexter
Lowell
Oakridge
Blue River
McKenzie River
Cougar
North Sister
Middle Sister
South Sister
Mount Washington
Diamond Peak
Willamette Region
Location Map
Upper Willamette Drainage Basin
Figure 2-1
N
0 5 10 Miles
Scale
Map Produced by LCOG, July 2002
Source: Water Resources Department, Upper Willamette Drainage Basin Map, 1976


Willakenzie Basin
Location Map
Figure-2
Metro Plan Boundary
Urban Growth Boundary
Stormwater Basin Boundary
West Springfield Drainage Area
N
0 5,000 10,000 feet
Scale
River Road-
Santa Clara
Bethel-
Danebo
AM
B-D
AM
Willow
Creek
Amazon
Willakenzie
Willamette
River
Laurel
Hill
Willamette
River
Ridgeline
West Springfield
Drainage Area
Hwy. 99
River Road
Willamette
River
I-5
Irvington Rd.
Clear Lake Rd.
Green Hill Rd.
Barger Ave.
Royal Ave.
Roosevelt Ave.
11th Ave.
18th Ave.
Amazon
Creek
Crow Rd.
Beltline
Road
Hwy. 126
Beltline Road
Coburg
Road
Delta
Hwy.
Cal Young Rd.
Harlow Rd.
105/126
Centennial
Blvd.
Gateway St.
McKenzie
River
Marcola Rd.
Q St. Floodway
Pioneer Parkway
Hwy. 126
14th
28th St.
48th
Main Street
Hwy. 126
Franklin Blvd.
24th Ave.
Willamette St.
30th Ave.
Middle
Fork
Willamette
River
Jasper Rd.
Hwy. 58
I-5
Dillard Rd.
Bailey Hill Rd.
Lorane Hwy
Map Produced by LCOG, April 2002

2.1.3 Willakenzie Basin

The Willakenzie basin forms the northeastern corner of the Eugene metropolitan area as shown on Figure 2-2. It is generally bounded by the McKenzie River on the north, Interstate 5 on the east, and the Willamette River on the south and west. With a total area of approximately 7,314 acres, 83 percent of the basin (6,096 acres) is within the UGB. The remaining 17 percent of the basin (1,218 acres) is outside the UGB. The portion outside the UGB is designated as agriculture, parks and open space, and sand and gravel land uses.

2.2 Climate

The climate in the study area is primarily affected by humid air masses from the west and south, and infrequent influxes of cold, continental air masses from the east. As a result, the year-round climate in Eugene is moderate with relatively cool, wet winters, and warm, dry summers. Average minimum winter temperatures are in the mid-30s with extremes seldom dropping below 10 degrees Fahrenheit (-12.2 Celsius). Average maximum summer temperatures are in the low 80's (26.7 to 28.9 Celsius) with extremes seldom exceeding 100 degrees Fahrenheit (37.8 Celsius). Snowfall constitutes only 2 percent of the annual precipitation in Eugene. Winter snow does not accumulate; however, quick snow melt can contribute to flooding problems throughout the Eugene area.

The National Weather Service records rainfall information at the Mahlon Sweet Airport in Eugene. Average annual precipitation is approximately 46 inches with 86 percent occurring from October to May. Figure 2-3 presents the average monthly rainfall distribution based on the airport's 48-year rainfall record from 1949-1987.

Figure 2-3
Average Monthly Rainfall

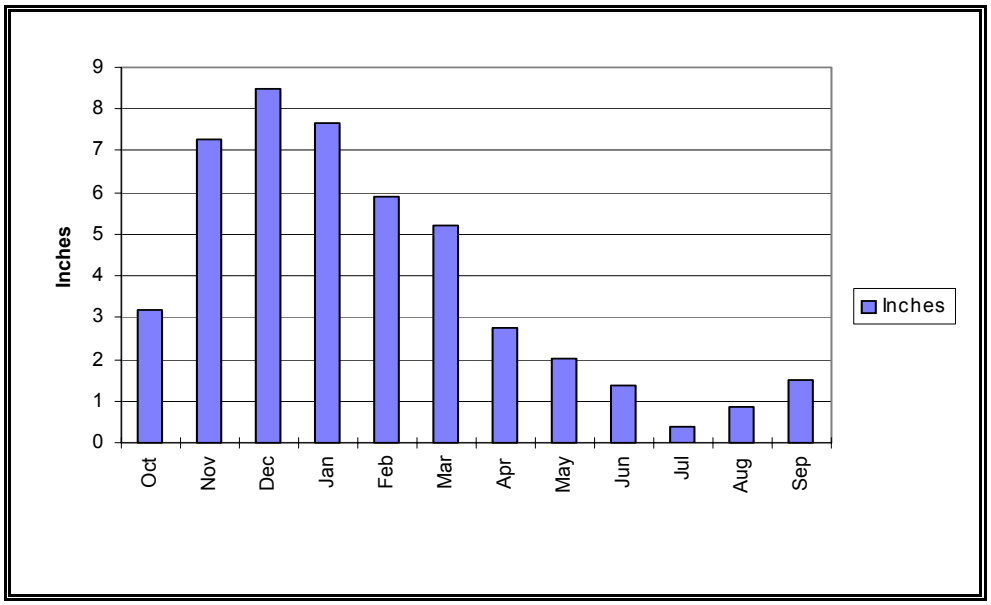


Table 2-1 characterizes a typical storm event for the Eugene area based on the historic 48-year precipitation record measured at the Eugene Airport:

Table 2-1
Average Storm Event

Storm Event Parameter	Average
Volume	0.67 inches
Duration	16.9 hours
Intensity	0.042 inches per hour

Since 1992, rainfall information has been recorded at six rain-gage stations within the Eugene city limits. Comparison of those data with the National Weather Service's Eugene Airport data indicates a significant difference between the two, with the airport data approximately 30 percent higher. For additional information regarding this issue, see Appendix A of Volume I.

Historically, performance of the City's drainage system has been very good. For example, the City's system handled the February 1996 storm event with very few problems even though this event caused widespread flooding in the Willamette River Valley

2.3 Land Use and Surface Cover

The conversion from undisturbed to developed land uses can significantly affect the quantity and quality of stormwater runoff. Runoff volumes and velocities increase as impervious surface areas increase. Likewise, stormwater quality decreases due to nonpoint source pollution from highways and urban land uses such as commercial, industrial, and residential. The purpose of this section is to describe existing land use and impervious surface conditions within the basin and to forecast changes in these conditions due to buildout of remaining vacant lands according to *Metro Plan* designations. Existing land use data presented in Map 1 are current to November 1998. Buildout data presented in Map 2 are based on current *Metro Plan* designations. See maps at the end of Section 2.

2.3.1 Existing Land Use

As shown in Table 2-2, the current predominant urban land use in the basin is low-density residential, which covers approximately 30 percent of the total basin area (2,189 acres). Approximately 26 percent (1,913 acres) of the Willakenzie basin is currently vacant or in forest or agriculture use. The majority of this undeveloped land is found in the area to the north of Beltline Road and to the west of Delta Highway. In addition, 165 acres of sand and gravel use is found along the northern edge of the basin.

Significant quantities of high-density residential, commercial, and school uses are also found throughout the basin. Less than one percent of the basin is now in industrial use. Streets and associated right-of-way currently cover an additional 19 percent (1,408 acres) of the basin.

Park and recreational uses including the Delta Ponds area, Ascot Park, the majority of Alton Baker Park, and several neighborhood parks cover almost 6 percent of the basin (429 acres). In addition, the Oakway Golf Course and the Eugene Country Club, both in the southern portion of the basin, encompass 195 acres.

Table 2-2
Existing Land Use – Willakenzie Basin

Land Use Categories	Acres	Percent of Area
Inside UGB		
Low-/Medium-Density Residential	2,149	29.4%
Medium-/High-Density Residential	274	3.8%
Commercial	295	4.0%
Industrial	38	0.5%
Communication and Utilities	73	1.0%
Parks, Open Space, and Recreation	372	5.1%
Golf Courses	195	2.7%
Schools, Churches, and Cemeteries	244	3.3%
Other Government	51	0.7%
Agriculture	294	4.0%
Timber/Forest	2	0.0%
Other Undeveloped Land	825	11.3%
Railroad (not in use)	2	0.0%
Streets (R.O.W.)	1,282	17.5%
Subtotal	6,096	83.3%
Outside UGB		
Low-density residential	40	0.5%
Commercial	1	0.0%
Sand and Gravel	165	2.3%
Parks, Open Space, and Recreation	57	0.8%
Golf Courses	0	0.0%
Other Government	15	0.2%
Agriculture	438	6.0%
Schools, Churches, and Cemeteries	15	0.2%
Other Undeveloped Land	351	4.8%
Railroad (not in use)	10	0.1%
Streets (R.O.W.)	125	1.7%
Subtotal	1,218	16.6%
Grand Total	**7,314**	**100.0%**

Source: LCOG GIS Parcel File 1998

2.3.2 Buildout Land Use

The primary land use policies covering the Willakenzie Basin are contained in the following locally adopted policy documents:

- Eugene-Springfield *Metro Area General Plan* (1987).
- *The Willakenzie Area Plan* (1992).

Lane County zoning applies to areas outside the UGB and City Codes apply within the UGB. Table 2-3 summarizes the buildout land use for the Willakenzie basin.

2.3.2.1 Buildout Land Use Within the UGB

This area includes both the current city limits and the unincorporated UGB. Approximately 83 percent of the land in the basin (6,096 acres) is currently contained within the UGB. Of this, 1,124 acres are considered vacant. For the purposes of this report, the term "vacant acres" refers to lands that are within the UGB and expected to develop to urban uses. As shown in Table 2-3, the most significant category of new development will be low-density residential (514 acres), followed by medium-density residential (181 acres), industrial (93 acres), high-density residential (67 acres), and commercial (58 acres).

2.3.2.2 Buildout Land Use Outside the UGB

Approximately 17 percent (1,218 acres) of the Willakenzie basin lies outside the UGB. This portion of the basin will remain almost entirely in agriculture, forest, sand and gravel, and park uses based on current plan designation. Areas outside the UGB are not permitted to develop to urban uses and, therefore, "vacant" acres do not apply here.

Table 2-3
Buildout Land Use

Generalized Plan Designation	Designated Acres	
	Total	Vacant* (1998) for future Urban Development
Inside UGB		
Low-Density Residential	2,824	514
Medium-Density Residential	512	181
High-Density Residential and Mixed	195	67
Commercial and Commercial-Residential Mixed	345	58
Industrial and Commercial-Industrial Mixed	182	93
Natural Resource, Parks, Open Space	637	40
Government and Education	105	-
Agriculture and Agriculture/Airport Reserve	-	-
Sand and Gravel	1	1
Streets (R.O.W.)**	1,296	169
Subtotal	6,096	1,124
Outside UGB		
Low-Density Residential	7	**0**
Commercial and Commercial-Residential Mixed	**0**	**0**
Natural Resource, Parks, Open Space	72	**0**
Agriculture and Agriculture/Airport Reserve	443	**0**
Sand and Gravel	474	**0**
Streets (R.O.W.)**	221	**0**
Subtotal	1,218	**0**
Grand Total	**7,314**	**1,124**

Source: LCOG and City of Eugene Geographic Information System, 1998

***For purposes of this report, vacant acres apply on to lands within the urban growth boundary.**

***Notes*: *Streets (Right of Way). The Metro Plan does not have a "Streets" Plan designation. This amount was estimated based on the difference between total designated area and total basin size. In undeveloped areas, 15 percent of the land area was put into the Streets (Right of Way) category to account for streets that will serve future designated development.*

2.3.3 Surface Cover

Other than precipitation, surface cover is perhaps the single most influential factor that affects the volume, quality, and velocity of stormwater runoff and the ability to treat runoff through filtration and other natural processes. Pervious surfaces are undisturbed natural areas that retain native prairie or forest vegetation or lands in developed areas that are typically covered with lawn, agricultural fields, or pasture. In both cases, water is free to infiltrate into the ground. Undisturbed natural areas provide significant beneficial stormwater functions. They help reduce the volume and velocity of runoff by facilitating infiltration of precipitation into the groundwater. Stormwater quality is best in undisturbed natural areas. The vegetative cover associated with undisturbed natural areas is also important for stabilizing steep slopes and streambanks. Pervious surfaces in developed areas also provide stormwater benefits, although to a lesser degree than undisturbed natural areas. The infiltration capacity may be reduced during

conversion to urban lawns and agricultural crops. Stormwater quality may also be impacted by lawn care and agricultural practices.

In contrast, impervious surfaces are lands covered by hard surfaces such as rooftops, roads, and parking lots and allow little or no infiltration of water. Impervious surfaces are unable to absorb and infiltrate precipitation, which results in greater runoff volumes, higher but shorter duration peak flows, and higher concentrations of pollutants. The transition from undisturbed to developed land uses and densities involves a significant change from pervious to impervious surfaces. As a consequence, adequate facilities must be planned, constructed, and maintained to minimize drainage and flood problems and impacts to water quality and natural resources.

The purpose of this section is to describe surface cover conditions as they exist in 1998 and as they are projected to exist at buildout of the Willakenzie basin urban growth boundary (UGB).

2.3.3.1 Impervious Surfaces

Total impervious surface area for the study area was calculated using a set of impervious surface area factors (ISAF) that were applied to the existing and buildout land use data. To calculate total impervious surface area, the ISAF percentages were multiplied by the total land area in each of the land use categories.

The ISAFs used are provided in Volume I. These factors were derived through a process that used existing developed properties in Eugene to generate typical impervious percentages. Impervious surface area for residential, commercial, and industrial land uses had previously been digitized as the basis for calculating stormwater user fees. By using this data source, the resulting ISAFs have been calibrated specific to the City of Eugene and in some cases specific to the basin. The ISAFs for land use categories that were not previously digitized were derived through review of national standards and by calculating the impervious surface area on sample sites.

The amount of existing impervious surface area in the UGB portion of the Willakenzie basin is estimated to be 2,258 acres or 37 percent of the basin's UGB area. [Note: calculations for this data are available from the City of Eugene.] The majority of this impervious surface is found in the southern two-thirds of the basin, where most of the development has occurred and relatively little vacant land remains. Map 3 depicts the existing generalized impervious surface area in pink. Due to the map scale and data restrictions, developed lots are shown entirely in pink. These pink areas are a mix of impervious surface and pervious surfaces associated with the land use such as lawns, streetscapes, parking lot planting, and other landscaped areas.

Assuming that future growth in the basin will follow conventional stormwater drainage practices and will develop according to the land use categories depicted on the Eugene-Springfield Metro Plan designations (see Map 2), the amount of impervious acres in the UGB portion of the basin is projected to increase to 2,842acres, or 47 percent of the basin's UGB area at buildout. [Note: calculations for this data are available from the City of Eugene.]

2.3.3.2 Pervious Surfaces

Currently, the majority of the remaining large blocks of pervious surface area contained within the Willakenzie basin are located in the area to the north of Beltline Road and are predominantly in agricultural and quarrying uses. The majority of pervious surface contained within the southern two-thirds of the basin is primarily in the form of lawns and landscaped areas associated with developed land uses, golf courses, parks, and small vacant lots.

Overall, pervious area cover is expected to decrease from the current 63 percent of the UGB portion of the basin (4,084 acres) to 54 percent at UGB buildout. For the purposes of this report, pervious surface areas were identified and grouped into *Forest Cover*, *Landscaping*, and *Other Vegetated Areas* (refer to Figure 2-4) for the following reasons:

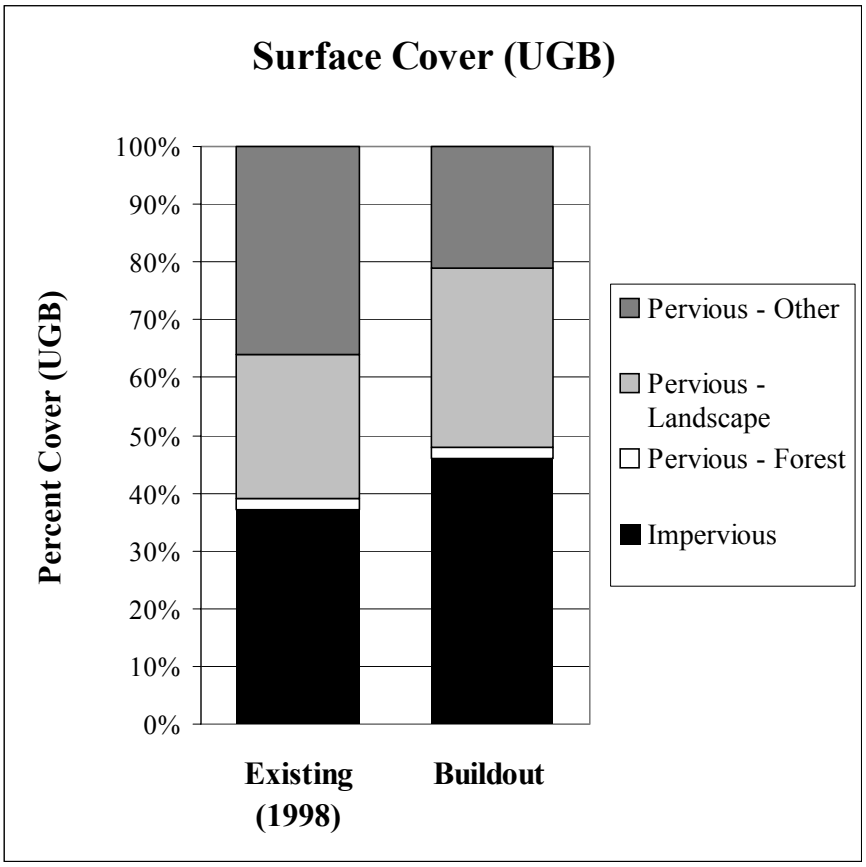
- Forest Cover is highly effective in reducing runoff volumes, and in preventing erosion (e.g., reduces soil impact by slowing down the velocity of precipitation and by intercepting up to 35 percent of it before hitting the ground) and stabilizing steep slopes (established root zones). Areas were included in this category if the forested area exceeded one acre in size. Approximately 2 percent of the Willakenzie basin is currently in forest cover. At UGB buildout, forest cover percentage is projected to remain the same.

- Landscaping areas, including lawns, streetscape and parking lot landscaping are associated with site improvements due to urban development. This category was distinguished to highlight both its positive and potential negative impacts on stormwater resources and is included in the area shaded pink on Map 3. Positive impacts include protection of surface soils, filtration of sediments, and some infiltration (although this is reduced from pre-development conditions). The use of chemical fertilizers, pesticides, and herbicides can cause negative impacts to water quality. The amount of landscaped area in the UGB is projected to increase from the existing 25 percent to 31 percent at buildout.

- Other Vegetated Areas are those not in *forest cover* or *landscaping* use, such as agricultural fields, pasture, vacant lots, prairie wetlands, and small clusters of trees (less than one acre). Similar to the landscaping category, these areas have both positive and negative impacts on stormwater resources. Agriculture and pasture uses can be significant contributors of pollutants in this category due to the use of chemical fertilizers, pesticides, herbicides, and fecal coliform due to grazing. This category is expected to decrease from 36 percent of the UGB to 21 percent at buildout.

Figure 2-4 compares the percentage of existing and projected surface cover for the UGB portion of the Willakenzie basin.

Figure 2-4
Surface Cover in the Willakenzie Basin UGB



2.4 Landform, Topography, Slopes

The Willakenzie basin contains the floodplain between the converging Willamette and McKenzie Rivers. Prior to the construction of flood control dams on the Willamette River during the 1950s and '60s, it is likely that this area was flooded annually. Shifting river channels and annual flooding left a mosaic of soils in this area. Many of the soil types are oriented in a distinct southeast-northwest pattern, mimicking the directional flow of the two bounding rivers.

This basin is essentially flat, 92 percent of the basin has a slope no greater than 5 percent, and less than 5 percent of the basin has a slope greater than ten percent (see Table 2-4). The only significant landforms are the Gillespie and Stone Crest Buttes, intrusive formations in the western portion of the basin that rise approximately 600 feet above the basin floor. See Map 4.

Table 2-4
Willakenzie Basin Slope Distribution

Location	Slope Distribution (percent)				
	Slopes 0-5%	Slopes 6-10%	Slopes 11-15%	Slopes 16-25%	Slopes >25%
Within UGB	92%	5%	1%	1%	<.005%
Outside UGB	83%	11%	3%	2%	<.0025%
Total Basin	90%	6%	2%	2%	<.005%

2.5 Surface Water Features and Drainage System

This section describes the existing drainage features of the basin including the City's stormwater facilities, open waterways, and wetlands. Refer to Map 5.

2.5.1 Waterways

Pre-settlement (prior to 1855) morphological conditions in the Willamette Valley reflected a network of shallow, broad swales that would often flood during storm events creating ponded conditions. Today, most of the drainages have been altered into narrow, deep, and well-defined channels where the management objectives of preventing flooding conditions have been accomplished for the most frequent storm events. To accomplish this in the Willakenzie basin, most of the low-land drainage system has been modified.

Stormwater conveyance in the Willakenzie basin is through a combination of open waterways and a piped system. As development has occurred, many of the open waterways have been altered, diverted, and fragmented with the construction of pipes. About one-third (32 percent) of the runoff in this basin is collected and conveyed in open waterways with the rest being collected by a piped system. The basin has about 25 miles of open waterways compared to about 54 miles of pipes. Before the construction of Interstate 5, many of the waterways in the Willakenzie basin drained much of the west Springfield area, carrying much larger quantities of water than they do today. Waterways generally flow in a northwest direction, usually entering sloughs or open ponds before water is finally conveyed into the Willamette River or in a few instances into the McKenzie River.

2.5.1.1 North Beltline Floodway

The North Beltline Floodway is the main open waterway north of Beltline Road. This channelized waterway is about two miles long and flows west along Beltline Road and northwest from Beltline Road to Ayres Pond (See Map 5). Other than culverts at road intersections, this waterway remains uninterrupted by a piped system. This intermittent stream is fringed with riparian vegetation through residential areas, with Oregon ash the predominant tree species. In industrial areas, it has little riparian vegetation other than grasses. The waterway is not part of the *National Wetlands Inventory (*NWI). This waterway is listed on the Draft Inventory for the Metropolitan Plan Natural Resources Study (NR Study) as a riparian resource (refer to E48a:

Beltline Drainage Channel). The conclusions of the NR Study suggest that the channel does have high enhancement potential that could improve the natural and stormwater benefits for the northern Willakenzie area.

Ayers Pond is a former borrow pit that is currently surrounded by residential development. Its is listed as a riparian resource on the NR Study (refer to E48b: Ayers Pond/Dotson Slough).

2.5.1.2 Dotson Slough

The waterway outlet from Ayers Pond is referred to as the Dotson Slough. Dotson Slough exits Ayers pond and flows westerly under Delta Highway and out of the UGB where a short waterway joins it from the southwest and then flows northwesterly before discharging into the Willamette River. This waterway is listed as a riparian resource on the NR Study (refer to E48b: Ayers Pond/Dotson Slough).

2.5.1.3 Gilham Creek

Gilham Creek is a channelized waterway that opens from a piped system near Bonnie View and Sara Streets and flows northwesterly where it discharges into River Point Pond, a human-made pond. The segment north of Ayres Road is listed on the NR Study as a riparian resource (refer to E77: Gilham). The NR Study indicates Gilham Creek as having relatively high wildlife habitat values with diversity of habitat types, including fir forest, and cottonwood, willow, and other riparian species.

2.5.1.4 Willakenzie Floodway

Commonly referred to as the Willakenzie Floodway, the primary drainageway south of Beltline Road runs from Harlow Road flowing northwesterly and extending about three miles. It ultimately reaches the Delta Ponds in the western portion of the basin. Of the three mile corridor, nearly one-third has been piped, diverted, and segmented. The current headwater of the open waterway is near Monroe Middle School. It is piped just east of Coburg Road and flows are diverted to the north. West of Coburg Road it remains mostly piped until north of Cal Young Road where it opens and remains that way, except for two short stretches, until it again joins with a piped system just before draining into the Delta Ponds near Beltline Road (See Map 5). There are also piped culverts along the drainageway where the waterway flows under intersecting streets. Water from the waterway east of Coburg Road is diverted into the main piped system along Coburg Road taking the natural flow north to the North Beltline Floodway. This diversion significantly reduces the natural flow that once moved through the waterway west of Coburg Road.

Residential development borders most of the open portions of the waterway and dumping of garbage and yard debris is a common problem. Riparian vegetation with a predominance of Oregon ash lines the waterway in most of the open portions. Over half of the waterway length is identified in the NWI. This waterway is listed as a riparian resource on the NR Study (refer to E45: Ascot Park).

2.5.1.5 Debrick Slough

Debrick Slough lies south of Gillespie Butte in the southern portion of the Willakenzie basin. It extends from Country Club Road, through an open space, and eventually contributes to the Delta Ponds. Debrick Slough exits the Delta Ponds just south of Beltline Road, flows under Beltline and continues for a short distance until it joins the Willamette River. In the NR Study, the waterway is recognized as serving storm drainage, flood retention, wildlife habitat, and open space functions. This waterway is identified in the NR Study as being an important resource that would benefit from enhancement and establishment of riparian buffers. Debrick Slough is given site review zoning protection by the City of Eugene to protect the natural features of the slough and its wildlife habitats. This waterway is listed on the NR Study as a riparian resource (refer to E50: Debrick Slough).

2.5.1.6 Goodpasture Island Slough

Goodpasture Island Slough joins Debrick Slough near the intersection of Delta Highway and Beltline Road. This 31-acre area includes an open waterway and a riparian forested area that extends west to the Willamette River. Willows and cottonwoods predominate along the waters edge with invading Himalayan blackberries. The riparian forest is dominated by black cottonwood, big leaf maple, and red alder with an understory of indian plum, swordfern, and blackberries. This waterway is listed as a riparian resource on the NR Study (refer to E75: Goodpasture Island Slough).

2.5.1.7 Q Street Floodway

The Q Street Floodway originates in the City of Springfield and flows westerly into the Willakenzie Basin at Interstate 5. It then flows along the south side of Interstate 105 and into Alton Baker Park where it joins with the Canoe Canal before discharging into the Willamette River. This waterway is listed on the NR Study as a riparian resource (refer to E42: Alton Baker Riparian).

2.5.1.8 Canoe Canal

The Canoe Canal is the most southerly waterway which flows into and through Alton Baker Park. This waterway is a human-made canal and is listed on the NR Study as a riparian resource (refer to E42: Alton Baker Park Riparian).

2.5.1.9 Patterson Slough

Patterson Slough is a branch of the Canoe Canal that flows northerly and eventually into the Q Street Floodway. This waterway is listed as a riparian resource on the NR Study (refer to E42: Alton Baker Riparian).

2.5.2 Wetlands

A comprehensive local inventory and evaluation of wetlands has not been conducted for the Willakenzie basin, so wetland features and characteristics described in this section are based on the NWI and the NR Study. The NWI provides basic data about general characteristics and the extent of wetlands. The NWI identifies general wetland boundaries; however, in many instances actual wetland boundaries and features are more extensive than what is identified through this national classification system. Although the NR Study provides a higher level of detail about many of the wetland sites within the basin, the emphasis of the NR Study is on habitat values rather than stormwater functions and values.

Wetlands in the Willakenzie basin identified in the NWI comprise about 436 acres and about 25 linear miles. About half (46 percent) of the wetland acres are located outside the UGB. Most linear wetland features (92 percent) are found within the UGB. These open water and seasonally inundated areas are located primarily in the western portion of the basin where they are hydrologically linked with open waterways and the Willamette River (See Map 5). This system of sloughs, ponds, waterways, and other wetland types plays a critical role in treating, storing, and conveying stormwater in the basin before its eventual release into the Willamette River.

The western portion of the Willakenzie basin contains several ponds including: the Delta Ponds, Ayres Pond, and ponds associated with the Goodpasture Island Slough. Most of these ponds were created by past gravel extraction, but have evolved into an integral part of the stormwater conveyance system. As can be seen on Map 5, these ponds and adjacent land areas are identified as wetlands in the NWI.

More than 25 ponds are found within the Delta Pond system located both east and west of Delta Highway, between Valley River Center and Beltline Road. Natural processes have almost completely re-vegetated these former gravel pits, with over 90 species of plants. These ponds also support over 60 species of birds, and many mammals, reptiles, and fish species. Water quality problems associated with Debrick Slough, which feeds into the ponds, are reportedly impacting the Delta Pond system. According to the *Natural Resource Assessment of Delta Ponds,* about 160 acres of the Delta Ponds system are considered jurisdictional wetlands (a portion of the system is not in the Willakenzie basin). The entire Delta Ponds system is within the adopted Willamette Greenway boundary.

Ayres Pond is a 28-acre former borrow pit that has become part of the Dotson Slough system in the northwest portion of the basin. The area surrounding the pond has been highly disturbed on both developed and undeveloped sites. Vegetation is sparse around the perimeter of the pond consisting mostly of deciduous trees along the southwest side. Some grasses, cattails, and reed canary-grass have become established at the water's edge, but for the most part, there is little native vegetation on the banks of the pond. There is a fairly steep bank around most of the pond limiting the extent of wetland area surrounding the open water. Although the pond is not stocked, there are substantial populations of bass, crappie, and bluegill. The NR Study recognizes Ayres Pond as having a high potential for enhancement of aesthetic and wildlife habitat values.

The Goodpasture Island Slough area contains a combination of open water and seasonally inundated wetland types. Wetlands extending along the length of the waterway include two small ponds and an adjacent riparian forest area between the slough and the Willamette River. Willow and black cottonwood predominates along the water and black cottonwoods, big leaf maples, and red alder predominate the riparian forested area.

Other than those wetlands discussed above that are a part of, or adjacent to, the ponds or open waterways, there is one other wetland area identified in the NWI in the Willakenzie basin. This small area is located just west of County Farm Road in the northeastern part of the basin.

2.5.3 Piped System

Due to extensive development and the fragmentation of open waterway and natural drainage features, the piped stormwater system in the Willakenzie basin is extensive. Currently there are about 54 miles of stormwater pipe in the basin. Nearly all of the basin within the UGB is serviced by a piped system with the exceptions being those properties directly adjacent to open waterways and a few areas on the outer fringe of the basin.

2.5.4 Maintaining the Drainage System

Maintenance activities in the Willakenzie basin include occasional cleaning of open waterways and periodic checking and cleaning of catch basins. In several areas, debris accumulates at the open waterway - pipe interface interrupting flow. Waterway maintenance activities are performed to clear debris in order to ensure hydraulic capacity to prevent flooding problems.

2.5.5 Floodplain

A flood insurance study for the Federal Emergency Management Agency (FEMA) has been conducted within the Willakenzie basin. As part of this study, areas subject to flooding up to the 100-year flood event have been identified. As is shown on Map 5, most of the 100-year flood hazard area is associated with the contours of the Willamette River and open waterways relatively near the Willamette River. There are about 1,928 acres of flood hazard area, located primarily along the western and southwestern portions of the basin and an area associated with the Gilham Creek in the northern part of the basin. There is also an extensive floodplain area associated with the McKenzie River all along the northern edge of the basin primarily outside of the UGB.

2.6 Water Quality

This section provides a description of water quality conditions in the Willakenzie basin. Water quality conditions can vary dramatically depending on time of day, weather conditions, land use activities conducted in the watershed, and location in the water body. Therefore, without significant amounts of data, it is often difficult to adequately evaluate water quality conditions. It is even more difficult to evaluate the water quality impacts of stormwater runoff on receiving waters. Therefore, a variety of available sources of water quality-related information were

reviewed in an attempt to provide a general picture of water quality conditions in the basin. The following sources of information were reviewed and are described below:

- Documented water quality problems based on existing chemical data, biological data, and field observations.
- Oregon Department of Environmental Quality's (DEQ's) designations of water quality limited water bodies.
- Natural and built environmental conditions that influence water quality.

2.6.1 Documented Water Quality Problems

The following subsections describe the water quality problems that have been documented for the Willakenzie basin in terms of chemical stormwater monitoring data, macroinvertebrate sampling, and field observations.

2.6.1.1 Chemical Stormwater Monitoring Data

The City collected and analyzed samples of stormwater runoff from 1992 to 1997 at 6 sampling stations in Eugene (see Figure 2-5). The 6 sampling stations were selected to represent runoff from various land uses. In 1998, the storm event monitoring at the 6 sampling stations was discontinued and a pilot project on the A3 Channel using a basin approach to water quality monitoring was implemented. The revised monitoring plan consisted of collecting monthly composite samples at the original industrial land use station on the A3 Channel (station I1) and collecting samples at selected high source areas in the piped system on the A3 Channel.

The following table provides a summary of the results collected during 1992 to 1997 from the 6 sampling stations. Table 2-5 includes a description of the problem pollutants, typical sources of the pollutants, specific results from Eugene, and potential problems associated with the pollutants. Although none of these data were collected from within the Willakenzie basin, they provide general information regarding stormwater quality in Eugene and were used in identifying a stormwater management strategy for this basin.

Table 2-5
Summary of Stormwater Quality Monitoring in Eugene

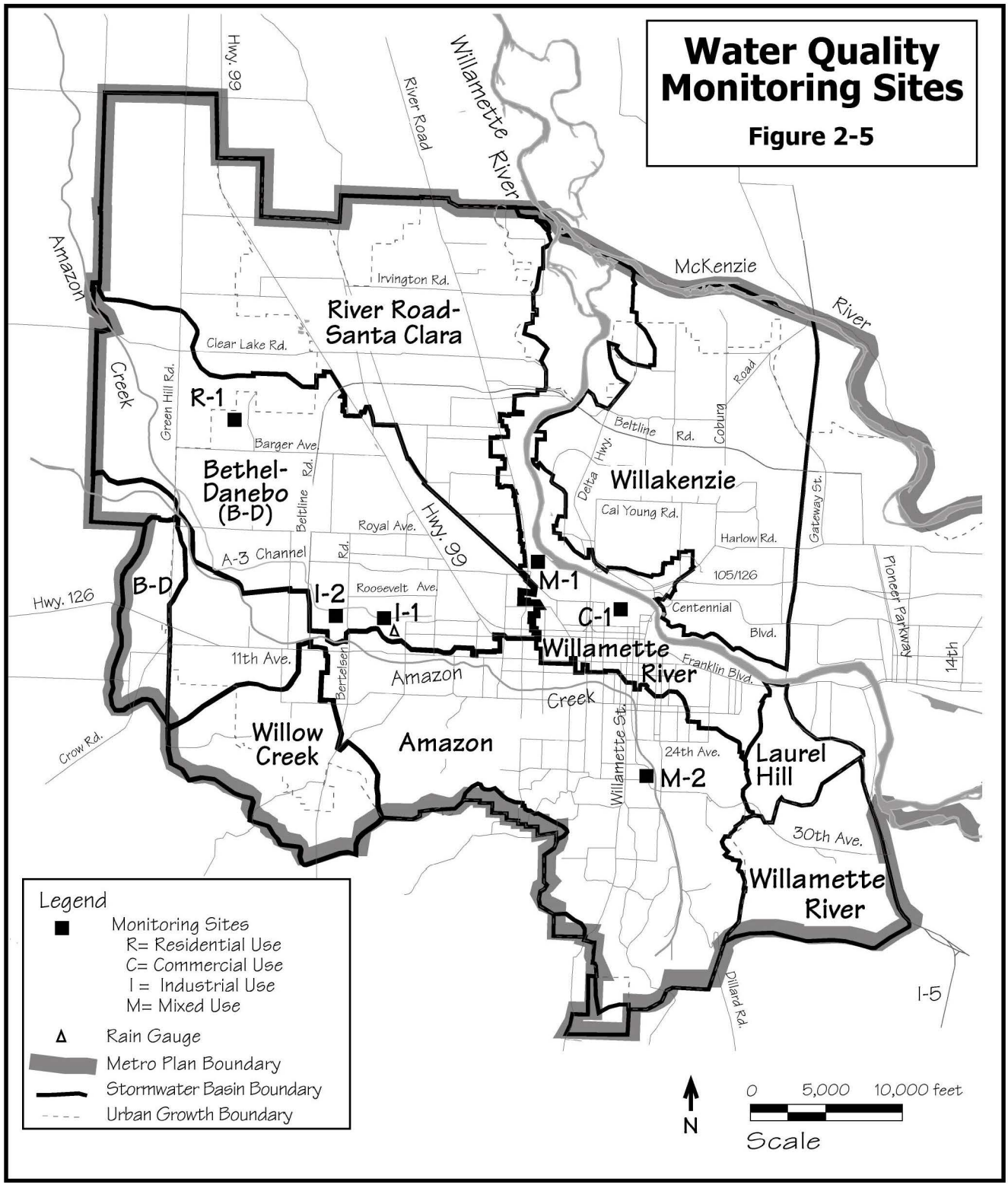
Pollutant	Description	Sources	Eugene's Results	Potential Problems
Bacteria	- Enterococcus, - Fecal coliform, and - Fecal streptococcus	- Animal Wastes (droppings from wild/domestic animals), - Human Wastes (leaking sanitary sewer pipes, and seepage from septic tanks).	**Results from almost all of the samples significantly exceeded the DEQ standard for water quality**.	These are commonly used indicators of human pathogens. Water contact may cause eye and skin irritations and gastro-intestinal diseases if swallowed.
Heavy Metals	Antimony Arsenic Beryllium Cadmium Chromium Copper Lead Mercury Nickel Selenium Silver Thallium Zinc	- Vehicles (combustion of fossil fuels, improper disposal of car batteries, wear/tear of tires and brake pads), - Metal Corrosion, - Pigments for Paints, - Solder, - Fungicides, - Pesticides, - Wood Preservatives	Cadmium, chromium, copper, lead, nickel, and zinc were typically present in samples. **Copper, lead, and zinc in stormwater samples frequently exceeded DEQ standards for the protection of aquatic life.**	Heavy metals are toxic to freshwater aquatic ecosystems. These metals are considered to be the most significant toxic substances which are commonly found in urban stormwater runoff.

Table 2-5 (continued)

Pollutant	Description	Sources	Eugene's Results	Potential Problems
Oil & Grease	A broad group of pollutants including: - Animal fats, and - Petroleum products.	- Food Wastes (animal and vegetable fats from garbage), - Petroleum Products (gas, engine oil, lubricants, etc.).	**Two of fifty-three samples had concentrations which exceeded discharge limitations specified for industrial stormwater discharges (i.e., > 10 mg/L).**	These compounds can coat the surface of the water limiting oxygen exchange, clog fish gills, and cling to waterfowl feathers. When ingested these compounds can be toxic to birds, animals and other aquatic life.
Sediments	Sediments in the water are considered pollutants when they exceed natural concentrations and negatively affect water quality and/or beneficial uses of the water.	- Erosion from increased stream flows, - Construction site runoff, - Landscaping activities, - Agricultural activities, - Logging, - All other activities where the ground surface is disturbed.	**Excess levels were measured at all stations. Results from the urban sampling stations in Eugene were all 40% to 70% higher than results from an open space (i.e., undeveloped) sampling.**	Sediments cause increased turbidity, reduced prey capture for sight feeding predators, clogging of gills/filters of fish and aquatic insects, and blocked light which limits food production available for fish. Sediments also accumulate in stream bottoms which reduces the capacity of the stream (and hence increases the potential for flooding) and covers stream bottom habitats. Sediment also acts as a carrier of toxic pollutants such as metals and organics.
Nutrients	- Nitrate - Ammonia - Kjeldahl Nitrogen - Phosphorus - Orthophosphate	- Landscaping activities, - Yard debris, - Human wastes (leaks from septic tanks and sanitary sewers), - Animal wastes, - Vehicle exhausts, - Agricultural activities, - Detergents (car washing), - Food Processing	**The DEQ guidance value of 0.1 mg/L for total phosphorus was exceeded in 100% of the samples collected.**	Excess levels of nutrients can lead to eutrophication in downstream receiving waters. Problems include surface algal scums, odors, reduced oxygen levels, and dense mats of algae. In addition to water quality problems, these effects have a negative impact to the aesthetic quality of water bodies.
Organics	There are many organic compounds, however, the synthetic organics are of most concern and include: - Fuels - Solvents - Pesticides - Herbicides.	- Illegal dumping, - Illicit connections, - Spills, - Leaks from drums and storage tanks, - Landscaping activities - Agricultural activities.	Although sampling for these compounds was limited, **nine volatile organic compounds were detected (including one pesticide).**	Most synthetic organics are highly toxic to aquatic life at very low concentrations, and many are carcinogenic (cancer causing) or suspected carcinogens. Diazinon has been identified in many recent studies as one of the causes of toxicity in stormwater.
Litter and other Floatable Debris	- Plastics, - Paper products, - Yard debris, - Tires, - Metal, - Glass.	- Littering, - Dumping, - Spills.	Sampling for litter and floatables was not conducted, however, **specific problem dumping areas have been identified in Eugene** (see notes below).	These pollutants degrade the aesthetic quality of water bodies. In addition, they contribute pollutants as they decompose, and they can reduce the capacity of the water body. Excess yard debris contributes to high levels of nutrients and it reduces oxygen levels as it decomposes.

Based on results from the above monitoring program and the results from state-wide monitoring efforts (ACWA, 1997), industrial and commercial land uses have been identified as significant sources of stormwater pollutants (i.e., high source areas). In the Willakenzie basin, the commercial and industrial areas are in the following locations:

- Adjacent to Chad Drive between Coburg Road and Interstate 5.
- At the intersection of Cal Young Road and Coburg Road.
- Along Coburg Road immediately north of Interstate 105.
- In the Valley River Center area along Delta Highway.
- Along North Delta Highway north of Beltline Road.


Water Quality Monitoring Sites
Figure 2-5
Hwy. 99
River Road
Willamette River
McKenzie River
Amazon Creek
Irvington Rd.
River Road-Santa Clara
Clear Lake Rd.
Green Hill Rd.
R-1
Barger Ave.
Bethel-Danebo (B-D)
Beltline Rd.
Royal Ave.
A-3 Channel
Hwy. 99
B-D
Hwy. 126
I-2
Roosevelt Ave.
I-1
11th Ave.
Bertelsen Rd.
Crow Rd.
Willow Creek
Amazon Creek
Amazon
Delta Hwy.
Beltline Rd.
Coburg Road
Willakenzie
Cal Young Rd.
Harlow Rd.
Gateway St.
105/126
Centennial Blvd.
Pioneer Parkway
M-1
C-1
Willamette River
Franklin Blvd.
Willamette St.
24th Ave.
M-2
Laurel Hill
30th Ave.
Willamette River
14th
I-5
Dillard Rd.
Legend
Monitoring Sites
R= Residential Use
C= Commercial Use
I = Industrial Use
M= Mixed Use
Rain Gauge
Metro Plan Boundary
Stormwater Basin Boundary
Urban Growth Boundary
N
0 5,000 10,000 feet
Scale

2.6.1.2 Findings from Macroinvertebrate Sampling

Aquatic macroinvertebrate sampling is useful in evaluating water quality and ecological integrity. Pronounced changes in biological communities indicate a disruption of healthy environmental conditions and can be useful in identifying cumulative effects of pollutants, habitat alterations, effects from bioaccumulative chemicals, and other impacts that chemical monitoring may not reveal.

No macroinvertebrate sampling has occurred in the Willakenzie basin.

2.6.1.3 Field Observations of Water Quality Problems

In addition to the information obtained from the stormwater monitoring data described above, specific water quality related problems/issues have been observed in this basin as follows:

- *Delta Ponds:* The City receives complaints that the Delta Ponds on the south side of Good Pasture Island Road are often stagnant and covered with algae.

- *Tip-ups:* Sediment and debris that has been observed to accumulate in tip-ups is likely getting flushed into downstream open waterways during larger storm events.

- *Debris in the Open Waterways:* Significant amounts of trash and debris are dumped into the open waterways in this basin and maintenance access is often limited for removing debris.

2.6.2 Oregon Department of Environmental Quality Water Quality Limited Designations [303(d) List]

The federal Clean Water Act requires states to maintain a list of water bodies that do not meet water quality standards. These standards are established to protect beneficial uses such as drinking water, fisheries, industrial water supply, recreational, and agricultural uses. This list is called the 303(d) List based on the section of the Clean Water Act that mandates this requirement. The list is meant only as a means of identifying water quality problems and not the causes.

States must monitor water quality and review available data and information to determine if the standards are being met. In Oregon, this responsibility is carried out by the Department of Environmental Quality (DEQ). If available data indicate a water body is not meeting water quality standards, and the data meet listing guidelines, DEQ must assume that the water body is water quality limited. Water bodies with no information, or information incompatible with the EPA guidelines, are not included on the 303(d) list. The 303(d) list is updated and revised every two years. Once a water body is included on the 303(d) list, DEQ is required to develop a total maximum daily load (TMDL) requirement for both point and non-point sources of the pollutants of concern. It is anticipated that DEQ will develop TMDL requirements for all designated water quality limited water bodies in the State of Oregon sometime within the next ten years.

As water quality data have not been collected in this basin, no water bodies in the Willakenzie basin appear on the 303(d) list.

2.6.3 Natural and Built Conditions

Evaluating the natural and built conditions that influence water quality can be useful in indirectly assessing water quality conditions in the basin. As urbanization occurs, negative impacts to the health of receiving waters result from changes in the quality of stormwater runoff. Natural features such as riparian areas, wetlands, and open drainage systems have the ability to treat stormwater pollutants, prevent waterway scour by slowing down runoff rates, settle out sediments, and protect stream banks from erosion. However, with research showing that water quality degradation occurs at relatively low levels of imperviousness (10-20 percent), the implications of development on water quality is significant.[1] Figures 2-6, 2-7, and 2-8 examine natural and built conditions relative to the other Eugene drainage basins.

Figure 2-6
Extent of Open Drainage System in the Willakenzie Basin (UGB)

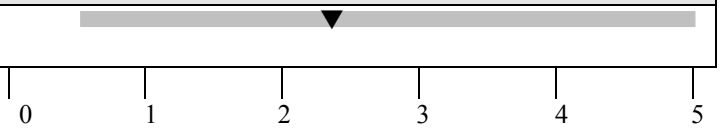
Miles per Square Mile Of Open Drainage System in the Willakenzie Basin	Willakenzie Basin Relative [▼] to The Range in Other Eugene Basins (miles/sq mile)
2.3	

Figure 2-7
Extent of Area as a Percentage of the Willakenzie Basin (UGB)

Factors	Percent of UGB	Willakenzie Basin (▼) Relative to the Range in Other Eugene Basins
Remaining Vacant Lands*	18%	
Existing Impervious Surface Area	37%	
Projected Impervious Surface Area	47%	
Wetlands	6%	
100-Year Floodplain	26%	

*_Vacant land_ includes tax-lotted areas currently in vacant, agricultural, and timber uses.

[1] Tom Schueler, et al. *Site Planning for Urban Stream Protection: The Importance of Imperviousness*, 1995.

Figure 2-8
Extent of 100-Year Floodway Fringe that is Vacant in the Willakenzie Basin (UGB)

Percent of 100-Yr. Floodway Fringe Vacant* in the Willakenzie Basin UGB	Willakenzie Basin Relative to the Range in Other Eugene Basins
16%	

**Vacant land* includes tax-lotted areas currently in vacant, agricultural, and timber uses.

2.6.4 Conclusions

A summary of the above findings suggest that degraded water quality conditions exist in the Willakenzie basin as follows:

- Based on the analysis of stormwater runoff samples collected from Eugene and other urban areas in Oregon, the pollutants of concern that were identified are as follows:
  - Total Suspended Solids (TSS)
  - Nutrients
  - Heavy Metals
  - Bacteria
  - Oil and Grease
- Commercial and industrial areas have shown to be the most significant contributors of specific stormwater pollutants.
- The extent of the open drainage system in the basin on a miles per square mile basis is in the middle range when compared with other Eugene drainage basins.
- At 37 percent, the basin currently has levels of imperviousness that are expected to degrade water quality. Projections indicate that the impervious surface area will increase to 47 percent.
- Only eight percent of the basin's tax-lotted 100-year floodway fringe is currently vacant.
- Delta Ponds on the south side of Good Pasture Island Road are often stagnant and covered with algae.
- Sediment and debris that has been observed to accumulate in tip-ups is likely getting flushed into downstream open waterways during larger storm events.
- Significant amounts of trash and debris are dumped into the open waterways in this basin and maintenance access is often limited for removing debris.

2.7 Rare, Threatened, and Endangered Plants, Animals, and Communities

Stormwater management decisions and practices can affect rare, threatened, and endangered plant and animal species. Local populations can be reduced or even eliminated as a result of decisions to pipe a waterway, install upstream detention, or to allow significant increases in runoff due to new development. The purpose of this section is to describe the known rare species and communities located in the Willakenzie basin so that the details of these resources can be consulted prior to any stormwater management decisions.

Review of the Oregon Natural Heritage Program (ONHP) database reveals no records of rare plant and animal observations in this basin. Given this condition is a snapshot in time, the ONHP data base should be consulted for updated information for future project design issues and or policy application.

There is sparse habitat associated with sensitive species within the Willakenzie basin, lowering the likelihood of their occurrence. Public access to areas where species of concern might be located, such as along the McKenzie River floodplain, is very restricted reducing opportunities for surveys.

In March 1999, the National Marine Fisheries Service (NMFS) listed spring-run Chinook salmon as a threatened species under the Endangered Species Act (ESA). It includes all naturally spawned populations of Spring Chinook in the Clackamas River and in the Willamette River and its tributaries above Willamette Falls, Oregon. Because runoff from Eugene discharges either directly or indirectly to the Willamette River, this listing affects the city's stormwater management program and practices.

A species that is listed as *threatened* means it is *likely to become endangered within the foreseeable future throughout all or a significant portion of its range.* Protective regulations, known as 4(d) rules have been developed that are *deemed necessary and advisable to provide for the conservation of the species*. These rules spellout the *take* prohibitions that pertain to Spring Chinook and focus on the type of activities that are likely to lead to a *take*. The City is in the process of reviewing its own processes, procedures, and development standards for identifying and adjusting those that may not be compatible with the 4(d) rules.

2.8 Soils

Soil characteristics are important factors in predicting the amount, rate, and quality of stormwater runoff and for selecting management measures for addressing the effects of runoff. This section describes the key soil parameters relative to stormwater issues and the distribution of those parameters in the Willakenzie basin. All soils data were obtained from the *USDA Soil Survey of Lane County*. Refer to Tables 2-6 to 2-8 and Maps 6 to 10 for a description of the soil mapping units and relevant stormwater related data found in Willakenzie basin.

2.8.1 Permeability

Soil permeability measures the rate of water movement through the soil horizon. This factor is important in managing stormwater quantity and quality. Soils with slow permeability rates are more likely to result in higher stormwater runoff volumes than soils of high permeability. Under these conditions, larger and more extensive stormwater facilities are needed to accommodate new development where space permits. In more densely developed areas, slow permeable soils may be better suited to stormwater conveyance and storage facilities than infiltration facilities. Storage facilities could include detention ponds and treatment ponds where time is desired for settling and filtering purposes.

Permeability rates in the Willakenzie basin vary from very rapid to very slow. These characteristics are depicted on Map 6. Permeability rates are assigned based on the dominant soil horizon (15-40 inches). Nearly 40 percent of the basin has soil permeability in the moderately rapid to very rapid category. Most of these rapidly draining soils are located south of Beltline Highway and are in areas already developed. Undeveloped parcels in this basin support the entire spectrum of permeability rates, necessitating site-specific stormwater management plans that address local conditions. Soil runoff potential (see section 2.8.2), high water table (see section 2.9), and depth to bedrock are other important features to consider when developing stormwater management plans.

Table 2-6
Soil Permeability in the Willakenzie Basin

Location	Permeability (percent)							
	Very Rapid	Moderately Rapid	Moderate	Moderately Slow	Slow	Very Slow	No Data*	Total
Within UGB	22%	17%	12%	41%	1%	2%	5%	100%
Outside UGB	10%	37%	10%	10%	0%	0%	33%	100%
Total Basin	20%	20%	12%	36%	1%	2%	9%	100%

Source: USDA Soil Survey of Lane County Area, Oregon, 1987.
**Includes borrow pits and ponds.*

2.8.2 Runoff Potential

Soil groups have been rated according to their runoff potential under nonvegetated and saturated conditions without consideration of topographic conditions. Runoff potential measures a soil's capacity to permit infiltration and, therefore, can be used to describe degree of runoff expected during storm events. For example, soils rated with a "low runoff potential" are more likely to have high infiltration rates and, conversely, soils with a "high runoff potential" are more likely to have very slow infiltration rates. Hydrologic stormwater models often use this parameter in conjunction with slope and surface cover factors for estimating surface flows under undeveloped conditions.

As shown on Map 7, soils of the Willakenzie basin demonstrate the full range of runoff potential rates. Undeveloped areas support mostly soils with moderate runoff rates. This characteristic, combined with the near absence of slope in the basin, means that stormwater runoff is not likely to be problematic except in areas where higher runoff rates coincide with soils of slower permeability. This situation exists in the largely undeveloped area bounded by Game Farm Road, Crescent Road, and County Farm Loop.

The following table displays the distribution of soils by rate of runoff for the basin:

Table 2-7
Runoff Potential in the Willakenzie Basin

Location	Runoff Potential (percent)					
	High	Moderately High	Moderately Low	Low	No Data*	Total
Within UGB	10%	34%	47%	7%	2%	100%
Outside UGB	0%	10%	49%	18%	23%	100%
Total Basin	9%	31%	47%	8%	5%	100%

*Source: USDA Soil Survey of Lane County Area, Oregon, 1987.**Includes borrow pits and ponds.
**Includes borrow pits and ponds.*

2.8.3 Erodible Soils

Highly erodible soils have significant stormwater management implications. If not properly protected during construction and land clearing activities, erosion and sedimentation from these soils can have the following negative effects:

- Reduction in the conveyance capacity of downstream stormwater facilities resulting in potential drainage and flooding problems.
- Reduction or elimination of aquatic habitat and covering or destroying of spawning beds.
- Water quality impacts due to pollutants that are attached to sediments.

As shown on Map 8, less than two percent of the soils in this basin are highly erodible, and no moderately erodible soils are present. The highly erodible soils are limited almost exclusively to Gillespie and Stone Crest Buttes. Only the southern portion of Gillespie Butte remains largely undeveloped.

The City's erosion prevention program has designated highly erodible soils as one of the criteria for sensitive area designation. Construction sites containing these soils are required to obtain an erosion prevention permit so that appropriate management measures can be designed and implemented to prevent and/or minimize erosion impacts.

2.8.4 Unstable Slopes

Less than one percent of the basin is affected by soils that are subject to slumping (see Map 10 soil types). These areas present structural problems especially where extensive grading is made for roads and building pads. Roads requiring significant cuts should not be located on these soils. Properly designed drainage systems can help mitigate slump potential. Soils affected are:

- 52B Hazelair silty clay loam, 2 to 7 percent slope.
- 99H Ochrepts-Umbrepts, very steep.

The Ochrepts-Umbrepts soils are found on the undeveloped southern side of Gillespie Butte. Because of the steep slopes, development limitations may be necessary.

2.8.5 Hydric Soils

Hydric soil is one of three criteria for determining the presence of wetlands; the other two being inundated or saturated soil conditions and the presence of hydrophytic vegetation. Federal and state regulations limit activities that can occur in wetlands, including the direct discharge of untreated stormwater runoff. The Oregon DEQ has not yet established such standards for discharging into wetlands.

Map 9 displays the basin's hydric soils (about 12 percent of the basin) and the NWI wetlands in the basin. Although field checking is needed to confirm the presence of wetlands in these areas, wetlands should be suspected to exist for planning purposes. Siting of future stormwater facilities and stormwater management actions should be chosen carefully so as to not alter the hydrologic regime of wetlands by either adding or taking away water. The following table displays the percent of hydric soils found in the basin:

Table 2-8
Hydric Soils in the Willakenzie Basin

Location	Hydric Soils (percent)	
	No	Yes
Within UGB	88%	12%
Outside UGB	90%	10%
Total Basin	88%	12%

Source: USDA Soil Survey of Lane County Area, Oregon, 1987.

Soil characteristics are important factors in predicting the amount, rate, and quality of stormwater runoff and for selecting management measures for addressing the effects of runoff. This section describes the key soil parameters relative to stormwater issues and the distribution of those parameters in the entire study area. All soil data were obtained from the *Soil Survey of Lane County*.

2.9 Groundwater

Two aspects related to groundwater need to be given special consideration when planning for stormwater management. The first relates to the regional aquifer that underlies much of the lower Willamette Valley basin. This aquifer is the source of drinking water for rural residents and several nearby communities (i.e., Springfield, Coburg, Junction City) and has also been investigated as a potential future source of water for Eugene. For this reason, consideration needs to be given to the effects that stormwater management can have on groundwater quality and quantity.

Two recent studies help to characterize the groundwater resource in the Willakenzie basin. A study contracted by the Eugene Water & Electric Board in 1993 to assess the feasibility of developing groundwater for municipal and agricultural purposes in the Eugene-Springfield metropolitan area has identified the Confluence Area, a large area near the confluence of the McKenzie and Willamette Rivers that includes the northeastern half of the Willakenzie basin,

as the most promising area for future large-scale groundwater development (GEM, 1993). The study also acknowledges that this shallow, unconfined aquifer is susceptible to contamination resulting from land use activities, surface spills, and other potential sources of contaminants.

A second study of groundwater in this area was completed in 1995 by the Springfield Utility Board (SUB) and Rainbow Water District (RWD). SUB and RWD contracted with Golder Associates to map and model the groundwater resources that supply their wells. These wells provide the water supply for Springfield and adjacent portions of unincorporated Lane County. This effort also led to the delineation of wellhead protection areas (WHPAs) for each of SUB's and RWD's supply wells. A portion of the WHPA for SUB's Interstate 5 wells extends into the Willakenzie basin (see Map 11 High Water Table map). Stormwater management decisions affecting land lying within this WHPA should be made with consideration given the potential risk of degrading groundwater quality.

The other groundwater issue relates to the depth to the seasonal high water table. Map 11 shows the depth to high water table during the wet season. This information is linked to soil type and comes from the *USDA Soil Survey of Lane County* (1987). A high water table (less than three feet below the ground's surface) will play a significant role in determining both how stormwater disperses and what types of stormwater facilities might work well in a given area. In general, a high water table will contribute to high runoff levels and can limit the effectiveness of infiltration facilities.

The high water table for the majority of the Willakenzie basin is greater than six feet deep which is a positive indicator for infiltration suitability. The general Chad Drive area is in a shallow water table area, less than two feet deep. The remaining undeveloped parcels are in areas where the high water table is greater than six feet deep. The undeveloped area between Coburg and Game Farm Roads is located above a groundwater, acquifer recharge zone for drinking-water water wells located east of I-5 owned and managed by the Springfield Utility Board (SUB).

2.10 Recreational and Educational Facilities

The CSWMP multiple-objectives approach to stormwater management includes recreational and educational facilities. Recreational facilities, such as trails and parks, are compatible with and are often located within areas that are prone to flooding. Drainage can provide corridors for hiking and biking trails as well as for conveying stormwater runoff. Unimproved Park areas can be used as storm event overflow areas with minimal property repair cost. Drainage and wetlands provide opportunities for classroom study and open space recreation and, therefore, their proximity to schools have educational benefits. The following section describes existing and future parks, trails, recreational, and educational facilities within proximity to the Willakenzie basin. Refer to Map 12.

2.10.1 Existing and Planned Educational Facilities

The Willakenzie basin currently contains a total of 12 public or private schools, including one public high school and two public middle schools. The school buildings and associated

grounds cover approximately 200 acres of the basin. No additional schools are currently planned for the basin.
There is some opportunity in the basin for utilization of the stormwater drainage system and related facilities for educational purposes in conjunction with school curriculum. Of the 12 schools in the basin, four are immediately adjacent to waterways. Dodson Slough flows past Cal Young Middle School, Debrick Slough runs past Monroe Middle School, and open waterways flow past Willagillespie and Gilham Elementary Schools. Delta and Ayres Ponds both have potential to be used for stormwater or other educational or interpretive purposes, but are not within easy walking distance of any schools within the basin.

2.10.2 Existing and Planned Park and Recreational Facilities

There are currently 418 acres of publicly owned park land on 16 different City parks and one Lane County park, in the Willakenzie basin. These include Delta Ponds Park, Armitage Park (Lane County), Marche Chase Park, Country Lane, Garden Way, Ascot, Tandy Turn, Gillespie Butte, Sheldon Sports Park, Bond Lane Park, Brewer Park, Crescent Park, Cone Park, Gilham Park, Sterling Woods, Sorrel Way, approximately 2/3 of Delta Ponds, and approximately 2/3 of Alton Baker Park. In addition, the Oakway Golf Course and the Eugene Country Club cover a total of 195 acres, but are both in private ownership.

In November 1998, voters in Eugene passed a $25.3 million general obligation bond measure for purposes of purchasing new parkland, and constructing park improvements. In the Willakenzie Basin, five new parks will be developed with these funds. These plans are consistent with the *Parks, Open Spaces and Natural Areas Study* (1996).

Much of the basin is currently served with on-street bicycle lanes, routes and paths. A *Eugene-Springfield Transportation System Plan (TransPlan)* (1986) proposed bicycle path along the southern edge of Delta Ponds will provide better pedestrian and bicycle access to this park area in the future and could offer stormwater interpretive opportunities.

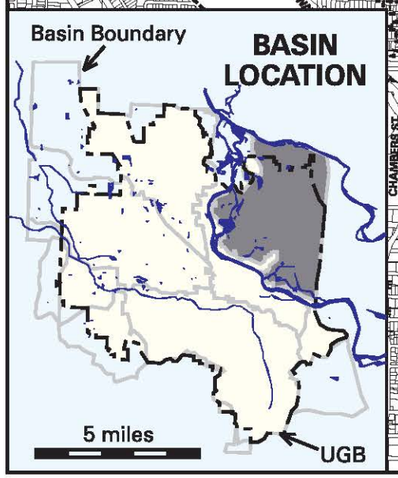
Willakenzie Basin

Existing Land Use *

L E G E N D

- Low-Med. Density Residential
- Med.-High Density Residential
- Commercial (Services & Trade)
- Industrial (Except Sand & Gravel)
- Sand and Gravel Operations
- Railroads
- Communication and Utilities
- Parks, Open Space, and Recreation (Except Golf)
- Golf Courses and Driving Ranges
- Schools, Churches, & Cemetaries
- Other Government
- Agriculture
- Timber/Forest
- Other Undeveloped Land
- Waterways and Ponds
- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* Landuse Data current to November 1998



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Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 1

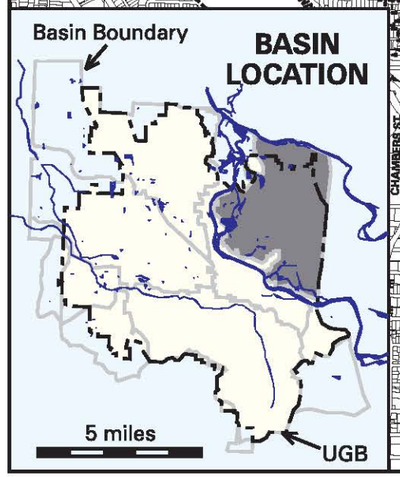
Willakenzie Basin

Projected Land Use *

L E G E N D

- Low-Density Residential
- Med.-Density Residential and MDR Mixed Use
- High-Density Residential and HDR Mixed Use
- Commercial & Commercial-Residential Mixed Use
- Industrial & Commercial-Industrial Mixed Use
- Sand and Gravel
- Natural Resource, Parks and Open Space
- Education and University Research
- Government
- Agriculture (and Ag/Airport Reserve)
- Waterways and Ponds
- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* Projected Land Use according to Metro Area General Plan, as updated to 1998, with revisions to reflect public acquisition of lands for wetland protection.



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Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 2

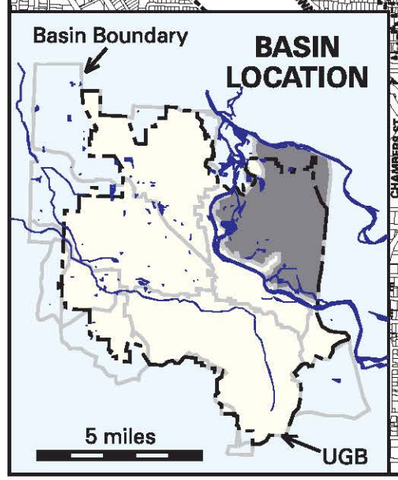
Willakenzie Basin

Surface Cover*

L E G E N D

- Impervious Surface Areas
- Generalized Forest Cover
- Other Vegetated Areas
- Waterways and Ponds
- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* The Impervious Surface Areas category is derived from the 1998 Landuse layer, and includes all developed parcels and road right-of-way. The actual percentage of impervious surface present on each parcel varies by land use category (see table in text for breakdown). Generalized Forest Cover is based on 1994 Aerial Photographs, and includes all forest patches over one acre in size.



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Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 3

Willakenzie Basin

Slope and Topography*

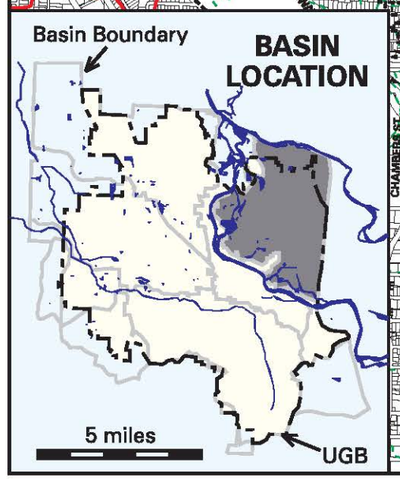
L E G E N D

- 0 - 5% Slopes
- 5 - 10% Slopes
- 10 - 15% Slopes
- 15 - 25% Slopes
- > 25% Slopes
- Waterways and Ponds

- 100-foot contours
- 20-foot contours
- Intermediate contours

- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* Slopes and Contours derived from enhanced 10-meter USGS Digital Elevation Models (DEMs)



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Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 4

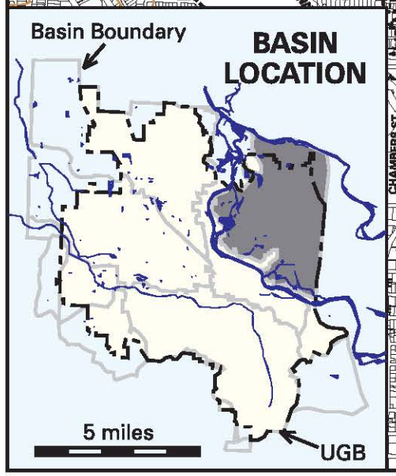
Willakenzie Basin

Surface Water and Drainage System Features

L E G E N D

- 100-yr Floodplain (Hazard Zone A) *
- Floodway (from FEMA maps)
- Waterways and Ponds *
- Wetlands (from West Eugene Wetlands Plan & National Wetland Inventory)
- Storm Pipes 36"+ in Basin*
- Storm Pipes <36" in Basin*
- Storm Pipes in Basin, size unknown*
- 100-foot Contour Lines
- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* from City of Eugene data



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Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 5

Willakenzie Basin

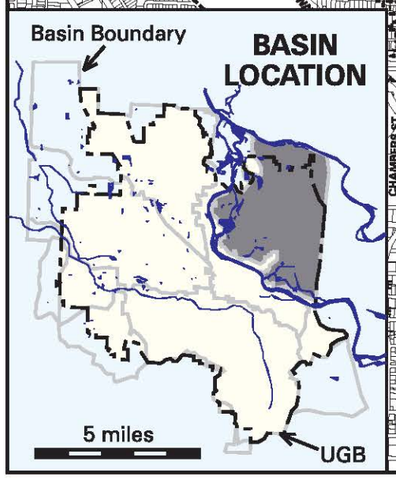
Soil Permeability *

L E G E N D

- Very Rapid
- Moderately Rapid
- Moderate
- Moderately Slow
- Slow
- Very Slow
- Variable
- Pits and Water Bodies from Soil Layer (no data)
- Waterways and Ponds

- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* from USDA Soil Conservation Service data



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Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 6

Willakenzie Basin

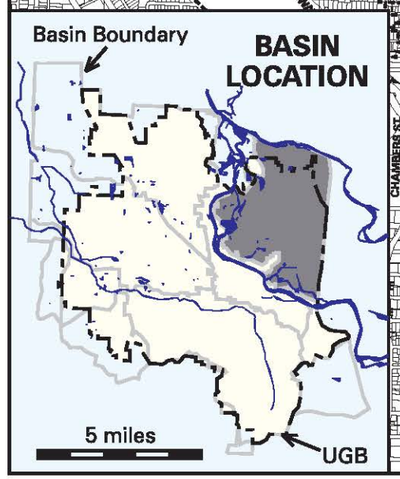
Soil Runoff Potential *

L E G E N D

- Low
- Moderately Low
- Moderately High
- High
- Pits and Water Bodies from Soil Layer (No data)
- Waterways and Ponds

- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* from USDA Soil Conservation Service data



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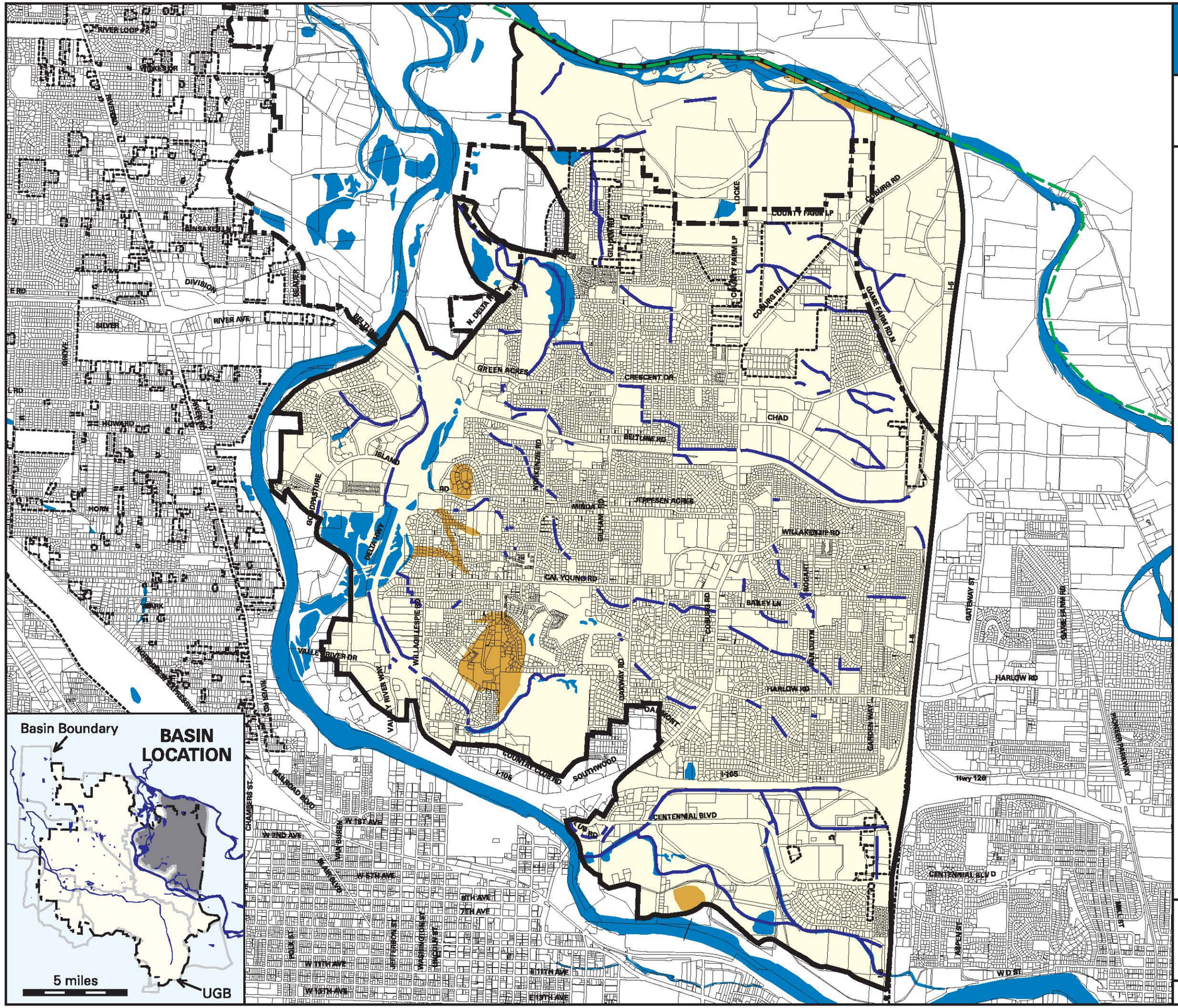
Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 7

Willakenzie Basin

Highly Erodible Soils *



LEGEND

- Highly Erodible Soils
- Moderately Erodible Soils
- All Other Soils
- Waterways and Ponds
- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* Derived by LCOG from USDA Soil Conservation Service data

0 0.5 mile

N

Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 8

Willakenzie Basin

Hydric Soils *

L E G E N D

- Hydric Soils
- All Other Soils
- Waterways and Ponds
- Wetlands (from West Eugene Wetlands Plan & National Wetland Inventory)

- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streets and Channels in Basin
- Metropolitan Plan Boundary

* from USDA Soil Conservation Service Data

0 0.5 mile

N

Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 9

Basin Boundary

BASIN LOCATION

5 miles

UGB

Willakenzie Basin

Soil Types *

L E G E N D

Soils subject to slumping

All other soil types

5, AWBRIG SILTY CLAY LOAM
6, AWBRIG-URBAN LAND COMPLEX
8, BASHAW CLAY
22, CAMAS GRAVELLY SANDY LOAM
23, CAMAS-URBAN LAND COMPLEX
24, CHAPMAN LOAM
25, CHAPMAN-URBAN LAND COMPLEX
26, CHEHALIS SILTY CLAY LOAM
27, CHEHALIS-URBAN LAND COMPLEX
28E, CHEHULPUM SILT LOAM, 12 - 40% SLOPES
29, CLOQUATO SILT LOAM
30, CLOQUATO-URBAN LAND COMPLEX
31, COBURG SILTY CLAY LOAM
32, COBURG-URBAN LAND COMPLEX
33, CONSER SILTY CLAY LOAM
34, COURTNEY GRAVELLY SILTY CLAY LOAM
48, FLUVENTS, NEARLY LEVEL
52B, HAZELAIR SILTY CLAY LOAM, 2 - 7% SLOPES
56, HOLCOMB SILTY CLAY LOAM
75, MALABON SILTY CLAY LOAM
76, MALABON-URBAN LAND COMPLEX
79, MCBEE SILTY CLAY LOAM
95, NEWBERG FINE SANDY LOAM
96, NEWBERG LOAM
97, NEWBERG-URBAN LAND COMPLEX
99H, OCHREPTS-UMBREPTS, VERY STEEP
100, OXLEY GRAVELLY SILT LOAM
101, OXLEY-URBAN LAND COMPLEX
106A, PENGRA-URBAN LAND COMPLEX, 1 - 4% SLOPES
109F, PHILOMATH-URBAN LAND COMPLEX, 12 - 45% SLOPES
110, PITS
114, RIVERWASH
118, SALEM GRAVELLY SILT LOAM
119, SALEM-URBAN LAND COMPLEX
138E, WITZEL VERY COBBLY LOAM, 3 - 30% SLOPES
W, WATER

Waterways and Ponds

Willakenzie Basin Boundary

Urban Growth Boundary

Eugene City Limits

Streams and Channels in Basin

Metropolitan Plan Boundary

* from USDA Soil Conservation Service Data

Basin Boundary

BASIN LOCATION

5 miles

UGB

0 0.5 mile

N

Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 10

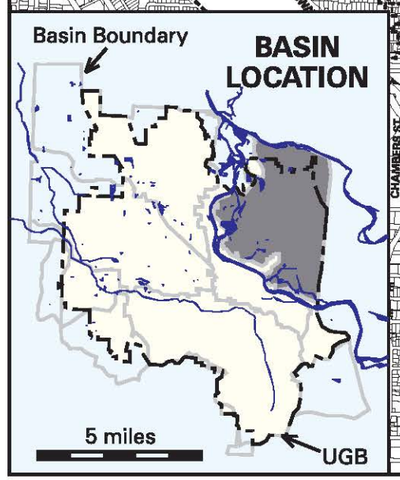
Willakenzie Basin

High Water Table *

L E G E N D

- Soils with Shallow Water Table (generally less than 2 feet during winter months)
- Other Soils (water table generally 6 feet or deeper)
- Pits and Water Bodies from Soil Layer (no data)
- Waterways and Ponds
- I-5 Wellhead Protection Area
- Willakenzie Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* from USDA Soil Conservation Service data



0 0.5 mile

Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 11

Willakenzie Basin

Park, Recreation & Education Facilities

L E G E N D

EXISTING

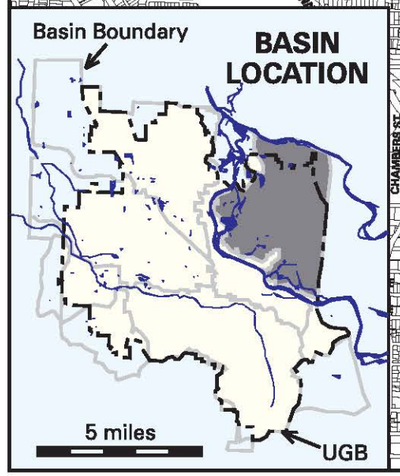
- Parks
- Schools (Pub. & Pvt.)
- Golf Courses
- Bikeways in Basin
- Trails

FUTURE

- Parks in Basin *
- Bikeways in Basin **
- Trails *
- Waterways and Ponds
- Willakenzie Basin Boundary
- Urban Growth Boundary
- Streams and Channels in Basin

* Eugene Parks & Recreation Plan, 1989; Parks, Open Spaces, and Natural Areas Study, 1996.

** Draft TransPlan Update, November 1997.



0 0.5 mile

N

Map Produced by LCOG 2/99

Map based on imprecise source data, subject to change

MAP 12

To identify flooding problems and opportunities, a flood control evaluation was completed for the drainage system in the Willakenzie basin that is described in Section 2.5 and illustrated on Map 5. Section 3.1 describes the process used to identify flooding problems and a general description of each problem. Section 3.2 describes the capital project alternatives and development standard alternatives that were proposed to address the flooding problems. Section 3.3 describes the selected flood control alternatives.

3.1 Evaluation of Flood Control Under Existing and Expected Future Conditions

To develop a flood control strategy for the Willakenzie basin, a computer model was used to evaluate hydrologic/hydraulic conditions of the public storm drainage system. The storm system was evaluated under both existing and buildout land use conditions using XP-SWMM model software. In general, the evaluation concentrated on the significant components of the public drainage system; typically, all storm sewer pipes with a diameter of 36" or greater, and major roadway crossings and open waterways on the North Beltline Floodway, Debrick Slough, Willakenzie Floodway, Gilham Creek and Dodson Slough.

The Willakenzie basin drainage system is shown on Figures 3-2 through 3-6. Figure 3-1 is an index map that illustrates the relative locations of Figures 3-2 through 3-6. Modeled drainage segments and locations of the proposed capital projects are also illustrated on Figures 3-2 through 3-6.

The City-wide summary in Volume I contains detailed information regarding the process and sources of information that were used for identifying flooding problems and opportunities. Section 3 of Volume I specifically includes detailed information regarding the following:

- Model selection process.
- Sources of model input data.
- Model calibration.
- Design storm selection process.

This section of the Willakenzie report provides a summary of the basin specific hydrologic and hydraulic data used in the models and a summary of the basin specific model results with respect to flood control.

3.1.1 Hydrologic Data

The Willakenzie basin was subdivided into 8 major subbasins. The major basin boundaries are presented on Figure 3-1. The 8 major subbasins were further divided into 88 subbasins. Not all subbasins were included in the model (i.e., 21 subbasins were excluded). The subbasins that were not included and the reasons why they were not included are presented later in this section. The subbasin boundaries presented on Figures 3-2 through 3-6 were delineated based on both topography and the storm drainage system layout. The subbasin boundaries were digitized into the City's GIS so that hydrologic data could be compiled for each subbasin.

Seven-character names were assigned to each subbasin. The first two characters represent a two-letter abbreviation for the major basin; in this case WK for Willakenzie. The second two characters represent a two-letter abbreviation for the major subbasin. The 8 major subbasins in the Willakenzie basin are as follows:

GL = Gilham Road Major Subbasin
CF = County Farm Road Major Subbasin
DH = Delta Highway Major Subbasin
NB = North Beltline Major Subbasin
GN = Gilham-Norkenzie Major Subbasin
DP = Delta Ponds Major Subbasin
DS = Debrick Slough Major Subbasin
QF= Q-Street Floodway Major Subbasin
MC = McKenzie River Major Subbasin

The last three characters of the subbasin name consist of numbers, starting with 010 and increasing in increments of 10 for each additional subbasin. For example, the first two subbasins in the North Beltline major subbasin of the Willakenzie basin are WKNB010 and WKNB020. In addition, each subbasin has an associated inlet node number. The hydrologic component (i.e., RUNOFF block) of XP-SWMM was used to generate a stormwater runoff hydrograph for each subbasin. This hydrograph was routed by the hydraulic component (i.e., the EXTRAN block) of XP-SWMM to model the storm drainage system. The subbasin inlet node is the point where the subbasin hydrograph enters the storm drainage system for routing.

The following parameters were required for each subbasin in the hydrology component of XP-SWMM.

1. Subbasin name or number.
2. Channel or pipe inlet node number into the storm drainage system.
3. Subbasin area (acres).
4. Hydraulically connected impervious percentage for both existing and future land use scenarios (percent).
5. Average ground slope (dimensionless, ft/ft).
6. Subbasin width (feet).
7. Manning's roughness coefficient for impervious areas.
8. Manning's roughness coefficient for pervious areas.
9. Depression storage for impervious areas (inches of water over subbasin).
10. Depression storage for pervious areas (inches of water over subbasin).
11. Green-Ampt soil infiltration parameters: average capillary suction (inches) saturated hydraulic conductivity (inches/hour), and initial moisture deficit (volume air/volume voids).

Table 3-2 (provided at the back of this section) provides the major hydrologic information for each of the 67 subbasins included in the Willakenzie basin model. Specifically, the table provides the information for parameters 1 – 5 listed above and the expected increase in impervious surface under future conditions. More detailed hydrologic information, including

information described for parameters 1 – 11, can be found in Appendix E of Volume I. Table 3-2 also provides peak runoff discharge information for each modeled subbasin.

The following subbasins were not included in the model:

- The Q-Street Floodway subbasins (WKQF-010 through WKQF-120) were excluded in the model since a significant portion of the urban runoff in the Q Street Floodway originates from the drainage area located in the City of Springfield.
- For this modeling effort, stormwater runoff from subbasin WKCF-010 was not added to the County Farm storm drainage system since WKCF-010 drained to a series of dry wells (sumps) located at the intersection of Wester Street and Downing Street. However, since the time the models were completed, a piped system has been constructed to direct drainage from this subbasin to the County Farm Rd. system. The map in Figure 3-2 reflects the updated pipe system. As model updates are made, these changes will also be reflected in Tables 3-1 and 3-2.
- Subbasins WKDP-010, WKDP-020, WKDP-030, and WKDP-070 do not include any major storm drainage systems (e.g., pipes greater than 36" in diameter) and contribute flow downstream of the major subbasin model of the Debrick Slough drainage system. In addition, the flow through the Debrick Slough and Delta Ponds within these subbasins during high flow events is controlled by the level of the Willamette River.
- Subbasins WKDP-040, WKDP-050 and WKDP-060 include recent development on Goodpasture Island. The storm drainage system constructed for this development consists of pipes and open waterways that discharge to a series of lakes whose outflow is controlled by gates. Prior to construction, a detailed hydraulic analysis was completed for this development and its drainage system as part of the development approval process. Therefore, further hydraulic analysis was not repeated as part of the Basin Master Planning Project.
- Subbasin WKDH-010 was not included for the following reasons combined: 1) this is the most downstream subbasin in the Delta Highway major subbasin, 2) the subbasin is mostly undeveloped (agricultural uses), and 3) drainage from the subbasin is not expected to contribute any significant runoff to the system that was modeled in this subbasin.
- Subbasin MC-000 is located outside the Urban Growth Boundary and does not contain any major storm drainage systems (e.g., pipes greater than 36" in diameter).

3.1.2 Willakenzie Basin Hydraulic Data

The primary purpose of the modeling was to evaluate capacity of the storm drainage system. The evaluation of the storm drainage system included a hydraulic analysis of the major storm pipes, culverts, and open channels which convey stormwater discharges. Information for the piped system was obtained from the City's GIS. Information for the culverts and open channel segments was compiled from previous flood control and natural resource studies and supplemented with field surveys where deemed necessary. In order to analyze the hydraulic capacity of the storm drainage system, the hydraulic component of XP-SWMM required the following parameters for each pipe, culvert or open channel section:

1. Conduit name.
2. Upstream node number.
3. Downstream node number.
4. Conduit size (diameter for pipes and culverts; and cross-section dimensions for open channels).
5. Conduit length.
6. Conduit material for pipes and culverts.
7. Upstream and downstream invert elevations.
8. Upstream and downstream ground surface elevations.
9. Channel roughness coefficients (for open channels).

For the Willakenzie basin, the model was used to evaluate the capacity of approximately 162 open waterway and pipe segments under existing and future land use conditions. Table 3-3 (provided at the back of this section) provides the major hydraulic information for each of the modeled conduits in the Willakenzie basin. Specifically, the table provides the information for parameters 1 – 6 listed above in addition to the drainage area for each conduit, the relevant design storm, and the model results for the relevant design storm. Model results are presented in terms of peak flows and maximum water surface elevations. The results for all storm events that were routed through the models (i.e., 10-year, 25-year, 50-year, and 100-year storms) can be found in an appendix to Volume I.

3.1.3 Flooding Problems Identified by the Model

This section provides a general description of model-identified flooding problems. The model results are summarized in Table 3-3 which includes peak flows and water surface elevations for the relevant design storm under both existing and buildout conditions. The last column in the table indicates which conduits are expected to be deficient and when (i.e., under existing and/or future land use conditions). For pipe segments and roadway crossings, surcharging was considered to be acceptable and flooding problems were only identified if the models showed water getting out of the system and into the streets. For open waterways, deficiencies were identified when the depth of the design flow exceeded the tops of the channel banks.

In general, very few flooding problems were identified in the Willakenzie basin. Specifically, no flooding problems are expected to occur in the County Farm, Gilham/Norkenzie, and Delta Ponds major subbasins. Twelve open channel segments were identified as deficient for their respective design storms in the remaining four major subbasins (i.e., North Beltline, Delta Highway, Gilham Road and Debrick Slough). Eleven of these twelve segments are expected to be deficient under existing land use conditions. Only one open channel segment is expected to have overbank flooding under buildout conditions. Each of these problems is described in more detail in Section 3.2 in association with the proposed capital project to address the problem.

3.1.4 Other Identified Flooding Related Problems

In addition to flooding problems identified as a result of system modeling, other flooding-related problems have been identified through field observations of maintenance staff. In general, these problems included flooding associated with tip-ups, clogging of pipes draining to Ayres Pond,

and overflows from River Point Pond. Each of these problems is described in more detail in Section 3.2 in association with the proposed capital project to address the problem.

3.2 Development of the Flood Control Strategy

As shown in the stormwater basin master planning process flow chart in Figure 1-1, Step 1 included a compilation of basin characteristics. These basin characteristics are summarized in Section 2.0 of this document. Step 2 in the process included problem identification under both existing and future land use conditions. The results of this step for flood control are provided in Section 3.1 above. The next step included the development of potential stormwater management tools (i.e., capital projects or development standards) to address the identified problems. These stormwater management tools were developed as a result of an all-day basin assessment meeting. The meeting was attended by a large multi-disciplinary group of people including staff with experience in water quality, engineering, maintenance, natural resources, planning, and groundwater resources. Preliminary ideas were developed based on the goals and objectives of the project. This section describes the capital project and development standard alternatives that were proposed to address the identified flooding problems.

3.2.1 Capital Project Alternatives

All existing and future flooding problems identified through modeling and proposed capital projects to address these problems are presented in Table 3-1. The locations of these proposed capital projects are illustrated on Figures 3-2 through 3-6. As shown in Table 3-1, two capital projects, i.e., WK08A and WK16A, were proposed to address the expected flooding problems identified based on modeling results in the Willakenzie basin. Table 3-1 also lists when the flooding problem is expected to occur (i.e., under existing or future conditions). Note that the flooding problems listed in Table 3-1 are associated with segment names. To locate a segment, one should first look up the upstream node and downstream node associated with the segment in Table 3-3, then pinpoint the segment on Figures 3-2 through 3-6.

Table 3-1
Capacity Deficiencies Identified Through Modeling and Proposed Capital Projects to Address Them

Expected Flooding Problems		Capital Project Alternatives Considered for Addressing Capacity Deficiencies	Selected Flood Control Capital Projects
Segment Name	**When Deficient**		
Delta Highway Major Subbasin			
WKDH010A WKDH010G WKDH010H WKDH010I WKDH010B WKDH010C WKDH010D WKDH010E WKDH020A	25-yr existing	**None –** These open channel segments are flooded due to high water levels in the Willamette River. They are not expected as a result of insufficient capacity for runoff from upstream drainage areas. The City of Eugene does not have the ability to control high water levels in the Willamette River. In addition, these open channel segments flow through an open space. It is highly unlikely that the open space would be occupied during a flooding event. For these reasons, a capital project was not proposed to address these flooding problems.	
North Beltline Major Subbasin			
WKNB190A	10-yr existing	WK16A – Ascot Park Waterway Improvements; WK16B – Ascot Park Flood Control Facility;	**WK16A** - This capital project includes replacing the undersized culvert and modifying the open waterway to eliminate the expected flooding problems. The location of the capital project is illustrated on Figure 3-5.
Gilham Road Major Subbasin			
WKGL020A	10-yr future	WK08A – Gilham Road Culvert Replacement	**WK08A**- This capital project includes replacing the existing 48" diameter culvert located between Ayres Road and River Point Pond with a bridge to eliminate the expected overbank flooding in the open waterway segment directly upstream of the culvert. The location of the capital project is illustrated on Figures 3-2 and 3-3.
Debrick Slough Major Subbasin			
WKDS040E	10yr existing	**None** – As this open waterway segment is located in the Eugene Country Club, this expected capacity deficiency is not expected to cause any property damage or pose any threat to safety. Therefore, a flood control capital project was not proposed for this site.	

In addition to the flooding problems identified as a result of basin modeling, the following capital projects were proposed to address other identified flooding problems.

Citywide Annual Budget Line Item - Tip-ups – Tip-ups were identified as potential causes of flooding problems in this basin. There are five tip-ups that have been identified in the Willakenzie basin. A tip-up is a negatively sloped pipe segment that conveys stormwater discharges from a deeper pipe system to an open waterway with a higher elevation. In many cases, the negative slope of the tip-up causes sediment and debris buildup resulting in localized flooding problems. Typically, the tip-ups do not have adequate access for maintenance. Tip-up retrofits were proposed to address potential maintenance-related flooding issues at these locations. The tip-up retrofits that were proposed included manhole or vault-like structures that

would allow for the capture and removal of sediments/debris and would also allow for maintenance access. The tip-up locations that have been identified in this basin are as follows:

1) WKGL020C-located at Ayres Rd. (48")
*Node 71283 - 71284
Page 62 of 97
Segment length = 15 feet
Tip-up offset = 9 feet

2) 61102 to 61078 (36")
*Page 76 of 97
Comes off of a 60" line which runs north along Satre St.
Segment length = 6 feet
Tip-up offset = 4.7 feet

3) Node 59804 to 59781 (42")
*Page 75 of 97
Located north of Elysium Ave. and just east of the north end of Valhalla St.
Segment Length = 14 feet
Tip-up offset = 1.1 feet

4) Node 66184 to 67040 (12")
*Page 51 of 97
Located to the west of Ridgeway Dr. and north of Happy Ct.
Segment Length = 43 feet
Tip-up offset = 3.0 feet

5) Node 59445 to 67049 (18")
*Page 75 of 97
Located at the north end of Finch Lane
Segment Length = 6.5 feet
Tip-up offset = 3.9 feet

** Page numbers listed above refer to page numbers in the City of Eugene Wastewater and Stormwater Index Map Book.*

WK13 - Outlet to Ayres Pond – The North Beltline Floodway discharges into Ayres Pond through two 72" concrete pipes that are located at the end of a relatively inaccessible portion of the open waterway. The debris racks that protect the inlets of these two pipes collect a large amount of debris and garbage. Periodic maintenance is required to prevent these trash racks from becoming clogged. Since they are located in an area that is difficult to access, the maintenance is very difficult to perform. In order to maintain the conveyance of these pipes and reduce the maintenance effort, installation of a water quality facility upstream of this location was proposed in order to capture the debris and garbage in a more accessible location adjacent to Gilham Rd.

WK07 - River Point Pond Outlet – Presently, River Point Pond does not have an outlet. When the water level of the pond rises during large storm events, the flow out of the pond travels overland into the Wildish gravel quarry located to the north of the pond. This causes flooding problems on the Wildish property and disrupts the operation of the quarry. In order to eliminate this flooding problem, construction of an open waterway or pipe was proposed to carry outflows

from the pond to the McKenzie River. The open waterway could also be constructed to provide water quality and natural resources benefits.

3.2.2 Development Standard Alternatives

In addition to capital project alternatives, development standard alternatives were evaluated for addressing those problems that are expected to occur as a result of future buildout conditions. The two flood control development standards that were evaluated for the Willakenzie basin were as follows:

- *Require post-development peak flows to equal pre-development peak flows* – This standard would require developers to ensure that post-development peak flow rates would not exceed pre-development peak flow rates from their sites for the flood control design storm of concern. This requirement could be met through the use of reduced effective impervious areas, infiltration, or detention.

- *Require post-development peak flows to equal available capacity* – This standard would require developers to ensure that post-development peak flow rates would not exceed the design capacity of the existing public stormwater conveyance system that would be accepting these flows. This standard would allow developers to take advantage of available surplus capacity where it exists in the public system. This standard would require that the City conduct hydraulic analyses in order to provide information to developers regarding available capacity. This requirement could also be met through the use of reduced effective impervious areas, infiltration, or detention. This standard is currently required where there are no modeled results and capital projects are not proposed.

3.3 Selected Alternatives

Capital projects were selected to address all of the flooding problems expected to occur under existing conditions. When several capital project options were proposed for addressing the same flooding problem, one capital project option was chosen as a result of a capital project selection and prioritization process that was implemented for this project (see Section 4.0 and Appendix J of Volume I).

For addressing flooding problems expected to occur under future buildout conditions, the capital project and development standards alternatives were compared in terms of both costs and effectiveness. For the Willakenzie basin, the capital project alternatives were estimated to be more cost effective than the development standard alternatives for the following reasons:

- The flooding problem on the North Beltline Floodway adjacent to Ascot Park is expected to occur under existing land use conditions as well as future land use conditions. Therefore, development standards alone would not be expected to resolve this problem and a capital project will be required at this location regardless of which approach is taken.
- Implementing flood control development standards throughout the Willakenzie basin may only result in eliminating the need for one capital project (WK08A – Gilham Road Culvert Replacement). Therefore, implementation of a flood control development standard to address

one open waterway in the Willakenzie basin does not appear to be the most practical and cost-effective solution and was not recommended.

In summary, the selected flood control alternatives to address the expected flooding problems under both existing and future conditions for this basin include each of the capital projects listed below. For more detail regarding each of these projects, capital project fact sheets are provided in the Appendix. The full range of flood control, water quality and natural resource capital projects are listed in Section 6.3 and shown on Figures 3-2 through 3-6.

- **Capital Project Citywide Annual Budget Line Item – Retrofit of Tip-ups:** Retrofit the existing tip-ups located throughout the basin with a sedimentation manhole that provides maintenance access.

- **Capital Project WK07 – River Point Pond Outlet Channel:** Construct a new open waterway outlet for the River Point Pond to either the McKenzie or the Willamette Rivers.

- **Capital Project WK08A – Gilham Road Culvert Replacement:** Replace the existing 48" diameter culvert with a bridge to eliminate the expected flooding problems.

- **Capital Project WK13 – Ayres Pond Outfall Retrofit:** Install a stormwater quality facility upstream of the outfall to remove large debris from the inaccessible portions of the open waterway.

- **Capital Project WK16A – Ascot Park Waterway Improvements:** Replace the undersized culvert and modify the open waterway to eliminate the expected flooding problems.

- **Multiple Objective Stormwater Capital Improvement Program:** In general, all stormwater capital projects, including water quality and natural resources projects, will consider flood control objectives when feasible and appropriate.

TABLE 3-2
MAJOR HYDROLOGIC INPUT/OUTPUT DATA FOR THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Subbasin Name	Inlet Node	Subbasin Area (acres)	Impervious Area (%)					Average Subbasin Slope (ft/ft)	Subbasin Peak Flow (cfs) Existing Land Use Conditions					Subbasin Peak Flow (cfs) Future Land Use Conditions				
			Existing Land Use		Future Land Use		Increase [1] (%)		10-Year	25-Year-W[2]	25-Year-S[3]	50-Year	100-Year	10-Year	25-Year-W[2]	25-Year-S[3]	50-Year	100-Year
			Mapped	Effective	Mapped	Effective												
Willakenzie North - County Farm																		
WKCF-020	58172	85.5	11.1	9.4	43.1	36.6	27.2	0.016	23	18	16	30	39	35	32	41	67	81
WKCF-030	66533	98.9	13.1	11.1	43.1	36.6	25.5	0.012	28	23	21	38	49	41	38	48	78	93
WKCF-040[4]	58356	154.5	13.1	11.1	43.1	36.6	25.5	0.002	31	26	25	44	55	54	51	67	95	114
WKCF-050[4]	66196	96.4	5.1	4.3	42.0	35.7	31.4	0.002	7	5	5	12	16	26	26	38	56	66
WKCF-060	59489	47.7	26.0	22.1	33.1	28.1	6.0	0.008	17	14	16	28	35	18	16	19	33	40
WKCF-070	59511	75.8	41.1	34.9	58.0	49.3	14.4	0.002	20	19	29	50	60	27	27	41	67	79
Willakenzie North - Gilham Road																		
WKGL-010	71280	65.9	9.0	7.7	39.0	33.2	25.5	0.042	3	4	6	9	11	15	15	24	41	46
WKGL-020	71281	110.4	18.0	15.3	49.1	41.7	26.4	0.017	11	12	19	33	40	31	32	51	85	99
WKGL-030	58454	66.6	17.1	14.5	43.1	36.6	22.1	0.005	6	7	11	19	22	16	17	27	43	50
WKGL-040	58511	50.9	33.1	28.1	44.0	37.4	9.3	0.018	10	10	16	26	31	13	13	21	35	40
WKGL-050	58499	43.1	28.0	23.8	45.1	38.3	14.5	0.004	7	7	11	18	21	11	12	18	28	32
WKGL-060	58463	93.6	38.0	32.3	46.0	39.1	6.8	0.013	24	23	34	56	65	28	28	41	65	76
Willakenzie North - Delta Highway																		
WKDH-020	58447	83.3	25.1	21.3	42.0	35.7	14.4	0.087	12	12	20	33	38	20	21	33	56	63
WKDH-030	58450	71.6	32.6	27.7	53.9	45.8	18.1	0.024	13	14	22	36	40	22	23	36	56	63
WKDH-050	59799	99.2	43.1	36.6	50.8	43.2	6.6	0.067	24	25	40	66	74	28	30	48	77	87
Willakenzie North - North Beltline																		
WKNB-010	58442	92.8	41.1	34.9	42.0	35.7	0.8	0.079	22	23	36	61	68	22	23	37	62	70
WKNB-020	59755	63.1	48.0	40.8	48.0	40.8	0.0	0.008	20	20	29	48	56	20	20	29	48	56
WKNB-030	69005	67.2	46.0	39.1	46.0	39.1	0.0	0.002	17	18	29	45	52	17	18	29	45	52
WKNB-040	59772	83.7	50.0	42.5	51.1	43.4	0.9	0.003	30	30	41	63	74	31	30	42	64	75
WKNB-050	59519	66.3	51.1	43.4	53.1	45.1	1.7	0.000	19	20	30	39	45	19	20	31	40	47
WKNB-060	59426	61.9	54.0	45.9	55.1	46.8	0.9	0.005	22	23	32	52	61	23	23	33	53	62
WKNB-070	59497	95.1	6.0	5.1	16.7	14.5	9.4	0.002	18	15	11	21	27	23	21	20	35	44
WKNB-080	71239	253.3	43.1	36.6	47.1	40.0	3.4	0.010	75	75	105	154	180	80	80	114	164	192
WKNB-090	61140	36.5	39.1	33.2	45.1	38.3	5.1	0.002	8	9	13	22	25	9	10	16	25	29
WKNB-100	59462	29.0	51.1	43.4	56.0	47.6	4.2	0.006	11	10	14	27	32	11	11	16	29	34
WKNB-110	59476	22.3	39.1	33.2	46.0	39.1	5.9	0.002	8	7	9	16	20	9	8	11	19	22
WKNB-120	61133	32.1	38.0	32.3	43.1	36.6	4.3	0.003	7	7	12	19	22	8	8	13	22	25
WKNB-130	69048	29.2	41.1	34.9	43.1	36.6	1.7	0.002	7	7	11	16	19	7	7	12	17	20
WKNB-140	61213	59.0	52.0	44.2	55.1	46.8	2.6	0.002	17	18	28	38	44	18	19	30	40	46
WKNB-150	66590	59.5	38.0	32.3	46.0	39.1	6.8	0.001	13	14	21	29	34	16	16	25	34	39
WKNB-160	99575	38.6	38.0	32.3	43.1	36.6	4.3	0.001	8	9	14	20	23	9	10	16	23	26
WKNB-170	61142	125.5	25.1	21.3	44.0	37.4	16.1	0.001	18	19	29	42	47	31	32	50	64	74
WKNB-180	61199	40.2	44.0	37.4	45.1	38.3	0.9	0.001	10	11	17	27	30	10	11	17	27	31
WKNB-190	61086	59.1	39.1	33.2	40.0	34.0	0.8	0.001	13	14	22	34	39	13	14	22	35	40
WKNB-200	62750	110.9	45.1	38.3	46.0	39.1	0.8	0.003	28	30	47	65	74	29	30	48	66	75
WKNB-210	61235	72.5	39.1	33.2	44.0	37.4	4.2	0.001	16	17	26	34	39	18	19	29	37	42
Willakenzie South - Delta Ponds																		
WKDP-080	66556	20.8	46.0	39.1	46.0	39.1	0.0	0.067	5	6	9	15	17	5	6	9	15	17
WKDP-090	60844	26.2	40.0	34.0	42.0	35.7	1.7	0.040	6	6	10	17	19	6	7	10	18	20
WKDP-100	59197	41.6	30.0	25.5	46.0	39.1	13.6	0.075	7	7	12	20	22	11	11	18	30	34

TABLE 3-2 (continued)
MAJOR HYDROLOGIC INPUT/OUTPUT DATA FOR THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Subbasin Name	Inlet Node	Subbasin Area (acres)	Impervious Area (%)					Average Subbasin Slope (ft/ft)	Subbasin Peak Flow (cfs) Existing Land Use Conditions					Subbasin Peak Flow (cfs) Future Land Use Conditions				
			Existing Land Use		Future Land Use		Increase [1] (%)		10-Year	25-Year-W[2]	25-Year-S[3]	50-Year	100-Year	10-Year	25-Year-W[2]	25-Year-S[3]	50-Year	100-Year
			Mapped	Effective	Mapped	Effective												
WKDP-110	60771	37.1	36.0	30.6	45.1	38.3	7.7	0.016	8	8	13	20	23	9	10	16	25	28
WKDP-120	60804	38.9	40.0	34.0	44.0	37.4	3.4	0.035	9	9	15	25	28	10	10	16	27	31
WKDP-130	60760	55.4	35.1	29.8	51.1	43.4	13.6	0.033	25	22	26	47	57	28	26	33	59	71
WKDP-140	60828	48.0	32.0	27.2	42.0	35.7	8.5	0.196	9	9	15	25	28	11	12	19	32	37
WKDP-150	60811	29.9	39.1	33.2	42.9	36.5	3.3	0.076	12	11	14	26	31	13	12	15	27	33
WKDP-160	61595	47.7	43.1	36.6	46.0	39.1	2.5	0.072	15	14	19	37	46	16	15	21	40	48
Willakenzie South - Debrick Slough																		
WKDS-010	60786	76.9	68.0	57.8	71.1	60.4	2.6	0.015	30	31	49	77	88	31	33	52	80	91
WKDS-020	60730	48.4	58.0	49.3	64.0	54.4	5.1	0.066	16	17	27	47	55	18	19	29	52	60
WKDS-030	62474	68.6	29.1	24.7	61.1	51.9	27.2	0.105	11	12	19	32	36	24	25	40	66	75
WKDS-040	99058	214.3	14.0	11.9	26.0	22.1	10.2	0.080	32	26	30	66	87	46	41	54	107	132
WKDS-050	62914	78.7	27.1	23.0	33.1	28.1	5.1	0.025	13	13	20	36	43	16	16	25	43	51
WKDS-060	62978	55.2	36.0	30.6	38.0	32.3	1.7	0.002	11	12	19	28	32	12	13	20	30	34
WKDS-070	62946	75.2	41.1	34.9	42.9	36.5	1.6	0.014	17	18	29	48	54	18	19	31	50	57
WKDS-080	62989	139.5	51.1	43.4	52.9	45.0	1.6	0.022	40	43	67	111	126	42	44	70	115	130
WKDS-090	62713	44.5	43.1	36.6	43.1	36.6	0.0	0.003	12	13	18	30	35	12	13	18	30	35
WKDS-100	71101	47.2	41.1	34.9	42.9	36.5	1.6	0.016	11	12	18	29	33	11	12	19	30	34
Willakenzie South - Gilham-Norkenzie																		
WKGN-010	59134	52.9	43.1	36.6	47.1	40.0	3.4	0.106	13	14	22	36	41	14	15	24	40	45
WKGN-020	68175	41.2	44.0	37.4	44.0	37.4	0.0	0.169	10	11	17	29	33	10	11	17	29	33
WKGN-030	59868	53.9	46.0	39.1	47.1	40.0	0.9	0.008	14	15	23	39	45	14	15	24	40	46
WKGN-040	59878	37.8	41.1	34.9	42.0	35.7	0.8	0.003	9	9	15	23	26	9	9	15	23	27
WKGN-050	59859	41.5	42.0	35.7	44.0	37.4	1.7	0.001	10	10	16	22	25	10	11	17	23	26
WKGN-060	59889	61.9	42.0	35.7	42.9	36.5	0.8	0.005	19	18	25	41	49	19	19	26	42	50
WKGN-070	61562	91.4	42.0	35.7	45.1	38.3	2.6	0.001	22	23	36	55	63	23	25	39	59	67
WKGN-080	72432	53.8	38.0	32.3	56.0	47.6	15.3	0.002	16	15	21	33	38	21	21	30	43	51
WKGN-090	99498	48.0	41.1	34.9	42.0	35.7	0.8	0.011	11	12	19	31	36	11	12	19	32	36
WKGN-100	61423	54.6	44.0	37.4	45.1	38.3	0.9	0.001	13	14	22	29	33	14	14	22	29	34

Note.
1. Increase in effective impervious percentage from existing land use conditions to future land use conditions.
2. W = Winter
3. S = Summer
4. Modeling data for these subbasins has recently been updated and is available by contacting the City of Eugene Public Works Department, Engineering Division.

TABLE 3-3
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
Willakenzie North - Delta Highway												
WKDH010A	72606	72603	Natural	880	25	305	343	383.5	383.4	383.5	383.4	25-yr Existing
WKDH010G	72605	72606	Natural	1080	25	22	36	383.5	383.5	383.5	383.5	25-yr Existing
WKDH010H	72604	72605	Natural	10	25	22	36	383.5	383.5	383.5	383.5	25-yr Existing
WKDH010I	67019	72604	Natural	80	25	22	36	383.5	383.5	383.5	383.5	25-yr Existing
WKDH010J	58450	67019	72" CSP	85	25	22	36	383.5	383.5	383.5	383.5	
WKDH010JRD	58450	67019	Roadway	85		0	0	383.5	383.5	383.5	383.5	
WKDH010B	72602	72606	Natural	10	25	297	330	383.6	383.5	383.7	383.5	25-yr Existing
WKDH010C	72601	72602	Natural	410	25	297	330	383.7	383.6	383.7	383.7	25-yr Existing
WKDH010D	72600	72601	Natural	10	25	297	330	383.9	383.7	384.0	383.7	25-yr Existing
WKDH010E	58446	72600	Natural	230	25	297	330	383.9	383.9	384.0	384.0	25-yr Existing
WKDH010F1	58447	58446	84"CMP	83	50	160	175	384.3	384.0	384.5	384.1	
WKDH010F2	58447	58446	84"CMP	83	50	160	175	384.3	384.0	384.5	384.1	
WKDH010FRD	58447	58446	Roadway	83		0	0	383.8	383.8	383.9	383.9	
WKDH020A	58442	58447	Natural	2500	25	304	334	384.2	384.2	384.4	384.4	25-yr Existing
Willakenzie North - North Beltline												
WKNB010D	59792	58442	Natural	1000	25	40	47	384.2	384.2	384.4	384.4	
WKNB010E	59799	59792	48" CMP	365	25	40	48	385.8	384.1	386.2	384.2	
WKNB010ERD	59799	59792	Roadway	365		0	0	384.1	384.1	384.2	384.2	
WKNB010A1	58441	58442	72" CMP	83	25	166	181	400.1	399.1	400.3	399.3	
WKNB010A2	58441	58442	72" CMP	83	25	166	181	400.1	399.1	400.3	399.3	
WKNB010ARD	58441	58442	Roadway	83		0	0	384.1	384.1	384.2	384.2	
WKNB010B	58371	58441	Natural	2250	25	333	362	403.2	400.1	403.5	400.3	
WKNB010C1	59755	58371	72" CMP	329	25	167	182	405.1	403.2	405.8	403.5	
WKNB010C2	59755	58371	72" CMP	329	25	167	182	405.1	403.2	405.8	403.5	
WKNB010CRD	59755	58371	Roadway	329		0	0	402.8	402.8	403.1	403.1	
WKNB020A	59766	59755	Natural	1220	25	322	352	405.9	405.1	406.5	405.8	
WKNB020B1	59753	59766	72" CSP	85	25	163	179	406.5	405.9	407.1	406.5	
WKNB020B2	59753	59766	72" CSP	85	25	163	179	406.5	405.9	407.1	406.5	
WKNB020BRD	59753	59766	Roadway	85		0	0	405.2	405.2	405.6	405.6	
WKNB020C	59778	59753	Natural	530	25	328	363	407.1	406.5	407.7	407.1	
WKNB020D1	69005	59778	72" CMP	85	25	165	183	407.9	407.1	408.6	407.7	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
WKNB020D2	69005	59778	72" CMP	85	25	165	183	407.9	407.1	408.6	407.7	
WKNB020DRD	69005	59778	Roadway	85		0	0	406.3	406.3	406.8	406.8	
WKNB030A	59774	69005	Natural	1350	25	325	363	409.3	407.9	409.7	408.6	
WKNB040A1	59772	59774	30"CMP	89	25	20	20	411.9	410.6	411.9	410.7	
WKNB040A2	59772	59774	30"CMP	89	25	20	20	411.9	410.6	411.9	410.7	
WKNB040ARD	59772	59774	Roadway	89		0	0	408.5	408.5	409.0	409.0	
WKNB030B	59425	59774	Natural	1300	25	313	355	410.6	409.3	411.0	409.7	
WKNB030C1	59426	59425	72" CSP	603	25	158	180	412.2	410.6	412.8	411.0	
WKNB030C2	59426	59425	72" CSP	603	25	158	180	412.2	410.6	412.8	411.0	
WKNB030CRD	59426	59425	Roadway	603		0	0	410.0	410.0	410.3	410.3	
WKNB060A	67893	59426	66" CSP	340	25	105	109	412.5	412.2	413.2	412.8	
WKNB060ARD	59426	67893	Roadway	340		0	0	411.6	411.6	412.0	412.0	
WKNB060B	59519	67893	66" CSP	1043	10	83	87	412.7	411.6	413.0	412.0	
WKNB060BRD	59519	67893	Roadway	1043		0	0	411.6	411.6	412.0	412.0	
WKNB050A	59518	59519	42" CSP	105	10	25	26	412.9	412.7	413.1	413.0	
WKNB050ARD	59518	59519	Roadway	105		0	0	412.7	412.7	413.0	413.0	
WKNB050B	59546	59518	36" CSP	436	10	7	8	413.2	412.9	413.2	413.1	
WKNB050BRD	59518	59546	Roadway	436		0	0	413.2	413.2	413.2	413.2	
WKNB050C	59495	59546	42" CSP	656	10	7	7	414.6	413.4	414.7	413.4	
WKNB050CRD	59495	59546	Roadway	656		0	0	413.2	413.2	413.2	413.2	
WKNB050D	59545	59495	36" CSP	34	10	7	7	414.7	414.6	414.7	414.7	
WKNB050DRD	59495	59545	Roadway	34		0	0	414.7	414.7	414.7	414.7	
WKNB050E	67912	59545	3' X 5' Conc. Box	148	10	7	7	414.7	414.7	414.7	414.7	
WKNB050ERD	67912	59545	Roadway	148		0	0	414.7	414.7	414.7	414.7	
WKNB050F	68227	67912	3' X 5' Conc. Box	920	10	7	7	415.8	414.7	415.8	414.7	
WKNB050FRD	68227	67912	Roadway	920		0	0	414.7	414.7	414.7	414.7	
WKNB050G	69048	68227	42" CSP	169	10	7	7	419.0	415.8	419.1	415.8	
WKNB050GRD	69048	68227	Roadway	169		0	0	415.8	415.8	415.8	415.8	
WKNB050H	61213	59519	54" CSP	2545	10	59	62	415.6	412.7	416.0	413.0	
WKNB050HRD	61213	59519	Roadway	2545		0	0	412.7	412.7	413.0	413.0	
WKNB140A	61212	61213	54" CSP	701	10	44	47	416.3	415.6	416.6	416.0	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
WKNB140ARD	61212	61213	Roadway	701		0	0	415.6	415.6	416.0	416.0	
WKNB140B	66590	61212	42" CSP	591	10	44	47	417.7	416.3	418.1	416.6	
WKNB140BRD	61212	66590	Roadway	591		0	0	417.7	417.7	418.1	418.1	
WKNB150A	61030	66590	42" CSP	532	10	34	34	420.0	417.7	420.0	418.1	
WKNB150ARD	61030	66590	Roadway	532		0	0	417.7	417.7	418.1	418.1	
WKNB150B	71108	61030	Natural	250	10	34	34	420.5	420.0	420.5	420.0	
WKNB150C	71109	71108	Natural	620	10	34	34	421.4	420.5	421.4	420.5	
WKNB150D	61085	71109	Natural	350	10	34	34	421.5	421.4	421.5	421.4	
WKNB150E	61086	61085	42" CSP	68	10	34	35	421.8	421.5	421.8	421.5	
WKNB150ERD	61085	61086	Roadway	68		0	0	421.8	421.8	421.8	421.8	
WKNB190A	61087	61086	Natural	620	10	25	25	421.9	421.8	422.0	421.8	10-yr Existing
WKNB190B	61049	61087	Natural	340	10	27	28	422.1	421.9	422.1	422.0	
WKNB190C1	67095	61049	48" CSP	42	10	14	14	422.3	422.1	422.3	422.1	
WKNB190C2	67095	61049	48" CSP	42	10	14	14	422.3	422.1	422.3	422.1	
WKNB190CRD	67095	61049	Roadway	42		0	0	422.1	422.1	422.1	422.1	
WKNB190D	62684	67095	Natural	400	10	28	28	423.6	422.3	423.6	422.3	
WKNB190E1	62685	62684	48" CSP	75	10	9	9	423.6	423.6	423.6	423.6	
WKNB190E2	62685	62684	48" CSP	75	10	9	9	423.6	423.6	423.6	423.6	
WKNB190E3	62685	62684	48" CSP	75	10	9	9	423.6	423.6	423.6	423.6	
WKNB190ERD	62685	62684	Roadway	75		0	0	423.6	423.6	423.6	423.6	
WKNB190F	62688	62685	Natural	470	10	28	29	424.1	423.6	424.1	423.6	
WKNB190G1	62712	62688	60" CMP	100	10	14	14	424.3	424.1	424.3	424.1	
WKNB190G2	62712	62688	60" CMP	100	10	14	14	424.3	424.1	424.3	424.1	
WKNB190GRD	62712	62688	Roadway	100		0	0	424.1	424.1	424.1	424.1	
WKNB190H	62750	62712	36" CSP	262	10	28	29	425.2	424.3	425.3	424.3	
WKNB190HRD	62712	62750	Roadway	262		0	0	425.2	425.2	425.3	425.3	
WKNB060C	59428	59426	Natural	580	25	197	238	414.2	412.2	414.6	412.8	
WKNB060D	59401	59428	Natural	1100	25	199	241	416.0	414.2	416.5	414.6	
WKNB070A	59497	59401	54" CSP	880	10	17	19	415.2	415.2	415.7	415.6	
WKNB070ARD	59497	59401	Roadway	880		0	0	415.2	415.2	415.6	415.6	
WKNB060E	59385	59401	Natural	900	25	198	232	417.3	416.0	417.8	416.5	
WKNB110A	59476	59385	72" CSP	120	25	64	70	417.4	417.3	417.9	417.8	
WKNB110ARD	59476	59385	Roadway	120		0	0	416.4	416.4	416.8	416.8	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
WKNB110B	59420	59476	72" CSP	110	10	37	41	416.4	416.4	416.9	416.9	
WKNB110BRD	59476	59420	Roadway	110		0	0	416.4	416.4	416.9	416.9	
WKNB110C	61133	59420	72" CSP	1337	10	38	41	416.6	416.4	417.1	416.9	
WKNB110CRD	61133	59420	Roadway	1337		0	0	416.4	416.4	416.9	416.9	
WKNB120A	60890	61133	66" CSP	130	10	32	35	416.6	416.6	417.1	417.1	
WKNB120ARD	60890	61133	Roadway	130		0	0	416.6	416.6	417.1	417.1	
WKNB120B	99575	60890	66" CMP	1458	10	33	35	417.7	416.6	418.0	417.1	
WKNB120BRD	99575	60890	Roadway	1458		0	0	416.6	416.6	417.1	417.1	
WKNB160A	61199	99575	60" CSP	1201	10	25	27	418.0	417.7	418.3	418.0	
WKNB160ARD	61199	99575	Roadway	1201		0	0	417.7	417.7	418.0	418.0	
WKNB180A	61183	61199	48" CSP	1214	10	16	18	419.6	418.0	419.7	418.3	
WKNB180Ard	61183	61199	Roadway	1214		0	0	418.0	418.0	418.3	418.3	
WKNB180B	61235	61183	42" CSP	480	10	16	18	420.9	419.6	421.0	419.7	
WKNB180Brd	61183	61235	Roadway	480		0	0	420.9	420.9	421.0	421.0	
WKNB100A	66880	67043	72" CSP	130	25	54	79	417.6	417.6	418.2	418.1	
WKNB100ARD	67043	66880	Roadway	130		0	0	416.7	416.7	417.1	417.1	
WKNB100B	59462	66880	60" CSP	47	10	33	48	416.7	416.7	417.2	417.1	
WKNB100BRD	59462	66880	Roadway	47		0	0	416.7	416.7	417.1	417.1	
WKNB100C	59421	59462	66" CSP	30	10	24	38	416.7	416.7	417.2	417.2	
WKNB100CRD	59462	59421	Roadway	30		0	0	416.7	416.7	417.2	417.2	
WKNB100D	61140	59421	60" CSP	905	10	24	39	416.8	416.7	417.4	417.2	
WKNB100DRD	61140	59421	Roadway	905		0	0	416.7	416.7	417.2	417.2	
WKNB090A	61142	61140	48" CSP	1037	10	17	30	417.1	416.8	418.0	417.4	
WKNB090ARD	61142	61140	Roadway	1037		0	0	416.8	416.8	417.4	417.4	
WKNB110D	67043	59385	Natural	400	25	139	167	417.6	417.3	418.1	417.8	
WKNB100E	71240	67043	Natural	1930	25	101	110	418.8	417.6	418.9	418.1	
WKNB100F	71239	71240	Natural	150	25	103	112	424.0	418.8	424.1	418.9	
Willakenzie North - Gilham Road												
WKGL010A	71280	71279	Natural	1200	10	55	103	391.2	385.6	391.9	385.7	
WKGL010B	71281	71280	48" CMP	30	10	53	89	392.2	391.2	393.4	391.9	
WKGL010BRD	71281	71280	Roadway	30		0	0	391.2	391.2	391.9	391.9	
WKGL020A	71282	71281	Natural	920	10	43	62	395.2	392.2	396.0	393.4	10-yr Future
WKGL020B	73036	71282	Natural	1280	10	43	63	397.5	395.2	398.1	396.0	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
WKGL020C	70865	73036	48" CSP	15	10	43	63	397.7	397.5	398.3	398.1	
WKGL020D	70862	70865	72" CSP	1015	10	43	63	397.8	397.7	398.6	398.3	
WKGL030A	58511	70862	42" CSP	610	10	10	13	397.9	397.8	398.7	398.6	
WKGL030ARD	70862	58511	Roadway	610		0	0	397.9	397.9	398.7	398.7	
WKGL030G	58499	70862	54" CMP	562	10	7	11	397.8	397.8	398.7	398.6	
WKGL030GRD	58499	70862	Roadway	562		0	0	397.8	397.8	398.6	398.6	
WKGL030B	58454	70862	42" CSP	70	10	28	41	397.7	397.8	398.9	398.6	
WKGL030BRD	58454	70862	Roadway	70		0	0	397.8	397.8	398.6	398.6	
WKGL030C	70121	58454	Natural	1650	10	21	25	400.9	397.7	400.8	398.9	
WKGL030D	70120	70121	48" CSP	85	10	21	25	401.1	400.9	401.2	400.8	
WKGL030DRD	70120	70121	Roadway	85		0	0	400.9	400.9	400.8	400.8	
WKGL030E	71289	70120	Natural	400	10	21	25	402.2	401.1	402.3	401.2	
WKGL030F	58463	71289	Natural	410	10	21	25	404.1	402.2	404.3	402.3	
Willakenzie North - County Farm												
WKCF020A	58172	58169	78" CSP	2866	10	104	166	397.3	392.5	398.9	393.3	
WKCF020ARD	58172	58169	Roadway	2866		0	0	388.0	388.0	388.1	388.1	
WKCF020B	66533	58172	78" CSP	1596	10	85	140	399.4	397.3	400.6	398.9	
WKCF020BRD	58172	66533	Roadway	1596		0	0	399.4	399.4	400.6	400.6	
WKCF030A	58356	66533	66" CSP	1085	10	60	107	401.2	399.4	402.4	400.6	
WKCF030ARD	58356	66533	Roadway	1085		0	0	399.4	399.4	400.6	400.6	
WKCF040A	59511	58356	60" CSP	2093	10	35	63	405.4	401.2	406.1	402.4	
WKCF040ARD	59511	58356	Roadway	2093		0	0	401.2	401.2	402.4	402.4	
WKCF070D	66196	59511	54" CSP	2465	10	5	24	406.7	405.4	407.9	406.1	
WKCF070DRD	66196	59511	Roadway	2465		0	0	405.4	405.4	406.1	406.1	
WKCF070A	68994	59511	54" CSP	467	10	15	16	405.7	405.4	406.2	406.1	
WKCF070ARD	68994	59511	Roadway	467		0	0	405.4	405.4	406.1	406.1	
WKCF070B	59487	68994	42" CSP	581	10	15	16	407.2	405.7	407.2	406.2	
WKCF070BRD	59487	68994	Roadway	581		0	0	405.7	405.7	406.2	406.2	
WKCF070C	59489	59487	36" CSP	533	10	15	16	408.4	407.2	408.4	407.2	
WKCF070CRD	59487	59489	Roadway	533		0	0	408.4	408.4	408.4	408.4	
Willakenzie South - Debrick Slough												
WKDS010A	60730	71171	Natural	1200	25	126	163	389.9	388.8	390.1	388.8	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
WKDS010B	60786	60730	54" CSP	486	10	30	31	394.8	393.6	394.9	393.6	
WKDS010BRD	60786	60730	Roadway	486		0	0	389.8	389.8	390.0	390.0	
WKDS020A	71172	60730	Natural	600	25	98	122	391.0	389.9	391.2	390.1	
WKDS020B	71173	71172	72" CSP	640	50	115	145	394.0	391.1	394.5	391.3	
WKDS020BRD	71173	71172	Roadway	640		0	0	391.0	391.0	391.1	391.1	
WKDS020C	62475	71173	Natural	200	25	98	122	394.3	393.6	394.7	394.1	
WKDS020D	62474	62475	72" CSP culvert	316	50	115	145	395.8	394.6	396.4	395.0	
WKDS020DRD	62474	62475	Roadway	316		0	0	394.2	394.2	394.5	394.5	
WKDS030A	71176	62474	Natural	1300	25	92	109	397.1	395.5	397.3	396.0	
WKDS030B	99056	71176	Natural	380	25	92	110	397.4	397.1	397.6	397.3	
WKDS030C1	99058	99056	3.75'x6' CSP culvert	49	25	48	57	397.4	397.4	397.7	397.6	
WKDS030C2	99058	99056	3.75'x6' CSP culvert	49	25	44	53	397.4	397.4	397.7	397.6	
WKDS030CRD	99058	99056	Roadway	49		0	0	397.3	397.3	397.5	397.5	
WKDS040A	71179	99058	Natural	220	10	65	68	399.2	397.4	399.2	397.5	
WKDS040B	71180	71179	Natural	40	10	65	68	399.2	399.2	399.3	399.2	
WKDS040BRD	71180	71179	Roadway	40		0	0	399.2	399.2	399.2	399.2	
WKDS040C	71182	71180	Natural	2370	10	66	69	401.1	399.2	401.1	399.3	
WKDS040D	71183	71182	36" CMP culvert	49	10	66	69	404.5	401.1	404.8	401.1	
WKDS040DRD	71183	71182	Roadway	49		0	0	401.1	401.1	401.1	401.1	
WKDS040E	71185	71183	Natural	430	10	69	72	404.5	404.5	404.8	404.8	10-yr Existing
WKDS040F	71186	71185	72" CMP culvert	20	10	75	78	404.6	404.5	404.9	404.8	
WKDS040FRD	71186	71185	Roadway	20		0	0	404.5	404.5	404.8	404.8	
WKDS040G	71187	71186	Natural	220	10	83	87	404.6	404.6	404.9	404.9	
WKDS040H	71188	71187	72" CMP culvert	99	10	86	91	404.8	404.6	405.1	404.9	
WKDS040HRD	71188	71187	Roadway	99		0	0	404.6	404.6	404.9	404.9	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
WKDS040I	62914	71188	Natural	430	10	90	94	404.8	404.8	405.1	405.1	
WKDS050A	62978	62914	72" CSP	716	10	81	83	405.0	404.8	405.3	405.1	
WKDS050ARD	62978	62914	Roadway	716		0	0	404.8	404.8	405.1	405.1	
WKDS060A	62946	62978	66" CSP	1100	10	72	74	405.6	405.0	405.9	405.3	
WKDS060ARD	62946	62978	Roadway	1100		0	0	405.0	405.0	405.3	405.3	
WKDS070A	62915	62946	60" CSP	1640	10	57	58	406.8	405.6	406.9	405.9	
WKDS070ARD	62915	62946	Roadway	1640		0	0	405.6	405.6	405.9	405.9	
WKDS070B	71121	62915	Natural	450	10	58	60	407.1	406.8	407.1	406.9	
WKDS070C	62891	71121	Natural	420	10	59	61	409.6	407.1	409.6	407.1	
WKDS070D	62989	62891	48" CSP	30	10	59	61	411.0	410.1	411.0	410.1	
WKDS070DRD	62989	62891	Roadway	30		0	0	409.6	409.6	409.6	409.6	
WKDS080A	62986	62989	36" CSP	650	10	20	20	413.5	411.0	413.5	411.0	
WKDS080ARD	62986	62989	Roadway	650		0	0	411.0	411.0	411.0	411.0	
WKDS080B	62760	62986	42" CSP	738	10	20	20	415.1	413.5	415.1	413.5	
WKDS080BRD	62760	62986	Roadway	738		0	0	413.5	413.5	413.5	413.5	
WKDS080C	62758	62760	36" CSP	242	10	20	20	415.6	415.1	415.6	415.1	
WKDS080CRD	62758	62760	Roadway	242		0	0	415.1	415.1	415.1	415.1	
WKDS080D	62713	62758	30" CSP	48	10	20	20	416.4	415.6	416.4	415.6	
WKDS080DRD	62713	62758	Roadway	48		0	0	415.6	415.6	415.6	415.6	
WKDS090A	62715	62713	Natural	457	10	10	11	416.5	416.4	416.5	416.4	
WKDS090B	62716	62715	30" CSP culvert	442	10	10	11	416.8	416.5	416.9	416.5	
WKDS090BRD	62716	62715	Roadway	442		0	0	416.5	416.5	416.5	416.5	
WKDS090C	71102	62716	Natural	310	10	11	11	416.9	416.8	416.9	416.9	
WKDS090D	71101	71102	Natural	364	10	11	11	418.2	416.9	418.2	416.9	
Willakenzie South - Delta Ponds												
WKDP130A	71156	71157	Natural	330	10	40	47	397.3	387.5	397.4	387.6	
WKDP130B	60760	71156	Natural	320	10	40	47	403.7	398.2	403.9	398.4	
WKDP130C	66584	60760	54" CSP	1332	10	19	22	403.8	403.7	404.1	403.9	
WKDP130CRD	66584	60760	Roadway	1332		0	0	403.7	403.7	403.9	403.9	
WKDP130D	60840	66584	48" CSP	553	10	19	22	404.0	403.8	404.3	404.1	
WKDP130DRD	66584	60840	Roadway	553		0	0	404.0	404.0	404.3	404.3	
WKDP130E	60828	60840	36" CSP	558	10	9	12	405.2	404.0	405.4	404.3	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
WKDP130ERD	60828	60840	Roadway	558		0	0	404.0	404.0	404.3	404.3	
WKDP130F	60811	60840	36" CSP	548	10	11	11	404.8	404.0	404.8	404.3	
WKDP130FRD	60811	60840	Roadway	548		0	0	404.0	404.0	404.3	404.3	
WKDP080A	66556	59213	36" CSP	313	10	46	52	394.1	388.6	396.3	388.6	
WKDP080ARD	66556	59213	Roadway	313		0	0	388.6	388.6	388.6	388.6	
WKDP080B	60844	66556	54" CSP	635	10	34	37	395.2	394.1	396.6	396.3	
WKDP080BRD	60844	66556	Roadway	635		0	0	394.1	394.1	396.3	396.3	
WKDP090C	60771	60844	24" CSP	786	10	8	9	399.7	395.2	400.0	396.6	
WKDP090CRD	60771	60844	Roadway	786		0	0	395.2	395.2	396.6	396.6	
WKDP090A	60856	60844	48" CSP	119	10	21	23	395.4	395.2	396.7	396.6	
WKDP090ARD	60856	60844	Roadway	119		0	0	395.2	395.2	396.6	396.6	
WKDP090B	60804	60856	42" CSP	1801	10	21	24	399.7	395.4	399.7	396.7	
WKDP090BRD	60804	60856	Roadway	1801		0	0	395.4	395.4	396.7	396.7	
WKDP120A	61595	60804	42" CSP	1894	10	13	13	402.1	399.7	402.2	399.7	
WKDP120ARD	61595	60804	Roadway	1894		0	0	399.7	399.7	399.7	399.7	
WKDP080C	59248	66556	30" CSP	439	10	8	11	394.2	394.1	396.6	396.3	
WKDP080CRD	59248	66556	Roadway	439		0	0	394.1	394.1	396.3	396.3	
WKDP080D	59218	59248	24" CSP	209	10	7	11	396.2	394.2	397.1	396.6	
WKDP080DRD	59218	59248	Roadway	209		0	0	394.2	394.2	396.6	396.6	
WKDP080E	59181	59218	30" CSP	150	10	7	11	396.9	396.2	397.3	397.1	
WKDP080ERD	59218	59181	Roadway	150		0	0	396.9	396.9	397.3	397.3	
WKDP080F	59198	59181	Natural	175	10	7	11	397.4	396.9	397.8	397.3	
WKDP080G	59197	59198	21" CSP	216	10	7	11	399.2	397.4	399.5	397.8	
WKDP080GRD	59197	59198	Roadway	216		0	0	397.4	397.4	397.8	397.8	
Willakenzie South - Gilham-Norkenzie												
WKGN010A	59134	59192	72" CSP	264	10	127	136	393.9	389.4	394.1	389.4	
WKGN010ARD	59134	59192	Roadway	264		0	0	389.4	389.4	389.4	389.4	
WKGN010B	68175	59134	36" CSP	895	10	11	11	396.5	393.9	396.5	394.1	
WKGN010BRD	68175	59134	Roadway	895		0	0	393.9	393.9	394.1	394.1	
WKGN010C	59868	59134	72" CSP	2151	10	105	113	399.5	393.9	399.7	394.1	
WKGN010CRD	59868	59134	Roadway	2151		0	0	393.9	393.9	394.1	394.1	
WKGN030D	59862	59868	36 "CSP	1880	10	10	10	403.6	399.5	403.6	399.7	
WKGN030DRD	59868	59862	Roadway	1880		0	0	403.6	403.6	403.6	403.6	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
WKGN030E	59859	59862	42" CSP	606	10	10	10	404.6	403.6	404.6	403.6	
WKGN030ERD	59862	59859	Roadway	606		0	0	404.6	404.6	404.6	404.6	
WKGN030A	59896	59868	66 " CSP	793	10	82	90	401.8	399.5	401.9	399.7	
WKGN030ARD	59868	59896	Roadway	793		0	0	401.8	401.8	401.9	401.9	
WKGN030B	59889	59896	66" CSP	1460	10	74	81	404.3	401.8	404.5	401.9	
WKGN030BRD	59889	59896	Roadway	1460		0	0	401.8	401.8	401.9	401.9	
WKGN030C	59878	59896	30 " CSP	509	10	9	9	405.0	402.9	405.0	402.9	
WKGN030CRD	59896	59878	Roadway	509		0	0	405.0	405.0	405.0	405.0	
WKGN040A	59875	59878	36" CSP	411	10	0	0	405.2	405.0	405.2	405.0	
WKGN040ARD	59875	59878	Roadway	411		0	0	405.0	405.0	405.0	405.0	
WKGN040B	59873	59875	27" CSP	258	10	0	0	406.4	405.8	406.4	405.8	
WKGN040BRD	59873	59875	Roadway	258		0	0	405.2	405.2	405.2	405.2	
WKGN040C	59889	59873	24" CSP	364	10	0	0	406.4	406.4	406.4	406.4	
WKGN040CRD	59873	59889	Roadway	364		0	0	404.3	404.3	404.5	404.5	
WKGN060A	61562	59889	66" CSP	1506	10	58	65	405.7	404.3	405.9	404.5	
WKGN060ARD	59889	61562	Roadway	1506		0	0	405.7	405.7	405.9	405.9	
WKGN070C	61554	61562	42" CSP	1014	10	13	18	406.8	405.7	407.2	405.9	
WKGN070CRD	61554	61562	Roadway	1014		0	0	405.7	405.7	405.9	405.9	
WKGN070D	61444	61554	36" CSP	43	10	13	18	411.2	406.8	411.3	407.2	
WKGN070DRD	61554	61444	Roadway	43		0	0	411.2	411.2	411.3	411.3	
WKGN070E	71196	61444	Natural	500	10	13	18	413.5	411.2	413.8	411.3	
WKGN070F	71197	71196	36" CSP culvert	31	10	13	18	413.6	413.5	414.0	413.8	
WKGN070FRD	71197	71196	Roadway	31		0	0	413.5	413.5	413.8	413.8	
WKGN070G	71198	71197	Natural	340	10	13	18	413.8	413.6	414.1	414.0	
WKGN070H	72432	71198	36" CSP culvert	17	10	13	19	414.0	413.8	414.3	414.1	
WKGN070HRD	71198	72432	Roadway	17		0	0	414.0	414.0	414.3	414.3	
WKGN070A	61565	61562	48" CSP	1999	10	24	25	407.8	405.7	407.8	405.9	
WKGN070ARD	61565	61562	Roadway	1999		0	0	405.7	405.7	405.9	405.9	
WKGN070B	99498	61565	42" CSP	695	10	24	25	409.8	407.8	409.9	407.8	
WKGN070BRD	99498	61565	Roadway	695		0	0	407.8	407.8	407.8	407.8	
WKGN090A	99495	99498	36" CSP	597	10	13	14	410.8	409.8	410.8	409.9	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAKENZIE BASIN STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
WKGN090ARD	99495	99498	Roadway	597		0	0	409.8	409.8	409.9	409.9	
WKGN090B	61437	99495	48" CSP	122	10	13	14	411.1	410.8	411.1	410.8	
WKGN090BRD	99495	61437	Roadway	122		0	0	411.1	411.1	411.1	411.1	
WKGN090C	61423	61437	Natural	800	10	13	14	413.8	411.1	413.8	411.1	

Willakenzie Basin Drainage System

INDEX MAP

This index map shows the layout of the Willakenzie basin into five geographic areas depicted on Figures 3-2 through 3-6. These figures contain detailed drainage system information for areas within the city limits and urban growth boundary (UGB).

L E G E N D

- Eugene City Limits
- Urban Growth Boundary
- Eugene Plan Boundary

Basin Map Coverage

(Alternating color borders to distinquish overlapping areas.)

Willakenzie Basin Major Subbasins

- CF = County Farm
- DH = Delta Highway
- DP = Delta Pond
- DS = Debrick Slough
- GL = Gilham Norkenzie
- GN = Gilham North
- MC = McKenzie River
- NB = North Beltline
- QF = Q Street Floodway

N W E S

1 inch equals 0.60 miles

Miles

0.3 0 0.3 0.6

Produced by LCOG - August 2002
g:\projects\basins\drainage_maps\WK_index.mxd

Figure 3-1

Willakenzie Basin Drainage System

No Map

Legend

- Drainpipe - Modeled
- Drainpipe - Not Modeled
- Waterway - modeled
- Waterway - not modeled

Major Subbasins on this map

- CF = County Farm
- DH = Delta Highway
- DP = Delta Pond
- MC = McKenzie River
- GL = Gilham Norkenzie
- NB = North Beltline

AB-123 Subbasin ID's within Major Subbasins

- Modeled Point
- *12345* Modeled Reference Numbers

Capital Projects

- WKxx Water Quality
- WKxx Natural Resources
- WKxx Flood Control

- Other Water Features
- Acquisition Corridor
- Urban Growth Boundary
- Eugene City Limits

Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.

N W E S

EUGENE

1 inch equals 1,000 feet

500 0 500 1,000 Feet

Produced by LCOG - August 2002
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Figure 3-2

Figure 3-3

Figure 3-4

Willamette River Basin

Willamette River

Debrick Slough

Dodson Slough

Gilham Creek

Ayers Pond

River Point Pond

North Beltline Floodway

WK07 WK08A WK08B WK13

GL-010 GL-020 GL-030 GL-040 GL-050 GL-060

CF-010

DH-010 DH-020 DH-030 DH-040 DH-050 DH-060

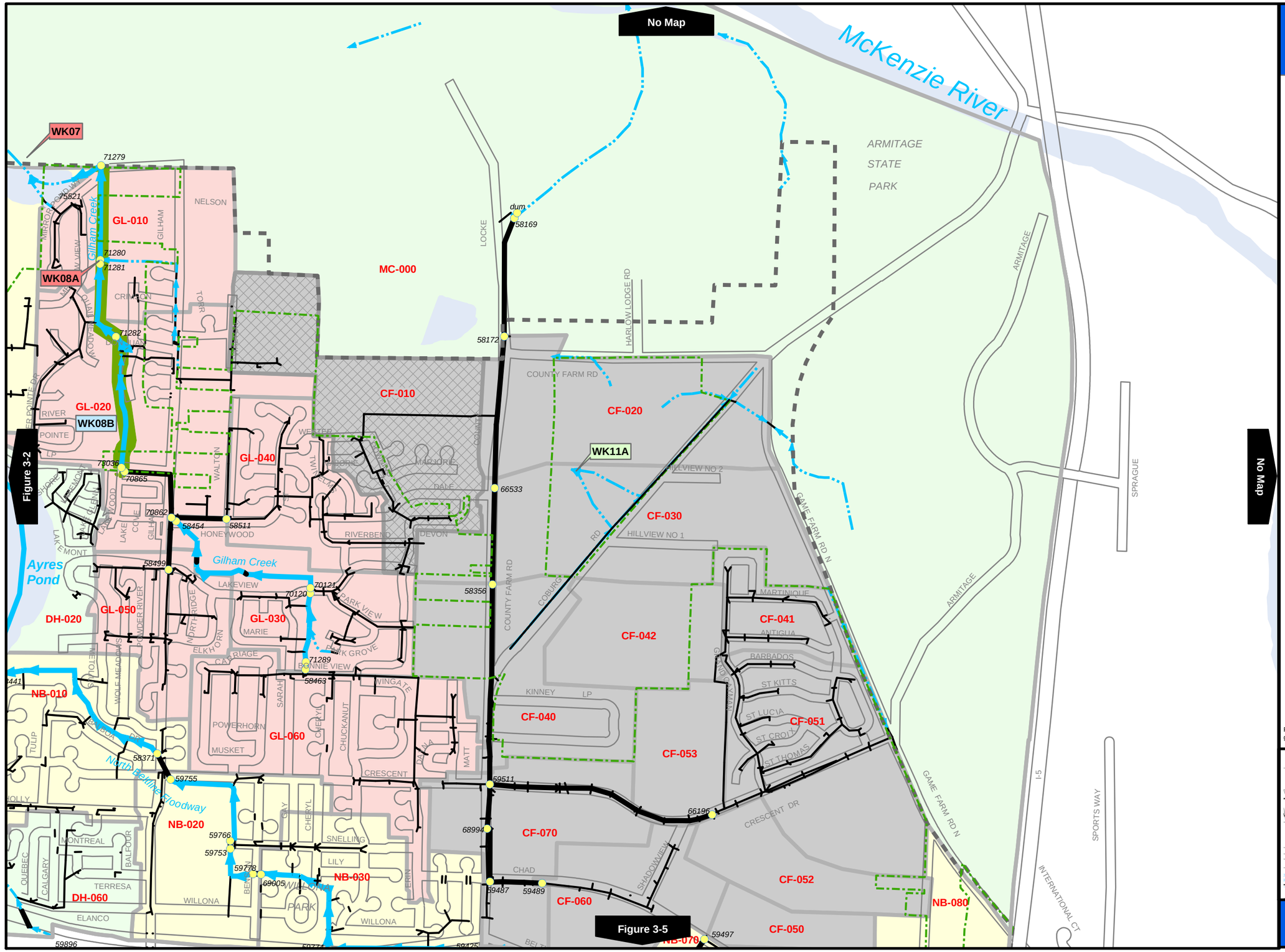
DP-010 DP-020 DP-030 DP-040 DP-050 DP-060

NB-010 NB-020 NB-030

GN-010

71279 75521 71280 71281 71282 72603 72606 72602 58446 72601 58447 72600 72604 72605 67019 58450 73036 70865 70862 58454 58511 58499 70121 70120 71289 58463 58442 58441 59792 59799 58371 59755 59766 59753 59778 69005 59774 59772 59192 59134 59868 59896 59878 59873 59889

Willakenzie Basin Drainage System



Legend

- Drainpipe - Modeled
- Drainpipe - Not Modeled
- Waterway - modeled
- Waterway - not modeled

Major Subbasins on this map

- CF = County Farm
- DH = Delta Highway
- MC = McKenzie River
- GL = Gilham Road
- NB = North Beltline

AB-123 Subbasin ID's within Major Subbasins

Subbasins have been refined in this area and updated hydrologic information is available by contacting the City of Eugene Public Works Department Engineering Division.

- Modeled Point
- *12345* Modeled Reference Numbers

Capital Projects

- WKxx Water Quality
- WKxx Natural Resources
- WKxx Flood Control

- Other Water Features
- Acquisition Corridor
- Urban Growth Boundary
- Eugene City Limits

Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.

N W E S

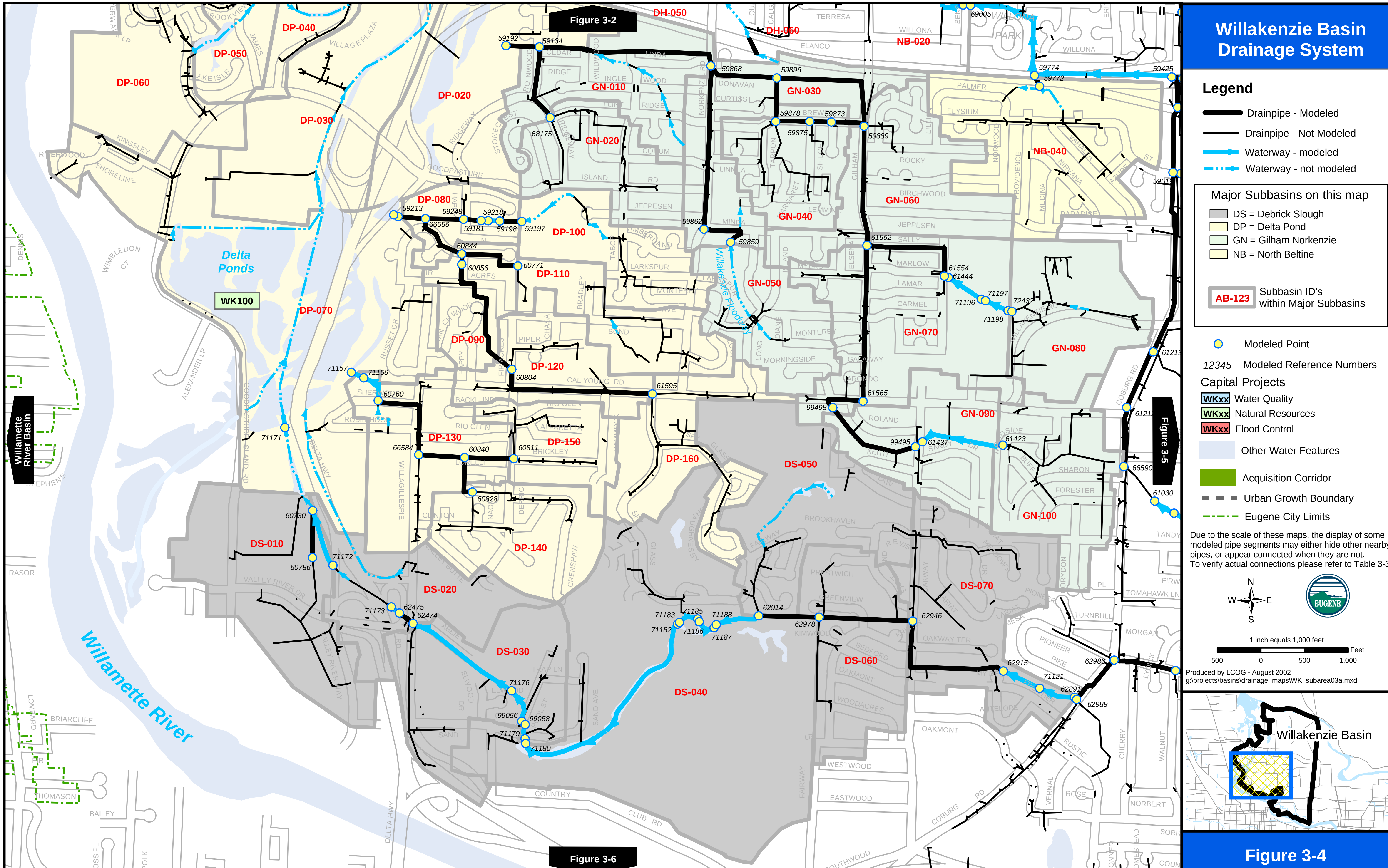
EUGENE

1 inch equals 1,000 feet

500 0 500 1,000 Feet

Produced by LCOG - July 2002
g:\projects\basins\drainage_maps\WK_subarea02.mxd

Figure 3-3



Willakenzie Basin Drainage System
Legend
Drainpipe - Modeled
Drainpipe - Not Modeled
Waterway - modeled
Waterway - not modeled
Major Subbasins on this map
DS = Debrick Slough
DP = Delta Pond
GN = Gilham Norkenzie
NB = North Beltine
AB-123
Subbasin ID's within Major Subbasins
Modeled Point
12345 Modeled Reference Numbers
Capital Projects
WKxx Water Quality
WKxx Natural Resources
WKxx Flood Control
Other Water Features
Acquisition Corridor
Urban Growth Boundary
Eugene City Limits
Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.
N
W
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EUGENE
1 inch equals 1,000 feet
500 0 500 1,000
Feet
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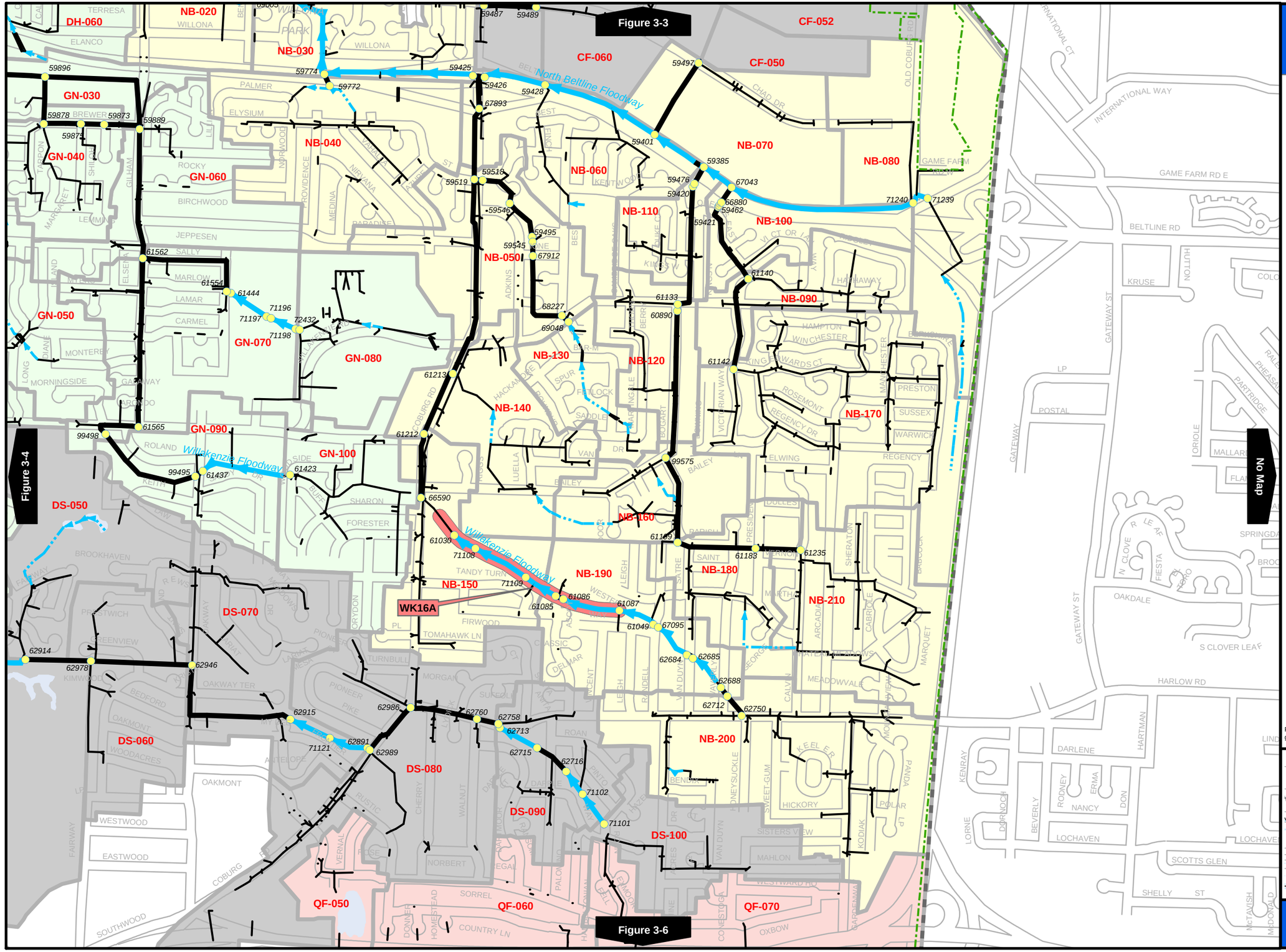
Willakenzie Basin
Figure 3-4
Figure 3-2
Figure 3-5
Figure 3-6
Willamette River Basin
Willamette River
Delta Ponds
WK100
Willakenzie Floodway
DP-030
DP-040
DP-050
DP-060
DP-020
DP-070
DP-080
DP-090
DP-100
DP-110
DP-120
DP-130
DP-140
DP-150
DP-160
DH-050
DH-060
NB-020
NB-040
GN-010
GN-020
GN-030
GN-040
GN-050
GN-060
GN-070
GN-080
GN-090
GN-100
DS-010
DS-020
DS-030
DS-040
DS-050
DS-060
DS-070

Willakenzie Basin Drainage System



Legend

- Drainpipe - Modeled
- Drainpipe - Not Modeled
- Waterway - modeled
- Waterway - not modeled

Major Subbasins on this map

- CF = County Farm
- DP = Delta Ponds
- DS = Debrick Slough
- GN = Gilham North
- NB = North Beltline
- QF = Q Street Floodway

AB-123 Subbasin ID's within Major Subbasins

- Modeled Point
- *12345* Modeled Reference Numbers

Capital Projects

- WKxx Water Quality
- WKxx Natural Resources
- WKxx Flood Control

- Other Water Features
- Acquisition Corridor
- Urban Growth Boundary
- Eugene City Limits

Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.

N W E S

1 inch equals 1,000 feet

500 0 500 1,000 Feet

Produced by LCOG - August 2002
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Willakenzie Basin

Figure 3-5

Willakenzie Basin Drainage System

Figure 3-5

71101

DS-040
DS-080
DS-100
NB-200
QF-010
QF-020
QF-030
QF-040
QF-050
QF-060
QF-070
QF-080
QF-090
QF-100
QF-110
QF-120

Q Street Floodway
Q Street Channel
Canoe Canal
Patterson Slough
Willamette River
ALTON BAKER PARK
I-105

Willamette River Basin

Legend

- Drainpipe - Modeled
- Drainpipe - Not Modeled
- Waterway - modeled
- Waterway - not modeled

Major Subbasins on this map

- DS = Debrick Slough
- NB = North Beltline
- QF = Q Street Floodway

AB-123 Subbasin ID's within Major Subbasins

- Modeled Point
- *12345* Modeled Reference Numbers

Capital Projects

- WKxx Water Quality
- WKxx Natural Resources
- WKxx Flood Control

- Other Water Features
- Acquisition Corridor
- Urban Growth Boundary
- Eugene City Limits

Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.

N W E S

1 inch equals 1,000 feet

500 0 500 1,000 Feet

Produced by LCOG - August 2002
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No Map

Willakenzie Basin

Figure 3-6

A general characterization of water quality in this basin is described in Section 2.6. This section describes the processes that were used to further evaluate the existing water quality data (Section 4.1). Then, it describes the capital project alternatives and development standard alternatives (Section 4.2) that were proposed to address the water quality problems. Section 4.3 describes the selected water quality alternatives.

4.1 Evaluation of Water Quality Under Existing and Expected Future Conditions

To supplement the water quality information provided in Section 2.6, pollutant loads for Total Suspended Solids were calculated for the basin. Although TSS has not been shown to be directly related to all other pollutants, it was used as a general indicator of other pollutants for the purposes of making relative comparisons. The relative values and not the absolute values of the pollutant loads were used to assign priorities and to target those drainage subbasins or land uses that appear to contribute the largest pollutant loads to receiving waters. The values were also used to evaluate the relative contribution of pollutant loads expected as a result of future development. The methods used to estimate pollutant loads are described in Volume I, Section 3.2. The results for the Willakenzie basin are provided in Figures 4-1 through 4-3 below. As mentioned in Section 2.6, these results are based on stormwater quality monitoring conducted in the City of Eugene. Although none of these data were collected from within the Willakenzie Basin, they provide general information regarding stormwater quality in Eugene and were used in identifying a stormwater management strategy for this basin. In general, the Willakenzie Basin pollutant load is 1,615,000 pounds per year under existing condition and pollutant load is expected to increase by 22% as a result of future development (based on results from the TSS pollutant loads estimations).

Figure 4-1
Estimated Total Suspended Solids Loads Per Year in the Willakenzie Basin (UGB)

Estimated TSS Pounds Per Year in the Willakenzie Basin	1,000 Pounds	Willakenzie Basin Relative to the Range of TSS Pounds Per Year in Other Eugene Basins
From Existing Development	1,615	
From Development of Vacant Land	362	
Total Buildout	1,977	

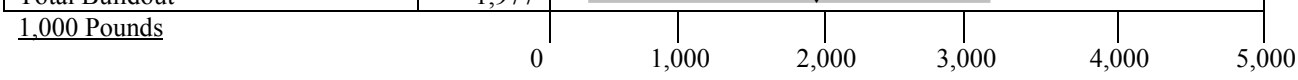


Figure 4-2
Estimated Increases in Total Suspended Solids Loads Associated with Future Buildout in the Willakenzie Basin (UGB)

Estimated Increase in TSS Loads	Percent	Willakenzie Basin Relative to the Range of Increase in TSS Loading in Other Eugene Basins
From Future Development	22	

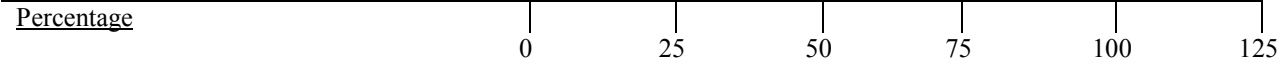


Figure 4-3
Estimated Total Suspended Solids Loads Per Acre - Per Year
in the Willakenzie Basin (UGB)

Estimated TSS Pounds Per Acre Per Year in the Willakenzie Basin	Pounds per Acre per Year	Willakenzie Basin Relative to the Range of TSS Pounds Per Acre Per Year in Other Eugene Basins
Existing Development	265	
Development of Vacant Land	59	
Total Buildout	324	

The above information, along with the information provided in Section 2.6, was used to develop capital project and development standard alternatives for addressing water quality. The capital project alternatives and the development standard alternatives are described in Section 4.2 and the selected alternatives for the water quality portion of the basin strategy are described in Section 4.4.

4.2 Development of the Water Quality Strategy

As shown in the stormwater basin master planning process flow chart in Figure 1-1, Step 1 included a compilation of basin characteristics. These basin characteristics are summarized in Section 2.0 of this document. Step 2 in the process included problem identification under both existing and future land use conditions. The results of this step for water quality are provided in Section 4.1 above. The next step included the development of potential stormwater management tools (i.e., capital projects or development standards) to address the identified problems. These stormwater management tools were developed as a result of an all-day basin assessment meeting. The meeting was attended by a large multi-disciplinary group of people including staff with experience in water quality, engineering, maintenance, natural resources, planning, and groundwater resources. Preliminary ideas were developed based on the goals and objectives of the project. This section describes the capital projects and water quality development standards that were proposed to address the identified water quality problems.

4.2.1 Capital Project Alternatives

Identifying potential capital projects to address water quality concerns is very different from identifying capital projects to address flooding issues. With respect to flooding, specific capacity deficiencies are identified through modeling and capital projects are proposed to address those deficiencies. With respect to water quality, pollutant discharges associated with urban runoff are ubiquitous. Therefore, with the exception of the specifically observed water quality problems, the focus of developing capital project alternatives for water quality was on identifying opportunity areas for the siting of surface water capital projects. This included looking for areas with the following characteristics: 1) sufficient space was available for a surface water quality facility, 2) space was available that was publicly owned or vacant and potentially available for

purchase, 3) the location drained a large and densely developed high source area, and 4) the location could be used to construct a capital project that addresses multiple objectives in addition to water quality control (i.e., flood control, natural resources enhancement, recreation, education).

For the Willakenzie basin, there were limited opportunities for larger-scale surface water quality projects. Some school locations were evaluated as potential opportunity areas including Gilham Elementary School, and Sheldon High School. However, a related project had already been completed for the open waterway adjacent to Gilham Elementary, and the space that exists at the Sheldon High School location is needed for their high school football field. Two opportunity areas were identified for potential surface water quality capital projects alternatives. These are listed below. In addition, capital project alternatives were discussed/proposed to address the four specific water quality related problems identified in this basin and listed in Section 2.6 (i.e., high source areas, Delta Ponds water quality problems, debris discharges from tip-ups, and debris in the open waterways).

WK08B – Gilham Road System Water Quality Facility – This proposed project alternative includes modification and enhancement of an open waterway system to improve water quality. The open waterway runs west of and parallel to Gilham Road and is located just north of Ayres Road. It is also identified as a proposed park site and could therefore be designed to include recreational/educational benefits.

WK13 – Ayres Pond Outfall Retrofit – This is a multiple-objective project that is also described under flood control capital project alternatives in Section 3.2 above. The North Beltline Floodway discharges into Ayres Pond through two 72" concrete pipes that are located at the end of a relatively inaccessible portion of the open waterway. The debris racks that protect the inlets of these two pipes collect a large amount of debris and garbage. Periodic maintenance is required to prevent these trash racks from becoming clogged. Since they are located in an area that is difficult to access, the maintenance is very difficult to perform. In order to maintain the conveyance of these pipes while also keeping debris and garbage out of the waterway and reducing the maintenance effort, installation of a water quality facility upstream of this location was proposed in order to capture the debris and garbage in a more accessible location adjacent to Gilham Road

Citywide Annual Budget Line Item – High Source Areas – This capital project would include retrofitting the piped stormwater drainage systems in high source areas with structural water quality facilities such as sedimentation manholes and select proprietary stormwater treatment devices to reduce the pollutant load. Single or multiple facilities may be appropriate for these high source areas and the facilities will be selected and designed to treat the particular pollutant of concern based on specific site conditions. The following eight potential locations for these retrofits were identified:

1) Node 59497
   Approximate drainage area = 46 acres
   Right-of-way of Chad Drive – east of Shadow View
2) Node 62495
   Approximate drainage area = 42 acres

South of Valley River drive and west of Valley River Way – near Valley River Center

3) Node 63736
   Approximate drainage area = 20 acres
   Intersection Bailey Hill Road and 7th Avenue
4) Node 63302
   Approximate drainage area = 7.2 acres
   Intersection of 5th Avenue and Market Street
5) Node 59458
   Approximate drainage area = 28 acres
   Right-of-way Old Coburg Road, south of Chad Drive
6) Node 62532
   Approximate drainage area = 16 acres
   Intersection of Country Club Road and Delta Highway
7) Node 59482
   Approximate drainage area = 18 acres
   Intersection of Shadow View and Chad Drive
8) Node 62965
   Approximate drainage area = 18 acres
   Intersection of Oakmont Way and Coburg Road

WK100- Delta Ponds Enhancement – Rather than develop a new capital project for the Delta Ponds system, the proposed capital project was to implement appropriate recommendations from an existing Delta Ponds Enhancement Study. This project will be integrated with a Corps of Engineers study of floodplain restoration along the Willamette River. The Corps project is intended to involve reconnecting the Delta Ponds to the Willamette River system and improving habitat and hydrology through the ponds.

Citywide Annual Budget Line Item - Tip-ups – Tip ups were considered to be opportunity areas for addressing multiple objectives. A tip-up is a negatively sloped pipe segment that conveys stormwater discharges from a deeper pipe system to an open waterway with a higher elevation. In many cases, the negative slope of the tip-up causes sediment and debris buildup resulting in localized flooding problems. In addition, when large storms come through, the accumulated sediment and debris may be flushed into the downstream open waterway. Typically, the existing tip-ups do not have adequate access for maintenance. Tip-up retrofits were proposed to address potential maintenance-related flooding issues at these locations as described in Section 3.2 above. To address multiple objectives, the tip-up retrofits that were proposed included manhole or vault-like structures for water quality benefits. These structures would allow for the capture and removal of sediments/debris and would also allow for maintenance access. There are five tip-up locations that have been identified in this basin. They are listed in Section 3.2 above.

Debris in the Open Waterway Systems – A discussion took place regarding the need to clear open waterways and associated culverts of debris and to also target an educational program at residents located adjacent to open waterways. These were considered to be maintenance rehabilitation and education projects as opposed to capital projects and the recommendations were therefore referred to those programs.

4.2.2 Development Standard Alternatives

Potential development standards were considered for addressing the identified water quality problems in the Willakenzie basin. The standards that were considered include:

- *Require Best Management Practices (BMPs) to reduce pollutants associated with stormwater runoff from new development for a design storm representing a specified amount of rainfall* – This standard would require developers to construct stormwater quality BMPs to reduce pollutants in stormwater runoff associated with a specific design event. Based on an analysis of rainfall data from Eugene, the design event was selected to represent 80% of the average total annual rainfall. An evaluation of the design storms representing 70%, 80%, and 90% of the average total annual rainfall was conducted. The design storm representing 80% was found to be the most cost effective. Significant cost increases were estimated using the 90% event with not much additional treatment. And, the cost difference between the 70% and 80% events was insignificant. Therefore, the 80% event was selected. As a result, the water quality design storm volume for detention type facilities is 1.4 inches over a 24 hour period; and the water quality design storm intensity for flow through type facilities is 0.22 inches/hour for on-line facilities and 0.13 inches/hour for off-line facilities. For more details on the analysis conducted to develop the water quality design storm parameters, see Appendix K of Volume I.

- *Require additional BMPs for specific land uses* – This standard would be implemented in addition to the standard listed above. The standard listed above would result in a base set of water quality BMPs required for all land uses. This development standard would require additional water quality BMPs for specific land uses. Specifically, it would require oil control for high traffic areas, and structural source controls for industrial/commercial activities that are exposed to stormwater.

- *Require developers to construct stormwater quality BMPs that remove a specified percentage of pollutants (e.g., 80% removal of TSS)* - This development standard was not considered viable, however, due to its many disadvantages including: 1) this approach is very difficult for the development community to address because there are many unknowns about how to meet such a performance standard; 2) it is difficult to enforce compliance with this approach without conducting very expensive chemical monitoring of the influent and effluent; and 3) this approach does not address the fact that some constituents may be of concern in one receiving water but not another.

- *Prohibit filling and/or piping of key waterways* – This standard would prohibit filling and piping of "key" waterways that provide important stormwater functions including water quality protection and treatment. Criteria would be established for identifying "key" waterways for protection. This standard is covered in Section 5.2.2 of this plan.

4.3 Selected Alternatives

The water quality management alternatives selected address pollutant discharges from both existing and new development. For existing development, the focus was on opportunity areas for

siting surface water quality capital projects. Where space is limited, underground water quality structures are recommended for high source areas. For future development, a development standard is recommended for all land uses and additional BMPs are recommended for high source areas. The development standard also applies to significant re-development as it will reduce additional pollutant discharges resulting from the re-development and will aid in addressing the existing water quality condition. The resulting water quality management strategy for the Willakenzie basin consists of the following elements. For more detail regarding each of the capital projects, capital project fact sheets are provided in the Appendix.

- **Water Quality Development Standards:**
  - Require treatment BMPs that are designed according to the BMP Manual and the City's water quality design storms.
  - Require additional BMPs for specific land use activities of concern (i.e., oil control for high traffic areas, and structural source controls for commercial/industrial activities that are exposed to stormwater).
  - Prohibit filling and/or piping of key waterways (covered in Section 5.2.2).
- **Incentives for Existing Development:** Financial incentives will be incorporated into the stormwater user fee structure to encourage existing development not subject to the new water quality development standards to construct (retrofit) new stormwater quality BMPs.
- **Capital Project WK08B – Gilham Road System Water Quality Facility:** Design and construct a neighborhood water quality facility in the Gilham Road drainage system to reduce the pollutant load into River Point Pond and provide educational and recreational opportunities for Gilham Elementary School.
- ***Capital Project WK13 – Ayres Pond Outfall Retrofit:** Install a stormwater quality facility upstream of the outfall to remove large debris from the inaccessible portions of the open waterway.
- **Capital Project Citywide Annual Budget Line Item – Water Quality Facilities in High Source Areas:** Retrofit the piped stormwater drainage systems in high source areas (e.g., commercial and industrial areas) with structural water quality facilities such as sedimentation manholes and other proprietary stormwater treatment devices to reduce the pollutant load. Single or multiple facilities may be appropriate for these high source areas and the facilities will be selected and designed to treat the particular pollutant of concern based on specific site conditions.
- **Capital Project WK100 – Delta Ponds Enhancement:** Implement recommendations of the Delta Ponds Enhancement Study.
- ***Capital Project Citywide Annual Budget Line Item – Retrofit of Tip-ups:** Retrofit the existing tip-ups located throughout the basin with a sedimentation manhole that provides maintenance access.

- **Multiple Objective Stormwater Capital Improvement Program:** In general, all stormwater capital projects, including flood control and natural resources projects, will consider water quality objectives when feasible and appropriate.

*Also listed under the flood control strategy in Section 3.0.

Note: It should be noted that this basin stormwater management strategy was intended to focus on water quality management tools in the form of development standards and capital projects. To comply with the National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges, the City is or has been also implementing a significant number of other stormwater quality management practices that will supplement this strategy and help to reduce the discharge of pollutants in stormwater. These include the following:

Inspection, Enforcement, and Monitoring

- Strengthen Enforcement to Prevent and Eliminate Illicit Connections
- Field Screening to Detect and Eliminate Illicit Connections
- Monitor Stormwater Discharges from Industrial Facilities

Operations and Maintenance

- Revise Comprehensive Operation and Maintenance Plans
- On-going Evaluation of City Vegetation Management Practices to Protect Stormwater Quality
- On-going Evaluation of Ice and Snow Road Traction Practices to Protect Stormwater Quality
- Evaluate and Improve DOT Practices to Improve Stormwater Quality
- Improve Clean-up After Accidents and Fires
- Evaluate and Improve Existing Street Sweeping Program
- Evaluate and Improve Effectiveness of Storm System Cleaning
- Storm System Mapping and Data Management
- Improve Litter Pickup Programs in Public Areas and Major Events
- Prevent Leaks and Spills from Municipal Trucks
- Maintain and Equip a Trained Environmental Spill Response Team

Planning and Administration

- Review Street Design Standards with Respect to Water Quality (this has been completed)
- Erosion Prevention and Construction Site Management Program (a new ordinance was developed in 1999)
- Illegal Dumping Program
- Improve Solid Waste Management Program to Address Stormwater Quality
- Inventory and Maintain Wetland Mitigation Sites to Ensure Benefits are Maintained in Perpetuity

Public Education

- Stormwater Information and Education Activities
- Storm Drain Stenciling
- Support government and community Tree Planting Programs
- Eugene Stream Team Volunteer Activities
- Educate Commercial/Industrial Business About Good Housekeeping Practices
- Improve Reporting of Illegal Dumping
- Education for Stormwater-Friendly Design Practices
- Expand Household Hazardous Waste Disposal Program

For purposes of the basin master planning process, the term "stormwater related natural resources" pertains specifically to the City's open waterways drainage system and the characteristics of it that provide or assist in providing beneficial stormwater functions such as: storm conveyance, flood storage, water quality preservation or treatment, aquatic and riparian habitat, and water temperature controls. These stormwater related natural resources include the primary waterway corridors of Eugene and adjoining riparian and wetland areas, and headwater streams and wetlands. These characteristics are described in Section 2.0 of this report.

Section 5.1 describes the evaluation process used and the basin-specific problems and opportunities identified under existing and expected future conditions. A description of existing waterway protection measures, other related efforts underway, and gaps in stormwater related natural resources data is also included. Sections 5.2 describes the alternatives considered for addressing these problems and opportunities, and Section 5.3 describes the selected alternatives.

5.1 Evaluation of Stormwater Related Natural Resources Under Existing and Expected Future Conditions

The following provides the objectives, methods, and results of the stormwater-related natural resources evaluation for the Willakenzie basin.

Objectives of the evaluation

- Determine the extent of the open waterway drainage system that should be protected for beneficial stormwater functions.
- Determine where existing protection policies apply and where gaps exist.
- Determine where restoration efforts should be targeted to improve stormwater functions.
- Determine where intervention efforts are needed to correct streambank stability problems.
- Determine what other efforts are underway which may ultimately provide protection consistent with stormwater program objectives.

Methods used to conduct the evaluation

Several methods were used to conduct the natural resources evaluation including the following:

- The following information was compiled and reviewed to assess the location, condition, and function of the Willakenzie Basin waterway system. Most of the data were contained in the City's geographic information system (GIS):
  - Open waterway drainage system.
  - Draft inventory of the Eugene-Springfield Metropolitan Plan Natural Resources Study.
  - FEMA floodway and floodplain areas.
  - National wetland inventory.
  - Soil Survey of Lane County Area, Oregon (1987), Natural Resources Conservation Service.
  - Historic photos, hydric soils – to help reconstruct the historic drainage system (i.e. pre-settlement).

  - Areas with stormwater pipe system.
  - Willakenzie Area Plan, September 1992.
  - 1999 aerial photography of the Willakenzie Basin.
- Site visits to collect and verify GIS information about select portions of the waterway system including location, size, condition, and function. For the site visits that were conducted, functions were evaluated using a modified version of the Oregon Freshwater Assessment Methodology (OFWAM). This method was modified to focus on the stormwater related benefits of natural resources.
- Eugene Public Works Department engineering and maintenance staff were interviewed as to their knowledge of the system.
- Property owners provided site specific information at public workshops and through other contacts.
- Policy plans were reviewed to determine where and how waterways were protected in the Willakenzie Basin.
- Other City of Eugene and Metro area staff were consulted to identify other on-going efforts which may ultimately provide protection for waterways consistent with stormwater program objectives.

Results of the evaluation

The results are provided below in terms of both existing conditions and expected future conditions.

Existing Waterway System Conditions:
- Most of the historic drainage system in the Willakenzie Basin has been segmented, with many segments filled and replaced with stormwater pipes.
- About 25 miles of waterways remain that provide a stormwater conveyance function and consist primarily of human created channels and sloughs, with some remnant natural channels.
- About 16 miles of these waterways also provide riparian function.
- About two-thirds of the remaining system are in public jurisdiction.
- Willakenzie Floodway and Debrick Slough are the largest remaining historic segments.
- Canoe Canal, Patterson Slough, Q Street Floodway, North Beltline, Gilham Creek, Dodson Slough, and the Delta Ponds system are human created channels and ponds that provide a significant conveyance function.
- The Willakenzie Floodway has been significantly altered but provides an opportunity for restoration.
- Delta Ponds is a system of remnant sand and gravel mining pits that now provide significant stormwater function with the potential for increased habitat function.

Expected Future Waterway System Conditions:
- Future conditions for "private" waterways are expected to deteriorate due to lack of specific waterway protection policies and measures in the Willakenzie Basin.
- Future conditions of "publicly owned and/or maintained" waterways are expected to remain the same or improve over existing conditions due to the City's commitment to

environmentally friendly maintenance practices and increasing level of responsibility for managing the open waterway system.

The remainder of this section provides additional context for the stormwater related natural resources evaluation:

Existing Protection Measures

- "Needed housing" standards would require, if needed housing track was selected by the property owner, to provide 50 feet of setback distance along waterways.
- The Planned Unit Development (EC 9.8300) provisions contain specific approval criteria for protecting significant natural resources. These criteria are to be balanced with other policy needs and standards and, therefore, offer some but no consistent protection standards for waterways.
- Site Review (EC 9.8425) provisions contain approval criteria that could be used for waterways protection if specifically identified for protection.

Other Related On-going Efforts

- Endangered Species/Salmon program is expected to develop strategies for responding to the *January 2001* listing of spring Chinook salmon. Strategies are likely to include incentives and regulatory measures for protection and restoration of salmon habitat in Eugene. Timeline for developing strategy options for Council consideration is fall 2002.
- The Metro Natural Resources Study (NR Study) is expected to provide long term protection for some waterways with riparian habitat functions. Timeline for implementation of protection measures is 2005.

Data Gaps

There is little or no available data as to existing aquatic habitat and species condition in the Willakenzie waterways. This data would not only help further inform the condition of the waterways, but would also allow for better evaluation of the effects of proposed capital improvements to these waterways.

5.2 Development of the Natural Resources Strategy

As shown in the stormwater basin master planning process flow chart in Figure 1-1, Step 1 included a compilation of basin characteristics. These basin characteristics are summarized in Section 2.0 of this document. Step 2 in the process included problem identification under both existing and future land use conditions. The results of this step for stormwater related natural resources are provided in Section 5.1 above. The next step included the development of potential stormwater management tools (i.e., capital projects or development standards) to address the identified problems and opportunities. These stormwater management tools were developed as a result of an all-day basin assessment meeting. The meeting was attended by a large multi-disciplinary group of people including staff with experience in water quality, engineering, maintenance, natural resources, planning, and groundwater resources. Preliminary

ideas were developed based on the goals and objectives of the project. This section describes the capital projects and development standards that were proposed to address the identified stormwater-related natural resource problems and opportunities.

5.2.1 Capital Project Alternatives

The following capital projects were considered that would address stormwater related natural resources problems and opportunities:

WK 11A Coburg and County Farm Roads – This is primarily an acquisition project that would protect the existing waterway and related riparian and wetland habitats.

WK 16A Ascot Park Waterway Improvements – This project's primary objective is to improve conveyance capacity but would also incorporate streamside habitat enhancements.

WK 100 Delta Ponds Enhancement – This Corps of Engineers/City partnership project has multiple objectives that include enhancement of habitat in addition to improving hydrology and flows from the Willamette River into and through the ponds.

Stream Corridor Acquisition - Stream corridors and specific sites with relatively high stormwater values which are also at risk of future development would be identified for acquisition. Gilham Creek corridor north of Gilham Road was identified for acquisition in the Willakenzie Basin.

Streambank Stabilization Generic – This would be an annual budget line item for identifying and implementing streambank stabilization projects to help streams adjust to increased runoff volumes while limiting negative impacts associated with downcutting, sedimentation, and erosion. Where appropriate, bioengineering techniques would be used.

Outfall Stabilization Generic – This would be an annual budget line item for identifying and retrofitting storm drainage system outfalls which are creating localized erosion and bank stability problems.

5.2.2 Development Standard Alternatives

Potential development standards were considered for addressing identified stormwater related natural resources problems and opportunities in the Willakenzie basin.

- *Prohibit filling and/or piping of key waterways* – Using this approach, criteria would be established for identifying "key" waterways to be protected. A map of the key waterways and requirements would be adopted that would prohibit filling and/or piping of the waterways unless exemptions could be obtained. The key waterways approach would recognize that certain waterways possess characteristics that provide important stormwater functions and should be protected, while other smaller, isolated, segmented waterways provide little or no stormwater function and protection would not be warranted. This code would only apply within the Eugene city limits.

- *Pursue setback protection requirements for key waterways through other appropriate processes* – There is a significant overlap between the stormwater program, NR Study, and ESA/Salmon program. This approach would rely on these other processes for providing some or all natural resources protection policies.

- *Require BMPs to reduce pollutants associated with stormwater runoff from new development* – This standard would require new development to control the quality of stormwater runoff by selecting, designing, constructing, and maintaining a water quality facility. This standard is covered in Section 4.2.2 of this plan.

5.3 Selected Alternatives

The selected natural resources management strategy includes a combination of capital projects, development standards, and other items to address existing and future stormwater related natural resources problems and opportunities, as follows:

- **Support Existing Waterway Protection Standards:** (i.e., Waterside Protection Overlay Zone, "Needed Housing", Natural Resource Zone, Planned Unit Development provisions, Site Review provisions as applicable).

- **Prohibit Filling and/or Piping of Key Waterways:**

  Note: This standard was selected and an ordinance was processed through the Eugene Planning Commission and City Council. Ultimately, this standard was replaced by an approach that would apply no-fill/no-pipe prohibitions to all waterways until the NR Study was completed. When processed for adoption, this standard was referred to as the Open Waterways ordinance. The Open Waterways ordinance was challenged and subsequently remanded back to the City by the Land Use Board of Appeals for further processing. This ordinance is no longer in effect. The strategy for protecting stormwater significant waterways from being piped and filled is currently under development.

- ***Water Quality Development Standards:** These standards are selected to prevent pollutants from entering the waterways. They include: treatment BMPs for stormwater runoff from new development, additional BMPs for specific land use activities of concern, and flow controls for headwater areas to protect water quality, and are covered in Section 4.2.2 of this plan.

- **Pursue Waterway Setback Protection Measures in Coordination with Natural Resources Study and ESA/Salmon Program (described in Section 5.1):** Coordination will continue to ensure consistency with stormwater program objectives for long term stream corridor protection and to identify and fill gaps in protection measures for waterways.

- **Stream Corridor Acquisitions:** Acquire the Gilham Creek corridor north of Gilham Road to the Urban Growth Boundary.

- **Capital Project WK11A Coburg and County Farm Roads:** This is primarily an acquisition project that will protect the existing waterway and related riparian and wetland habitats.

- *** Capital Project WK16A Ascot Park Waterway Improvements:** This project's primary objective is to improve conveyance capacity but would also consider streamside habitat enhancements (also listed under Section 3.0).

- *** Capital Project WK100 Delta Ponds Enhancement:** This Corps/City project has multiple objectives that include enhancement of habitat in addition to improving hydrology and flows from the Willamette River and into and through the ponds (also listed under Section 4.0).

- **Streambank Stabilization Annual Budget Line Item:** Projects to be determined on an annual basis.

- **Outfall Stabilization Annual Budget Line Item:** Projects to be determined on an annual basis.

- **Multiple objective stormwater Capital Improvement Program:** In general, all stormwater capital projects, including flood control and water quality projects, will consider natural resources protection and enhancement as project objectives when feasible.

- **Aquatic Habitat and Species Data Collection:** Opportunities to fill-in data gaps will be explored via local studies and/or as part of partnership arrangements with federal and state agencies.

* Also listed under the flood control strategy and/or the water quality strategy in Sections 3.0 and 4.0.

6.1 Integrated Stormwater Management Strategy

The stormwater management strategy for the Willakenzie basin represents the City's recommended combined approach of capital projects and development standards to address the flood control, water quality, natural resources and maintenance problems and opportunities associated with stormwater discharges. The purpose of this section is to summarize the flood control, water quality, and natural resource elements of the strategy as they were presented in Sections 3.0, 4.0, and 5.0 respectively. In addition, this section discusses the costs and priorities associated with implementing the strategy. The elements of the stormwater management strategy are presented below:

Flood Control Strategy

The following capital projects are proposed:

- **Capital Project Citywide Annual Budget Line Item – Retrofit of Tip-ups:** Retrofit the existing tip-ups located throughout the basin with a sedimentation manhole that provides maintenance access.
- **Capital Project WK07 – River Point Pond Outlet Channel:** Construct a new open waterway outlet for the River Point Pond to either the McKenzie or the Willamette Rivers.
- **Capital Project WK08A – Gilham Road Culvert Replacement:** Replace the existing 48" diameter culvert with a bridge to eliminate the expected flooding problems.
- **Capital Project WK13 – Ayres Pond Outfall Retrofit:** Install a stormwater quality facility upstream of the outfall to remove large debris from the inaccessible portions of the open waterway.
- **Capital Project WK16A – Ascot Park Waterway Improvements:** Replace the undersized culvert and modify the open waterway to eliminate the expected flooding problems.

Water Quality Strategy

In order to reduce the pollutant load, the City proposes to implement an on-site water quality development standard for all new development and significant redevelopment throughout the basin. This development standard requires treatment BMPs that are designed according to the BMP Manual. The standard also requires additional BMPs for specific land use activities of concern (i.e., oil control for high traffic areas, and structural source controls for commercial/industrial activities that are exposed to stormwater).

Financial incentives will be incorporated into the stormwater user fee structure to encourage existing development not subject to the new water quality development standards to construct (retrofit) new stormwater quality BMPs.

In addition, the following capital projects are proposed:

- **Capital Project WK08B – Gilham Road System Water Quality Facility:** Design and construct a neighborhood water quality facility in the Gilham Road drainage system to reduce the pollutant load into River Point Pond and provide educational and recreational opportunities for Gilham Elementary School.
- ***Capital Project WK13 – Ayres Pond Outfall Retrofit:** Install a stormwater quality facility upstream of the outfall to remove large debris from the inaccessible portions of the open waterway.
- **Capital Project Citywide Annual Budget Line Item – Water Quality Facilities in High Source Areas:** Retrofit the piped stormwater drainage systems in high source areas (e.g., commercial and industrial areas) with structural water quality facilities to reduce the pollutant load.
- **Capital Project WK100 – Delta Ponds Enhancement:** Implement recommendations of the Delta Ponds Enhancement Study.
- ***Capital Project Citywide Annual Budget Line Item – Retrofit of Tip-ups:** Retrofit the existing tip-ups located throughout the basin with a sedimentation manhole that provides maintenance access.

* Provide flood control benefits as well and are included in the list of flood control capital projects provided above.

Natural Resources Management Strategy

The natural resources strategy is focused on the protection and enhancement of open waterways for their stormwater functions and benefits. Part of the strategy will include support for existing waterway protection standards (i.e., Waterside Protection Overlay Zone, Natural Resource Zone, Planned Unit Developments provisions, Site Review provisions as applicable). Another part of the strategy involves coordinating with other related on-going efforts (NR Study, ESA) to ensure that, ultimately, the stormwater functions and benefits of stream corridors are protected and enhanced.

In addition, the following capital projects are proposed to improve open waterways in the basin:

- **Stream Corridor Acquisitions:** Acquire the Gilham Creek corridor north of Gilham Road.
- **Capital Project WK11A Coburg and County Farm Roads:** This is primarily an acquisition project that will protect the existing waterway and related riparian and wetland habitats.
- ***Capital Project WK16A Ascot Park Waterway Improvements:** This project's primary objective is to improve conveyance capacity but would also consider streamside habitat enhancements.
- ***Capital Project WK100 Delta Ponds Enhancement:** This project has multiple objectives that include enhancement of habitat in addition to improving hydrology and flows from the Willamette River and into and through the ponds.
- **Capital Project Citywide Annual Line Item – Streambank Stabilization:** Identify and implement streambank stabilization projects to help streams adjust to increased

runoff volumes while limiting negative impacts associated with downcutting, sedimentation, and erosion.

- **Capital Project City wide Annual Line Item – Outfall Stabilization:** Identify and retrofit storm drainage system outfalls that are creating localized erosion and bank stability problems.

* Also listed under either flood control capital projects or water quality capital projects.

Multiple Objective Stormwater Capital Improvement Program

It should be noted that, in general, all stormwater capital projects, will consider flood control, water quality and natural resources protection and enhancement as project objectives when feasible and appropriate. All stormwater capital projects will conform to adopted code requirements for private development, including stormwater quality standards. Opportunities to fill in aquatic habitat and species data gaps will be explored via local studies and/or as part of partnership arrangements with federal and state agencies.

6.2 Summary of Strategy Benefits

When implemented, the integrated strategy is expected to provide the following benefits:

1. Provide the required level of flood protection basin-wide through capital projects.
2. Reduce existing pollutant loads through capital projects and financial incentives to retrofit existing developments.
3. Reduce pollutant loads associated with new developments through development standards.
4. Identify, protect, and manage significant open waterways for their beneficial stormwater functions.

6.3 Summary of Strategy Implementation and Costs

For a description of implementation of water quality and stormwater related natural resources standards, refer to Volume I – Citywide Basin Master Plan Report.

This section describes the approach for capital project implementation in the Willakenzie basin. It also provides estimated costs and expected funding sources for each of the capital projects.

Seven specific projects were selected and prioritized for implementation over a 35-year time period (2001-2035). Eight generic capital project categories were also identified for construction city-wide on an on-going yearly basis over the same 35-year period. These generic capital project categories include retrofit of tip-ups and water quality facilities in high source areas as identified for the flood control and pollution prevention strategies above. In addition, 0.8 miles of stream corridors representing 13.0 acres are targeted for acquisition over a five-to-seven year period. Together these three categories of capital projects constitute the City's capital programming for the Willakenzie basin. Refer to Figures 3-1 through 3-6 for a generalized location of these projects.

For a general description of the capital prioritization methodology and financing approach, refer to Volume I – Citywide Basin Master Plan Report. The following tables show the priority schedule, cost, and funding allocations for the seven specific capital projects and the yearly line item projects.

A separate prioritization scheme was developed for prioritizing open waterway sites for acquisition. There is one stream corridor identified for acquisition in the Willakenzie basin: Gilham Creek Corridor. Within this corridor, one site has been identified prioritized for immediate acquisition. The remaining portions of the corridor have yet to be evaluated and prioritized for acquisition. Table 6-2 indicates the acquisition corridor and estimated cost. For more detailed background information see *City of Eugene Stream Corridor Acquisition Study (May 2001).*

Table 6-1
Implementation Schedule Years 2001 – 2035

Capital Project Identification	Priority	Total Estimated Cost	Estimated Funding Source and Allocation		
			SDCs	User Fees	Federal Priority Funds
WK 07 – River Point Pond Outlet Channel	2001 - 2005	$373,300	$153,053 [41%]	$220,247 [59%]	$0
WK 100 – Delta Ponds Habitat Enhancement	2001 – 2005	$2,330,600	$0	$815,710 [35%]	$1,514,890 [65%]
WK 08A – Gilham Rd System Culvert Replacement	2006 - 2010	$27,000	$27,000 [100%]	$0	$0
WK 08B – Gilham Rd Water Quality Facility	2006 - 2010	$653,800	$65,380 [10%]	$588,420 [90%]	$0
WK 13 – Ayers Pond Outfall Retrofit	2006 - 2010	$774,000	$0	$774,000 [100%]	$0
WK 11A – Wetland Protection Coburg/Co Farm Rds	2011 – 2035	$225,600	$63,168 [28%]	$162,432 [72%]	$0
WK 16A – Modify Ascot Park Open Waterway	2011 - 2035	$72,200	$47,652 [66%]	$24,548 [34%]	$0
Subtotal:		**$4,456,500**	**$356,253**	**$2,585,357**	**$1,514,890**
Yearly Capital Program Line Items Citywide: • Water Quality Facilities in High Source Areas • Stormwater Outfall Stabilization • Streambank Stabilization • Retrofit Tip-ups • General Rehabilitation • Stream Corridor Acquisition • Services for New Development • Wetland Mitigation Bank		These costs have not been calculated on a basin specific basis. See Volume I Citywide for overall cost estimates.			

Table 6-2
Stream Corridor Acquisition Schedule Years 2001 – 2007

Priority Stream Corridor	Area Miles/Acres	Estimated Cost
Gilham Creek Corridor	0.8 miles / 13.0 acres	$1,020,000

APPENDIX

CAPITAL PROJECT FACT SHEETS

Project Identifier	**WK01 - Citywide Annual Budget Line Item**
Project Title	**Willakenzie Streambank Stabilization**

Project Location

Open Waterways throughout the Willakezie Basin

Subbasin	**NA**	
GIS U/S Node Location	**NA**	
GIS D/S Node Location	**NA**	
Drainage Area Served by Capital Project	**NA**	Acres
% Impervious (1994 Existing Land Use)	**NA**	
% Impervious (Future)	**NA**	
Design Flow (Future Conditions	**NA**	cfs

Project Description

Implement streambank stabilization projects to help streams adjust to increased runoff volumes while limiting negative impacts associated with downcutting , sedimentation, and erosion. Where appropriate, use bioengineering techniques to stabilize streambanks.

Project Elements

0 SY – Streambank Stabilization

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Downcutting, sedimentation, and erosion problems have been observed in open waterways that are receiving increased runoff volumes associated with urbanization.

Opportunities

streambank stabilization provides the opportunity to improve or restore riparian vegetation and aquatic habitat conditions.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Streambank Stabilization	Inspect vegetation and banks for erosion.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP eliminates localized erosion of streambeds and streambanks.

Natural Resources

This CP can help restore native riparian vegetation and improve aquatic habitat conditions.

Other City Objectives Addressed by the Capital Project

To be completed by the City

Costs

Construction Costs:	
Site Acquisition:	$0
Engineering / Administration:	
Capital Project Implementation Costs	

There will be a $150,000 annual line item in the capital project budget to address streambank stabilization projects on a city-wide basis.

Annual Maintenance Costs	**$0**

Project Identifier	**WK02 - Citywide Annual Budget Line Item**
Project Title	**Water quality facilities for high source areas**

Project Location

Piped storm drainage systems located throughout the City of Eugene that convey stormwater runoff from mostly developed (i.e. no space for above ground water quality facilities) high pollutant source areas (i.e. commercial and industrial areas).

Subbasin	**N/A**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**N/A**	
Drainage Area Served by Capital Project	**N/A**	Acres
% Impervious (1994 Existing Land Use)	**N/A**	
% Impervious (Future)	**N/A**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

Construct offline, underground structural water quality facilities in developed, high pollutant source areas. Types of facilities include sedimentation manholes, and proprietary stormwater treatment devices. Depending on flow rate, costs vary from $2000 for a small sedimentation manhole to $60,000 for a large Storm Filter.

Project Elements

1 EA – Underground structural water quality facility

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Based on monitoring data collected within the City of Eugene, stormwater from high pollutant source areas is a significant source of pollutant loads to receiving waters.

Opportunities

Opportunity to reduce pollutant discharges in stormwater runoff from high pollutant sources in developed areas.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Underground structural water quality facility	Depending on the facility type, maintenance may be required once every month to once every two years.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP provides treatment of stormwater runoff from various sized high pollutant source drainage areas. Pollutant load reductions will depend on the type of facilities used and the locations of the facilities.

Natural Resources

N/A

Other City Objectives Addressed by the Capital Project

To be Completed by the City

Costs

Construction Costs:	
Site Acquisition:	$0
Engineering / Administration:	

Capital Project Implementation Costs

There will be a $150,000 annual line item in the capital project budget to address water quality facilities for high source areas on a city-wide basis.

Annual Maintenance Costs

Design Assumptions

Possible high source retrofit locations:

1) Node 59497 - Approximate drainage area = 46 acres
Right-of-way of Chad Drive - east of Shadow View

2) Node 62495 - Approximate drainage area = 42 acres
South of Valley River drive and west of Valley River Way - near Valley River Center

3) Node 63736 - Approximate drainage area = 20 acres
Intersection Bailey Hill Road and 7th Avenue

4) Node 63302 - Approximate drainage area = 7.2 acres
Intersection of 5th Avenue and Market Street

5) Node 59458 - Approximate drainage area = 28 acres
Right-of-way Old Coburg Road, south of Chad Drive

6) Node 62532 - Approximate drainage area = 16 acres
Intersection of Country Club Road and Delta Highway

7) Node 59482 - Approximate drainage area = 18 acres
Intersection of Shadow View and Chad Drive

8) Node 62965 - Approximate drainage area = 18 acres
Intersection of Oakmont Way and Coburg Road

Project Identifier	**WK03 - Citywide Annual Budget Line Item**
Project Title	**Outfall stabilization**

Project Location

All storm drainage system outfalls in the Willakenzie basin that are causing erosion and bank stabilization problems.

Subbasin	**N/A**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**N/A** Acres
% Impervious (1994 Existing Land Use)	**N/A**
% Impervious (Future)	**N/A**
Design Flow (Future Conditions	**N/A** cfs

Project Description

Identify and retrofit storm drainage system outfalls creating bank stability problems along open waterways in the Willakenzie basin.

Project Elements

1 Ea – Outfall Protection

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Erosion and bank stabilization problems, and in some cases maintenance access problems, exist at storm drainage system outfalls draining into open waterways in the Willakenzie basin.

Opportunities

Opportunity to retrofit storm drainage system outfalls to provide maintenance access, energy dissipation, and bank stabilization.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Outfall Protection	Inspect and clean outlet, inspect vegetation and slope protection.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP provides bank stabilization that will reduce sedimentation from erosion caused by storm drainage system outfalls draining into open waterways in the Willakenzie basin.

Natural Resources

This CP will reduce impacts on streambank vegetation and aquatic habitat.

Other City Objectives Addressed by the Capital Project

To be completed by the City

Costs

Construction Costs:	
Site Acquisition:	$0
Engineering / Administration:	
Capital Project Implementation Costs	

There will be a $125,000 annual line item in the capital project budget to address outfall stabilization projects on a city-wide basis.

Annual Maintenance Costs	**$0**

Project Identifier	**WK04 - Citywide Annual Budget Line Item**
Project Title	**Retrofit of Tip-ups**

Project Location

Tip-ups located throughout the Willakenzie Basin.

Subbasin	**N/A**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**N/A**	
Drainage Area Served by Capital Project	**N/A**	Acres
% Impervious (1994 Existing Land Use)	**N/A**	
% Impervious (Future)	**N/A**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

Retrofit the tip-ups with manholes that provide sedimentation storage and maintenance access. Re-install outlet pipe at a positive grade.

Project Elements

1 EA – Retrofit of Tip-up

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Surcharging, build up of sediment and debris, and limited access for maintenance are all problems associated with the existing tip-ups.

Opportunities

This CP provides an opportunity to reduce sedimentation problems and to facilitate maintenance.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Retrofit of Tip-up	Inspect sediment loading and debris accumulation, remove debris and sediment.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

This CP is expected to reduce capacity problems due to sediment buildup.

Water Quality

The new manhole will provide storage of sediment and debris which can be periodically removed.

Natural Resources

N/A

Other City Objectives Addressed by the Capital Project

To be Completed by the City

Costs

Construction Costs:

Site Acquisition: $0

Engineering / Administration:

Capital Project Implementation Costs

There will be a $125,000 annual line item in the capital project budget to address tip-up retrofit projects on a city-wide basis.

Annual Maintenance Costs

Design Assumptions

The following tip-ups within the Willakenzie Basin were identified for retrofit:

1) WKGL020C-located at Ayres Rd. (48")
Node 70865 - 73036, Page 62 of 97
Tip-up offset = 9 feet

2) 61102 to 61078 (36")
Page 76 of 97
Comes off of a 60" line which runs north along Satre St.
Tip-up offset = 4.7 feet

3) Node 59804 to 59781 (42")
Page 75 of 97
Located north of Elysium Ave. and just east of the north end of Valhalla St.
Tip-up offset = 1.1 feet

4) Node 66184 to 67040 (12")
Page 51 of 97
Located to the west of Ridgeway Dr. and north of Happy Ct.
Tip-up offset = 3.0 feet

5) Node 59445 to 67049 (18")
Page 75 of 97
Located at the north end of Finch Lane
Tip-up offset = 3.9 feet

Project Identifier	**WK07**
Project Title	**River Point Pond Outlet Channel**

Project Location

River Point Pond. The pond is shown on page 61 of the sewer index map.

Subbasin	**WKGL**
GIS U/S Node Location	**71279**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**356** Acres
% Impervious (1994 Existing Land Use)	**27**
% Impervious (Future)	**46**
Design Flow (Future Conditions	**90** cfs

Project Description

Construct an open waterway drainage system from River Point Pond to the McKenzie River. The waterway would re-establish the old channel from the outlet of the pond to the western property boundary of the Wildish property. It would then follow the property boundary north to the McKenzie River.

Project Elements

2.2 Ac – Industrial Property Acquisition

1 EA – WK07 Open Waterway Improvement

Problems and/or Opportunities Addressed by the Capital Projects

Problems

There is no existing defined outlet from River Point pond. Uncontrolled overflow from the pond causes flooding of Wildish property.

Opportunities

Opportunity to create a new open waterway drainage system with related natural resources benefits.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Industrial Property Acquisition	N/A
WK07 Open Waterway Improvement	Inspect vegetation and banks for erosion.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

This capital project will eliminate the uncontrolled overflow from the pond and associated flooding of the Wildish property for the 10-year design storm under future land use conditions.

Water Quality

This capital project will provide water quality benefits associated with open waterway systems.

Natural Resources

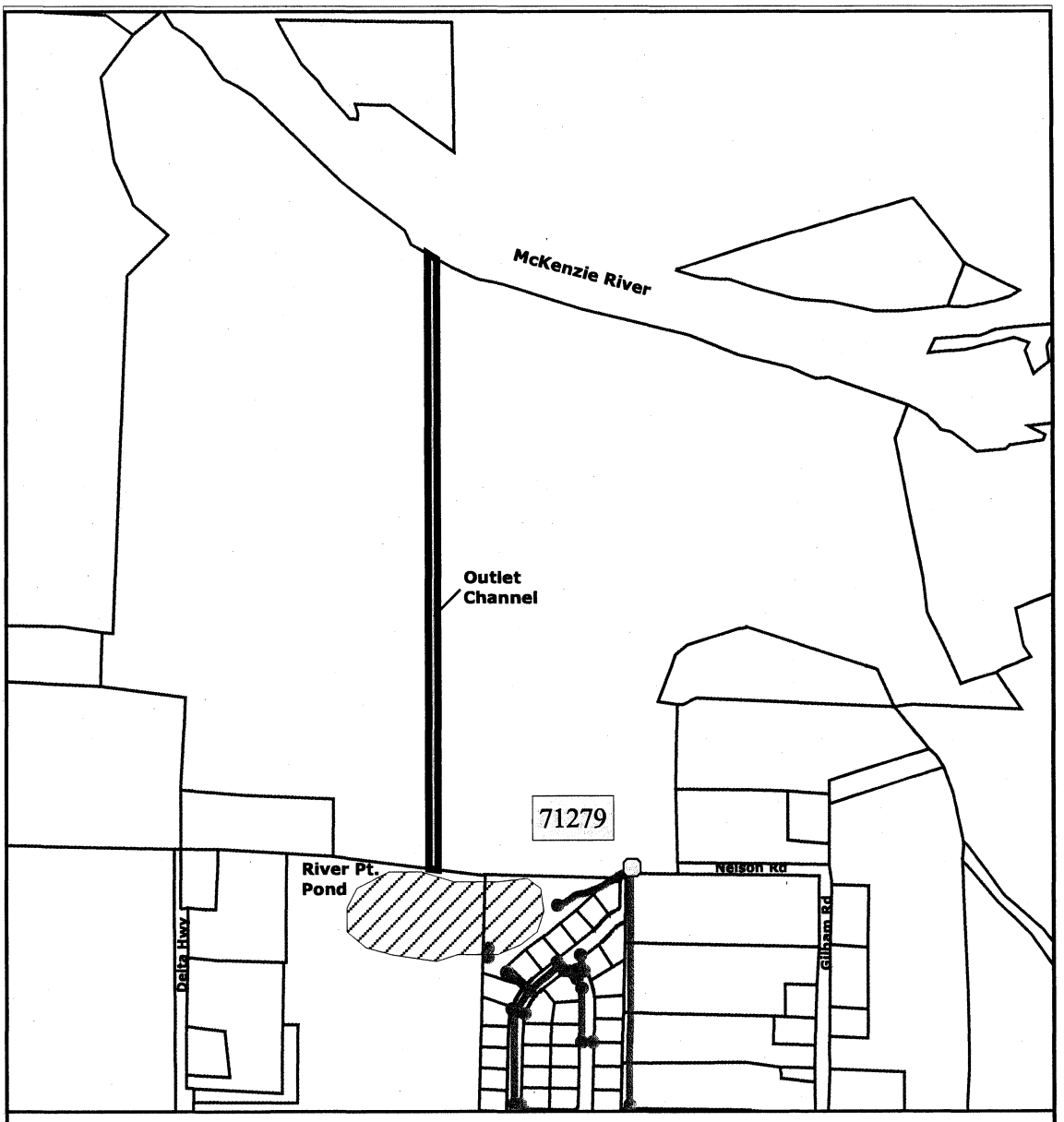
This capital project provides additional natural resource benefits associated with the construction of this new open waterway.

Other City Objectives Addressed by the Capital Project

To be completed by the City

Costs

Construction Costs:	$297,900
Site Acquisition:	$13,200
Engineering / Administration:	$62,200
Capital Project Implementation Costs	**$373,300**
Annual Maintenance Costs	**$0**



Property Parcel Boundary

Capital Project Location

Storm Drainage System (Pipe or Open Channel)

Capital Improvement Project Element

Upstream/Downstream Node

Upstream/Downstream Subnode

Manholes or Catch Basins

200 0 200 400 Feet

N

Site Map for CIP # WK07

River Point Pond Outlet Channel
Willakenzie Basin
City of Eugene
Capital Project

April 2001
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URS

WK07

Design Assumptions

It was assumed that:
1. The pond was full when the 10-yr storm arrives, therefore, the inflow to the pond of 91 cfs was the required capacity of the outflow channel
2. The pond inlet was at the same elevation as the constructed channel outlet at 379.49
3. The Manning's "n" value was 0.07
4. The slope of the constructed channel was similar to the natural channel slope upstream of the pond (0.81%)
5. The constructed channel has 2:1 sideslopes and a bottom width of 3 ft resulting in a depth of 4.5 ft under the 10-year storm and future land use conditions.
6. Land acquisition of 4500' x 21' open waterway = 94,500 sf. Land acquisition costs were assumed to be for industrial property.

Project Identifier	**WK08A**	
Project Title	**Gilham Rd. System Culvert Replacement**	
Project Location		
A 48-inch culvert (WKGL010B) for a pedestrian trail in the Gilham Road drainage system located between Ayres Rd. and River Point Pond, page 61 of the sewer index map.		
Subbasin	**WKGL**	
GIS U/S Node Location	**71281**	
GIS D/S Node Location	**71280**	
Drainage Area Served by Capital Project	**254**	Acres
% Impervious (1994 Existing Land Use)	**30**	
% Impervious (Future)	**45**	
Design Flow (Future Conditions	**92**	cfs

Project Description

Replace the 48" CMP culvert with an 8' wide x 30' long pedestrian bridge to maintain trail access. Reconstruct the channel to match the size and shape of the downstream open waterway.

Project Elements

240 SF – Pedestrian Bridge

1 EA – WK08A Open Waterway Improvements

Problems and/or Opportunities Addressed by the Capital Projects

Problems

The hydraulic capacity of the 48" CMP culvert (segment WKGL010B) is expected to be deficient for a 10-year design storm under future land use conditions. It is expected that this deficiency may cause overbank flooding in the open waterway directly upstream of the culvert.

Opportunities

N/A

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Pedestrian Bridge	N/A
WK08A Open Waterway Improvements	Inspect vegetation and banks for erosion.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

This capital project is expected to eliminate the overbank flooding in the upstream open waterway for the 10-year design storm under existing and future land use conditions.

Water Quality

N/A

Natural Resources

N/A

Other City Objectives Addressed by the Capital Project

To be completed by the City

Costs

Construction Costs:	$22,500
Site Acquisition:	$0
Engineering / Administration:	$4,500
Capital Project Implementation Costs	**$27,000**
Annual Maintenance Costs	**$0**

Property Parcel Boundary
Capital Project Location
Storm Drainage System (Pipe or Open Channel)
Capital Improvement Project Element
Upstream/Downstream Node
Upstream/Downstream Subnode
Manholes or Catch Basins

N

200 0 200 400 Feet

Site Map for CIP # WK08A

Gilham Rd. System Culvert Replacement
Willakenzie Basin
City of Eugene
Capital Project

April 2001
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URS

WK08A

Design Assumptions

N/A

Project Identifier	**WK08B**
Project Title	**Gilham Rd. System Water Quality Facility**

Project Location

This capital project is located adjacent to an open waterway segment (WKGL020B) in the Gilham Road drainage system located between Ayres Rd. and River Point Pond, page 61 of the sewer index map.

Subbasin	**WKGL**	
GIS U/S Node Location	**73036**	
GIS D/S Node Location	**73036**	
Drainage Area Served by Capital Project	**254**	Acres
% Impervious (1994 Existing Land Use)	**30**	
% Impervious (Future)	**45**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

Construct a 10.5 acre-ft neighborhood water quality facility adjacent to the open waterway in the area of a proposed park. The facility would treat runoff from a 254-acre drainage area.

Project Elements

10.5 Ac-Ft – Water Quality Pond

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Stormwater runoff carries problem pollutants such as sediments, metals, nutrients, bacteria, and oils and greases to open waterways in Eugene.

Opportunities

The open space adjacent to this open waterway provides opportunities to construct a neighborhood water quality facility that could provide natural resources, water quality, recreational, and educational benefits.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Water Quality Pond	Inspect and clean inlet and outlet, maintain vegetation, inspect sediment loading, remove sediment, remove debris, inspect separation berm.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This water quality facility will provide treatment of stormwater runoff from a 254-acre drainage area with an estimated annual discharge of 73,000 lbs of TSS under future land use conditions (95% low-density residential, 5% medium/high-density residential). This CP is expected to remove 35,000 of the 73,000 lbs/yr of TSS.

Natural Resources

This capital project provides natural resource enhancement of approximately 3 acres.

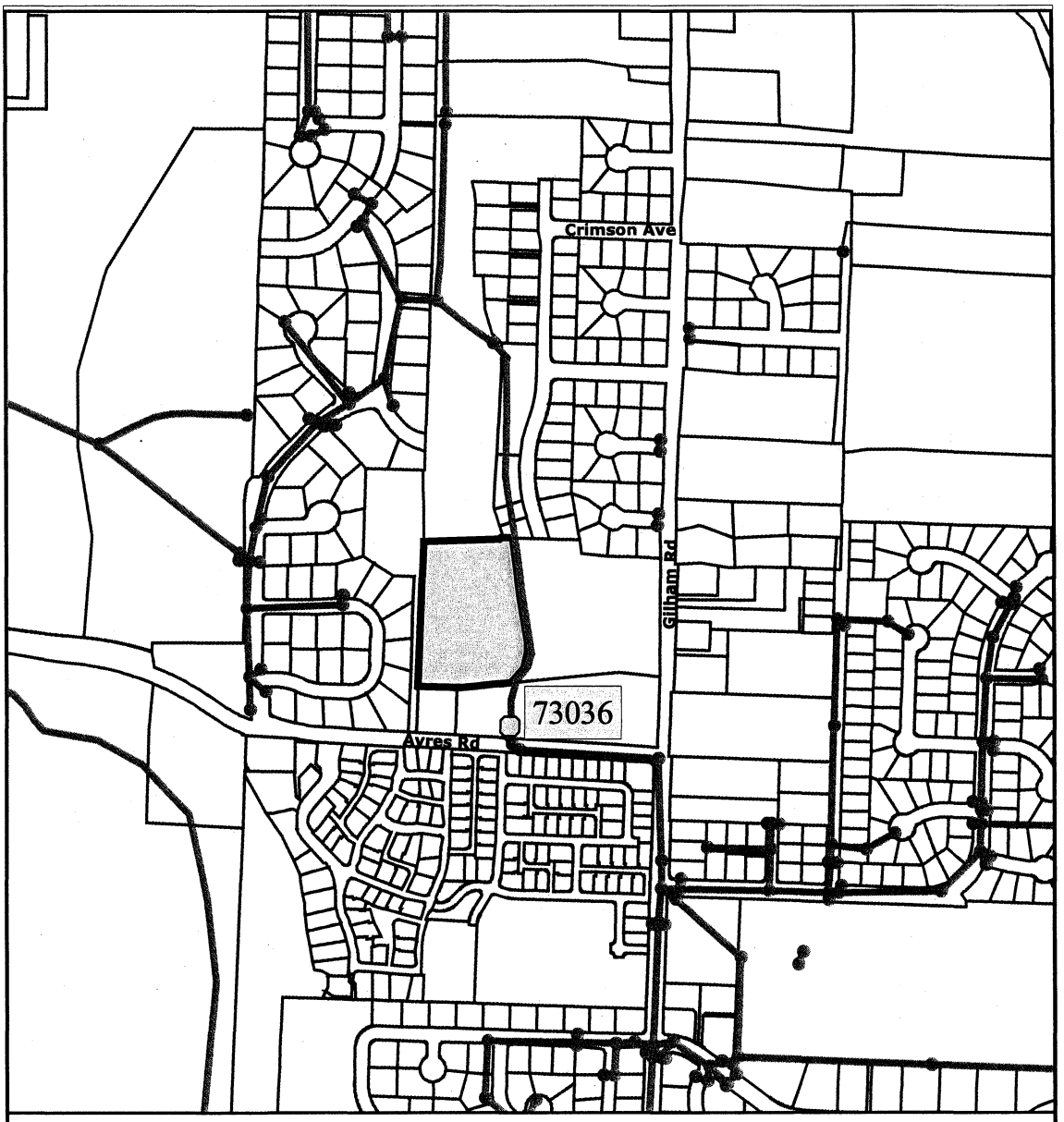
Other City Objectives Addressed by the Capital Project

To be Completed by the City

Costs

Construction Costs:	$544,900
Site Acquisition:	$0
Engineering / Administration:	$108,900

Capital Project Implementation Costs	**$653,800**
Annual Maintenance Costs	**$11,800**



Property Parcel Boundary

Capital Project Location

Storm Drainage System (Pipe or Open Channel)

Capital Improvement Project Element

Upstream/Downstream Node

Upstream/Downstream Subnode

Manholes or Catch Basins

200 0 200 400 Feet

N

Site Map for CIP # WK08B

Gilham Rd. System Water Quality Facility
Willakenzie Basin
City of Eugene
Capital Project

April 2001
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URS

WK08B

Design Assumptions

This CP would treat subbasins WKGL030-060 for water quality.

No acquisition cost for the construction of the water quality facility is assumed because it is to be located within a proposed park.

The TSS removal was estimated by multiplying the total TSS load by 0.8 (since the facility will treat 80% of the runoff) and then again by 0.6 (since the BMP used to provide treatment is expected to be approximately 60% effective.)

Project Identifier	**WK11A**
Project Title	**Acquisition of Wetland Adjacent to County Farm System**

Project Location

The wetland/open waterway (NRSS Site E73) between Coburg Road and County Farm Rd. north of Hillview Lane 2 (page 74 of the sewer index map).

Subbasin	**WKCF**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**N/A**	
Drainage Area Served by Capital Project	**60**	Acres
% Impervious (1994 Existing Land Use)	**12**	
% Impervious (Future)	**43**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

Acquire property or easements as necessary to protect this 4.7-acre wetland/open waterway system.

Project Elements

4.7 Ac – Residential Property Acquisition

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Development pressures on this privately-owned property may reduce or eliminate the flood control, water quality, and natural resources benefits of this wetland system.

Opportunities

Opportunity to protect existing flood control, water quality, and natural resource benefits associated with this wetland system.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Residential Property Acquisition	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

This CP protects the existing flood control benefits associated with the wetland/open waterways.

Water Quality

This CP protects the existing water quality benefits associated with the wetland/open waterways.

Natural Resources

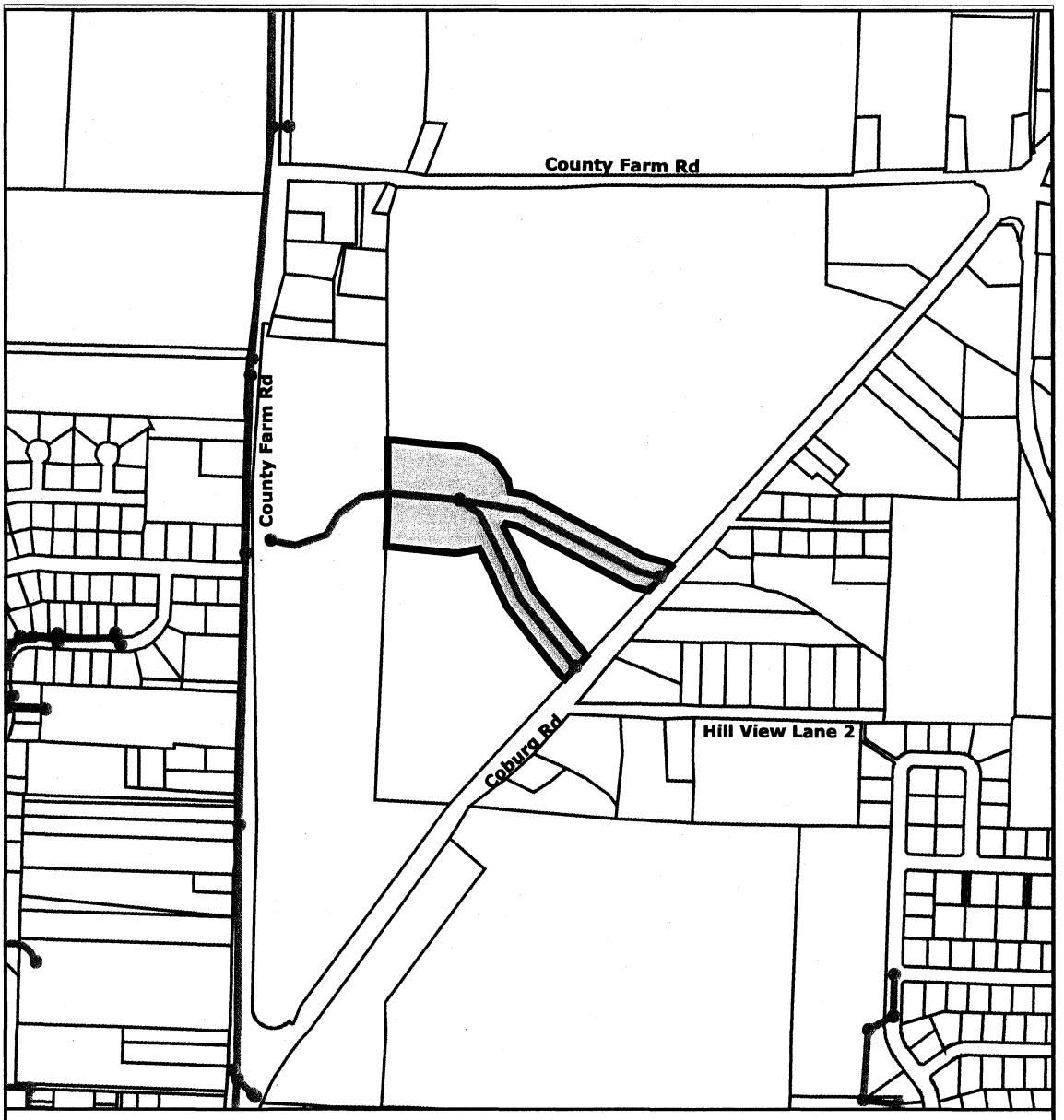
This CP includes the protection of approximately 4.7 acres of wetland/open waterways.

Other City Objectives Addressed by the Capital Project

To be Completed by the City

Costs

Construction Costs:	$0
Site Acquisition:	$188,000
Engineering / Administration:	$37,600
Capital Project Implementation Costs	**$225,600**
Annual Maintenance Costs	



Property Parcel Boundary
Capital Project Location
Storm Drainage System (Pipe or Open Channel)
Capital Improvement Project Element
Upstream/Downstream Node
Upstream/Downstream Subnode
Manholes or Catch Basins

200 0 200 400 Feet

N

Site Map for CIP # WK11A

Wetland Protection -
Coburg/Co. Farm Rds.
Willakenzie Basin
City of Eugene
Capital Project

April 2001
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WK11A

Design Assumptions

The acquisition area includes the existing wetland and open waterway systems with an additional 60-foot buffer width. All measurements were estimated from an aerial photograph (aerial photograph page 8). This is an acquisition site listed in the Open Space study.

Project Identifier	**WK13**
Project Title	**Ayers Pond Outfall Retrofit**

Project Location

Two 72 inch outfalls that convey the North Beltline Floodway into the upstream end of Ayers Pond (sewer index map page 62).

Subbasin	**WKNB**	
GIS U/S Node Location	**58441**	
GIS D/S Node Location	**58442**	
Drainage Area Served by Capital Project	**1450**	Acres
% Impervious (1994 Existing Land Use)	**41**	
% Impervious (Future)	**46**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

Install a stormwater quality facility system (CDS) upstream of the outfall to Ayers Pond to remove large debris from the inaccessible lower portions of the open channel. Retrofit the existing outfall structure with a larger concrete pad and energy dissipators.

Project Elements

1 Ea – CDS 240

1 EA – Ayers Pond Outfall Retrofit

Problems and/or Opportunities Addressed by the Capital Projects

Problems

There is a significant amount of debris which has deposited in the open channel upstream of the piped outfall. For maintenance purposes this segment of the channel is inaccessible. The inverts of these outfalls are elevated approximately 17.5 feet above the channel. The energy of water coming out of these outfalls during high flows is expected to cause erosion problems.

Opportunities

This CP provides an opportunity to improve the water quality, reduce the required maintenance, and reduce the erosion in this portion of the Beltline Floodway.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
CDS 240	Inspect sediment loading and debris accumulation, remove debris and sediment.
Ayers Pond Outfall Retrofit	N/A

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP will reduce the amount of debris transported through the open channel system, as well as to reduce the erosion downstream of the outfall.

Natural Resources

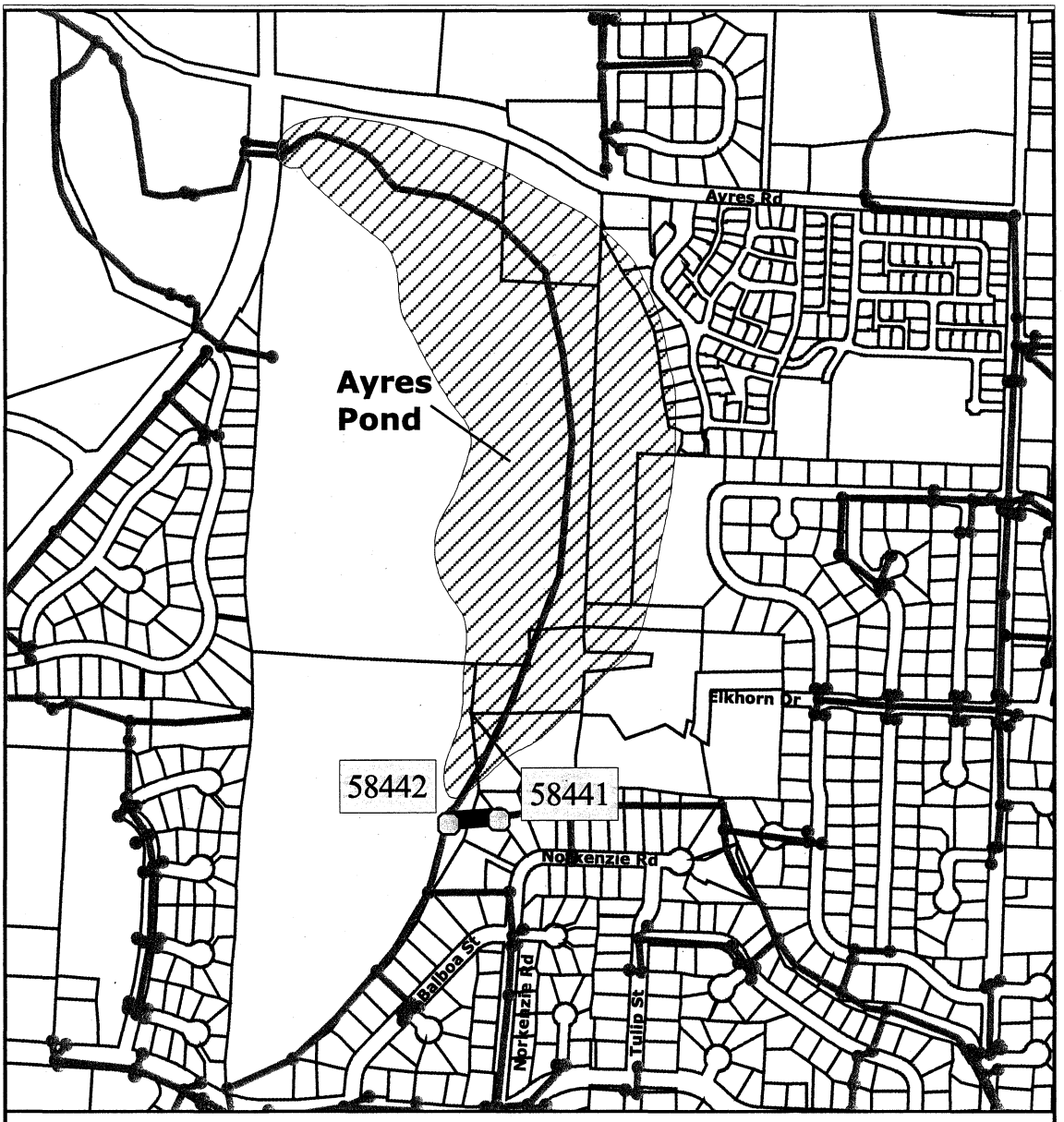
N/A

Other City Objectives Addressed by the Capital Project

To be completed by the City

Costs

Construction Costs:	$645,000
Site Acquisition:	$0
Engineering / Administration:	$129,000
Capital Project Implementation Costs	**$774,000**
Annual Maintenance Costs	**$1,000**



Property Parcel Boundary
Capital Project Location
Storm Drainage System (Pipe or Open Channel)
Capital Improvement Project Element
Upstream/Downstream Node
Upstream/Downstream Subnode
Manholes or Catch Basins

N

200 0 200 400 Feet

Site Map for CIP # WK13

Ayres Pond Outfall Retrofit
Willakenzie Basin
City of Eugene
Capital Project

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WK13

Design Assumptions

A CDS 240 is designed to convey up to 300 cfs, the 10-year design flow, any flows greater than 300 cfs are designed to bypass within the CDS system.

The outfall retrofit consists of an extended concrete pad as well as concrete block energy dissipators.

Project Identifier	**WK16A**
Project Title	**Modify Ascot Park Open Waterway**

Project Location

These open waterway segments in the North Beltline Floodway drainage system are located adjacent to Ascot Park east of Coburg Rd., page 76 of sewer index map.

Subbasin	**WKNB**	
GIS U/S Node Location	**61087**	
GIS D/S Node Location	**61081**	
Drainage Area Served by Capital Project	**170**	Acres
% Impervious (1994 Existing Land Use)	**43**	
% Impervious (Future)	**44**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

This capital project consists of open waterway improvements for segments WKNB190A, WKNB150B and WKNB150C. Waterway improvements include the removal of sediment and regrading of the waterway slope to improve the hydraulic capacity. Also segment WKNB150A1 a 42" CSP (node 61030 to 61081) was removed and replaced with a 42" CSP at a reduced slope.

Project Elements

1 Ft – 42" CSP (2-5 ft. cover)

1 EA – WK16A Open Waterway Improvement

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Within these culvert and open waterway segments, significant amounts of sediment have been deposited which has reduced their hydraulic capacity. The hydraulic capacity of segment WKNB190A is expected to be deficient under existing land use conditions for a 10-year design storm.

Opportunities

Opportunity to enhance the open waterways to provide natural resource benefits.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
42" CSP (2-5 ft. cover)	N/A
WK16A Open Waterway Improvement	Inspect vegetation and banks for erosion.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

This capital project will eliminate the expected overbank flooding problems in the open waterway segments for the 10-year design storm under existing and future land use conditions.

Water Quality

This capital project will protect existing water quality benefits associated with this open waterways.

Natural Resources

This capital project provides enhancement of a 40 foot wide buffer along 1840 LF of open waterway.

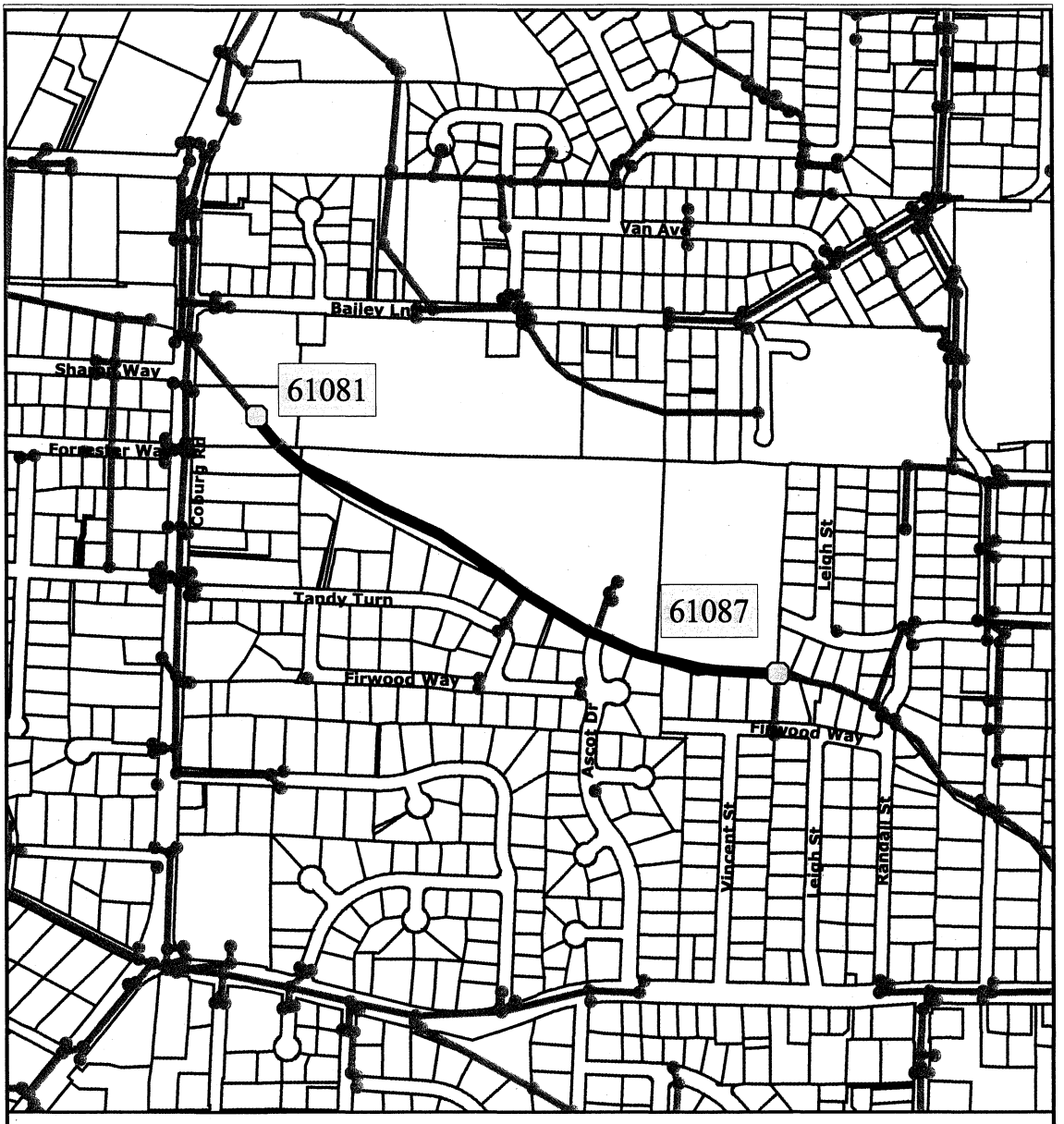
Other City Objectives Addressed by the Capital Project

To be completed by the City

Costs

Construction Costs:	$60,200
Site Acquisition:	$0
Engineering / Administration:	$12,000

Capital Project Implementation Costs	**$72,200**
Annual Maintenance Costs	**$0**



Site Map for CIP # WK16A

Modify Ascot Park Open Waterway
Willakenzie Basin
City of Eugene
Capital Project

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WK16A

Design Assumptions

Approximately 1' of sediment will need to be removed from open waterways WKNB190A.

The open waterway segments WKNB150B and WKNB150C will need to be regraded to a positive constant slope.

Capital Project Fact Sheet

Basin Name: Willakenzie Basin

Project Identifier	**WK100**
Project Title	**Delta Ponds Habitat Enhancement**
Project Location	
Delta Ponds	
Subbasin	**NA**
GIS U/S Node Location	**NA**
GIS D/S Node Location	**NA**
Drainage Area Served by Capital Project	**NA** Acres
% Impervious (1994 Existing Land Use)	**NA**
% Impervious (Future)	**NA**
Design Flow (Future Conditions	**NA** cfs

Project Description

This project which is being undertaken by the City and the Army Corps of Engineers proposes to restore flood plain habitat in the Delta Ponds system by connecting the ponds to the Willamette River and interconnecting the ponds internally through a system of large culverts and swales.

Project Elements

1 – Pond Enhancement Measures

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Low water flows between the ponds, inflows of untreated stormwater runoff, steep banks and lack of riparian vegetation have resulted in low quality habitat, high water temperatures, high nutrient levels and low dissolved oxygen.

Opportunities

This Army Corps/City project will address water quality and habitat loss problems in the Delta Ponds area.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Pond Enhancement Measures	

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

Maintain and potentially improve flood capacity of the ponds.

Water Quality

Provide water flow through the ponds in winter and spring, flushing the ponds and increasing flows to reduce water temperatures, reduce nutrients and increase dissolved oxygen levels.

Natural Resources

Riparian habitat around the steep pond banks will be restored by placing a 30 foot wide earth fill buffer and establishing appropriate riparian vegetation. The improved pond interconnections will also provide access for fish and other wildlife.

Other City Objectives Addressed by the Capital Project

This project will also include recreation components including small parking areas, viewing points, a foot bridge and gravel trails.

Costs

Construction Costs:

Site Acquisition:

Engineering / Administration:

Capital Project Implementation Costs $2,330,600

The Army Corps will also be funding approximately $3,884,450 of the project for a total estimated project cost of $6,215,100.

Annual Maintenance Costs

Capital Project Location

Water Bodies

Capital Improvement Project Element

Streets

500 0 500 1000 Feet

N

Site Map for CIP # WK100

Delta Ponds Habitat Enhancement
Willakenzie Basin
City of Eugene
Capital Project

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WK100